IAS
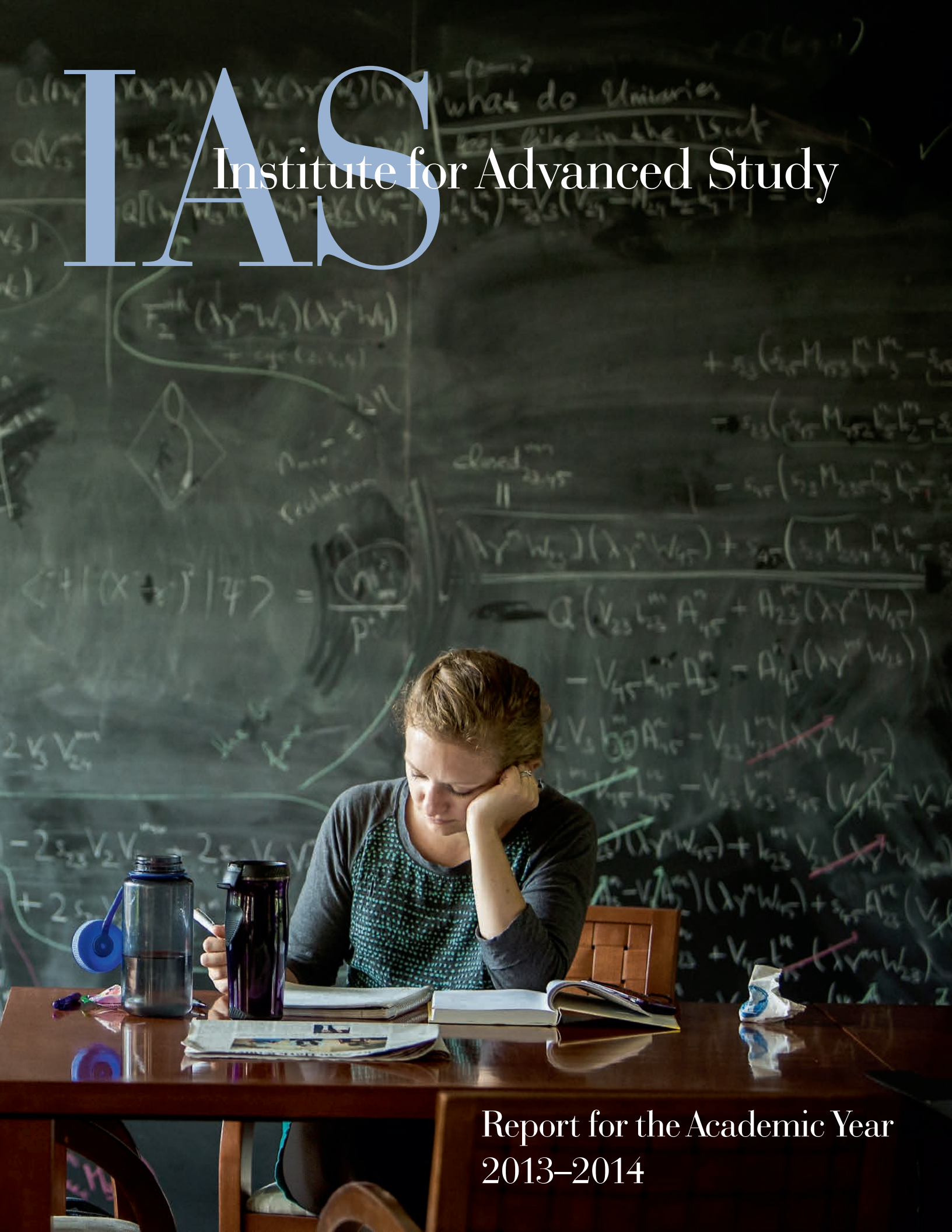
Institute for Advanced Study

Report for the Academic Year
2013–2014

Table of Contents

DAN KING

Report of the Chairman

I feel incredibly fortunate to directly experience the Institute's excitement and wonder and to encourage broad-based support for this most vital of institutions. Since 1930, the Institute for Advanced Study has been committed to providing scholars with the freedom and independence to pursue curiosity-driven research in the sciences and humanities, the original, often speculative thinking that leads to the highest levels of understanding.

The Board of Trustees is privileged to support this essential work. In 2013–14, we were very pleased to welcome Jeffrey Harvey, Enrico Fermi Distinguished Service Professor at the University of Chicago, who succeeds Curtis Callan as the Academic Trustee for the School of Natural Sciences; Margaret Levi, Jere L. Bacharach Professor of International Studies at the University of Washington and Director of the Center for Advanced Study in the Behavioral Sciences at Stanford University, who succeeds William Sewell as the Academic Trustee for the School of Social Science; and Shirley Tilghman, President Emerita and Professor of Molecular Biology and Public Affairs at Princeton University. In addition, Harold Shapiro, President Emeritus and Professor of Economics and Public Affairs at Princeton University, and Marina v.N. Whitman, the only child of John von Neumann, who was one of the Institute's five

original Faculty members, retired from the Board and were elected Trustees Emeriti. We have been profoundly enriched by their dedication and astute guidance.

The Institute's mission depends crucially on our financial independence, particularly our endowment, which provides 70 percent of the Institute's income; we provide stipends to our Members and do not receive tuition or fees. We are immensely grateful for generous financial contributions from Faculty, Trustees, Friends, Members and Visitors, foundations, and other supporters of the Institute's work. As of June 30, 2014, $74 million had been raised toward the $100 million unrestricted challenge grant from the Simons Foundation and the Charles and Lisa Simonyi Fund for Arts and Sciences, announced in 2011. The grant, which must be matched by funds from donors by 2015, serves as the basis for a $200 million campaign to support academic freedom at the Institute. The research described in the following pages is only possible because of our many benefactors whose contributions provide individual support for each scholar, help maintain our productive environment, and provide a critical platform for future breakthroughs.

Charles Simonyi
Chairman of the Board

Report of the Director

The Institute is a remarkable environment for concentration, inspiration, and ingenuity. Founding Director Abraham Flexner's idea of creating an institution focused on the advancement of "useless knowledge"—the deep ideas motivated by curiosity—has provided a haven for scholars to find answers to difficult questions for more than eight decades. A full-campus celebration in September 2013 of the ninetieth birthday of Professor Emeritus Freeman Dyson, whose keen observations and intrepid spirit have inspired generations at the Institute and beyond, was a reminder of the extraordinary scope and impact of our mission.

In 2013–14, distinguished economist Dani Rodrik joined the School of Social Science as Albert O. Hirschman Professor, and we announced the appointment of Sabine Schmidtke, a leading scholar of Islamic intellectual history. In July 2014, Sabine will succeed Patricia Crone, Andrew W. Mellon Professor in the School of Historical Studies, who will transition to Emerita status and whose pioneering and innovative approach to the history of Islam has brought about lasting change in the field. Also transitioning to Emerita status in July is Joan Wallach Scott, who has served as a Professor in the School of Social Science for nearly three decades and whose groundbreaking work has challenged the foundations of conventional historical practice. We are deeply grateful for their remarkable work and influence.

Our Faculty were recognized with major awards and recognition, including Danielle Allen, who was elected Chair of the Pulitzer Prize Board; Patricia Crone, who received the 2013 Giorgio Levi Della Vida Medal; Peter Sarnak, who was awarded the 2014 Wolf Prize in Mathematics; Richard Taylor, who was chosen for an inaugural Breakthrough Prize in Mathematics; and Edward Witten, who was recognized with the 2014 Kyoto Prize in Basic Sciences.

Composer Sebastian Currier began as the Institute's fifth Artist-in-Residence, curating the Edward T. Cone Concert Series. In addition, we welcomed Fred Van Sickle, most recently Executive Vice President for University Development and Alumni Relations at Columbia University, as Chief Development Officer and Associate Director for Development and Public Affairs, and Mark Baumgartner, formerly Director of Asset Allocation and Risk at the Ford Foundation, who joined the Institute as Chief Investment Officer.

I hope you will feel inspired by the following report, which provides a survey of the ideas, questions, and research underway at the Institute—from theories about the very beginnings of the universe to studying the environment in the social sciences. Collectively, they assert the power of curiosity.

Robbert Dijkgraaf
Director and Leon Levy Professor

Charles Simonyi (left), Chairman of the Board of Trustees, and Robbert Dijkgraaf (right), Director of the Institute and Leon Levy Professor, attend the Dreams of Earth and Sky conference held in honor of Professor Emeritus Freeman Dyson's ninetieth birthday and his sixtieth year as a member of the Institute Faculty.

Robbert Dijkgraaf described how the properties of molecules, atoms, nuclei, and elementary particles allow us to answer simple questions about the world around us, including what makes the grass green and the sky blue, in the first of a new series of talks, Science for Families.

The Institute for Advanced Study

It was founding Director Abraham Flexner's belief that if the Institute "eschews the chase for the useful, the minds of its scholars will be liberated, they will be free to take advantage of surprises, and someday an unexpected discovery, apparently leading nowhere, will be found to be an indispensable link in a long and complex chain that may open new worlds in theory and practice."

FROM THE DEVELOPMENT of programmable computers and the uncovering of the deep symmetries of nature to advances in societal understanding and historical practice, long and complex chains of knowledge have developed in numerous and astounding ways through research originating at the Institute for Advanced Study for more than eighty years.

Albert Einstein was one of the first in a long line of distinguished Institute scientists and scholars who have produced a deeper understanding of the physical world and of humanity. Yet the Institute's remarkable history does not seem to weigh heavily on current scholars and scientists. Instead, the atmosphere focuses on the present, where every twist and hairpin bend changes our view. What do we know? What do we yet need to understand? How should we try to comprehend it?

Work at the Institute takes place across historical studies, mathematics, natural sciences, and social science. Currently, a permanent Faculty of some thirty eminent academics each year award fellowships to some two hundred visiting Members, from about one hundred universities and research institutions throughout the world. The Institute's reach has been multiplied many times over through the more than seven thousand Members who have influenced entire fields of study as well as the work and minds of colleagues and students. Thirty-three Nobel Laureates and forty out of fifty-six Fields Medalists, as well as many winners of the Wolf and MacArthur prizes, have been affiliated with the Institute.

At the Institute, everything is designed to encourage scholars to take their research to the next level. This includes creating and sustaining an environment where Members live in an academic village of apartments, originally designed by Marcel Breuer in 1957, at the edge of the Institute's eight hundred acres of campus, woodland, and farmland. Members eat in the same dining hall, share common rooms and libraries, and carry out their work in an institutional setting where human scale has been carefully maintained to

encourage the sharing of ideas, mutual understanding, and friendship.

Each year a new intellectual mix is created by the Members, ranging from young postdoctoral fellows to distinguished senior professors, who typically stay a year but may stay up to five years and return for subsequent visits throughout their careers. A period spent as a Member is often a life-changing experience. Young scholars meet the contemporaries who, with them, will be leading figures in their field in the future. Senior Members have the time and freedom to initiate new lines of research. Freed from teaching and administration, Members are afforded opportunities for discussing their work with scholars and scientists from other fields. Here they are given the time to take advantage of serendipitous encounters at lunch, teatime, or at After Hours Conversations, an interdisciplinary program to encourage wide-ranging conversations in an informal and relaxed environment.

Throughout the year, the Institute hosts a broad array of concerts, lectures, and programs for the Institute community and the public. In addition, the Institute offers numerous and varied activities for Members, Visitors, and their families—from family science talks and children's activities to play readings, jazz evenings, tennis lessons, and trips to museums and other cultural sites.

In the 2013–14 academic year, two special events included Dreams of Earth and Sky, a conference to celebrate the ninetieth birthday and indelible contributions of Professor Emeritus Freeman Dyson, and Strings 2014, one of string theory's most important gatherings of international experts and researchers, which overlapped with the Institute's summer outreach program, Prospects in Theoretical Physics.

Fundamental research at the Institute furthers our grasp of a world of diverse facts, structures, ideas, and cultures. This is due in large part to the precious freedom that Faculty and Members at the Institute experience—an independence enabled by the generosity of the Institute's founders and subsequent benefactors. We share the conviction of our founders that such unrestricted deep thinking will change this world, but where and how is always a surprise.
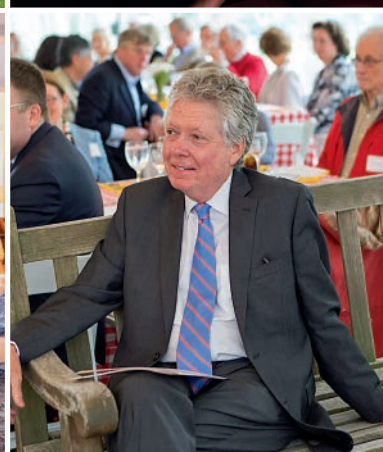
Above and left: In 2013, Freeman Dyson (at right, first image) celebrated his ninetieth birthday and also marked his sixtieth year as a Professor at the Institute, the longest tenure of any Faculty member in the Institute's history. When Dyson first arrived as a Member in 1948, the Institute was less than twenty years old. Dreams of Earth and Sky, a conference and celebration conceived by Dyson's colleagues in the School of Natural Sciences and held September 27–28, provided a perspective on his work and impact across the sciences and humanities. The program featured a range of talks on mathematics, physics, astronomy, and public affairs that reflect both the diversity of Dyson's interests and his ability to open new dialogues.

Below and right: The Institute and Princeton University cohosted Strings 2014 on June 23–27, which convened international experts and researchers to discuss string theory. A total of six hundred participants attended Strings 2014, making it one of the largest Strings conferences since their inception in 1995. The Strings conferences are focal points in the field, with scientists from around the world presenting new work and reviewing the most recent developments. Strings 2014 followed in this tradition, aiming for a unified presentation of the many strands of modern string theory and stimulating scientific exchanges among the researchers in the field.

Briony Fer, History of Art Professor at University College London, examines Russian artist Kazimir Malevich's systemic method, and the significance of its historical repercussions, in a public lecture, "Malevich's Nervous System." Her talk was part of an art history lecture series co-organized by Professor Yve-Alain Bois and cosponsored by the Institute for Advanced Study and the Department of Art and Archaeology at Princeton University.

School of Historical Studies

The School of Historical Studies, established in 1949 with the merging of the School of Economics and Politics and the School of Humanistic Studies, supports scholarship in all fields of historical research, but is concerned principally with the history of Western, Near Eastern, and Asian civilizations, with particular emphasis upon Greek and Roman civilization, the history of Europe (medieval, early modern, and modern), the Islamic world, East Asian studies, art history, the history of science and philosophy, and modern international relations. The School actively promotes interdisciplinary research and cross-fertilization of ideas.

AN EXCEPTIONALLY LARGE DIVERSITY OF SUB-FIELDS characterizes the work of the School of Historical Studies. But among the themes that are attracting the interest of both Faculty and Members are the history of ideas and mentality and the connections between historical studies and other disciplines, especially the natural sciences and the life sciences.

Seminars for the 2013–14 Members included modern international relations, which addressed issues of empire in the post–Napoleonic world and looked in particular at the imperial policies of the Ottoman, Qing, French, and Russian empires. In ancient history, there was an emphasis on the neglected subject of ancient law and the study of new epigraphic finds. There was a large and lively group of scholars on Islamic studies discussing subjects that ranged from the first centuries of Islam to the First World War as experienced by Ottoman soldiers. Persian studies seem to be making a comeback after decades of decline. In art history, Members addressed similar issues that concern the connection between text and image, generating particularly lively discussions.

The School carries out a broad range of outreach activities with conferences, international events, and lectures in universities and museums. The Faculty also cosponsors lectures, workshops, and seminars with Princeton University (for example, in art history and early modern history). Visiting Professor Michael van Walt van Praag organized in March a high-level meeting of experts, senior diplomats—including several ambassadors to the United Nations—and U.N. officials to explore the future of the Responsibility to Protect norm. The application of this emerging international norm is of critical importance today given experiences in Syria and the Central African Republic and developments in South Sudan.

With the support of the Dr. S.T. Lee Fund for Historical Studies, the School attracts a wider audience through its S.T. Lee Lectures. In 2013–14,

FACULTY

Yve-Alain Bois

Angelos Chaniotis

Patricia Crone
Andrew W. Mellon Professor

Nicola Di Cosmo
Luce Foundation Professor in East Asian Studies

Patrick J. Geary

Jonathan Israel

PROFESSORS EMERITI

Glen W. Bowersock

Caroline Walker Bynum

Giles Constable

Christian Habicht

Irving Lavin

Peter Paret

Heinrich von Staden

Morton White

AMY RAMSEY

van Walt invited Gareth Evans, one of Australia's longest-serving foreign ministers and President Emeritus of the International Crisis Group, who spoke on the future of the Responsibility to Protect principle. Joshua Fogel, former Visiting Professor (2001–03) and Professor at York University, gave a second S.T. Lee Lecture on modern Sino-Japanese relations.

In 2013–14, Professor **Yve-Alain Bois** pursued his work on the catalogue raisonné of the paintings and sculpture of the American artist Ellsworth Kelly. The manuscript of the first volume, whose completion was delayed by the discovery of paintings and drawings that were thought lost or destroyed, is now at the press, its publication scheduled for early 2015.

Although this did not leave Bois much time for any other scholarly activity, he presented two films (in July 2013 at Light Industry in Brooklyn and in April 2014 at New York University) in which the French literary critic Roland Barthes had been involved, and he gave a lecture on Kelly's late work at the Phillips Collection in Washington, D.C., in September, on abstraction in twentieth-century art at the Museum of Contemporary Art of Montréal in October, on color systems in twentieth-century art at the Musée des Beaux-Arts de Lyon in November, and on the French artist Sophie Calle at Boston's Isabella Stewart Gardner Museum in December.

Bois also participated in a symposium on Hubert Damisch at the Institut National d'Histoire de l'Art in Paris in November, in a seminar on cubism at the National Gallery of Art in Washington, D.C., in October, and, throughout the academic year, in a think tank on Picasso's sculpture at New York's Museum of Modern Art in preparation for an exhibition on the same subject. Due to his massive involvement in the Kelly project, Bois's publications were limited in scope during the past academic year. They include a "state of the field" essay on art history in America for a three-volume report on the humanities published in France, an essay on Henri Matisse and the role his travels played in the development of his art for Getty publications, an essay on the little-known French painter Christophe Verfaille, and the revised edition of two essays previously published regarding Venezuelan artist Gego and the Italian artist Lucio Fontana.

At the Institute, Bois's art history seminar benefited from a rare convergence in the interest of its participants who were all addressing similar issues concerning the connection between text and image. Anastasia Drandaki, a Byzantinist, examined how religious paintings promoted ideas of religious tolerance and coexistence between the Latin West and the Orthodox East. Michele Matteini explored the cultural and artistic life of a neighborhood in Beijing in the late eighteenth and early nineteenth centuries, in which literary "scholars" (poets, calligraphers, and painters) cohabited. Anna Boreczky studied the illustration history of a medieval best-seller, the *History of Apollonius, King of Tyre*. Annie Bourneuf finished a book on Paul Klee and began a new one on abstraction in art and literature at the time of World War I. Bois also co-organized (with Professor Irene Small) the sixth series of public lectures cosponsored with the Department of Art and Archaeology at Princeton University.

The main focus of Professor **Angelos Chaniotis**'s work was on new epigraphic evidence and the information it provides for Greek social, cultural, and religious history. He coedited *Supplementum Epigraphicum Graecum LIX* (Leiden, 2013), worked on his book "Epigraphic Research at Aphrodisias, 1995–2014," and completed two issues of the *Epigraphic Bulletin for Greek Religion* (for 2010 and 2011). In a long article, "Mnemopoetik: Die Epigraphische Konstruktion von Erinnerung in den Griechischen Poleis," he explores how inscriptions were used in order to construct collective memory in Greek cities. Since most Members and Visitors in ancient studies in the academic year 2013–14 shared similar interests, both the seminar on ancient studies (January–April 2014) and the second Epigraphic Friday (March 14, 2014) focused on inscriptions and papyri. The discussions concerned the interpretation of new and old epigraphic finds from Greece and Asia Minor as well as aspects of Greek law (amnesty, arbitration, homicide law, protection of graves), economy (water management in Hellenistic Egypt), and culture (inscribed epigrams).

Chaniotis's project "The Social and Cultural Construction of Emotions: The Greek Paradigm," funded by the European Research Council and based in Oxford, was completed in December 2013. The project examined how words and images function as acoustic and visual signals that attract attention, arouse emotion, stimulate memory, and influence decision-making. This research has demonstrated the increased importance of emotional display in public life in certain historical periods (ca. 300 B.C.E.–200 C.E.). In addition to coediting the volume *Unveiling Emotions*
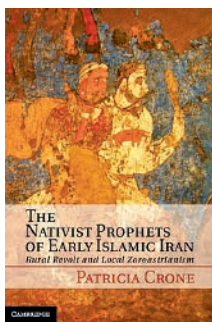
THE NATIVIST PROPHETS OF EARLY ISLAMIC IRAN
by Patricia Crone
(Cambridge University Press, 2012)

In 2013–14, Patricia Crone received four prizes for *The Nativist Prophets of Early Islamic Iran*: the Albert Hourani Book Award, for outstanding work in Middle East studies; the Houshang Pourshariati Iranian Studies Book Award; the Central Eurasian Studies Society Book Award; and the American Historical Society's James Henry Breasted Prize for the best book in English in any field of history prior to C.E. 1000.

II: Emotions in Greece and Rome: Texts, Images, Material Culture (Stuttgart, 2013), he published several studies on emotions in Greek historiography, public debates, religion, and law (amnesty). The presentation of selected sources in a searchable database (http://emotions.classics.ox.ac.uk) facilitates the use of paradigms from Greek antiquity by both classicists and researchers of emotions in other disciplines. He also worked on a book manuscript that will present a history of "The Greek World from Alexander to Hadrian."

In August and September, Chaniotis lectured in Australian universities and high schools as a Visiting Professor of the Australian Archaeological Institute at Athens. He also lectured at Columbia University and in Athens, Heidelberg, Liège, and Thessalonike. As a member of the Italian Comitato Nazionale dei Garanti per la Ricerca and the Scientific Committee "Sciences Humaines et Sociales" of the National Fund for Scientific Research in Belgium, he contributed to the evaluation of research in the humanities in these countries. In December 2013, the Academy of Athens elected him Corresponding Member. In March 2014, he was named Commander of the Order of the Phoenix by the President of Greece.

Patricia Crone, Andrew W. Mellon Professor, spent her last year as an active member of the Faculty with a large and diverse group of people studying subjects related to the Near and Middle East, but not always to Islam. The group was so large because it often included both Princeton University graduate students and former Members of IAS, and the result was both lively seminars and a great deal of socializing. The main subjects studied by the group and presented in the seminars related to the transition from the pre-Islamic to the Islamic Near East, to systematizing theology (*kalām*) and philosophy, and above all, to Iran. Present were a contingent of Members from Iran (though they did not all come directly from there), as well as others working on Iranian subjects, both Zoroastrian and Muslim. The nearest

During her stay as a Member at the Institute, Jing Tsu (center), pictured here in discussion with Member Ursula Birgit Brosseder (right), examined how the advent of modern Western scientific thinking was interpreted by Chinese intellectuals, amateur scientists, and industrialists in a rising cultural market for empirical novelties and falsifiable knowledge.

topic to the modern world was the First World War, when Member Yücel Yanikdağ spoke about the perceptions and experiences of Ottoman soldiers of that war. He was a member of Visiting Professor Michael van Walt van Praag's group, and he also attended Professor Jonathan Israel's seminars, at least from time to time, but he spent a good deal of time with the Islamicists, both academically and socially. Attending seminars outside the section to which one formally belongs is quite common.

The academic year ended with a conference on the city of Rayy to assess the impact of the Seljuq Turks, who invaded the Islamic world from western Turkestan in the eleventh century and started the transformation of Byzantine Anatolia into a Turkish country. Their impact on intellectual and religious life in Iran has not been properly studied, and Rayy was chosen because its religious and intellectual life before the coming of the Seljuqs is unusually well documented. Several Members were speakers, but many other speakers traveled to the Institute from Europe and other parts of the U.S. to participate.

The conference was made possible by financial support from the Fritz Thyssen Foundation, and the proceedings are expected to be published.

Crone herself worked with Masoud Jafarijaze, with whom she has collaborated before, on a Persian heresiography probably composed in Tabriz in the fourteenth century, which she hopes to complete in the coming year.

Crone received many honors during the academic year 2013–14. Her most recent book, *The Nativist Prophets of Early Islamic Iran: Rural Revolt and Local Zoroastrianism*, received four prizes (as a contribution to Islamic, Iranian, and Central Asian studies and to history in general), and she received an honorary doctorate at the University of Leiden, an honorary membership of her former college in Cambridge, the Georgio Levi Della Vida medal, the most prestigious award in the field of Islamic studies, and an honorary doctorate at the Hebrew University of Jerusalem. Having started her career with a provocative monograph that was much debated (but which ultimately prompted a new direction for the study of the first centuries of

The academic year ended with a short conference on the city of Rayy to assess the impact of the Seljuq Turks, who invaded the Islamic world from western Turkestan in the eleventh century and started the transformation of Byzantine Anatolia into a Turkish country. Pictured above, from left, Members Deborah Tor (seated), Hassan Farhang Ansari, Sabine Schmidtke, Professor Patricia Crone (seated), and Jan Thiele (seated) of the University of London gave talks at the conference, the proceedings of which are expected to be published.
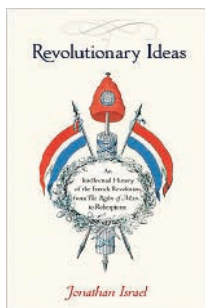
Islam), Crone was personally pleased to be recognized with full honors in the year of her retirement.

In 2013–14, **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, continued to work on collaborative projects that involved American, Mongol, and Chinese scholars. In the summer of 2013, he visited the Orkhon Valley in Mongolia, where he joined a team of physical geographers (dendrologists) working on the historical climate of Mongolia. A related study was published in March

---

REVOLUTIONARY IDEAS by Jonathan Israel
(Princeton University Press, 2014)

Jonathan Israel explores how the French Revolution was set in motion by radical eighteenth-century doctrines, how these ideas divided revolutionary leaders into vehemently opposed ideological blocs, and how these clashes drove the turning points of the Revolution. *Revolutionary Ideas* tells how the fierce rivalry between various groups shaped the course of the Revolution, from the Declaration of Rights, through liberal monarchism and democratic republicanism, to the Terror and the Post-Thermidor reaction.

2014 in the *Proceedings of the National Academy of Sciences*. The question at the heart of this study is whether the new information on Mongolian climate change based on tree-ring analysis can be the basis of a new hypothesis on the role of climate in the history of pastoral nomads in ancient and medieval times. Taking the Mongol empire as a case study, the question of how the political and social fabric of pastoral nomads can be impacted by economic upturns or downturns due to climate variability constitutes a new avenue of investigation that might add a critical new dimension to our understanding of the historical emergence of nomadic empires in the Asian steppes. Di Cosmo lectured on this theme at Arizona State University and West Virginia University and gave a keynote lecture for the Gerda Henkel Foundation in Berlin. On a broader spectrum of theoretical issues, Di Cosmo has been interested in the methods used by scientists to connect climatic and historical events on one end, and on the use of scientific data by historians on the other. He gave a lecture on this topic at the Institute in May 2014.

The academic work of Members in East Asian studies was very intense, with twenty encounters during the year. All events demonstrated the vibrancy of East Asian studies in general, but a few excelled in showing innovative methods or future avenues of study (especially interdisciplinary) in which East Asia will play a major role. Among them it is worth noting, first of all, the opening up of China studies to frontiers and peripheries. Li Zhang and Ursula Brosseder in archaeology, David Robinson and Matthew Mosca in history, Nancy Steinhardt in art history, and Stephen West, Paize Keulemans, and Wilt Idema in literature, all showed the importance of frontier regions and exchanges with foreign cultures in Chinese history and literature. A second strong trend is the relevance of East Asia in various branches of the history of science, as shown by David Pankenier in archaeoastronomy, Lei

Hsiang-lin in modern medicine, and Jing Tsu in the cultural history of science in twentieth-century China.

Professor **Patrick Geary** continued to direct a long-term, collaborative, and interdisciplinary project that brings together geneticists, historians, and archaeologists from the United States, Germany, Italy, Austria, Hungary, Britain, and the Czech Republic to study early medieval population demographics through the analysis of ancient DNA. To date, his team has collected over 1,100 samples and is in the process of extracting and sequencing their DNA. The technology that his project employs, Next Generation Sequencing, generates very large data sets, and the problem of analyzing recombinant DNA to establish relationships is creating computational challenges. He discussed these challenges in the School of Mathematics's "Workshop on Topology: Identifying Order in Complex Systems," in the lecture "Tracing Medieval Migration through Next Generation Sequencing: Finding Meaningful Models in a Sea of Data." He also presented the project at lectures held at the American Historical Association's annual meeting, as well as at Yale, Harvard, the University of California, Los Angeles, Heidelberg, Tübingen, Berlin, and Budapest. In March, he held a weeklong team meeting at the Foundation des Treilles near Nice, France, at which preliminary results of the project were presented and plans were made for the next phase of the project.

He also delivered lectures at the British Academy, the Newberry Library, the Austrian Academy of Sciences, and the University of Greifswald and assisted the Max-Planck-Gesellschaft in the selection of directors for its new Max Planck Institute for the Science of Human History. He continues to mentor the American Academy in Rome's Andrew W. Mellon Foundation–sponsored seminar "Framing Medieval Mediterranean Art," which brings together art historians, archaeologists,

curators, and historians from around the Mediterranean to examine how medieval-era materials are integrated into differing national narratives across the region. At the Institute, Geary organized a series of lunchtime seminars for Members and delivered a public lecture, "Rethinking Barbarian Invasions through Genomic History."

Professor **Jonathan Israel** continued developing his broad interpretation of the Western Enlightenment (1650–1830) in European and American contexts, which has proved increasingly divisive. Within the field of intellectual history there has been considerable agreement with, and supplementary work expanding, his main themes—work central to the international conference on the Radical Enlightenment held in Brussels in May 2013, the proceedings of which will be published by Ashgate. But many historians and philosophers have also reacted in a hostile fashion to the broad revisions implied regarding our understanding of the relationship between the Enlightenment and the French, American, and other revolutions down to 1830, and the origins of modern democracy and human rights. Israel's book on ideology in the French Revolution, *Revolutionary Ideas: An Intellectual History of the French Revolution from The Rights of Man to Robespierre*, was published by Princeton University Press in March 2014. Shortly afterwards, a general survey of these recent Enlightenment debates, edited by Israel together with Martin Muslow, a former IAS Member and now a professor at Erfurt, appeared under the title *Radikalaufklärung* (Berlin, 2014).

Israel led the seminar on early modern history in which IAS Members working on European and New World topics from the Renaissance to the nineteenth century (and sometimes other areas) regularly participated, as well as the eighteenth-century seminar, which he runs jointly with colleagues in the history department at Princeton University. The discussions ranged from Jewish and Russian history to the

Dutch Golden Age, history of philosophy, early modern Central America, and the Enlightenment.

Israel delivered public lectures and conference keynote addresses on the Enlightenment at Marburg, Wroclaw, Lyon, Zurich, Brock University in Niagara, and Krakow. Among his articles appearing this year were "'Radical Enlightenment'—Peripheral, Substantial, or the Main Face of the Trans-Atlantic Enlightenment (1650–1850)," *Diametros* 40 (June 2014), 73–98; "Civilisation and the 'State of Nature' in the Quarrel between Rousseau and the Diderot Circle," in *Civilisation*, edited by Kurt Almqvist and Alexander Linklater (Stockholm, 2014); "The Radical Enlightenment's Critique of Freemasonry: From Lessing to Mirabeau," in *Lumières radicales et franc-maçonnière*, edited by Cécile Révauger and Jean Mondot (Universite Bordeaux Montaigne, 2013); and "Leibniz's Theodicy as a Critique of Spinoza and Bayle—And Blueprint for the Philosophy Wars of the 18th Century," in *New Essays on Leibniz's Theodicy*, edited by Larry M. Jorgensen and Samuel Newlands (Oxford, 2014).

FACULTY & EMERITI AWARDS

Caroline Walker Bynum was awarded the Grand Merit Cross with Star of the Order of Merit of the Federal Republic of Germany.

Angelos Chaniotis was bestowed the Order of the Phoenix (Commander) by the President of the Greek Republic.

Patricia Crone received the 2013 Giorgio Levi Della Vida Medal for Excellence in Islamic Studies from the G. E. von Grunebaum Center for Near Eastern Studies at the University of California, Los Angeles.

Peter Paret was awarded the Great Cross of the Order of Merit of the Federal Republic of Germany.

f First Term ◆ *s* Second Term ◆ *v* Visitor ◆ *vp* Visiting Professor ◆ *a* Research Assistant ◆ *j* Joint Member School of Social Science

Hassan Farhang Ansari
Intellectual and Legal Studies ◆ Freie Universität Berlin
Funding provided by the Herodotus Fund

Sean William Anthony
Islamic History, Late Antiquity ◆ University of Oregon ◆ *f*
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Alison Beach
Medieval Religious Women ◆ The Ohio State University
Funding provided by the Patrons' Endowment and the Edwin C. and Elizabeth A. Whitehead Fellowship Fund

Edyta Bojanowska
Russian Literature and History ◆ Rutgers, The State University of New Jersey
Frederick Burkhardt Fellowship funded by the American Council of Learned Societies

Anna Boreczky
Medieval Manuscript Illumination, History of Illustration ◆ National Széchényi Library, Budapest
The Gladys Krieble Delmas Foundation Member; additional funding provided by the Elizabeth and J. Richardson Dilworth Fellowship Fund

Annie Bourneuf
European Art of the Early Twentieth Century ◆ School of the Art Institute of Chicago
Felix Gilbert Member; additional funding provided by the Herodotus Fund

David Prager Branner
Chinese Philology ◆ Columbia University ◆ *f*
Willis F. Doney Member

Ursula Birgit Brosseder
Eurasian Archaeology ◆ Rheinische Friedrich-Wilhelms-Universität
Elizabeth and J. Richardson Dilworth Fellow; additional funding provided by the Hetty Goldman Membership Fund

Rainer Brunner
Islamic Studies ◆ Centre National de la Recherche Scientifique, Paris

Judith Ann-Marie Byfield
African History ◆ Cornell University
Funding provided by the Fund for Historical Studies

Giorgio Caravale
Early Modern European Intellectual History ◆ Università degli Studi Roma Tre
Gerda Henkel Stiftung Member

Mark Cruse
Medieval French Literature ◆ Arizona State University
AMIAS Member; additional funding provided by the Herodotus Fund

Anastasia Drandaki
Byzantine Art and Archaeology ◆ Benaki Museum, Athens
Funding provided by the Herodotus Fund

Yaacob Dweck
Early Modern Intellectual History ◆ Princeton University
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Patricia Ebrey
Chinese History ◆ University of Washington ◆ *f*
Funding provided by The Andrew W. Mellon Foundation

Bonnie Effros
History of Archaeology; Early Medieval History and Archaeology ◆ University of Florida
George Kennan Member; additional funding provided by the Hetty Goldman Membership Fund

Stefan Esders
History of Late Antiquity and the Early Middle Ages ◆ Freie Universität Berlin ◆ *f*
Funding provided by the Fund for Historical Studies

Mehrdad Fallahzadeh
Historical Music Theory ◆ Uppsala University
Edward T. Cone Member in Music Studies; additional funding provided by the Elizabeth and J. Richardson Dilworth Fellowship Fund

Paul R. Goldin
Classical Chinese History and Philosophy ◆ University of Pennsylvania ◆ *f*
Willis F. Doney Member

Monica H. Green
History of Medicine ◆ Arizona State University
Willis F. Doney Member; additional funding provided by the National Endowment for the Humanities

Christopher Hamlin
History of Science, Technology, and Medicine ◆ University of Notre Dame
Hans Kohn Member

Kaja Harter-Uibopuu
Ancient Greek Law, Greek Epigraphy ◆ Österreichische Akademie der Wissenschaften ◆ *s*
Funding provided by the Fund for Historical Studies

Colin Heydt
Early Modern History of Philosophy ◆ University of South Florida
Funding provided by the National Endowment for the Humanities

Left: George Kennan Member Nikolay Tsyrempilov studies the role of Tibetan Buddhism in the modern history of Inner Asia, particularly how Buriat-Mongolian lamas lobbied in the upper circles of Russia and attempted to transmit European conceptions of state and politics to Mongolia and Tibet. *Center*: Professor Angelos Chaniotis (at left, center) leads an ancient studies seminar in a talk on new inscriptions from Aphrodisias. *Right*: Professor Patrick Geary presents his work on tracing medieval migration through Next Generation Sequencing to an audience of biologists and mathematicians at a topology workshop, "Identifying Order in Complex Systems," held by the Institute's School of Mathematics.

Masoud Jafarijaze
Islamic History ✦ Institute for Advanced Study ✦ *a*

Katherine L. Jansen
Medieval History ✦ The Catholic University of America ✦ *f*
George William Cottrell, Jr., Member

Sara Kaczko
Greek Literature, Epigraphy, Linguistics ✦ Università degli Studi di Roma, La Sapienza ✦ *s*
Willis F. Doney Member

Sean Hsiang-lin Lei
History of Science and Medicine in Modern East Asia ✦ Institute of Modern History, Academia Sinica
The Starr Foundation East Asian Studies Endowment Fund Member; additional funding provided by the Herodotus Fund

Michele Matteini
History of Chinese Art ✦ Reed College
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Naphtali S. Meshel
Religion ✦ Princeton University

Matthew W. Mosca
Chinese History ✦ The College of William & Mary
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Laura Nenzi
Early Modern Japanese History ✦ University of Tennessee ✦ *s*
Martin L. and Sarah F. Leibowitz Member

David William Pankenier
Archaeoastronomy, Astrology, Cosmology, and History of Ancient China ✦ Lehigh University
The Starr Foundation East Asian Studies Endowment Fund Member

Christopher Charles Parslow
Roman Archaeology ✦ Wesleyan University ✦ *f*
Funding provided by the Fund for Historical Studies

Sebastian Prignitz
Epigraphy, Classical Archaeology ✦ Inscriptiones Graecae, Berlin–Brandenburgische Akademie der Wissenschaften ✦ *s*
William D. Loughlin Member; additional funding provided by the Hetty Goldman Membership Fund

Matthew B. Restall
Latin America/Caribbean ✦ The Pennsylvania State University ✦ *f*

David Robinson
Chinese History ✦ Colgate University
The Starr Foundation East Asian Studies Endowment Fund Member

Roberto Romani
Modern Intellectual History ✦ Università degli Studi di Teramo ✦ *s*
The Gladys Krieble Delmas Foundation Member

Kim Lane Scheppele
Law ✦ Princeton University ✦ *j*

Sabine Schmidtke
Islamic Intellectual History ✦ Freie Universität Berlin

Stephen J. Shoemaker
Religion in Late Antiquity ✦ University of Oregon ✦ *f*
Funding provided by the Herodotus Fund

Gerhard Thür
Ancient Greek Law ✦ Österreichische Akademie der Wissenschaften ✦ *v, s*

Deborah Tor
Medieval Islamic History ✦ University of Notre Dame
Funding provided by The Andrew W. Mellon Foundation

Stephen V. Tracy
Greek History and Epigraphy ✦ Institute for Advanced Study ✦ *v*

Jing Tsu
History of Science and Technology in Modern China; Comparative Methods ✦ Yale University ✦ *s*
Funding provided by the Patrons' Endowment Fund

Nikolay Vladimirovich Tsyrempilov
Buddhism and International Relations in Modern Inner Asia ✦ Russian Academy of Sciences
George Kennan Member

Henk van Nierop
The Dutch Golden Age ✦ University of Amsterdam ✦ *s*

Michael van Walt van Praag
Modern International Relations and International Law ✦ Institute for Advanced Study ✦ *vp*

Sitta von Reden
Ancient History ✦ Albert-Ludwigs-Universität Freiburg
Friends of the Institute for Advanced Study Member

Emmanuel Voutiras
Classics, Greek and Roman Archaeology, Greek Epigraphy ✦ Aristotle University of Thessaloniki ✦ *s*
Elizabeth and J. Richardson Dilworth Fellow; additional funding provided by The Andrew W. Mellon Foundation

Barbara Walker
Modern History ✦ University of Nevada, Reno
Funding provided by the Fund for Historical Studies

Xi Wang
Chinese History; Mongolian and Manchu Studies ✦ Renmin University of China ✦ *a*

Stephen H. West
Chinese History and Literature of the Tenth to Sixteenth Centuries ✦ Arizona State University
Funding provided by The Andrew W. Mellon Foundation and the National Endowment for the Humanities

Jocelyn Wogan-Browne
Medieval Literature ✦ Fordham University ✦ *s*
Agnes Gund and Daniel Shapiro Member; additional funding provided by the Herodotus Fund

Yücel Yanikdağ
Ottoman and Turkish History ✦ University of Richmond
George Kennan Member

Left: George Kennan Member Bonnie Effros gives a lunchtime talk on how the French army's destruction of ancient Roman monuments in Algeria following the 1830 invasion also encouraged officers to document and preserve antiquities. *Center*: East Asian Studies workshop participants look at Hakka and Minnanese songs and ballads about overseas migration from Late Imperial and Early Republican China. *Right:* While Members at IAS, Michele Matteini (right) explored the cultural and artistic life of a neighborhood in Beijing in the late eighteenth and early nineteenth centuries, and Annie Borneuf (left) worked on books about Paul Klee and about abstraction in art and literature at the time of World War I.

GLEN BOWERSOCK ON PAGANISM AND THE LOD MOSAIC

Were pre-Islamic pagans monotheists, espousing one supreme god supported by lesser gods and messengers? Professor Emeritus Glen Bowersock's view is that most pagans were, in fact, polytheists. Bowersock has been exploring the concepts and practice of paganism in late antiquity with special attention to pagan angels in pre-Islamic Arabia, Syria, Palestine, and early Byzantine Anatolia. These angels evoke the pagan context from which Muhammad's Believers brought Islam to Palestine in the seventh century, as the Persian empire of the Sassanians was coming to an end. Bowersock presented his conclusions in Paris at the Collège de France at the end of September 2013 in a lecture that has appeared in the journal *Cahiers Glotz*.

At the same time, Bowersock has been preparing an introduction to the publication of the great mosaic from Lod in Israel, which will be housed in a new museum that is being constructed on the site through the generosity of Institute Trustee Shelby White. This beautiful but enigmatic mosaic, depicting animals but not humans, comes from the late third century. The recent discovery at Kfar'Othnay of a much less beautiful mosaic of the same date that mentions "God Jesus Christ" supports the possibility, already suggested by the excavator, that the Lod mosaic also belonged to a very early Christian building. Bowersock had argued previously that the central medallion at Lod represents Isaiah's Peaceable Kingdom, which was familiar to both Jews and Christians, but he can now compare a new fragment at Lod, which has unmistakably Christian images of doves and a chalice.

YVE-ALAIN BOIS ON ELLSWORTH KELLY

How are things that look apparently very simple in fact much more complex than they seem? Professor Yve-Alain Bois has been exploring this question in his work on the catalogue raisonné of the paintings and sculpture of the American artist Ellsworth Kelly. As a teenager, Bois recalls feeling betrayed when he learned of the "figurative" origin of Kelly's works, such as his first masterpiece, earlier known as *Construction—Relief in White, Grey and White*, now known as *Window, Museum of Modern Art, Paris* (1949), since it replicated in reduced size, one of the windows of the pre-Centre Pompidou, Musée National d'Art Moderne (see images above). "I gradually came to understand the function of the 'figurative' origin of many of [Kelly's] French paintings and reliefs—how it had nothing to do with representation but rather with a non-compositional system, which I call the 'transfer,' and, in turn, how this relates to other non-compositional strategies in his work of this period. In short, I was finally able to absolve Ellsworth from the 'high crime and misdemeanor' I had been accusing him of as a teenage prosecutor. The intellectual, visual, and affective pleasure I took in granting this absolution was only the beginning of a wonderful friendship." Read more at www.ias.edu/bois-kelly.

JONATHAN ISRAEL ON FREEDOM AND THEATER

How did freedom of the theater promise to be a major extension of liberty? Professor Jonathan Israel explores how the French Revolution raised the issue of liberty from theater censorship, something that did not exist in Europe at the time, or anywhere, and never had. The playwright Marie-Joseph Chénier led a publicity campaign demanding that his antimonarchical play *Charles IX* be performed for the public good. (Charles IX is shown in the sixteenth-century painting, at left, in front of the Parliament of Paris on August 26, 1572, attempting to justify the Saint Bartholomew's Day massacre.) According to Israel, the *Charles IX* uproar in 1789–90 was a major cultural revolutionary episode with implications extending beyond freedom of expression to the social function of culture itself. Read more at www.ias.edu/israel-freedom.

Nicola Di Cosmo on Climate Change and the Mongol Empire

ROY DELGADO
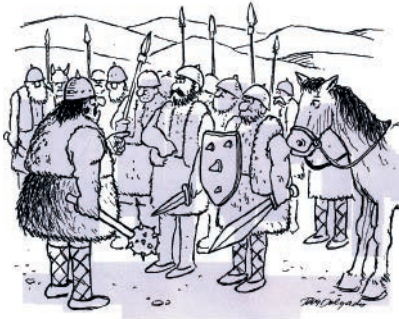
" Pillage and plunder, yes ... but *don't harm the environment !* "

Did an unusually favorable climate create conditions for a new political order under Chinggis Khan? Professor Nicola Di Cosmo is working on a National Science Foundation–funded project, "Pluvials, Droughts, Energetics, and the Mongol Empire," a rare collaboration between scientists and historians who are trying to understand a growing collection of historical climate data. Based on data collected in Mongolia, the project aims to study a particular set of circumstances, namely, the rise to power of Chinggis Khan and the beginning of one of the most remarkable events in world history. "Everyone knows Chinggis Khan but no one has so far been able to clearly explain the process through which the Mongols became so powerful nor why they would feel compelled to move out of Mongolia and conquer most of the Eurasian landmass," says Di Cosmo. "The reason why the rise of the Mongols, and their appetite for conquest, has never been explained is simple on the surface: there are no sources that can tell us what happened. Every history book repeats, with greater or lesser accuracy, what we learn from a special Mongol source, the epic saga, orally composed and transmitted sometime in the mid-thirteenth century, known as the *Secret History of the Mongols*."

Climate scientists involved in the project have reconstructed the climate of the Orkhon Valley, located in east-central Mongolia, for more than a thousand years. Di Cosmo's project aims to understand how a wetter climate, with an increment of the grassland biomass and increasing levels of energy, could have aided the rise of a more powerful state. "While the end of the twelfth century (especially the 1180s decade) was marked by prolonged droughts, the period from 1211 to 1225 was instead marked by persistently wet conditions, which would have increased the available pasturage, thus allowing for an increase in livestock," says Di Cosmo. "Such an anomalous sudden transition from a prolonged dry period to a prolonged wet period should indeed create conditions that might have affected the formation of a new political order in Mongolia." Read more at www.ias.edu/dicosmo-climate.

Edyta Bojanowska on Empire

Multiethnic empire? Colonialism? These aren't topics that are typically associated with Russian literature, yet Member Edyta Bojanowska argues that "a sprawling, expansionist, multiethnic empire was a determing factor of Russian history since at least the mid-sixteenth century." Bojanowska's research looks at the cultural heritage of works such as Ivan Goncharov's two-volume literary travelogue *The Frigate Pallada* (depicted above in an 1854 Nagasaki print), which influenced Russian imperial history. "To this day, whether in state pageantry, politics, or contemporary culture," says Bojanowska, "nineteenth-century Russia continues to supply Russians with revered national icons that inform their vision of the larger world and their own place in it." Read more at www.ias.edu/bojanowska-empire.

Michael van Walt van Praag on Identity-Based Conflicts

How should conflicting perceptions of history be addressed in identity-based conflicts, especially intrastate ones? Michael van Walt van Praag, Visiting Professor of International Relations and International Law, is exploring the origins and development of divergent narratives that emerged from distinct civilizational worlds that coexisted for centuries in Inner, East, and Southeast Asia and how they were transformed into modern conflictual national histories and instruments of political contestation. Van Walt's initial thoughts on the subject formed the basis of a paper, which he presented in Ulaanbaatar in the summer, at the thirteenth seminar of the International Association of Tibetan Studies hosted by the National University of Mongolia. The relationship between history and conflict resolution in the Middle Ages and the present was also the subject of a pair of lectures (see image at right) given in February as part of the Dialogues/Graduate Seminar Series at Villa La Pietra (New York University's Florence campus) with Professor Katherine Jansen, a Member in the School of Historical Studies in the fall and a fellow of the American Academy in Rome. In the summer, van Walt presented a paper at the India International Center in New Delhi (to be published in the fall of 2014), on a series of agreements concluded one hundred years ago at Simla in British India that are of importance today to tensions between China and India regarding competing territorial claims.

COURTESY OF VILLA LA PIETRA, NEW YORK UNIVERSITY
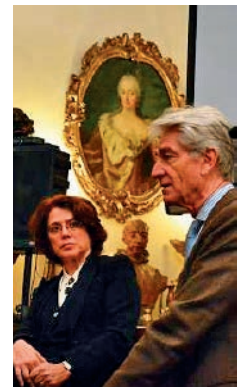
During the 2013–14 academic year, Nicholas Sheridan held a series of lectures on homological mirror symmetry, a field within the broader discipline of symplectic geometry. Sheridan is also using tropical geometry to study invariants of symplectic manifolds, such as symplectic cohomology and the Fukaya category. A Veblen Research Instructor, Sheridan holds a four-year appointment at both Princeton University and the Institute.

School of Mathematics

The School of Mathematics, established in 1933, was the first School at the Institute for Advanced Study. Several central themes in mathematics of the twentieth and twenty-first centuries owe their major impetus to discoveries that have taken place in the School, which today is an international center for research on mathematics and computer science.

How are two central themes of mathematical physics—random matrix theory and non-equilibrium dynamics—related? In 2013–14, the School of Mathematics held a special program, Non-equilibrium Dynamics and Random Matrices, which was led by Distinguished Visiting Professor Horng-Tzer Yau from Harvard University, a leading expert in both fields, and Professor **Thomas Spencer** of the School of Mathematics. They were joined by Visiting Professor Jürg Fröhlich, Eidgenössische Technische Hochschule Zürich; senior Members László Erdös, University of Munich; Martin Hairer, Warwick University; John Imbrie, University of Virginia; Antti Kupiainen, University of Helsinki; Joel Lebowitz, Rutgers, The State University of New Jersey; Jeremy Quastel, University of Toronto; and Herbert Spohn, Technische Universität München. Several of these senior Members received high honors during the year: Hairer was recognized with a 2014 Fields Medal; Lebowitz was awarded the 2014 Grande Médaille, the highest honor of the French Academy; and Spohn received the 2014 Cantor Medal, the highest distinction of the German Mathematical Society.

The study of large random matrices in physics originated with the work of Eugene Wigner who in the 1950s used them to predict the energy level statistics of a large nucleus. Today these statistics, called Wigner–Dyson statistics, are believed to describe a wide class of strongly correlated systems and are expected to obey a universal law, which depends only on the symmetry class. They appear in many parts of physics and mathematics including statistics, number theory, quantum chaos, combinatorics, communication theory, and quantum dynamics in a random environment. In number theory, extensive numerical studies show the zeros of the Riemann zeta function exhibit Wigner–Dyson statistics. Proving the observed universality for a broad class of systems was one of the central themes pursued during the year, and it will remain an active domain of research for many years to come.

FACULTY

Jean Bourgain
IBM von Neumann Professor

Helmut Hofer

Robert MacPherson
Hermann Weyl Professor

Peter Sarnak

Thomas Spencer

Richard Taylor
Robert and Luisa Fernholz Professor

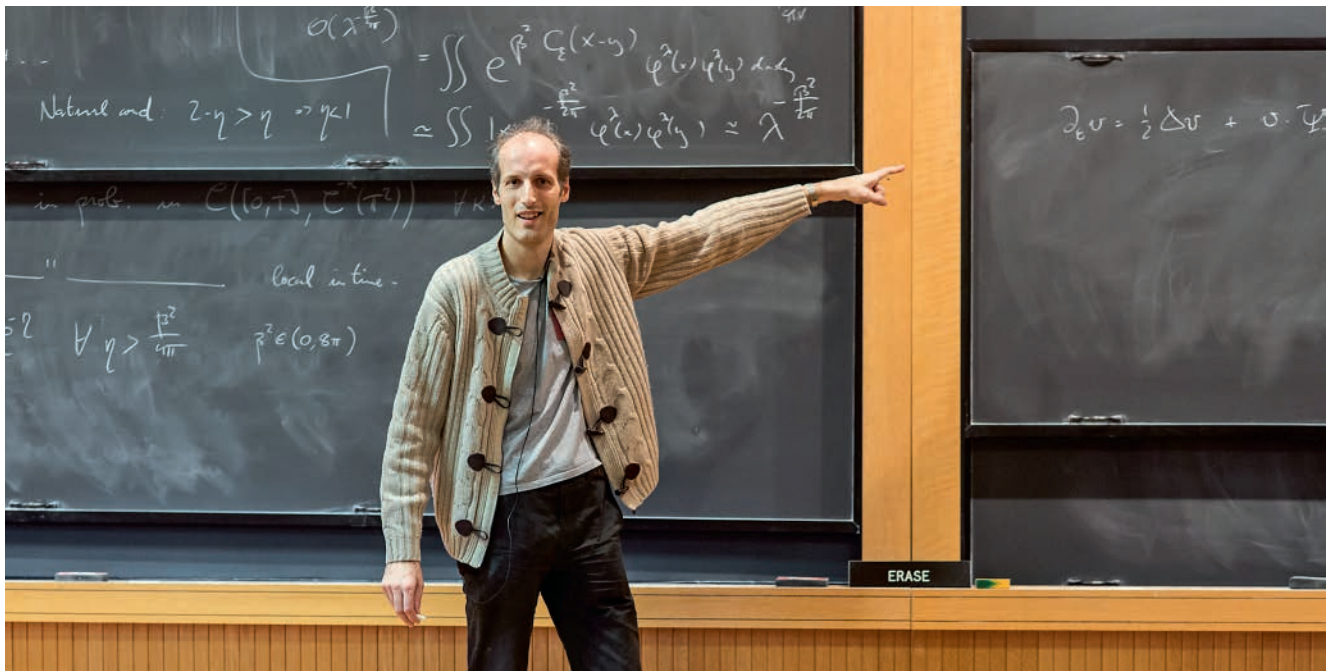Vladimir Voevodsky

Avi Wigderson
Herbert H. Maass Professor

PROFESSORS EMERITI

Enrico Bombieri

Pierre Deligne

Phillip A. Griffiths

Robert P. Langlands

At the Institute, Member Martin Hairer gave a number of lectures on the dynamical ϕ_3^4 model and spent time working on the theory of renormalization for very singular stochastic partial differential equations, with the ultimate goal of using the objects built by this theory to describe spacetime fluctuation fields for a variety of systems from statistical mechanics near criticality. Hairer was awarded a 2014 Fields Medal.

Non-equilibrium dynamics describes systems that are in flux. Examples include fluid dynamics, weather, and models in the financial and biological sciences. Although non-equilibrium dynamics are ubiquitous in the real world, it is one of the most challenging domains of mathematics and physics. Unfortunately, we still have only limited mathematical tools to analyze it. Nevertheless, there has been success in the study of special stochastic models, which are closely related to random matrices. These include Dyson-Brownian motion, used to study universality of Wigner matrices, and the Kardar-Parisi-Zhang (KPZ) equation, which is a ubiquitous class of random dynamical models.

The KPZ equation is a stochastic equation in one dimension that describes surface growth and rough interfaces in crystals. Its fluctuations are known to be closely related to the lowest eigenvalue of a random matrix. Many features of KPZ exhibit "stochastic integrability," and it is also related to asymptotic representation theory.

Freeman Dyson, Professor Emeritus in the School of Natural Sciences, formulated Dyson-Brownian motion to study eigenvalues of random matrices. The work of Members Erdös, Benjamin

Schlein, Yau, and Jun Yin, proved that this dynamic reaches local equilibrium very rapidly. Their result resolved some long-standing conjectures about the universality of eigenvalue spacing for Wigner matrices. This is a remarkable example of how non-equilibrium dynamics can be used to obtain universality.

The program had four main themes:

- *The foundations of the universality of random matrices.* The program aimed to unlock the deep, underlying reasons as to why random matrix statistics appear to be ubiquitous. More specifically, we would like to understand the spectral statistics for non-mean field type models, such as band matrices or the random Schrödinger equation.

- *KPZ universality.* Although this equation is understood in special cases, there are many interesting variations, which should belong to the same universality class.

- *Applications of random matrix theory to other areas of mathematics and to large data statistics, combinatorics, and condensed matter physics.*

- *Topics in non-equilibrium statistical physics.* A few years ago Erdös, Schlein, Yau, and Yin applied Green's functions, entropy, and parabolic differential

equations to discover the foundations of the universality. It was very effective for Wigner matrices and other mean-field type matrices (such as Erdös-Renyi graphs). In order to apply this idea to non-mean field type matrices, such as band matrices or the random Schrödinger equation, several participants of the program (including the previous names, as well as Member Paul Bourgade) have gradually pursued the idea of using quantum unique ergodicity (QUE) as a tool for going beyond mean-field theory. QUE was a concept pioneered by former Member Zeév Rudnick and Professor Peter Sarnak in their work on manifolds. It plays an important role here because, heuristically, a non-mean field model effectively behaves like a mean-field one, provided that QUE holds for this model. During the year, concrete progress was made toward proving QUE for random matrices, and its application to non-mean field models is very promising.

Progress was also made concerning universality at fixed energy. Due to a lack of an algebraic formula, the fixed energy universality had remained an open problem for the real symmetric matrices.

However, using a combination of coupling, homogenization, and regularity theory of parabolic partial differential equations, this last main problem in the class of the Wigner-Dyson-Mehta conjecture has finally been resolved.

Although universality at the scale of eigenvalue spacing has been the main focus of many universality results, interesting questions emerge regarding the mesoscale fluctuations. It turns out that the sub-leading terms to the well-known Altshuler-Shklovskii formula for the band matrix were not completely accurate. This was accomplished in a joint work by Member Antti Knowles and Erdös.

Originally, the KPZ equation was proposed by Kardar, Parisi, and Zhang (1986) to describe the motion of growing fronts. Large-scale mathematical activities started in the seminal work of former Member Percy Deift and Kurt Johansson (2000). The wide interest in the KPZ equation stems from its role in connecting seemingly different mathematical worlds, in particular, Dyson's Brownian motion, quantum Toda chain and related integrable models, statistical mechanics of line ensembles, directed polymers in a random medium, tilings, stochastic lattice gases, and stochastic conservation laws in one dimension. During the program, several introductory lectures were given on the KPZ equations and the recent progress in that direction.

Another major objective of this year's special program was to understand the applications of random matrix theory. The School had lectures on condensed matter physics, biology, engineering, number theory, quantum information theory, and statistics. These lectures provide excellent maps for future directions in random matrix theory. Interesting progress has also been made toward applications of current methods of statistics. The result (by Knowles-Yau-Yin), roughly speaking, provides a very precise description regarding when the principal component analysis is correct. In condensed matter physics, Member John Imbrie recently established impressive mathematical results about localization for strongly disordered quantum interacting spin systems. Localization for interacting systems has been the sub-

ject of a great deal of activity within theoretical physics. The precise mathematical problem was proposed by David Huse, a physicist at Princeton University and a frequent participant in the program.

The mathematical theory of dynamical systems provides tools to understand the complex behavior of many important physical systems. Of particular interest are Hamiltonian systems, which often arise when modeling systems having a preserved quantity, like energy. Since Poincaré's fundamental contributions, many mathematical tools have been developed to understand such systems. Surprisingly, these developments led to the creation of two seemingly unrelated mathematical disciplines: the field of dynamical systems and the field of symplectic geometry.

Hamiltonian systems are better understood in a combination of symplectic geometry and dynamical systems theory. In particular, symplectic field theory, a theory proposed by Yakov Eliashberg, Alexander Givental, and Professor **Helmut Hofer** in 2000, which defines invariants for symplectic spaces, has great potential for studying Hamiltonian systems. With collaborators Kris Wysocki and Eduard Zehnder, Hofer nears the end of a decade-long, 600-page two-part book project, *Polyfolds and Fredholm Theory*, a construction of symplectic field theory. Initially, Hofer thought he could complete it in a few years, but developing the theory required the resolution and streamlining of many problems and issues, including the generalization of differential geometry and nonlinear analysis. The theory involves a large class of a new type of spaces called polyfolds. These can be finite- and infinite-dimensional, usually have varying dimensions, and provide a powerful tool to study certain classes of partial differential equations.

Hofer and colleagues are focused on developing symplectic geometry tools that can be used to ask dynamical questions about Hamiltonian systems, such as: Are there rest points, i.e., states which will not change over time, or are there periodic movements? Is there a collection of invariant subsets with complicated dynamics, and can a theory

be developed to find these subsets?

This work follows from a special program organized by the School in 2011–12 to explore the possibility of a serious interaction between symplectic geometry and the field of dynamical systems, leading to a possible new field known as symplectic dynamics. Particularly noteworthy at that time were results by Barney Bramham, a postdoctoral fellow at IAS who was able to answer some important questions in dynamical systems, which seemed intractable.

Hamiltonian systems have potentially interesting applications. For example, the movement of a satellite under the influence of the sun and the planets can be modeled this way. One knows that this is a chaotic system, and the fact has been used since 1990 in moving around scientific spacecrafts in a fuel-efficient way and lengthening their useful life span. The recently developed symplectic methods hold promise for a much more global approach for finding interesting orbit designs. Hofer is developing these ideas with a graduate student from Princeton University.

The research group in symplectic geometry at IAS was led by Hofer, Members Daniel Cristofaro-Gardiner, Joel Fish, Doris Hein, and Veblen Research Instructor Nicholas Sheridan, who gave a mini-course on homological mirror symmetry. The joint symplectic geometry seminar with Princeton University was organized by the symplectic working group at IAS and Gang Tian and

---

FACULTY & EMERITI AWARDS

Phillip Griffiths was awarded the American Mathematical Society's Leroy P. Steele Prize for Lifetime Achievement.

Helmut Hofer received the 2013 Heinz Hopf Prize from Eidgenössische Technische Hochschule Zürich.

Peter Sarnak received the 2014 Wolf Prize in Mathematics from the Wolf Foundation.

Richard Taylor was one of five mathematicians to receive the Breakthrough Prize in Mathematics from the Breakthrough Prize Foundation.

Penka Georgieva of Princeton University.

Members Cristofaro-Gardiner, Fish, and Visitor Joanna Nelson jointly with Hofer and former Members Michael Hutchings and Dusa McDuff are organizing a summer school at IHES, Bur-sur-Yvette, in July 2015 on moduli problems in symplectic geometry, which is concerned with the polyfold theory and geometric perturbation methods.

A workshop on topology was organized by Hermann Weyl Professor **Robert MacPherson**, former Member Randall Kamien of the University of Pennsylvania, and Konstantin Mischaikow of Rutgers, The State University of New Jersey. The talks occurred during the first term, and the locations of the workshops alternated between the University of Pennsylvania and Rutgers. Speakers were Professor Patrick Geary (IAS); Andrew Blumberg, University of Texas, Austin; Raúl Rabadán, Columbia University; Rob Vandervorst, Vrije Universiteit, Amsterdam; Peter Bubenik, Cleveland State University; Gary Gibbons, Cambridge University and University of Pennsylvania; Rakesh Vohra, University of Pennsylvania and John Beggs, Indiana University.

Among other projects, Professor **Peter Sarnak** worked on the affine sieve, which was introduced by Sarnak, Professor

Jean Bourgain, and former Member Alexander Gamburd about seven years ago and has interesting applications to diophantine equations. In particular, Sarnak is interested in diophantine problems known as thin groups, which are non-arithmetic, have very few elements, and do not fit into the automorphic world. In the past, there were no tools to address these thin groups, but now there are some rudiments of very general tools for attacking these diophantine problems. These tools utilize inputs from many different fields, but an unusual input comes from so-called expander graphs in computer science and combinatorics. Sarnak is using ideas from computer science to show that these thin groups, and certain objects and graphs associated with them, are expanders.

Another topic that Sarnak has been working on involves random matrix theory, particularly as it relates to the zeros of a random polynomial. With Igor Wigman, Sarnak has shown that there is some universal behavior for the topology of a random real variety, which suggests connections to percolation theory in mathematical physics. It is believed that when a classically chaotic system is quantized, the eigenstates behave like certain random functions. The belief is that a highly excited modular form corresponds to the quantization of a

classically chaotic mechanical system, which is very difficult to analyze rigorously. But because they are modular forms, number theoretic tools can be used to understand what is going on. The theme of much of Sarnak's work is to construct, using number theory, explicit objects coming from number theory, which appear as though they are random.

Together with Member Chris Skinner and Sophie Morel, both of Princeton University, **Richard Taylor**, Robert and Luisa Fernholz Professor, continued to organize a working group on algebraic number theory. A group of Faculty, Members, postdocs, and graduate students from the Institute, Princeton, and Columbia University met once a week to work through in detail some of Peter Scholze's papers on perfectoid spaces— very large spaces with a particular collection of properties—which have become a powerful tool with implications for various subjects, including geometry, algebraic geometry, p-adic Hodge theory, and extensions of the Langlands program, a set of far-reaching conjectures developed by Professor Emeritus Robert Langlands. This is the second year in a row during which the working group has been devoted to this topic. In addition, Scholze, of the Mathematisches Institut de Universität Bonn, came to the Institute in February to give the thirty-sixth Marston Morse Lectures on "Arithmetic Hyperbolic 3-manifolds, Perfectoid Spaces, and Galois Representations."

In his own work, Taylor continued to focus on a project with former Members Michael Harris and Kai-Wen Lan, and Jack Thorne, involving regularity and self-duality in the Langlands program. The regular self-dual case has become fairly complete. Taylor, Harris, Lan, and Thorne asked, "Can we go beyond this regular self-dual setting?" In a 200-plus-page paper, their main innovation was removing the self-duality hypothesis on the automorphic representation. Taylor is now thinking about extending these results.

In theoretical computer science, one major object of study was information

AMY RAMSEY

Pictured here at the Dreams of Earth and Sky conference, Distinguished Visiting Professor Horng-Tzer Yau (second from left) studies the connection between the universality of random matrices and quantum unique ergodicity in the setting of random matrices, as well as related questions in other matrix models; the connection between the KPZ equation random matrices; and applications of random matrix theory in biology, statistics, engineering, and finance.

complexity. Information complexity is an extension of the classical information theory of Claude Shannon. Most of information theory deals with one person who wants to send information to another person across some kind of noisy channel. The basic problems involved are correcting the errors, understanding how much information can be transferred, the amount of redundancy needed, and so on.

Information complexity and communication complexity are about two or more people interacting. For example, two people want to agree on when they'll meet next week, solve some complicated problem involving their individual knowledge, or agree on a secret. For such tasks, basic questions include determining the best communication-efficient way for accomplishing them, as well as how do we cope with errors?

Visiting Professor Ran Raz, Member Gillat Kol, and their colleagues worked to recreate the theory of bidirectional communication, an area that is rich, complicated, and related to other questions in computational complexity. In particular, Raz and Kol achieved a very important result related to the capacity of the channel, meaning given some amount of noise, how much information can be relayed at what cost or redundancy. This is well understood in the unidirectional case, but they applied it in the bidirectional case. Another important result they obtained is proving the optimal gap between information complexity and communication complexity.

One project that occupied **Avi Wigderson**, Herbert H. Maass Professor, involves the basic scientific problem of trying to understand the mechanisms underlying basic systems (physical, biological, digital, etc.) from their behavior. The classical model (e.g., within computational learning theory) is assuming that the system is black-box, namely we can only observe its input-output relation. However, in this model there are many examples of natural systems that cannot be understood (or learned) efficiently.

With his collaborators, Wigderson defined a "gray-box" model, which allows the observer partial and changing snapshots of the internal workings of the system.

Inna Zakharevich (left), Member in the School of Mathematics, who worked on algebraic K-theory and developing a theory of scissors congruence, enjoys teatime with Mehrdad Mirbabayi (right), Member in the School of Natural Sciences.

To study this model, they introduced a problem they call "population recovery" that captures that learning problem. Efficient algorithms for this problem were developed, but many problems remain open and are currently under study.

A Goncharov reading group was organized by Member Inna Zakharevich as an informal seminar the goal of which was to read and understand A. Goncharov's paper "Volumes of Hyperbolic Manifolds and Mixed Tate Motives." The group met weekly, and each meeting had an informal talk by one of the participants on a topic that was necessary for the paper, such as Hodge theory, algebraic K-theory, and a basic theory of motives. Although the speakers were asked to prepare an hour of material, the talks ended up being long, about two hours each. The rest of the time was filled with participants asking questions and discussing examples. The original idea of the group meeting was to make it possible for everyone, regardless of their background, to understand the basics of each topic. The seminar was quite a success with a good turnout of people from different backgrounds: group theory, physics, number theory, algebraic geometry, and algebraic topology.

In February, Spencer and Fröhlich organized cross-disciplinary informal talks by Institute Faculty, which attracted a large audience. From the School of Natural

Sciences, Charles Simonyi Professor Edward Witten gave the talk "A New Look at the Jones Polynomial of a Knot"; Professor Nathan Seiberg spoke on "Duality and Emergent Gauge Symmetry"; Professor Juan Maldacena addressed "Emergent Geometry: The Duality between Gravity and Quantum Field Theory"; and Professor Stanislas Leibler gave the talk "On the (Un)reasonable (In)effectiveness of Mathematics in Biology."

The weekly Mathematical Conversations continued to attract Faculty, Members, short-term visitors, and Members from Natural Sciences and mathematicians from neighboring universities. This is an informal seminar covering many aspects of mathematics and occasionally physics and biology with an emphasis on creating a dialogue between the speaker and the audience. A few highlights were a talk by Etienne Ghys about clothing surfaces (with an international mystery story about a lost manuscript by Chebyshev on the side), Wigderson's talk explaining how to efficiently test an alien's claim to have a winning strategy at chess, and Member Mark Goresky's talk about how Professor Emeritus Pierre Deligne's solution of the Weil conjectures finds natural applications in cell phones and GPS. (Deligne's response, when asked what he thought of these practical applications of his work: "I do not complain.")

2013–14 MEMBERS AND VISITORS

f First Term ✦ *s* Second Term ✦ *m* Long-term Member ✦ *v* Visitor ✦ *vp* Visiting Professor ✦ *dvp* Distinguished Visiting Professor ✦ *vri* Veblen Research Instructorship ✦ *vnf* von Neumann Fellowship

Noga Alon
Combinatorics ✦ Tel Aviv University ✦ *vp, f*
Neil Chriss and Natasha Herron Chriss Founders' Circle Visiting Professor; additional funding provided by the Charles Simonyi Endowment and the National Science Foundation

Andris Ambainis
Computer Science ✦ University of Latvia ✦ *vnf, s*
Funding provided by the National Science Foundation

Stefanos Aretakis
Partial Differential Equations, Mathematical Physics ✦ Institute for Advanced Study and Princeton University ✦ *vri*
Funding provided by the National Science Foundation

Roland Bauerschmidt
Mathematical Physics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Costante Bellettini
Mathematics and Geometric Analysis ✦ Institute for Advanced Study and Princeton University ✦ *vri*

Vladimir Berkovich
Non-Archimedean Analytic Geometry ✦ Weizmann Institute of Science
Friends of the Institute for Advanced Study Member; additional funding provided by the Oswald Veblen Fund

Raphaël Beuzart-Plessis
Mathematics ✦ Institute for Advanced Study
Funding provided by the Florence Gould Foundation Fund and The Bell Companies Fellowship Fund

Bhargav Bhatt
Arithmetic Algebraic Geometry ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Paul Bourgade
Mathematics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Christopher Brav
Algebraic Geometry ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Anna Gwenaelle Cadoret
Arithmetic Geometry ✦ Institute for Advanced Study ✦ *vnf*
Funding provided by the Fernholz Foundation and the National Science Foundation

Ana Caraiani
Number Theory ✦ Institute for Advanced Study and Princeton University ✦ *vri*

Daniel Cristofaro-Gardiner
Symplectic Geometry ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Anindya De
Theoretical Computer Science ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Andrew Drucker
Computer Science ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

László Erdös
Quantum Dynamics, Mathematical Physics ✦ Ludwig-Maximilians-Universität München
AMIAS Member; additional funding provided by the Oswald Veblen Fund

Yuval Filmus
Computer Science ✦ Institute for Advanced Study ✦ *s*
Funding provided by the National Science Foundation

Joel Fish
Symplectic/Contact Topology, Hamiltonian Dynamics ✦ Massachusetts Institute of Technology
Funding provided by the Ellentuck Fund

Jürg Fröhlich
Theoretical and Mathematical Physics ✦ Eidgenössische Technische Hochschule Zürich ✦ *vp*
Funding provided by the Fernholz Foundation

Edinah Gnang
Computer Science ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Mark Goresky
Geometry, Automorphic Forms ✦ Institute for Advanced Study ✦ *m*
Funding provided by the Oswald Veblen Fund

Daniel R. Grayson
Mathematics ✦ University of Illinois at Urbana-Champaign
Funding provided by the Oswald Veblen Fund and The Bell Companies Fellowship Fund

Philipp Habegger
Number Theory ✦ Goethe-Universität Frankfurt am Main ✦ *vnf, f*
Funding provided by the National Science Foundation

Martin Hairer
Probability, Analysis ✦ University of Warwick ✦ *s*

Doris Hein
Symplectic Geometry ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Olga Holtz
Analysis ✦ University of California, Berkeley ✦ *vnf, s*
Funding provided by the National Science Foundation

Hao Huang
Combinatorics, Theoretical Computer Science ✦ Institute for Advanced Study ✦ *v*

John Imbrie
Mathematical Physics ✦ University of Virginia
Funding provided by the Ellentuck Fund

Bruce Kapron
Computer Science ✦ University of Victoria ✦ *s*

E. Birgit Kaufmann
Mathematical Physics ✦ Purdue University ✦ *f*

Ralph Martin Kaufmann
Algebra, Geometry, Topology ✦ Purdue University ✦ *f*

Valerie King
Computer Science ✦ University of Victoria ✦ *s*

Antti Knowles
Probability ✦ New York University ✦ *f*

Gillat Kol
Theory of Computation ✦ Institute for Advanced Study

Alex Kontorovich
Number Theory, Automorphic Forms ✦ Yale University
Funding provided by the Charles Simonyi Endowment

Left: Professor Thomas Spencer (center) co-organized the School's 2013–14 special year on non-equilibrium dynamics and random matrices. *Center:* Frequent Member and Visitor Sophie Morel (2006–09, 2010–11, 2012–13) of Princeton University attends an Institute seminar on perfectoid spaces by Member Arno Kret, a number theorist. *Right:* Participants in the Random Matrices workshop take a coffee break between lectures.

Arno Kret
Number Theory ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Antti Kupiainen
Mathematical Physics ✦ University of Helsinki ✦ *f*
Funding provided by the James D. Wolfensohn Fund

Joel Lebowitz
Statistical Mechanics, Mathematical Physics ✦
Rutgers, The State University of New Jersey

Zhen Lei
Applied Mathematics ✦ Fudan University ✦ *s*
*Funding provided by the S. S. Chern Foundation for
Mathematics Research Fund and the Charles Simonyi
Endowment*

Brandon Levin
Number Theory ✦ The University of Chicago
Funding provided by the National Science Foundation

Allison Lewko
Theoretical Computer Science, Mathematics ✦
Columbia University ✦ *v*

Mark Lewko
Harmonic Analysis ✦ Institute for Advanced Study

Xue-Mei Li
Mathematics ✦ University of Warwick ✦ *v, s*

Peter LeFanu Lumsdaine
Categorical Logic, Formalization of Mathematics ✦
Institute for Advanced Study
Funding provided by the National Science Foundation

Or Meir
Computer Science ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Joanna Nelson
Symplectic and Contact Topology ✦ Institute for
Advanced Study ✦ *v*

Alon Nishry
Analysis ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Yoshiki Oshima
Lie Groups ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Ori Parzanchevski
Algebra, Combinatorics ✦ Institute for Advanced
Study

Oana Pocovnicu
Mathematics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Jeremy Quastel
Probability ✦ University of Toronto

Maksym Radziwill
Number Theory ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Ran Raz
Computational Complexity ✦ Weizmann Institute of
Science ✦ *vp*
*Funding provided by the Charles Simonyi
Endowment*

Michael Reiterer
Mathematical Physics ✦ Institute for Advanced
Study
*Funding provided by the Giorgio and Elena Petronio
Fellowship Fund and the National Science Foundation*

Colleen Robles
Geometry ✦ Institute for Advanced Study
Funding provided by the Fernholz Foundation

Jeffrey Schenker
Mathematical Physics ✦ Michigan State University

Benjamin Schlein
Mathematical Physics ✦ Rheinische Friedrich-
Wilhelms-Universität Bonn ✦ *s*

Kevin Schnelli
Probability Theory, Mathematical Physics ✦ Institute
for Advanced Study

Mira Shamis
Mathematical Physics ✦ Institute for Advanced
Study ✦ *f*
Funding provided by the National Science Foundation

Peng Shao
Harmonic Analysis ✦ Institute for Advanced Study
*Funding provided by the Ky Fan and Yu-Fen Fan
Membership Fund and the National Science Foundation*

Nicholas Sheridan
Symplectic Geometry ✦ Institute for Advanced Study
and Princeton University ✦ *vri*

Ali Kemal Sinop
Theoretical Computer Science ✦ Institute for
Advanced Study
Funding provided by the National Science Foundation

Michael Spiess
Arithmetic Algebraic Geometry ✦ Universität
Bielefeld

Herbert Spohn
Statistical Mechanics ✦ Technische Universität
München

Florian Sprung
Number Theory ✦ Institute for Advanced Study and
Princeton University ✦ *vri*
Funding provided by the National Science Foundation

Christine Taylor
Evolutionary Game Theory, Evolution of Cooperation ✦
Institute for Advanced Study and Princeton
University ✦ *v*

Simone Warzel
Mathematical Physics ✦ Technische Universität
München ✦ *vnf, f*
Funding provided by the National Science Foundation

Charles Weibel
K-theory, Motivic Cohomology ✦ Rutgers, The State
University of New Jersey

Horng-Tzer Yau
Probability Theory, Mathematical Physics ✦ Harvard
University ✦ *dvp*
*Funding provided by The Ambrose Monell
Foundation and the Charles Simonyi Endowment*

Jun Yin
Probability, Analysis, Mathematical Physics ✦
University of Wisconsin–Madison ✦ *vnf*
Funding provided by the National Science Foundation
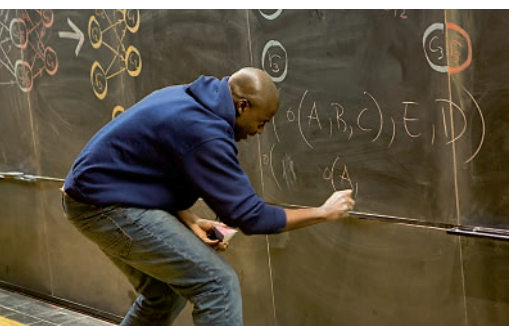
Jun Yu
Computer Science ✦ Institute for Advanced Study
*Funding provided by the National Science Foundation
and the Charles Simonyi Endowment*

Inna Zakharevich
Algebraic Topology ✦ Institute for Advanced Study
*Funding provided by The Bell Companies Fellowship
Fund*

Yitang Zhang
Laudau-Siegel Zeros ✦ University of New
Hampshire ✦ *s*

Left: Member Edinah Gnang's focus in theoretical computer science is on algebraic approaches to hyper-graph expanders and the combinatorial Nullstellensatz method.
Center: Member Herbert Spohn (left), pictured with Director's Visitor Siobhan Roberts, was awarded the Cantor Medal, the German Mathematical Society's highest distinction. *Right:* Members Daniel Cristofaro–Gardiner (left) and Joel Fish (right) share interests in symplectic topology and geometry.

Yitang Zhang on Primes

In April 2013, the editors of the *Annals of Mathematics*, a journal published by the Institute and Princeton University, received an email with a submission by an unknown mathematician. "Bounded Gaps Between Primes" by Yitang Zhang, an adjunct professor at the University of New Hampshire, immediately caught the attention of the editors as well as Professors in the School of Mathematics. It was refereed by mathematicians who were visiting the Institute at the time and was accepted three weeks later, an unusually expedited pace.

Zhang showed that there are infinitely many pairs of distinct primes whose difference is less than a fixed explicit number k, a striking achievement. His work relied heavily on the work of Professor Emeritus Enrico Bombieri and frequent Members John Friedlander of the University of Toronto and Henry Iwaniec of Rutgers, as well as sieving techniques due to the late IAS Professor Atle Selberg.

Zhang visited IAS for a week in the fall of 2013 to give lectures on his achievement as part of the IAS/Princeton University joint number theory seminar, and subsequently came to the Institute as a Member during the second term. "I was born for math," says Zhang, who spent periods working as an accountant and at a Subway sandwich shop. "For many years, the situation was not easy, but I didn't give up. I just kept going, kept pushing. Curiosity was of first-rank importance—it is what makes mathematics an indispensible part of my life."

Zhang received four honors for his work: the 2013 Ostrowski Prize, the Royal Swedish Academy's Rolf Schock Prize, the 2013 Morningside Special Achievement Award in Mathematics, and the 2014 Frank Nelson Cole Prize in Number Theory. Read more at www.ias.edu/zhang-breakthrough.
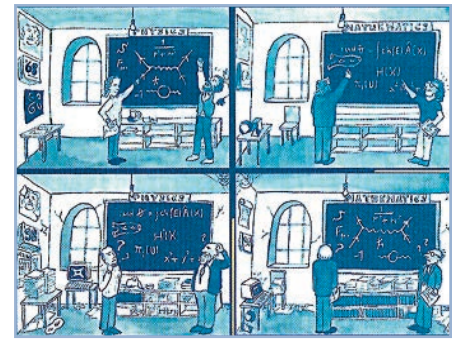
Ralph Kauffmann on Mathematical Language

What is the form and function of mathematical language inside and outside its community of speakers? Member Ralph Kaufmann describes how mathematical ideas, to be fully grasped, have to be rediscovered or reimagined, much like in the translation of poetry.

The interplay between mathematicians and physicists at IAS

"Mathematical text itself is highly stylized. Apart from its most abstract form of symbols and equations, the language contains diagrams (pictures) and stylized natural text, such as the standard composition structure: *definition*, *lemma*, *theorem*," says Kaufmann. "In the field of mathematics itself, the situation is not as homogenous as one might think. How much truth is contained in a proof by pictures is quite different in algebra versus geometry, and, historically, there is great variation in what is considered a proof—mainly how stylized the language should be. Being too relaxed can lead to foundational crises and questions like those Helmut Hofer is working out in symplectic geometry. An extreme position, which I call Frege's dream, is also alive today with Vladimir Voevodsky and his colleagues through their endeavors to formalize language as much as possible to maximize verifiability." Read more at www.ias.edu/kaufmann-mathematical-language.

Random Matrix Theory: From Prime Numbers to Nuclear Physics and Beyond

In April 1972, Hugh Montgomery, who had been a Member in the School of Mathematics the previous year, visited the Institute. During teatime, he shared a new result with Freeman Dyson, Professor in the School of Natural Sciences. It involved the statistical distribution of the zeros on the critical line of the Riemann zeta function, which Montgomery found has a certain property, now called Montgomery's pair correlation conjecture, wherein the zeros tend to repel between neighboring levels.

In the 1960s, Dyson had worked on random matrix theory, which was proposed by physicist Eugene Wigner in 1951 to describe nuclear physics. Dyson immediately saw that the statistical distribution found by Montgomery appeared to be the same as the pair correlation distribution for the eigenvalues of a random Hermitian matrix that he had discovered a decade earlier.

More than forty years after that teatime conversation between Dyson and Montgomery, the answer to the question of why the same laws of distribution seem to govern the zeros of the Riemann zeta function and the eigenvalues of random matrices remains elusive, but the hunt for an explanation has prompted active research at the intersection of number theory, mathematical physics, probability, and statistics. The search is producing a much better understanding of zeta functions, prime numbers, and random matrices from a variety of angles, including analyzing various systems to see if they reflect Wigner's prediction that the energy levels of large complex quantum systems exhibit a universal statistical behavior, a delicate balance between chaos and order defined by a precise formula.

Universality of various matrix ensembles was one of the major themes of the School's special year program on non-equilibrium dynamics and random matrices led by Distinguished Visiting Professor Horng-Tzer Yau of Harvard University. Read more at www.ias.edu/primes-random-matrices.
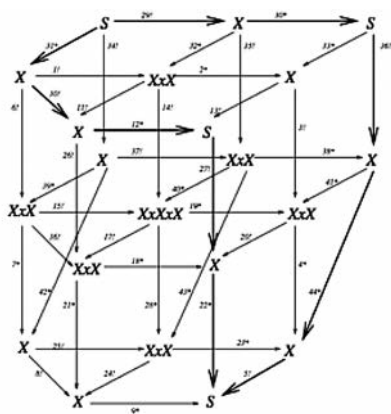
This three-dimensional diagram is an example of the kind of "formulas" that Voevodsky would have to use to support his arguments about 2-theories.

Vladimir Voevodsky on the Origins of Univalent Foundations

How can a mathematician avoid mathematical mistakes? Professor Vladimir Voevodsky describes his personal mission to develop computer proof verification, a tool he felt compelled to construct after discovering errors in his work and those of others. "Around the time that I discovered the mistake in my motivic paper, I was working on a new development, which I called 2-theories," says Voevodsky.

"But to do the work at the level of rigor and precision I felt was necessary would take an enormous amount of effort and would produce a text that would be very hard to read. And who would ensure that I did not forget something and did not make a mistake, if even the mistakes in much more simple arguments take years to uncover? I think it was at this moment that I largely stopped doing what is called 'curiosity-driven research' and started to think seriously about the future. I didn't have the tools to explore the areas where curiosity was leading me and the areas that I considered to be of value and of interest and of beauty. . . . It soon became clear that the only long-term solution was somehow to make it possible for me to use computers to verify my abstract, logical, and mathematical constructions." Read more at www.ias.edu/voevodsky-origins.

HOW'S YOUR QUANTUM COMPUTER PROTOTYPE COMING ALONG?

GREAT!

THE PROJECT EXISTS IN A SIMULTANEOUS STATE OF BEING BOTH TOTALLY SUCCESSFUL AND NOT EVEN STARTED.

CAN I OBSERVE IT?

THAT'S A TRICKY QUESTION.

Andris Ambainis on What We Can Do with a Quantum Computer

"When I was in middle school, I read a popular book about programming in BASIC (which was the most popular programming language for beginners at that time). But it was 1986, and we did not have computers at home or school yet. So, I could only write computer programs on paper, without being able to try them on an actual computer.

"Surprisingly, I am now doing something similar—I am studying how to solve problems on a quantum computer. We do not yet have a fully functional quantum computer. But I am trying to figure out what quantum computers will be able to do when we build them.

"The story of quantum computers begins in 1981 with Richard Feynman, probably the most famous physicist of his time. At a conference on physics and computation at the Massachusetts Institute of Technology, Feynman asked the question: Can we simulate physics on a computer? The answer was—not exactly. Or, more precisely—not all of physics." Read more at www.ias.edu/ambainis-quantum.

Olga Holtz on Random Walks with Pólya and Szegő

"My love affair with George Pólya began when I was seventeen. It was in Chelyabinsk, Russia, and my first year at the university was coming to an end. I had come across a tiny local library with an even tinier math section, which nobody ever seemed to visit, and had taken out most of those math books one by one before I came across The Book. It was George Pólya's *Mathematics and Plausible Reasoning*.

"By that time I was a total book-worm, having devoured almost a thousand volumes of my parents' home library, mostly fiction. My familiarity with math books was much poorer although, growing up, I had enjoyed Yakov Perelman's popular books for children on math and physics. I was a proud graduate of a specialized math and physics school, the only one in town, and had had a few wins at local olympiads in math and science. A top kid in class as far back as I could remember, I was arrogant as hell.

"I read the introduction to *Mathematics and Plausible Reasoning* and its Chapter I standing up next to the bookshelf. It read like a novel. A cerebral one alright, which made you pay quick attention. Chapter I started out in the least orthodox way, comparing mathematical induction to a domino chain. The book endeavoured to explain not only what was mathematically true but how and why. I was hooked. Chapter I ended with a list of problems. I solved a couple of them still standing up but quickly came to a halt on Problem 3.

"The arrogance kicked in—I had to solve those problems." Read more at www.ias.edu/holtz-walks.

Members, Visitors, and conference attendees relax and work between Strings 2014 talks in Bloomberg Hall.

School of Natural Sciences

The School of Natural Sciences, established in 1966, supports research in broad areas of astrophysics, systems biology, and theoretical physics. Areas of current interest include investigating the origin and composition of the universe; conducting research at the interface of molecular biology and the physical sciences; and elementary particle physics, string theory, quantum theory, and quantum gravity.

EACH YEAR THE SCHOOL OF NATURAL SCIENCES has about sixty Members, the majority of them postdoctoral fellows, who are typically appointed for three years, some for up to five years. Collaboration is encouraged among Members who work in the School's many scientific areas—from molecular biology to mathematical physics.

From its earliest days, the Institute has been a leading center for fundamental physics, contributing substantially to many of its central themes, which now interrelate with astrophysics and biology. Areas of current interest in theoretical physics include elementary particle physics, string theory, quantum theory, and quantum gravity, and their relationship to geometry, theoretical and observational astrophysics, and cosmology. Research in the School's astrophysics group encompasses astronomical systems from nearby planets to distant galaxies, from black holes to the dark matter and dark energy that dominate the evolution of the universe. There is a growing cross-fertilization between astrophysics and elementary particle physics, and the work of many Members and Faculty crosses the boundary between these two disciplines. Members in the astrophysics research group employ an array of tools from theoretical physics, large-scale computer simulations, and ground- and space-based observational studies to investigate the origin and composition of the universe, and to use the universe as a laboratory to study fundamental physics. At the Simons Center for Systems Biology, the tools of modern physics and mathematics are being applied to biological investigation, on varying scales, from molecular to organismic, and in some cases focusing on understanding disease processes.

The School's collaborative and pioneering approach to the sciences, which extends to the Institute's School of Mathematics, Princeton University, and the larger scientific community, continues to transform research in these fields and open opportunities for powerful and important discoveries.

FACULTY

Nima Arkani-Hamed

Peter Goddard

Stanislas Leibler

Juan Maldacena

Nathan Seiberg

Scott Tremaine
Richard Black Professor

Edward Witten
Charles Simonyi Professor

Matias Zaldarriaga

PROFESSORS EMERITI

Stephen L. Adler

Freeman J. Dyson

Peter Goldreich

Arnold J. Levine

Astrophysics

One of the most remarkable developments in astronomy over the past decade has been the discovery of planets orbiting thousands of stars. The most prolific planet hunter has been NASA's Kepler spacecraft, which identifies those exoplanets whose orbits happen to appear edge-on by searching for periodic dips caused by planetary transits (partial eclipses) of the stellar disks. Such measurements are best done from space, where stars do not twinkle, because the transit of an Earth-like world blocks only eighty parts per million of the stellar flux. Kepler has revealed that the architecture of planetary systems is remarkably diverse, and often very different from our own solar system. Its discoveries include systems with up to seven planets, planets orbiting binary star systems, rocky planets smaller than Earth, and planets orbiting their host star in only ten hours.

For the first time, we have a large, well-characterized catalogue of planets with sizes comparable to the Earth; the challenge is now to understand how these planets formed and why these planetary systems are so different from the solar system. Some of the puzzles that **Scott Tremaine**, Richard Black Professor, and his collaborators are investigating include: Do planets close to their host star form in situ or did they migrate from larger radii? What is the relationship between small, rocky planets like Earth and much larger gas-dominated planets like Jupiter? Many of the planets discovered by Kepler have rocky cores surrounded by extended atmospheres, in contrast to the thin

veneer of Earth's atmosphere; where did this gas come from, and why are the atmospheres so diverse in composition and extent? Most planetary systems appear to be flat, like the solar system, but in contrast to the solar system the equators of their host stars are not aligned with the planetary system; what caused this misalignment? The abundance of heavy elements in the host stars of the Kepler planets varies by more than an order of magnitude, but this abundance appears to be uncorrelated with the number of planets orbiting the star; why is it not easier to form rocky planets if there is a higher abundance of the elements from which they are made?

The last decades saw important advances in cosmology driven in large part by advances in observations. Cosmology now has a very successful standard model that can account for these observations, which span a wide range of spatial scales and probe the state of the universe throughout cosmic history.

Although very successful, the standard model requires physics that goes beyond what has already been established in the laboratory. To explain the clustering of matter, the formation of objects such as galaxies, the model relies on the existence of large amounts of dark matter, matter whose existence we can only infer due to its gravitational force on visible matter. We currently do not know when in cosmic history the dark matter formed, what sets its abundance, and whether it interacts appreciably with regular matter. We do not know much about it other than its total abundance.

To explain the late-time acceleration of the cosmic expansion, the standard model relies on the so-called cosmological constant or some other similar substance that leads to a gravitational repulsive force. The late-time acceleration of the cosmic expansion took cosmologists by surprise. We are still trying to make more precise measurements in the hopes of uncovering some additional clues that might shed some light on this component.

Finally, we have learned that structures in the universe grew as a result of the attractive nature of gravity out of primordial seeds. Observations have established that these primordial seeds were created before the hot Big Bang phase of the cosmic history. Thus they are a relic of the very early universe and potentially probe physics at energy scales substantially above what can be probed in the laboratory.

The activities of Professor **Matias Zaldarriaga** and Members working on cosmology have all centered around one or more of these puzzles. In the next few decades, additional information that might help answer these questions will come from surveys of the distribution of matter in the late universe. The process of structure formation—the growth of the initial seeds into objects of various sizes—is sufficiently complicated that extracting cosmological information from some of these measurements can be challenging. Zaldarriaga and collaborators have been engaged in trying to develop new tools to compute the predictions of the cosmological model for these types of observations.

Last year, there was a report from the BICEP2 experiment of a detection of a stochastic background of gravitational waves that originated during the very early universe, the period of inflation. Inflation is our best candidate for what could have come before the hot Big Bang phase of cosmic history and what could be responsible for many of the observed properties of our universe, including the production of the seeds for structure formation. The claim involved measurements of the polarization of the cosmic microwave background. If the claim stands, it would probably be the biggest discovery in cosmology in over a decade and would significantly impact our understanding of what might have happened in the very early universe.

A large effort from many Members of the School was devoted to scrutinizing this claimed detection, to interpreting its theoretical consequences, and to understanding what might be the next steps to gather additional information.

FACULTY AWARDS

Scott Tremaine was awarded the Tomalla Prize for his work on gravitational dynamics by the Tomalla Foundation for Gravity Research of Basel, Switzerland.

Edward Witten was awarded the 2014 Kyoto Prize in Basic Sciences, Japan's highest private award for global achievement, by the Inamori Foundation.

Members in an astrophysics workshop participate in a discussion on type 1a supernovae.

Most notable was the work of Member Raphael Flauger. He reanalyzed the BICEP data and data from other experiments and showed that the results from BICEP2 could result from contamination rather than gravitational waves, in particular, polarized microwave emission from dust grains in our galaxy. His work received a lot of attention, significantly reduced the initial enthusiasm generated by the BICEP results, and pointed to measurements that could be used to settle the issue. These measurements should become available in the very near future.

Systems Biology

Enormous diversity of phenomena in biology implies also a large diversity of topics, which are being tackled in biological research. In the tradition of theoretical approaches in physics, Professor **Stanislas Leibler** and the Members working at the Simons Center for Systems Biology are striving to find some common mechanisms that could operate across different scales of length and time and across different organizational levels of biological systems. For instance, at all scales, from molecular machines to the whole brain, living systems exhibit overwhelming complexity; but what part of this complexity is relevant to function? In other words, what is the dimension of the phenotype space in which biological functions evolve? It seems that in some cases, the effective phenotypic space is a low-dimensional one.

For example, Members Tiberiu Tesileanu and Lucy Colwell, together with Leibler, have been analyzing sequences of "protein families," i.e., proteins that share their sequences to some extent. Such analysis, focused on evolutionary sequence correlations, can extract useful information about both protein structures and lower-dimensional subsets of amino acids (the so-called "sectors"), which are relevant for protein functioning. The work of Member Tsvi Tlusty has indicated that the phenotype space of the ribosome, the multicomponent cellular complex responsible for synthesis of all proteins, is roughly one-dimensional. On even larger scales, the behavior of swimming microbes seems also to be described quite well in a low-dimensional space, as demonstrated by Leibler and his collaborators at Rockefeller University. Finally, the research of Member BingKan Xue, which focuses on evolutionary dynamics of microbial populations, also suggests that in the space of possible microbial survival strategies low-dimensional manifolds may emerge as relevant entities. All this work implies that mapping the high-dimensional genetic information to phenotypes and function involves enormous dimensional reduction. One of the challenges of future research will be to understand the underlying mechanisms.

Theoretical Physics

The modern theoretical understanding of fundamental physics is built on the two great revolutions of the twentieth century, encoded in the principles of spacetime and quantum mechanics as united in the framework of quantum field theory. But gravity and quantum

mechanics together make it impossible to talk of precise spacetime events, and there are persistent difficulties in applying quantum mechanics to describe cosmologies like our accelerating universe. These clues suggest that quantum mechanics and spacetime may come to be thought of as approximate, derived ideas from more primitive building blocks. Another clue is the simple fact that we live in a large, macroscopic universe, while violent quantum fluctuations at ultra-short distances would naively seem to destroy any possibility of the large-scale order we see.

These mysteries have continued to drive **Nima Arkani-Hamed**'s research for the past year, and he has been approaching them from two directions.

Given that "spacetime is doomed," a long-term goal of his research has been to reformulate the physics of ordinary quantum field theories so that the usual ideas of quantum-ruled local interactions in spacetime do not play a starring role, but are seen to emerge secondarily from new starting points. A six-year program for doing this in the context of the simplest nontrivial quantum field theory—the famous maximally supersymmetric gauge theory in four dimensions in the planar limit—culminated in the discovery of a new geometric object—the amplituhedron—whose volume calculates the amplitudes for scattering processes in a new way, with the spacetime and quantum interpretation of the amplitudes arising from the logic of the geometry. Arkani-Hamed continues to explore this structure with a number of fellow physicists and mathematicians. A deeper understanding of the geometry has led to a simple but striking conjecture about a hidden positivity of scattering amplitudes, valid to all orders of the perturbative expansion, which has non-trivially passed all checks to date. He has also been extending the understanding of scattering amplitudes from the perspective of this geometry to more general theories, in particular beyond the planar limit and to theories with less supersymmetry.

The question "Why is there a macroscopic universe?" becomes more urgent with the discovery of the Higgs boson; the very simplicity of the Higgs makes its existence extremely mysterious, since violent quantum fluctuations should make its large-scale coherence across our universe impossible in the absence of seemingly absurd fine adjustments of physical parameters. In order to better understand this physics, it is essential to experimentally study the quantum fluctuations in the vacuum and its effects on the Higgs as accurately as we can, and this necessitates a large new experimental facility, taking us an order of magnitude further than the Large Hadron Collider in both precision and energy, housed in a new 100-kilometer accelerator complex. Since giant new particle accelerators take at least two decades to conceive and build, planning for the next stage beyond the LHC must start now. China has indicated a strong interest in hosting this machine, and in 2014, Arkani-Hamed has joined their effort in helping make the physics case for this project, directing a new Center for Future High Energy Physics in Beijing, and helping put together a preliminary conceptual design report for this "Great Collider" to be presented to the Chinese government in early 2015.

Professor **Peter Goddard** has spent much of the year studying equations that encode the kinematics of massless particle interactions and whose solution provides formulae for the tree amplitudes for theories of massless particles in arbitrary dimensions. He has been doing this work in collaboration with Louise Dolan. These equations have been called the scattering equations by Freddy Cachazo, Song He, and Ellis Yuan (CHY), whose work is primarily responsible for the current interest in them.

A year ago, CHY proposed formulae for the tree amplitudes in pure gauge theory, and in gravity, in a spacetime of arbitrary dimension, presenting evidence to support their suggestions. Goddard and Dolan gave a proof of the CHY formulae for pure gauge theory, by first establishing the corresponding result for massless scalar ϕ^3 theory using a BCFW recurrence relation and then extending this to the gauge theory case. Similar methods should work for the case of gravity. As a byproduct of this work, Goddard and Dolan found how to generalize the scattering equations to describe massive particles, enabling the formulae of CHY

Teatime in Fuld Hall Common Room

to be extended to massive ϕ^3 theory.

The scattering equations of CHY are not new, having first been proposed, it seems, by David Fairlie and David Roberts in 1972, in the context of seeking to generalize the dual resonance model that gave birth to string theory, and subsequently appearing in studies by David Gross and Paul Mende in 1988 of the high energy behavior of string theory. Goddard and Dolan found a reformulation of the scattering equations for N particles as a Möbius invariant system of $N-3$ homogeneous equations in N variables, with the exceptional property of being linear in each variable taken separately. This linearity facilitates computation, e.g., the elimination of variables to obtain single variable equations determining the solutions.

Goddard also continued to serve on the boards of institutes in Hong Kong, Jerusalem, São Paolo, and Vancouver.

Joining together quantum mechanics and special relativity led to the development of quantum field theory. This is a theory respecting the causal relations of special relativity, where nothing moves faster than light, as well as the probabilistic rules of quantum mechanics. The vacuum in quantum field theory is a rich and complex state. This complexity arises from the fact that interactions are strictly local and causal, together with the requirements of quantum mechanics. This means that the local degrees of freedom are highly entangled in any physical state, including the vacuum.

When we think about the vacuum near a black hole horizon, this entanglement gives rise to the thermal properties of black holes. This entanglement also contributes to the entropy of black holes. Moreover, consistency of black hole thermodynamics demands some special properties from this entanglement, which are indeed true in general quantum field theories.

In theories of gravity, one expects general connections between geometry and thermodynamics. The entropic interpretation of the area of the horizon of a black hole is a special example. Another

From left to right: Members Vera Gluscevic, Cora Dvorkin, and Mehrdad Mirbabayi attend Paul Steinhardt's talk on quasicrystals. Gluscevic's research focuses on using the cosmic microwave background to test physical theories, including those invoked to explain dark energy and inflation. Dvorkin is connecting ideas in theoretical physics to observable phenomena in cosmology. Mirbabayi works on early universe cosmology and the theory of gravity.

ANDREA KANE

example is the Bousso bound, the idea that the entropy flow through light-like surfaces should be bounded by the area increase of these surfaces. A version of this bound was recently proven in a couple of papers (R. Bousso, H. Casini, Z. Fisher, J. Maldacena, ArXiv:1004.5635, ArXiv:1406.4545) by Professor **Juan Maldacena**, Visitor Horacio Casini, and collaborators using some detailed properties of the entropy of localized states in quantum field theory.

Additional studies of the entanglement properties in the vacuum or other states in the field theory were undertaken by other Members of the School. This included the development of techniques to compute it exactly in various theories. Regions of space that are close to each other are highly entangled. There are good reasons to think that the opposite is also true, that highly entangled states are, in some way, also close to each other, connected by a geometric wormhole with a Lorentzian geometry that does not allow the propagation of signals through it. This connection seems to be present in some very specific examples of the gauge/gravity duality. However, it might be true in

general, with a suitable generalization of the notion of geometry. Understanding how this works in a more precise way was an important part of Maldacena's research efforts.

Professor **Nathan Seiberg**'s activities and interests also circle around questions in quantum field theory. Quantum field theory, which combines quantum theory with Einstein's special relativity, is the language used in the study of elementary particle physics—the basic building blocks of nature and the forces between them. Exactly the same language also turns out to be useful in the study of condensed matter systems, where it describes properties of materials. Also, there are many deep connections between quantum field theory and string theory—our best candidate for a theory of gravity. Finally, quantum field theory is a powerful tool in a number of problems in mathematics. These diverse applications make it an extremely interesting research direction and suggest that it will continue to yield deep and far-reaching consequences.

During the past year, Seiberg focused on specific subtleties in quantum

field theory, which become particularly important when the system under study includes some defects, or when it has a boundary. A careful analysis of such defects and boundaries has uncovered rich and unexpected phenomena. In particular, the theory depends on new subtle data that had not been appreciated earlier. (It is associated with inequivalent consistent ways of summing over non-trivial topological sectors of the gauge fields.) The identification of this data helped resolve a number of confusing problems, especially in the context of electric-magnetic duality. Also, this new understanding has led to the recognition of new surprising behavior about the long-distance behavior of these theories. For example, some systems have a gap in the long distance excitations, but they exhibit long-range topological order. Similar phases had been previously recognized in condensed matter physics, thus demonstrating again the interconnectedness of different branches of science.

Perturbation theory is the general framework for computing quantum effects in physical theories when they are small. (There is no general method to compute quantum effects when they are large: every problem is unique.) In ordinary quantum field theory, pertur-bation theory is based on diagrams that are known as Feynman diagrams, which describe the branching and joining of point particles as they travel through spacetime.

In string theory, the Feynman diagrams are replaced by two-dimensional surfaces, known as Riemann surfaces, which describe the motion of strings in spacetime. Moreover, the version of the theory that really works is based on "super" Riemann surfaces, where the adjective means roughly that some quantum elements are incorporated in the geometry of the two-dimensional surface.

Clarifying the foundations of perturbation theory for superstring theory has been one of the main interests of **Edward Witten**, Charles Simonyi Professor, in recent years. In 2011–13, Witten wrote a series of papers on the general formalism of superstring perturbation theory, and his more recent work has been devoted mainly to concrete examples of how the formalism works in practice. He continued this work in 2013–14 in publications with coauthors Ron Donagi, a Visitor from the University of Pennsylvania, and Nathan Berkovits, a former Visitor (2006) from the Universidade Estadual Paulista in São Paulo, Brazil.

Witten also continued his work on a new quantum or string theory approach to knot theory. In his article "Two Lectures on the Jones Polynomial and Khovanov Homology," he gave an overview of this approach for mathematicians. He developed an important foundational result in this approach in his work with Rafe Mazzeo of Stanford University on "The Nahm Pole Boundary Condition." Work now in course with Mazzeo aims at a refinement of these results.

Finally, Witten approached completion of two major projects with Princeton University students. In "Branes and Supergroups," with Victor Mikhaylov, Witten has extended the concepts in his work on knot theory in a new direction, in which the symmetries are not an ordinary classical Lie group but a "supergroup." This generalization is made possible by a series of surprises, some of which had been foreshadowed by previous results in the literature. And in "Some Details on the Gopakumar-Vafa Formula," with Mykola Dedushenko, Witten has aimed for a much clearer understanding of one of the remarkable formulas that was discovered in string theory work of the 1990s. This formula has had many subsequent applications in mathematics and mathematical physics, but its foundations have been in need of clarification.

2013–14 MEMBERS AND VISITORS

f First Term ✦ *s* Second Term ✦ *m* Long-term Member ✦ *v* Visitor ✦ *vp* Visiting Professor ✦ *jvp* Junior Visiting Professor

Yacine Ali-Haïmoud
Theoretical Astrophysics, Cosmology ✦ Institute for Advanced Study
Frank and Peggy Taplin Member

Tobias Baldauf
Cosmology ✦ Institute for Advanced Study
Funding provided by the W. M. Keck Foundation Fund

Till Bargheer
Quantum Field Theory, String Theory ✦ Institute for Advanced Study
European Commission Marie Curie Fellowship

Christopher John Beem
Theoretical Physics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Ravindra Bhatt
Condensed Matter Physics ✦ Princeton University

Simeon Paul Bird
Cosmology ✦ Institute for Advanced Study
Funding provided by the W. M. Keck Foundation Fund and the National Science Foundation

Kfir Blum
Particle and Astroparticle Physics ✦ Institute for Advanced Study ✦ *m*
Funding provided by the United States–Israel Binational Science Foundation and the United States Department of Energy

Jo Bovy
Cosmology, Astrophysics ✦ Institute for Advanced Study
Space Telescope Science Institute Hubble Fellow

Timothy David Brandt
Astrophysics ✦ Institute for Advanced Study
Corning Glass Works Foundation Fellowship

Simon Caron-Huot
Mathematical Physics, Statistical Mechanics, String Theory, Supersymmetry ✦ Institute for Advanced Study ✦ *m*
Funding provided by the National Science Foundation

Horacio Casini
Quantum Field Theory ✦ Instituto Balseiro and Consejo Nacional de Investigaciones Científicas y Técnicas ✦ *v, s*

Lucy J. Colwell
Applied Mathematics, Biology ✦ MRC Laboratory of Molecular Biology ✦ *v, f*

Paolo Creminelli
Cosmology ✦ The Abdus Salam International Centre for Theoretical Physics, Trieste ✦ *jvp, s*
IBM Einstein Fellow

Raffaele Tito D'Agnolo
Particle Physics ✦ CERN, Institute for Advanced Study
Funding provided by the National Science Foundation

Tudor Dan Dimofte
Mathematical and Particle Physics ✦ Institute for Advanced Study ✦ *m*
William D. Loughlin Member; additional funding provided by the United States Department of Energy

Ron Donagi
Algebraic Geometry and String Theory ✦ University of Pennsylvania ✦ *v*

Cora Dvorkin
Cosmology, Astrophysics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Thomas Faulkner
Theoretical Physics ✦ Institute for Advanced Study ✦ *f*
Funding provided by the National Science Foundation

Raphael Flauger
Theoretical Physics ✦ Institute for Advanced Study
Funding provided by the Raymond and Beverly Sackler Foundation Fund

Vera Gluscevic
Cosmology, Astrophysics ✦ Institute for Advanced Study
Friends of the Institute for Advanced Study Member

Song He
Particle Physics ✦ Institute for Advanced Study
Zurich Financial Services Member; additional funding provided by The Ambrose Monell Foundation

Johannes Henn
Particle Physics ✦ Institute for Advanced Study ✦ *m*
Marvin L. Goldberger Member; additional funding provided by the United States Department of Energy

Anson Hook
Particle Physics ✦ Institute for Advanced Study
Funding provided by the United States Department of Energy

Yu-tin Huang
Particle Physics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Veronika Hubeny
Theoretical Physics ✦ Durham University ✦ *s*
Funding provided by The Ambrose Monell Foundation

Marina Huerta
Field Theory ✦ Instituto Balseiro and Consejo Nacional de Investigaciones Científicas y Técnicas ✦ *v, s*

Boaz Katz
Astrophysics ✦ Institute for Advanced Study ✦ *m*
John N. Bahcall Fellow

Vladimir Kazakov
Quantum Field Theory, String Theory, Statistical Mechanics, Integrability ✦ École Normale Supérieure, Paris ✦ *s*
Funding provided by The Ambrose Monell Foundation

Bence Kocsis
Astrophysics ✦ Institute for Advanced Study
Funding provided by NASA and the W. M. Keck Foundation Fund

Graham Kribs
Particle Physics ✦ University of Oregon ✦ *f*
Funding provided by The Ambrose Monell Foundation

Doron Kushnir
Astrophysics ✦ Institute for Advanced Study
Martin A. and Helen Chooljian Founders' Circle Member

Brian Lacki
Astrophysics ✦ Institute for Advanced Study
National Radio Astronomy Observatory Jansky Fellowship

Ramalingam Loganayagam
Particle Physics ✦ Institute for Advanced Study
Funding provided by the United States Department of Energy

Sergio Lukic
Biology ✦ Institute for Advanced Study
Addie and Harold Broitman Member in Biology

Shiraz Minwalla
Quantum Gravity, Quantum Field Theory, String Theory ✦ Tata Institute of Fundamental Research, Mumbai ✦ *jvp*
IBM Einstein Fellow

Mehrdad Mirbabayi
Astrophysics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Jonathan Mitchell
Astrophysics ✦ University of California, Los Angeles ✦ *jvp, f*
IBM Einstein Fellow

Kohta Murase
Astroparticle Physics ✦ Institute for Advanced Study
Space Telescope Science Institute Hubble Fellow

Jean-Claude Nicolas
Biology ✦ Université Pierre et Marie Curie
Funding provided by the Florence Gould Foundation Fund

Tatsuma Nishioka
Particle Physics ✦ Institute for Advanced Study

Luca Peliti
Statistical Physics ✦ Università degli Studi di Napoli Federico II ✦ *f*

Vasily Pestun
Theoretical Physics ✦ Institute for Advanced Study
Roger Dashen Member; additional funding provided by the National Science Foundation

Rami Pugatch
Biology ✦ Institute for Advanced Study
Eric and Wendy Schmidt Member in Biology

Mukund Rangamani
Particle Physics ✦ Durham University ✦ *s*
Funding provided by The Ambrose Monell Foundation

Leonardo Rastelli
Quantum Field Theory, String Theory ✦ Stony Brook University, The State University of New York ✦ *f*

Shlomo Razamat
Theoretical Physics ✦ Institute for Advanced Study
Martin A. and Helen Chooljian Member; additional funding provided by the National Science Foundation

Amit Sever
String Theory, Quantum Field Theory ✦ Perimeter Institute for Theoretical Physics ✦ *s*
Funding provided by the United States Department of Energy

David Simmons-Duffin
Particle Physics ✦ Institute for Advanced Study
Funding provided by the United States Department of Energy

David S. Spiegel
Exoplanetary Science ✦ Institute for Advanced Study
AMIAS Member

Rashid Sunyaev
Astrophysics ✦ Max–Planck–Institut für Astrophysik ✦ *vp*
Maureen and John Hendricks Visiting Professor

Tiberiu Tesileanu
Biology ✦ Institute for Advanced Study
Charles L. Brown Member in Biology

Tsvi Tlusty
Biology ✦ Institute for Advanced Study
Martin A. and Helen Chooljian Member in Biology

Jihad Touma
Applied Mathematics, Astrophysical Dynamics ✦ American University of Beirut ✦ *v*

Brian M. Willett
Particle Physics ✦ Institute for Advanced Study
Funding provided by the United States Department of Energy

Dan Xie
Particle Physics ✦ Institute for Advanced Study
Funding provided by the United States Department of Energy

BingKan Xue
Biology ✦ Institute for Advanced Study

Masahito Yamazaki
*Particle Physics* ✦ Institute for Advanced Study

Kazuya Yonekura
Particle Physics ✦ Institute for Advanced Study

Nima Arkani-Hamed on the Amplituhedron

"It's not obvious where this is going. Maybe it will be something spectacular. Maybe it will just be a curiosity. We don't know. But it's something. And it's a beautiful something."—Nima Arkani-Hamed

The latest tool for calculating how particles interact (image at right) was introduced in a December 2013 paper, "The Amplituhedron," by Professor Nima Arkani-Hamed and his student Jaroslav Trnka. The amplituhedron gives a concrete example of a theory where the description of physics using spacetime and quantum mechanics is emergent, rather than fundamental.

"The entire drama of twentieth-century physics has been learning how to combine the rules of quantum mechanics and the rules of relativity at the same time," says Arkani-Hamed. "While we have found various ways of making these principles work together, we realize we don't understand very deeply what it is we are dealing with yet. This is tied to one of our deepest challenges in the twenty-first century: What are the building blocks out of which spacetime emerges?"
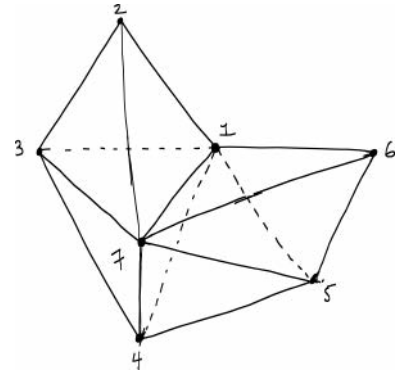
Arkani-Hamed developed the amplituhedron after conversations with Robert MacPherson and Pierre Deligne, Professors in the School of Mathematics, which connected a scattering process for particles to a mathematical structure known as the positive Grassmannian (left image, from a 2012 paper, "Scattering Amplitudes and the Positive Grassmannian," by Arkani-Hamed et al.).
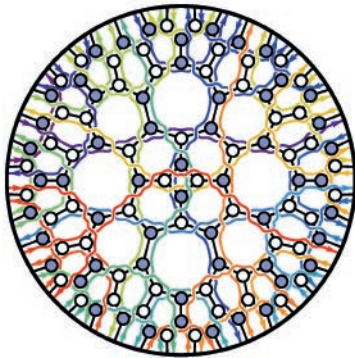
"This work would have never, in my own particular experience, happened anywhere other than the Institute," says Arkani-Hamed. "I got dragged into it, following my nose. To be at a place where I could walk over and talk t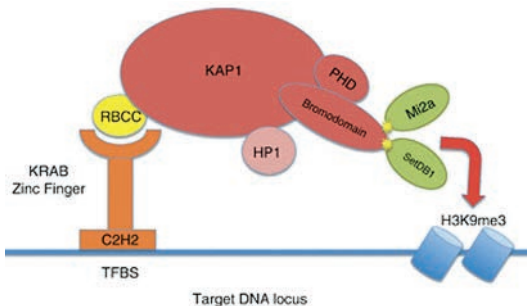o living legends like Pierre and Bob … once a week for three months, for four or five hours at a time. No one had class to rush off to or a committee meeting or other administrative obligations, making it possible to work intensively and get some serious things done."

Arnold Levine on Epigenetics, Virology, and Cancer

What might remnants of ancient retroviral infections reveal about the molecular clock of primate divergence? In a study with Members Sergio Lukic and Jean-Claude Nicolas concerning human endogenous retroviruses, "The Diversity of Zinc-Finger Genes on Human Chromosome 19 Provides an Evolutionary Mechanism for Defense Against Inherited Endogenous Retroviruses" (*Cell Death and Differentiation,* 2014), Professor Emeritus Arnold Levine explored remnants of ancient retroviral infections of the germline that can remain capable of replication within the host genome. About 8 percent of the human genome consists of remnants of endogenous retrovirus (ERV) elements associated with several dozen independent invasions in the human lineage. As evolutionary biologists seek to construct accurate phylogenetic trees, human endogenous retrovirus (HERV) presence may help in assessing the molecular clock of primate divergence. The role and function of proteins coded (HERV-W and ERV-3) may also shed light on key factors in autoimmune disease and maternal immune inhibition during fetal development (spontaneous abortions).

A study with Member (2008–13) Ben Greenbaum and former Members Simona Cocco and Remi Monasson, "Quantitative Theory of Entropic Forces Acting on Constrained Nucleotide Sequences Applied to Viruses" (*PNAS*, 2014), developed a theory, inspired by statistical mechanics, of the interplay of entropic forces and selective forces upon dinucleotide frequencies in viral genomes that occur when a virus migrates to a new host. The theory leads to many predictions about statistical features of viral evolution. The approach is expected to have wider applications. For example, an analysis of avian influenza entering the human genome has identified selection against CG dinucleotides, which have been shown to trigger a response of the innate immune system and interferon production.

An illustration from Professor Levine's paper with Members Sergio Lukic and Jean-Claude Nicolas

In collaboration with former Member Chang Chan and others, Levine studied germline mutation in the tumor suppressor TP53, which causes Li-Fraumeni syndrome (LFS), a complex predisposition to multiple cancers. Types of cancers and ages at diagnosis vary among subjects and families, with apparent genetic anticipation, i.e., earlier cancer onset with successive generations. It has been proposed that anticipation is caused by accumulation of copy number variations (CNV) in a context of TP53 haploinsufficiency. Using genome/exome sequencing, the study found no evidence of increased rates of CNVs in two successive generations of TP53 mutation carriers or in successive generations of Trp53-deficient mice, and it proposed a stochastic model called "genetic regression" to explain apparent anticipation in LFS caused by segregation of rare SNP and de novo mutations rather than by cumulative DNA damage.

Nathan Seiberg on What's Next

CHRIS MADDEN

"Take a look at this everyone - it just could be the signature we've been looking for!"

How will new physics change our view of the world? Professor Nathan Seiberg explored this question in a public lecture at the Institute, excerpts of which follow.

"The model of particle physics uses two of the revolutions of the twentieth century: quantum mechanics and special relativity. The cosmology model uses the third revolution of twentieth-century physics: general relativity. We need to combine the principles of one model with the principles of the other model. In other words, we need to combine quantum mechanics and general relativity. . . .

"We would like to explain all of the parameters in these two models. Some of these parameters are unstable. If we make small changes at short distances, they make a huge difference at long distances. An ongoing experiment, the Large Hadron Collider (LHC), is going to give us input into this question. If there is a stabilizing mechanism for this instability, it will be discovered at the LHC. . . .

"The experiments will find a new stabilizing mechanism or, alternatively, that there is no stabilizing mechanism. If there is no stabilizing mechanism, we may have to go to a multiverse arena where there are lots of universes and we are just in one random universe, where these parameters are environmental; and we will have to start learning how to think about physics in such a setup. Clearly these are very interesting issues. I asked at the beginning of the talk, 'What is next?' The answer is we do not know, but it's guaranteed to be exciting." View the full lecture at https://video.ias.edu/seiberg-2013.

Raphael Flauger on Spacetime Ripples and Galaxy Dust

"Space Ripples Reveal Big Bang's Smoking Gun," read the *New York Times* headline on March 17, 2014. In a seemingly momentous news conference at the Harvard–Smithsonian Center for Astrophysics, researchers using a BICEP (Background Imaging of Cosmic Extragalactic Polarization) telescope at the South Pole announced that they had detected "the first direct evidence for cosmic inflation," a theory about the very beginnings of the universe first proposed in 1979.
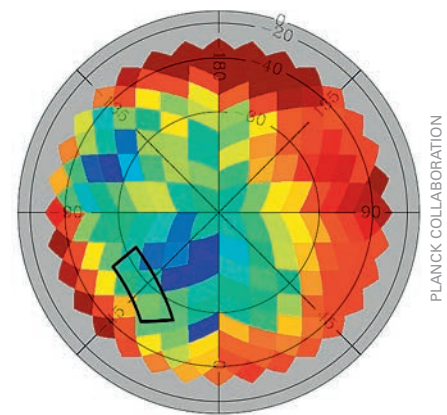
The BICEP announcement claimed that the first images of gravitational waves, or ripples in spacetime, had been detected, a tantalizing and long hoped-for connection between quantum mechanics and general relativity. The landmark claim ignited the field and led to talk of a new era of cosmology.

At the Institute, Member Raphael Flauger began looking closely at the data. The year prior, Flauger had analyzed the first round of cosmic microwave background data released by the Planck satellite, a mission of the European Space Agency, which the BICEP team had used in its findings.

"Initially, the announcement was very exciting," says Flauger. "Like everyone, I thought it would be great if they had detected quantum fluctuations in the spacetime metric that were generated when the universe was 10^{-30} seconds old. That's a big, big thing to look at. It was a unique opportunity."

PLANCK COLLABORATION

Planck data indicating levels of dust contamination in the southern galactic sky, with red regions the most contaminated and blue regions the least. The black outline in the lower left quadrant shows the approximate region studied by BICEP.

But as Flauger delved deeper into the evidence, he grew to doubt whether the BICEP team had detected evidence of primordial gravitational waves. The issue hinged on the nature of the detected B-modes, a polarization pattern identified as a means for detecting such waves by Matias Zaldarriaga, Professor in the School of Natural Sciences, and Uros Seljak in 1997. Foreground contamination from dust in the Milky Way can lead to a similar B-mode signature. Flauger began to believe that the BICEP team had underestimated the level of dust in a Planck slide, based on unpublished polarization data, that the team had lifted from a 2013 presentation and used in their study.

Flauger presented his own analysis at Princeton University in May 2014, and his doubts and those of others about BICEP's claims were widely reported in the media. "BICEP definitely detected B-modes, but it is unclear if they are caused by primordial gravitational waves or if they are caused by dust in our galaxy," says Flauger, who coauthored the paper "Toward an Understanding of Foreground Emission in the BICEP2 Region" with astrophysicists James Colin Hill and Visitor David Spergel. Read more at www.ias.edu/flauger-bicep.

Juan Maldacena on Entanglement and the Geometry of Spacetime
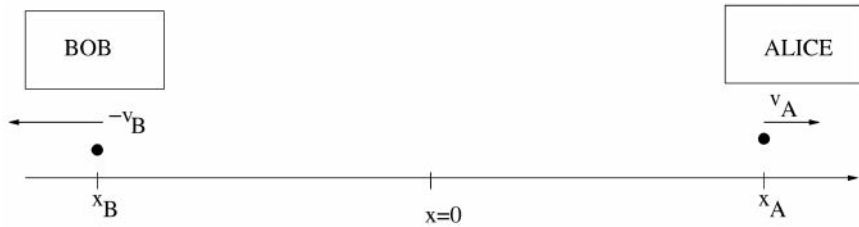
Can the weird quantum mechanical property of entanglement give rise to wormholes connecting far away regions in space? Professor Juan Maldacena explains how this is possible. He begins with two papers written in 1935 by Albert Einstein and collaborators at the Institute for Advanced Study. The first paper, written with Boris Podolsky and Nathan Rosen and commonly known as EPR, pointed out that quantum mechanics has a funny property now known as quantum entanglement wherein two distant physical systems are mutually connected. The second paper, written by Einstein and Rosen, describes a wormhole or Einstein-Rosen bridge connecting regions of spacetime that are far away. Though these papers seemed to be on two completely disconnected subjects, recent research by Maldacena and others suggest that they are closely connected.

The figure above shows the setup for the EPR experiment. Two particles are generated at $x = 0$ moving with relative velocity v^{rel}. Alice and Bob are two distant observers who can choose to measure either the position or velocity of their respective particles. They do this many times, always starting from the same state. Alice finds a very random set of possible results for the measurement of the position of her particle and a similarly random set when she decides to measure the velocity. Similar results hold for Bob. However, when both Alice and Bob measure the positions, they are perfectly correlated. The same holds when they both measure the velocity. Read more at www.ias.edu/maldacena-entanglement.
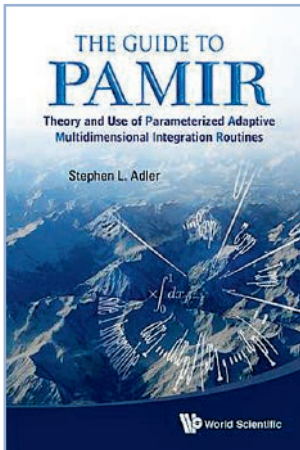
Stephen Adler on Emergent Quantum Theory and Gravity

After finishing his PAMIR(Parameterized Adaptive Multidimensional Integration Routines) numerical integration project, which resulted in a short book and programs online, Professor Emeritus Stephen Adler returned to the program of creating a pre-quantum theory as outlined in his book *Quantum Theory as an Emergent Phenomenon* (Cambridge University Press, 2004). Adler's aim this past year was to expand the treatment of the book to include gravitation and related issues in cosmology, and to try to connect it to particle phenomenology.

The biggest mysteries in cosmology are the origins of the dark matter that comprises about 24 percent of stuff in the universe, and the dark energy that comprises about 72 percent, the remaining 4 percent being the ordinary matter that we are made of. Adler's pre-quantum ideas suggest that there are two sectors to particle physics, one where quantum mechanics uses an imaginary unit i and one where it uses the imaginary unit $-i$ (both of which are square roots of –1). In a short essay, he suggested that dark matter may comprise a hidden sector where quantum theory has an imaginary unit of opposite sign to that in our sector. In exploring the incorporation of gravity into his pre-quantum framework, Adler suggested that there is a frame-dependent correction to Einstein gravity (presumably tied to the rest frame of the cosmological background radiation). For cosmology, this has just the form of the usual dark energy, but for other situations, such as around a black hole, it has a very different form. Working out the consequences for a black hole in collaboration with Princeton University postdoc Fethi Ramazanoglu, they found that the frame-dependent correction term leaves the astrophysics of black holes unchanged, but eliminates the black hole horizon when one looks within microscopic distances of where the horizon is expected to be. This could have important implications, yet to be worked out, for paradoxes connected with loss of information when things fall into a black hole.

Adler's book on emergent quantum theory suggests a connection to theories in which state vector reduction is a real physical process. In a final piece of gravity-related work this past year, he proposed that the universal noise needed in such theories arises from small, complex number-valued fluctuations in the spacetime metric, i.e., complex number-valued "spacetime foam," an idea that will appear in a Cambridge University Press book commemorating the fiftieth anniversary of the Bell inequalities.

Adler's pre-quantum ideas require boson-fermion balance (i.e., equal numbers of bosonic and fermionic degrees of freedom), which is a weaker requirement than full supersymmetry. Implementing this idea using counting inspired by the most symmetric supergravity model has led to a proposal for a novel grand unification theory that connects to experimentally viable phenomen-ology. This was an unanticipated result, and it will be the focus of his research next year. His proposal for a new grand unified theory will appear in a World Scientific book commemorating the fiftieth anniversary of the quark model.

Freeman Dyson on Blunders

How do blunders play an important role in science? In an article for the *New York Review of Books* ("The Case for Blunders," March 6, 2014), Professor Emeritus Freeman Dyson explains:

> Science is not concerned only with things that we understand. The most exciting and creative parts of science are concerned with things that we are still struggling to understand. Wrong theories are not an impediment to the progress of science. They are a central part of the struggle.... No matter whether wrong ideas are helpful or unhelpful, they are in any case unavoidable. Science is a risky enterprise, like other human enterprises such as business and politics and warfare and marriage. The more brilliant the enterprise, the greater the risks. Every scientific revolution requires a shift from one way of thinking to another. The pioneer who leads the shift has an imperfect grasp of the new way of thinking and cannot foresee its consequences. Wrong ideas and false trails are part of the landscape to be explored.

Shiraz Minwalla on Connections Between Fluid Dynamics and Gravity
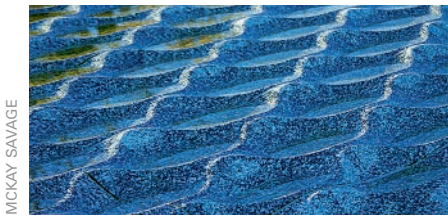
MCKAY SAVAGE

How does the movement of water molecules correspond to ripples in space-time? Member Shiraz Minwalla explores an interesting connection between the equations of hydrodynamics and superfluid dynamics and Einstein's equations of general relativity. In particular, Minwalla's research concerns how the equations of hydrodynamics pop up in an apparently completely unrelated setting: in the study of the long wavelength dynamics of black holes governed by Einstein's equations with a negative cosmological constant.

Recent theoretical investigations within string theory have focused attention on Einstein's equations with a negative cosmological constant (negative value of λ). The simplest solution of this equation, which does not have flat space as a solution, is a highly symmetric spacetime called anti-de Sitter (AdS) space. Minwalla looks at asymptotically AdS solutions of Einstein's equations with a negative cosmological constant in five spacetime dimensions, which (with or without a gravitational constant) admit a huge variety of black hole solutions. The equations with a negative cosmological constant also admit rather unusual related solutions called black branes. The exact four-parameter set of time-independent black brane solutions may be generalized to an infinite number of approximate solutions of Einstein's equations. These solutions are characterized by varying (rather than uniform) energy and momentum density fields. The fields are functions of spatial position as well as time, but are constrained to obey dynamical equations. Minwalla explains the so-called fluid-gravity correspondence, wherein long wavelength fluctuations of black branes are governed by the equations of hydrodynamics, with gravitationally determined constitutive relations. Read more at www.ias.edu/minwalla-dynamics.

LUCY COLWELL/WWW.PYMOL.ORG

Lucy Colwell on Using Protein Sequences to Predict Structure

How do proteins self-assemble into functional molecules? Member Lucy Colwell describes how each protein (the molecules that enable life, numbering around 50,000 in the human genome and as many as 20,000,000 copies in a single cell) is a remarkable example of a self-organizing system. Once folded, the protein is described as a monomer, and often different monomers or multiple copies of the same monomer self-assemble into protein complexes that form functional molecules.

"We currently live in a hugely exciting time for the biological sciences, for the simple reason that technological advances have greatly increased our ability to accurately collect large amounts of data. In particular, over the last twenty years our ability to cheaply and precisely determine the sequences of proteins has vastly increased, leading to the assembly of large, freely accessible collections of protein sequences from different species," says Colwell.

"However, experimentally determining the three-dimensional structure of a protein is expensive and difficult, leading us to ask if we can use the sequence data available for each protein to predict its three-dimensional structure. The crucial point is that the sequence of a particular protein varies between different species. Hemoglobin, the protein in our blood that binds and transports oxygen, provides a good example. Versions of hemoglobin from different species are very similar, both in their three-dimensional structure and in the function they carry out. However, there are differences between the hemoglobin amino acid sequences that occur in different species. An exciting current direction of research is to exploit this evolutionary sequence variation and crack the code that relates amino acid sequence to protein structure and function." Read more at www.ias.edu/colwell-proteins.

Danielle Allen, pictured here leading a seminar for Members, was elected Chair of the Pulitzer Prize Board. Read her remarks to the Pulitzer Board's annual luncheon at www.pulitzer.org/allen_2014luncheon_remarks.

School of Social Science

The School of Social Science, founded in 1973, is devoted to a multidisciplinary, comparative, and international approach to the analysis of societies and social change and the examination of historical and contemporary problems. Every year, the School designates an annual theme, although some Members are selected to pursue research in other areas.

HOW CAN AND SHOULD A TOPIC AS LARGE AND UNWIELDY AS "the environment" be studied in the social sciences? This was a central question of the 2013–14 theme seminar, "The Environmental Turn and the Social Sciences," directed by Professors Didier Fassin and Joan Wallach Scott. Climate change was one aspect of the material covered, which included the utility of the concept of the Anthropocene—an informal geologic chronological term coined in the 1980s that refers to the ways in which human activities have had a significant global impact on the Earth's ecosystems. The diversity of the participating Members—anthropologists, sociologists, philosophers, historians, and scholars of literature and of international relations—was reflected in the additional topics covered, which included residential water delivery in Mumbai, the polluting effects of leather tanning in Japan, the situation of Indigenous groups in the Amazon, the history and politics of environmental movements, and the role of zoos in establishing our relation to nature. The theme seminar also gave rise to an ongoing project that involves writing critical joint papers about the current focus in the social sciences and humanities—apparent in philosophy, literature, political science, gender studies, science, and technology studies—on what some are calling the "posthuman," meaning the exploration of the independent agency of animals and things as they impact human life.

How can the ideal of political equality be revived and more broadly understood beyond its standard association with voting and civic rights? The work of **Danielle Allen**, UPS Foundation Professor, turned around this question through her book *Our Declaration* (Liveright Publishing Corporation, 2014); her editing of "From Voice to Influence: Citizenship in a Digital Age" (University of Chicago Press, forthcoming in spring 2015) to which she contributed three chapters having to do with new media and civic agency; her Tanner Lectures on "Education and Equality" for October 2015; a set of interconnected essays for a draft monograph under the working

FACULTY

Danielle Allen
UPS Foundation Professor

Didier Fassin
James D. Wolfensohn Professor

Dani Rodrik
Albert O. Hirschman Professor

Joan Wallach Scott
Harold F. Linder Professor

PROFESSOR EMERITUS

Michael Walzer

title "Democracy as Justice"; and her participation in the MacArthur Foundation research network on youth and participatory politics. One of the central questions of the research network is how to engage young people in ethical and equitable forms of public participation.

In addition, Allen has been building the Democratic Knowledge Project, a series of interconnected research and action projects that involve the bodies of knowledge, skills, and capacities that are necessary to sustain democratic political institutions over the long term. The Democratic Knowledge Project encompasses research initiatives concerning the value of the humanities and liberal arts to civic education; the relationship between arts of "bonding" and arts of "bridging" in the formation of social capital; the integration of traditions of political thought from around the globe; and the ethical, pragmatic, and psychological demands placed on citizens in contemporary, digital public spheres.

For 2013–14 Members who were not connected with the theme year,

Allen organized a work-in-progress seminar. Topics spanned from nineteenth-century shipwrecks and humanitarian relief organizations to Japanese employee trainings; from cooperation in the context of war to Latino Republicans; from election-related effects on national economies to religion and politics in South Sudan.

How can the social sciences approach morals and ethics in a way that is both distinct from and complementary to the philosophical approach? An attempt to answer this question was a four-year project, "Toward a Critical Moral Anthropology," which **Didier Fassin**, James D. Wolfensohn Professor, concluded in 2013. The project, which was awarded an Advanced Grant "Ideas" by the European Research Council, involved the proposal of an interpretive framework, combining moral economies, to analyze broad evolutions in terms of legitimate values and effects, such as the recent emergence of humanitarianism, on the one hand, and ethical subjectivities, to account for individual dilemmas, deliberations, and decisions in concrete situations, on the

other. The empirical part of the project consisted in a collective research using this framework to study contemporary transformations of the state, in particular when confronted with the management of precarious populations such as the poor, minorities, immigrants, and asylum seekers. Three ideal-typical forms were discussed —the social, punitive, and liberal state— which create tensions within a given national context at a specific historical time. The theoretical dimension was developed in *Moral Anthropology: A Critical Reader* (Routledge, 2014), whereas the empirical one will be presented in the forthcoming "At the Heart of the State: The Moral World of Institutions" (Pluto Press). Fassin delivered a series of keynote and invited lectures on these questions in the United States, Latin America, and Europe, as well as a course on "The Ethnography of the State" at the École des Hautes Études en Sciences Sociales in Paris.

As an extension of this research, Fassin conducted an epistemological and ethical reflection on what is generally

Wendy Griswold, Rosanna and Charles Jaffin Founders' Circle Member, studies literature and American cultural regionalism: distinctive, place-based cultural forms at any level. Her research, which extends from the nineteenth century to the present, supports the thesis that literature—and not just works but authors, institutions, and readers—produces the understandings and practices associated with enduring cultures of place.

Professor Dani Rodrik, pictured here giving a lecture at IAS on economic convergence, recently joined the Global Commission on the Economy and Climate, an international initiative to analyze and communicate the economic benefits and costs of acting on climate change. Rodrik writes a monthly column for *Project Syndicate*, which may be read at www.project-syndicate.org/columnist/dani-rodrik.

regarded as the major qualitative method in the social sciences: ethnography. One can consider ethnography both from a genealogical perspective as the long-term observation of a local community, be it an African village or a French police precinct, and from an etymological point of view as the exercise of rendering this social world and the lives of the people inhabiting it through writing. How, then, can these local findings be converted into general statements about social mechanisms and processes and how can local scenes be related to larger historical changes and political issues? Addressing these issues led to discussions of the links and differences between the social sciences and the world of fiction and art as well as the public role of the ethnographer in contemporary society. This was the subject of Fassin's keynote lectures at the annual conferences of the Canadian Anthropology Society in Toronto and of the British Society of Criminology in Liverpool, a course on "Ethnography and Its Publics" at Princeton University, and articles published in *Social Science and*

Medicine, *Cultural Anthropology*, and *American Ethnologist*. It is also on this theme that two international workshops on "Ethnography and Policing" and on "Public Ethnography" were hosted at the Institute, with the support of the Fritz Thyssen Stiftung.

The research of **Dani Rodrik**, Albert O. Hirschman Professor, focused on three lines of inquiry in 2013–14. First, he continued his research on economic growth in the developing and emerging-market economies. In this research, Rodrik underscored the importance of the process of structural transformation and, in particular, industrialization as a driver of growth. He examined the rate of structural transformation in diverse countries and produced an introduction to a collection of country studies on the subject, as well as a paper that examines Africa's future growth prospects from this perspective. The second line of his research examined the role of ideas, as distinct from vested interests, in determining political outcomes. Working jointly with the University of Warwick's

Sharun Mukand, Rodrik is building on his 2014 *Journal of Economic Perspectives* article to formulate a theory of the "political economy of ideas." This conceptual work is paired with an empirical project designed to quantify and analyze the extent to which political speech appeals to ideas, whether in the form of identity politics or worldview politics. Finally, Rodrik also has been writing a book on the role of "models" in economics. The book explains how models are the scientific core of economics, although they are often misunderstood by outsiders and misused by economists themselves. Economics is a collection of models that clarify the nature of causal relationships and their implications. They are necessarily setting specific, so model selection plays a critical, though underappreciated, role in making economics a useful science. The diversity of models belies the charge that economics is a homogenous discipline that always provides the same answer to policy questions. But economists are often their worst enemy insofar as they have

Member Ellen Stroud (second from left) talks with other scholars at an After Hours Conversation. Stroud's research focuses on unexpected connections between social processes and both built and natural environments. At the Institute, she worked on an environmental history of the modern American corpse, examining the role of dead human bodies in the shaping of twentieth-century American landscapes.


Nikhil Anand, Wolfensohn Family Member, researches the politics and ecology of urban infrastructures. At the Institute, he gave a talk on biopolitics and the state of water pipes in Mumbai. He is pictured here (second from right) attending the School's theme seminar, "The Environmental Turn and the Human Sciences," organized by Professors Didier Fassin and Joan Wallach Scott.

a tendency to overlook the contextual nature of their analysis and treat *a* model as *the* model.

Joan Wallach Scott, Harold F. Linder Professor, has been working on a book about secularism and its relationship to gender equality. The book (under contract with Princeton University Press) is in response to the "clash of civilizations" rhetoric that has posed the contrast between Islam and the West in terms of the oppression or the emancipation of women. In this polemic, it is the religion of Islam that is taken to be responsible for women's oppression, the secularism of the West that enables their emancipation.

Scott's work and that of many other feminist and postcolonial historians suggests a more complicated picture about secularism in the West. In her book, she returns to that scholarship in order to make more complex the story of secularism and equality. She argues that secularism—a political movement to subordinate religious authority to state regulation—was not initially concerned with equality. Secularism was a discourse about state neutrality in relation to the private conscience of individuals and about the absence of institutional religion in the domain of politics. Moreover, the process of secularization—the substitution of the profane (rational calculation, divisions of labor, bureaucracy, market calculation) for the sacred in the organization of the nation-state—introduced ideas about the family and women that justified gender inequality.

Scott's book will recount this history. She argues that although there are many important differences, the stark Islam/West opposition covers over continuing inequalities on both sides of the divide. Scott developed the arguments for the book chapters in a series of lectures given as a Visiting Distinguished Fellow for the Program for the Study of Women, Gender, and Sexuality at Johns Hopkins University; as the Priestly Lecturer at University College of the University of Toronto; as the Byrne Lecturer at Vanderbilt University; and as a participant in a conference on "Emancipation" in Paris.
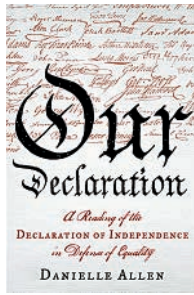
OUR DECLARATION **by Danielle Allen**
(Liveright Publishing Corporation, 2014)

Troubled by the fact that so few Americans actually know what it says, **Danielle Allen** explores the arguments of the Declaration with both adult night students and University of Chicago undergraduates, and finds that while it is riddled with contradictions—liberating some while subjugating slaves and Native Americans—the Declaration nevertheless makes a coherent argument about equality.
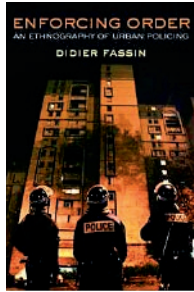
ENFORCING ORDER **by Didier Fassin**
(Polity Press, 2013)

Based on a fifteen-month ethnographic study carried out by **Didier Fassin**, this book examines the daily interactions between the police and the inhabitants of disadvantaged neighborhoods outside of Paris. Describing the invisible manifestations of violence and unrecognized forms of discrimination against minority youth, undocumented immigrants, and Roma people, it analyzes the historical, political, and social conditions that make them possible and tolerable.

"ECONOMICS: SCIENCE, CRAFT, OR SNAKE OIL?" **by Dani Rodrik**
(*The Institute Letter*, Fall 2013)

Dani Rodrik describes the flexible, contextual nature of his field, arguing that economists devote too little time to determining which model best applies to a particular real-world setting. Read more at www.ias.edu/rodrik-economics.

"JOAN W. SCOTT'S CRITICAL HISTORY OF INEQUALITY" by Clyde Plumauzille
(*The Institute Letter*, Summer 2014)

With each shift in her historiographical focus, **Joan Wallach Scott** has found the material needed to fuel her critical thought and shed light on the blind spots of social systems from the time of the French Revolution until the present day. Read more at www.ias.edu/plumauzille-scott.

MICHAEL WALZER ON *DISSENT*

In his remarks at *Dissent*'s sixtieth anniversary celebration on October 24, 2013, **Michael Walzer**, who co-edited the magazine from 1975 until 2013, articulated *Dissent*'s commitments as believing "in the possibility of—not perfect justice, not the messianic kingdom, not even a classless society—but what Irving Howe called 'a world more attractive'—more attractive than the one we live in: a better place, a more egalitarian society."

2013–14 MEMBERS AND VISITORS

Nikhil Anand
Anthropology, Geography ✦ University of Minnesota
Wolfensohn Family Member

Cristina Beltrán
Political Science ✦ New York University

Elizabeth Popp Berman
Sociology ✦ University at Albany, State University of New York
Richard B. Fisher Member

Milton Cameron
Philosophy ✦ The Australian National University ✦ *v*

Brandice Canes-Wrone
Political Science ✦ Princeton University
Roger W. Ferguson, Jr., and Annette L. Nazareth Member

Filippo Cesarano
Economics ✦ Institute for Advanced Study ✦ *v, f*

Yvonne Chiu
Political Science ✦ The University of Hong Kong

Nitsan Chorev
Sociology ✦ Brown University
AMIAS Member

Elizabeth Anne Davis
Anthropology ✦ Princeton University

Omar Dewachi
Anthropology ✦ American University of Beirut ✦ *v, f*

Pinar Doğan
Economics ✦ John F. Kennedy School of Government, Harvard University ✦ *v*

James Doyle
Philosophy ✦ Institute for Advanced Study ✦ *v*

Jeffrey Flynn
Philosophy ✦ Fordham University

David I. Grazian
Sociology ✦ University of Pennsylvania

Mark Greif
Literature, Intellectual History ✦ The New School

Wendy Griswold
Sociology ✦ Northwestern University
Rosanna and Charles Jaffin Founders' Circle Member

Joseph D. Hankins
Anthropology ✦ University of California, San Diego

Dagmar Herzog
History ✦ The Graduate Center, The City University of New York ✦ *v, s*

Gabrielle Benette Jackson
Philosophy ✦ University of Toronto ✦ *v*

Dale Jamieson
Environmental Studies, Philosophy ✦ New York University

Joseph P. Masco
Cultural Anthropology, Science Studies ✦ The University of Chicago
Ralph E. and Doris M. Hansmann Member

Ann McGrath
History ✦ The Australian National University
Louise and John Steffens Founders' Circle Member

Ramah McKay
Anthropology ✦ University of Minnesota ✦ *v*

Vanessa Ogle
International and Global History ✦ University of Pennsylvania

John F. Padgett
Political Science ✦ The University of Chicago
Deutsche Bank Member

Manuela Lavinas Picq
Political Science ✦ Universidad San Francisco de Quito

Noah Salomon
Religion ✦ Carleton College

Kim Lane Scheppele
Law · Princeton University ✦ *j*

Sverker Sörlin
Environmental History, History of Science ✦ KTH Royal Institute of Technology, Stockholm

Ellen Stroud
U.S. Urban and Environmental History ✦ Bryn Mawr College
Frederick Burkhardt Fellowship funded by the American Council of Learned Societies

Joanna Tokarska-Bakir
Cultural and Historical Anthropology ✦ Uniwersytet Warszawski ✦ *v, f*

Henning Trüper
History ✦ Centre de Recherches Historiques, École des Hautes Études en Sciences Sociales, Paris

Richard York
Sociology ✦ University of Oregon
Friends of the Institute for Advanced Study Member

CHRIS MADDEN

GABRIELLE BENETTE JACKSON ON CONSCIOUSNESS

How do we understand consciousness without becoming complicit in that understanding? Visitor Gabrielle Benette Jackson, Assistant Professor at Stony Brook University, looked at the role of neurophenomenology in understanding the relationship between the mind and the body— between consciousness and the physical substrates that realize it. The deeper problem of trying to investigate consciousness, contends Jackson, is that "we never establish identity statements linking neurochemical processes directly to consciousness. What we do get are equivalences linking our conception of neurochemical processes to our conception of consciousness. We then have to wonder how accurate and stable our concepts are. To what extent do the concepts we use transform the explananda?" Read more at www.ias.edu/jackson-consciousness.

ANDREA KANE

SVERKER SÖRLIN ON THE ENVIRONMENT

Will the environmental turn in the human sciences become decisive enough? Member Sverker Sörlin, Professor of Environmental History in the Division of History of Science, Technology, and Environment at the Royal Institute of Technology, argues that "in a world where cultural values, political and religious ideas, and deep-seated human behaviors still rule the way people lead their lives, produce, and consume, the idea of environmentally relevant knowledge must change. We cannot dream of sustainability unless we start to pay more attention to the human agents of the planetary pressure that environmental experts are masters at measuring but seem unable to prevent." Sörlin is cofounder of the KTH Environmental Humanities Laboratory and editor, with Libby Robin and Paul Warde, of *The Future of Nature: Documents of Global Change* (Yale University Press, 2013), which recently won the New England Book Fair Prize for Best Edited Collection. Read more at www.ias.edu/sorlin-environment.

LT. THOMAS K. AITKEN, BRITISH ARMY PHOTOGRAPHER/IMPERIAL WAR MUSEUMS

YVONNE CHIU ON CONSPIRING WITH THE ENEMY AND COOPERATING IN WARFARE

What role does cooperation play in warfare? From soccer games to drone ethics, Member Yvonne Chiu described how some of the more amazing stories of cooperation in warfare come from the trenches of World War I and a "live and let live" system that led to a reciprocal exchange—of minimization of injury and death. Chiu notes that 1) cooperation in warfare is certainly not the norm, 2) cooperation in warfare is not a uniquely modern phenomenon, and 3) the rules are not always obeyed and are more often deliberately violated. She also addresses how the idea of cooperation has adapted to developments in technology, how the ethic of cooperation has worked its way into practical thinking about just war theory, and how a belief in reciprocal risk still persists, particularly in debates about the fairness and ethics of drone warfare. Chiu is Assistant Professor in the Department of Politics and Public Administration at the University of Hong Kong. Read more at www.ias.edu/chiu-war. *Pictured at left: A wounded German soldier lights a cigarette for a wounded British soldier at a British field hospital during the Battle of Épehy, near the end of the First World War.*

Figure 1. Multiple-network ensemble Renaissance Florence
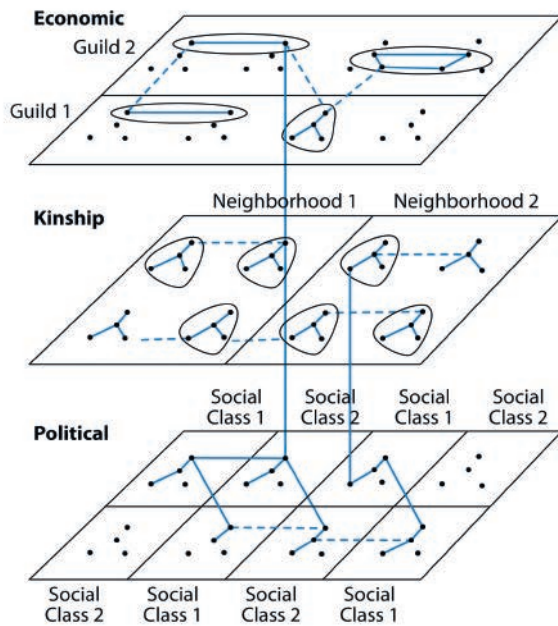
Note: a) Solid lines are constitutive ties. Dotted lines are relational social exchanges. Oblongs are formal organizations (families and firms.)
b) People in multiple roles are vertical lines connecting corresponding dots in the domains of activity in which people are active. (Only two are shown.)

JOHN PADGETT

JOHN PADGETT ON HISTORY, EVOLUTION, AND SOCIAL NETWORKS

Where do new types of people, organizations, social movements, states, and markets in history come from? John Padgett, Deutsche Bank Member, sketched one way in which coevolution and autocatalysis can be conceptualized in terms of the multiple social networks of Renaissance Florence (see image above). He suggests that the largest outstanding gap in social science's collective understanding is our weak processual knowledge about the emergence of actors and proposes that history might fruitfully be analyzed, in line with the new scientific maturity in biochemistry, as interacting sets of dynamically evolving (and tipping) networks of people and practices. Padgett is Professor of Political Science at the University of Chicago, with courtesy appointments also in the Departments of Sociology and History. Read more at www.ias.edu/padgett-evolution.

KIM LANE SCHEPPELE ON GLOBAL SECURITY LAW AFTER 9/11

What happened when the United Nations Security Council passed Resolution 1373 to fight terrorism but failed to define it? Kim Lane Scheppele, a joint Member in the Schools of Historical Studies and Social Science, explored how more than a decade after the attacks of 9/11, global security law is still setting the framework for some of the most worrisome legislation around the world.

According to Scheppele, the passing of Resolution 1373, which represented the first time in the history of international law that a nonrepresentative body within an international organization claimed the power to make binding law for all member states, has "encouraged the worldwide creation of new, vague, and politically defined crimes; sanctioned evasion of prior legal limits before state authorities could search places and people; launched massive new domestic surveillance programs to capture electronic communications; encouraged states to spy on people within and across their borders; moved toward preventive detention and aggressive interrogation regimes; and installed new barriers in international migration." Scheppele is Laurance S. Rockefeller Professor of Sociology and International Affairs in the Woodrow Wilson School and the University Center for Human Values at Princeton University. Read more at www.ias.edu/scheppele-terrorism.

MILTON CAMERON ON ALBERT EINSTEIN'S INFLUENCE ON ARCHITECTURE
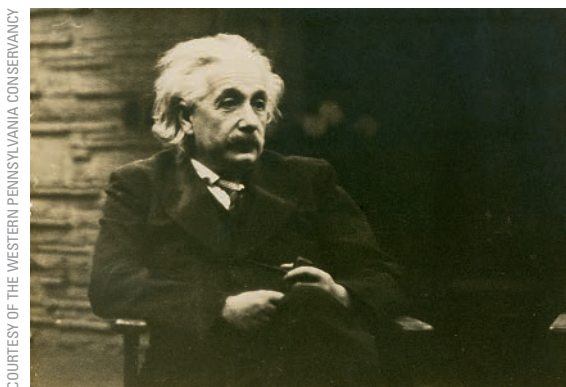
COURTESY OF THE WESTERN PENNSYLVANIA CONSERVANCY

What was the nature of the relationships between Albert Einstein and architects Frank Lloyd Wright and Le Corbusier? Visitor Milton Cameron researched ways in which modern architects and architectural historians sought to associate themselves with Einstein (seen here in the living room of Wright's Fallingwater) to gain intellectual credibility for their own work, or attempted to use aspects of Einstein's theories as metaphors for their own thought processes or as catalysts for paradigm shift within architectural design. Read more at www.ias.edu/cameron-einstein.

The Nunc Ensemble's artistic director and violinist/violist, Miranda Cuckson, performs composer Brian Ferneyhough's violin solo "Intermedio alla Ciaccona," displayed behind her, to a sold-out show in Wolfensohn Hall as part of the 2013–14 Edward T. Cone Concert Series.

Special Programs and Outreach

The Institute for Advanced Study is committed to the idea that science and learning transcend all geographic boundaries and scholastic disciplines, and that scholars and scientists are members of one commonwealth of the mind. It engages with the greater Princeton community through public lectures, concerts, and events, and extends its influence beyond academia through innovative programs designed to inspire and educate.

BEYOND THE WORK THAT TAKES PLACE in the four Schools, the Institute's scope is broadened and enhanced by its special programs, which contribute much to the vitality of the Institute.

The Program in Interdisciplinary Studies, directed by Professor Piet Hut, explores ways of viewing the world that span a range of disciplines from computational astrophysics, geology, and paleontology to artificial intelligence, cognitive psychology, and philosophy.

The Director's Visitor program enables the Director to invite scholars from a variety of fields, including areas not represented within the four Schools, to participate in the range of intellectual and social activities at the Institute. Beginning with Director J. Robert Oppenheimer (1947–66) and formalized by Director Harry Woolf (1976–87), the program has included nearly eighty scholars invited as Director's Visitors, including philosopher Paul Benacerraf, biochemist Paul Berg, political theorist Isaiah Berlin, former U.S. Ambassador William H. Luers, and writer Sylvia Nasar.

Throughout each academic year, the Institute offers lectures and special events that are open to the public, as well as the Edward T. Cone Concert Series and talks organized by the Institute's Artist-in-Residence. The Artist-in-Residence Program was established in 1994 to create a musical presence within the Institute community, and to have in residence a person whose work could be experienced and appreciated by scholars from all disciplines. Artists-in-Residence have included Robert Taub, Jon Magnussen, Paul Moravec, Derek Bermel, and, as of 2013, Sebastian Currier.

The Institute also engages in outreach beyond its local community. Since 1994, the IAS/Park City Mathematics Institute has integrated mathematics educators, researchers, and students through innovative programs. The Program for Women and Mathematics, sponsored jointly with Princeton University, provides substantive mathematics content as well as practical encouragement for women to pursue careers in the field of mathematics.

The School of Natural Sciences sponsors Prospects in Theoretical Physics, a two-week residential summer program held at the Institute for exceptionally promising graduate students and postdoctoral scholars. In 1999, the Institute created the Science Initiative Group, an international team of scientific leaders and supporters dedicated to fostering science in developing countries.

SPECIAL PROGRAMS

Program in Interdisciplinary Studies

Director's Visitors

Artist-in-Residence Program

OUTREACH

IAS/Park City Mathematics Institute

Women and Mathematics Program

Prospects in Theoretical Physics

Science Initiative Group

AMY RAMSEY

SPECIAL PROGRAMS

PROGRAM IN INTERDISCIPLINARY STUDIES

Left: Professor Piet Hut (right) hosts a series of lunchtime discussions. *Center*: An interdisciplinary group of scholars met regularly to discuss the search for life outside of our own planet. *Right*: Hut's "Category Theory for Scientists" workshop at IAS

As head of the Program in Interdisciplinary Studies at the Institute, Professor **Piet Hut** interacted with a range of Visitors in his program, covering areas from astrophysics, physics, mathematics, statistics, chemistry, genomics, bioinformatics, computer science, and artificial life to sociology, political science, literature, art history, philosophy, and photography.

During the year, Hut continued to lead a series, After Hours Conversations, together with colleagues Patrick Geary from the School of Historical Studies, Didier Fassin from the School of Social Science, and Helmut Hofer from the School of Mathematics. These conversations were held at IAS twice weekly for two months during each semester, and they were widely seen as an effective way to encourage inter-School communication at the Institute. In addition, Hut ran a series of weekly informal lunch conversations, IPA@IAS, short for Interdisciplinary Perspectives on Abiogenesis, on various topics related to astrobiology in general, and the origin of life in particular.

In other areas of astrophysics, Hut continued his research with Ataru Tanikawa, Douglas Heggie, and Jun Makino on the formation of double stars in dense stellar systems. They published a detailed analysis showing how such binary stars are typically formed through complex simultaneous multi-body interactions, in contrast to the conventional wisdom that three-body interactions dominate their formation process. Hut was also a member of the Advisory Committee for "GRAVASCO: N-Body Gravitational Dynamical Systems from $N=2$ to Infinity," a trimester of seminars and lectures for master's students and researchers, as well as specialized workshops at the Institut Henri Poincaré in Paris, from September to December 2013.

The Earth-Life Science Institute (ELSI), an interdisciplinary initiative launched at the end of 2012 at the Tokyo Institute for Technology, focuses on the study of the origins and evolution of life on Earth, and possibly on other planets as well, within the context of geology and astrophysics. Hut continued his association with ELSI as a foreign Principle Investigator and Councilor and as the co-organizer of the workshop "Why Life?" in January 2014. In March, Hut organized two shorter workshops at IAS, "Modeling Origins of Life" and "Category Theory for Scientists." During the summer, he was the co-organizer of a five-week workshop on "Modeling Origins of Life," held for two weeks at ELSI in Tokyo and for three weeks in Kobe, sponsored by its K computer, one of the world's fastest supercomputers.

Hut continued his involvement with the B612 Foundation, dedicated to trying to protect the Earth from asteroid impacts. As a cofounder, he served for more than ten years as a member of the Board, while in 2014 he took up the position of Strategic Advisor.

Piet Hut on Origins of Life

"Young children often pose the most interesting questions. 'Why are we here?' is one of them. And this question can take on many forms. One of them is 'Why is there anything at all?' Another is 'Why am I alive?' or 'Why am I me?' These questions are closely connected to central questions in natural science. In my opinion, there are three, and all three are concerned with origins. After all, 'Why is there X?' is closely related to 'Where does X come from?' So what are the most interesting puzzles about origins? I would say: the origin of matter; the origins of life; and the origin of consciousness. To put it in the form of questions: 'Where did matter come from?' 'How did matter become alive?' and 'How did living beings develop the capacity to ask these three questions?'

"Fortunately, modern science is now making inroads toward providing at least some answers to some aspects of these questions, while suggesting more precise ways to pose the questions." Read more at www.ias.edu/hut-origins.

2013–14 VISITORS

f First Term

Henderson James Cleaves II
Chemistry ◆ Carnegie Institution of Washington

Douglas S. Duckworth
Philosophy ◆ Temple University

Yuka Fujii
Planetary Science ◆ Earth-Life Science Institute, Tokyo Institute of Technology ◆ *f*

Jon Lindsay
Security Studies ◆ University of California, San Diego

Hyun Ok Park
East Asian Studies ◆ York University

Edwin L. Turner
Astrophysics ◆ Princeton University

ALL PHOTOS AMY RAMSEY

EARTH-LIFE SCIENCE INSTITUTE

ARTIST-IN-RESIDENCE PROGRAM

As the Institute's Artist-in-Residence, the composer **Sebastian Currier** curated the 2013–14 Edward T. Cone Concert Series, which featured performances by the Argento Ensemble and works like Currier's *Deep-Sky Objects*—a cycle of songs with text by Sarah Manguso that portray longing and desire on an intergalactic scale. In addition to the concert series, Currier organized a series for the Institute community, Artists Present, which included presentations and discussions by sculptor Judy Fox, author Ginger Strand, and filmmaker and video artist Pawel Wojtasik about the creative process.

During the 2013–14 academic year, three new works by Currier were premiered: *Cadence, Fugue, Fade*, commissioned by the American Brass Quintet; *Artificial Memory*, written for the Paul Dresher Ensemble; and *Parallel Worlds*, commissioned by the Chamber Music Society of Lincoln Center.

AMY RAMSEY

Over the years, acclaimed violinist Lara St. John has collected thousands of folk tunes from Eastern Europe and the Middle East, and she has commissioned composers to make arrangements of some of the material. In *Musical Geographies*, the second set of concerts of the 2013–14 season, she performed a group of pieces from this intriguing project, accompanied by pianist Martin Kennedy.

DIRECTOR'S VISITORS

AMY RAMSEY

Nickolas Barris wrote the screenplay for his film about scientific imagination and innovation, *Einstein's Light*, which is partly a historical review of the lives of Einstein and Lorentz as well as a filmic representation of cognition. *Einstein's Light* is the first major film accepted to the United Nations/UNESCO International Year of Light 2015 and will also be a primary film for celebrating the centenary of Einstein's theory of general relativity in 2015.

Ulrich Raulff further developed his ideas about the coexistence, frictions, and mutual inspirations between scientists and humanists at the Institute from 1945 until the second half of the fifties. In his Leibniz lecture at the Berlin-Brandenburgische Akademie der Wissenschaften in June 2014, he presented these ideas under the title "An American Renaissance: Princeton after the Second World War."
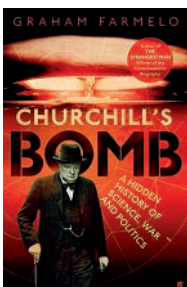
Graham Farmelo finalized the text of his book *Churchill's Bomb*, which was published in the fall of 2014. Additionally, Farmelo began to research his next book, which will illustrate how modern mathematics is enriching the development of fundamental theoretical physics, and vice versa.

In an *Institute Letter* article, Farmelo described how Churchill doubted whether politicians would be equal to the challenge of building nuclear weapons: www.ias.edu/farmelo-churchill.
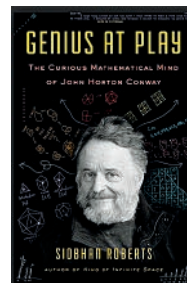
Siobhan Roberts edited and completed her book "Genius at Play: The Curious Mathematical Mind of John Horton Conway," which will be published in the spring of 2015 by Bloomsbury. She also collaborated with Professor Helmut Hofer in researching and writing a biography of the late German mathematician Andreas Floer.

In an *Institute Letter* article, Roberts explored the monster—the largest of the sporadic simple groups in mathematics—and what lies beneath its unimaginable 196,883 dimensions: www.ias.edu/roberts-monster.

OUTREACH
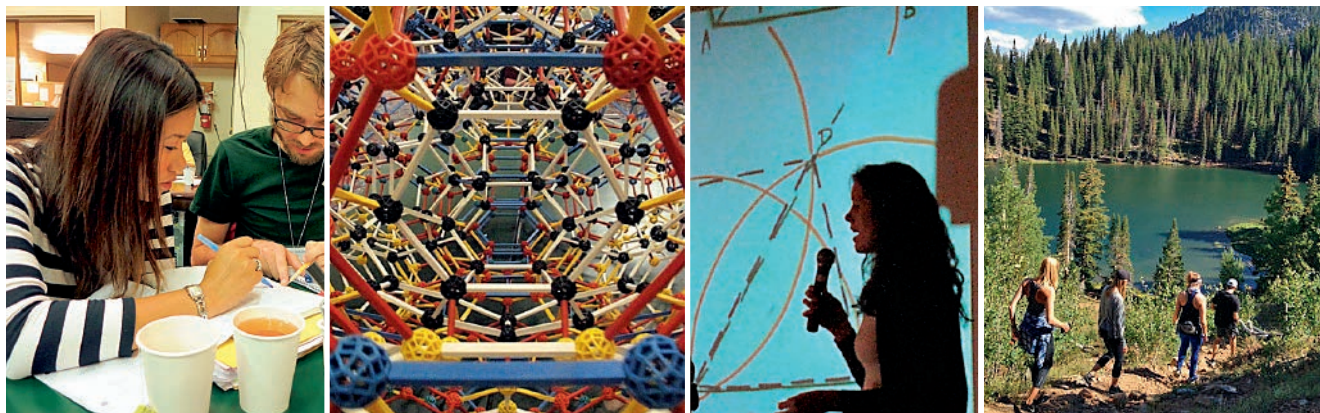
PARK CITY MATHEMATICS INSTITUTE

The Park City Mathematics Institute (PCMI) is an outreach program of the Institute for Advanced Study that provides an intensive mathematical experience for mathematics educators at the secondary and post-secondary levels, as well as mathematics researchers and students. Established in 1991 through a grant from the National Science Foundation, PCMI has been an Institute program since 1994.

Each year, the focus of the IAS/Park City Mathematics Institute is determined by its **Research in Mathematics Program**, which offers advanced scholars the opportunity to collaborate, research, and explore new teaching methods, and its **Graduate Summer School**, which invites graduate students to attend lectures by leading scientists. This year, these programs were a vibrant and interdisciplinary mix of mathematical and physical problems motivated by materials science. Both programs attracted students and faculty from departments of chemistry, physics, mathematics, and engineering. Topics were chosen to attract mathematicians to the fundamental geometric problems in materials science—which led to a focus on problems at the interface between statistical mechanics, geometry, and the calculus of variations—to ensure that all participants, especially the students, would obtain a core of knowledge that they would not be exposed to elsewhere. The mathematical techniques were drawn from analysis, the calculus of variations, discrete geometry, differential geometry, partial differential equations, and probability theory.

One major theme of the program, developed over three weeks, was a treatment of statistical mechanics that ranged from conceptual foundations (ergodicity and entropy, in principle and in practice) to rigorous mathematical treatments of phase transitions. Various applications of statistical mechanics were considered, including the study of particulate matter (tilings, packings, and crystals), and the development of models for emerging areas of nanoscience, such as synthetic self-assembly. A second theme was the development and analysis of models of soft matter physics, which included studies of the folding and wrinkling of thin films and the behavior of liquid crystals. These two themes were not distinct since certain problems in phase transitions, such as hysteresis, are studied using tools from the calculus of variations, while statistical mechanics plays a fundamental role in the modeling of liquid crystals.

In a parallel program, the **Undergraduate Summer School**, undergraduate students followed two three-week courses studying mathematics fundamental in the study of materials. They learned the calculus of variations in one course and about aperiodic tilings and quasicrystals in another. Undergraduates are rarely exposed to applications of mathematics in materials science for a lack of suitable course material. Participants in the **Undergraduate Faculty Program** laid the foundation for an undergraduate course on the mathematics of materials. The Undergraduate Faculty Program lecturer, with some other PCMI participants, plans to write an undergraduate text on the subject, building on the work done during PCMI.

The mathematics course for the **Teacher Leadership Program** was centered on geometric topics that included tilings of the plane, sphere packing, and related questions about fractions. The teachers also discussed pedagogical issues related to making classroom discussions more productive, and they prepared materials to support the implementation of the Common Core mathematics standards.

One notable feature of this year's program was the degree to which participants from the various programs interacted. It was not uncommon to see researchers, teachers, and students together, constructing origami structures or building a model of a three-dimensional quasicrystal. Such interactions are the glue that holds PCMI together and helps build bridges between the various components of the mathematical community. To learn more about the IAS/Park City Mathematics Institute, including its organizers, programs, publications, and recent news, visit https://pcmi.ias.edu.

PROGRAM FOR WOMEN AND MATHEMATICS

ANDREA KANE

The Program for Women and Mathematics, held annually at the Institute for Advanced Study, aims to encourage undergraduate and graduate students to continue their mathematics education. Sponsored by the Institute and Princeton University and generously supported by the National Science Foundation, the program's theme for 2014 centered on random matrix theory and was organized by Dusa McDuff of Barnard College, Antonella Grassi of the University of Pennsylvania, and Christine Taylor and Sun-Yung Alice Chang of Princeton University. The program included lectures, research seminars, Women-in-Science seminars, panels, colloquia, and a tour of Princeton Plasma Physics Lab. In addition to mathematical work, participants engaged in activities aimed at helping them improve their interpersonal skills, appear more confident, and balance their career and family roles. These included improvisational skits to enact different roles in the mathematical profession, a seminar on using language to offset stereotypical behavior and overcome communication pitfalls, and discussions centered on the career and family options women mathematicians have undertaken.

This year, informal mentoring partnerships were organized for participants interested in having a mentor who is further along in her mathematical career and can serve as a sounding board, friend, counselor, cheerleader, and promoter. Participants found their mentors from among the participants in this year's program and, through an extensive alumnae database, among older alumnae who share similar experiences to those of some participants, particularly those from smaller universities and liberal arts colleges.

Top: Former Member (2012–13) Nalini Anantharaman, the first of two women to be awarded the Henri Poincaré Prize, gave a colloquium on quantum ergodicity. *Above, clockwise from top left:* Member Olga Holtz gave a colloquium on "Randomization and Compressive Sensing"; a program participant working on the lawn south of Fuld Hall; daily review sessions were held in the Dilworth Room; Alice Guionnet of MIT taught the beginner colloquium, "Asymptotics of Moments in Random Matrix Theory"; Tadashi Tokeida of the University of Cambridge showed how simple everyday objects can illustrate profound mathematical and physical principles; participants in Alice Guionnet's colloquium.

PHOTO CREDITS, CLOCKWISE FROM TOP LEFT: DAN KOMODA, ANDREA KANE, ANDREA KANE, DAN KOMODA, AMY RAMSEY, DAN KOMODA   55

PROSPECTS IN THEORETICAL PHYSICS

The Institute's thirteenth annual Prospects in Theoretical Physics (PiTP) summer program for graduate students and postdoctoral scholars, which focused on string theory, was truly extraordinary in that it overlapped with Strings 2014. This is one of the field's most important gatherings, which the Institute hosted with Princeton University, convening international experts and researchers to discuss string theory and its most recent developments. Six hundred attendees gathered for Strings 2014, which made it one of the largest Strings conferences since their inception in 1995.

Strings 2014 talks covered topics from B-mode cosmology and the theory of inflation to quantum entanglement, the amplituhedron, and the fate of spacetime. Videos from Strings 2014 may be viewed at https://physics.princeton.edu/strings2014/Talk_titles.shtml. The program for PiTP and videos of its string theory talks may be viewed at https://pitp2014.ias.edu/schedule.html.

As part of the PiTP program, the Institute showed a screening of *Particle Fever*, a new film that follows six scientists, including the Institute's Nima Arkani-Hamed, during the launch of the Large Hadron Collider and fortuitously captures the discovery of the Higgs particle. Peter Higgs, who predicted the existence of the particle fifty years ago, gave one of his first seminars on the topic at the Institute in 1966.

Top: PiTP-Strings banners lined the sidewalks of the Institute campus. The artwork, which features iconic Institute and Princeton University buildings amid a swirling celestial backdrop, was created by Robbert Dijkgraaf, Institute Director and Leon Levy Professor, especially for the event. *Above, clockwise from upper left:* PiTP participants dine together outside Simons Hall; the lawn south of Fuld Hall was the center of activity during PiTP; Professor Juan Maldacena gave a lecture on causality constraints on graviton three-point amplitudes; the film *Particle Fever* was screened in Wolfensohn Hall and was followed by a discussion with filmmaker Mark Levinson, Robbert Dijkgraaf, and Professor Nima Arkani-Hamed; the Institute's dining services provided buffet-style dinners for program participants; a drum circle was organized on the first evening of PiTP.

SCIENCE INITIATIVE GROUP

The Science Initiative Group (SIG) has fostered science in developing countries since it became an IAS outreach program in 1999. For the past seven years, SIG has focused on the Regional Initiative in Science and Education (RISE). With funding from Carnegie Corporation of New York, RISE supports five university-based research and training networks for scientists and engineers pursuing master's and doctoral degrees in sub-Saharan Africa. Each RISE student receives his or her degree from one university, while having access to the complementary instruction, research opportunities, and laboratory facilities available at all institutions within the network. The five networks have substantial autonomy with respect to academic content and policy, budget allocation, and internal administration. SIG plays an advisory, coordinating, and developmental role.

The RISE networks' current areas of scientific training—materials science and engineering, natural products research, biochemistry and bioinformatics, water resources, and marine science—target some of Africa's most pressing ecological problems and technological deficits. Student projects address many of the key sustainable development challenges of the region.

Sharing Technological Expertise with Less-Advanced Countries

While Malawi is one of the richest tea-growing countries in Africa, its research capacity is modest compared to that of neighboring South Africa. For several years, one of the RISE networks has supported a partnership between the Tea Research Foundation of Central Africa (TRFCA) in Malawi and the University of Pretoria. Pelly Malebe, a RISE-supported Ph.D. student at Pretoria, has been working closely with Nick Mphangwe, a Malawian who recently earned his Ph.D. through RISE. A productive collaboration is centered around the link between Mphangwe's long field experience at tea breeding and Malebe's growing expertise in bioinformatics. Together with their advisor Professor Zeno Apostolides, Malebe and Mphangwe have identified tea genes that can give the plant drought resistance and other desirable genetic traits.

Adding Value to Natural Products

Many of the beaches in southwestern Africa are covered in red seaweeds that wash ashore and rot. For her M.Sc. research at the University of Namibia, Naomi Shifeta decided to do something useful with that wasted seaweed: she is using it to produce bioplastics. Most plastics manufactured today are carbon-based polymers derived primarily from the world's steadily dwindling stocks of non-renewable petroleum. They also constitute a major cause of pollution. Bioplastics, by contrast, are derived from renewable bioresources. Unlike many plant resources, the red seaweed Shifeta uses is produced freely, without fertilizers or pesticides, and has applications in numerous industrial products.

Catherine Kaingu Kaluwa's Ph.D. research is inspired by her desire to help the women of her region, the remote Tana River County of Kenya. Kaluwa discovered that in 2012 some 465,000 women in Kenya had abortions, a common practice partly attributed to unmet contraceptive needs in women of reproductive age. A 2013 African Population Health Research Centre report found that 266 of every 100,000 women in Kenya die yearly due to unsafe abortions. Kaluwa decided to carry out her research on two plants from Tana County said to affect the reproductive system of both animals and humans, after she had discovered that local women were using a mixture of extracts from these plants to prevent pregnancy. The protective effect was said to last two years, and yet almost nothing was known about how or why these plants were working. She used the rabbit as an animal model and found that the herbs increased the rate and amplitude of uterine contractions. Kaluwa is now conducting clinical trials and further research to test these natural products for efficacy and safety and to understand the scientific basis of their contraceptive properties.

Above, from left: Tea leaves are gathered for RISE-supported Ph.D candidate Pelly Malebe's research. Working closely with Nick Mphangwe, who has extensive field experience at tea breeding, Malebe aims to identify genes that can give tea plants drought resistance; red seaweeds that wash ashore are used by Naomi Shifeta to produce bioplastics as part of her M.Sc. research; Shifeta (left) presented her work at a recent RISE conference; to help reduce the number of unwanted pregnancies that result in unsafe abortions in Kenya, Catherine Kaingu Kaluwa is testing the efficacy and safety of plants used by local women as a means of contraception.

RECORD OF EVENTS

School of Historical Studies

September 24
Medieval Seminar ◆ *First Term Introductions* ◆
Patrick J. Geary, Professor, School of
Historical Studies

September 30
Historical Studies Lunchtime Colloquium ◆
First Term Introductions ◆ **Patrick J. Geary**,
Professor, School of Historical Studies

October 1
East Asian Studies Workshop ◆ *When Peripheries
Were Centers: New Perspectives on the "Northern
Zone" in Chinese Archaeology* ◆ **Li Zhang**,
Institute for the Study of the Ancient World,
New York University

Medieval Seminar ◆ *The Prophesied Rule of a
"Circumcised People": A Traveling Tradition from the
Seventh-Century Mediterranean* ◆ **Stefan
Esders**, Freie Universität Berlin; Member,
School of Historical Studies

October 2
Art History Seminar ◆ *Inaugural Session: Brief
Presentations of Work* ◆ **Anna Boreczky**,
National Széchényi Library, Budapest; Member,
School of Historical Studies, **Annie Bourneuf**,
School of the Art Institute of Chicago;
Member, School of Historical Studies,
Anastasia Drandaki, Benaki Museum,
Athens; Member, School of Historical Studies,
Michele Matteini, Reed College; Member,
School of Historical Studies

October 7
Historical Studies Lunchtime Colloquium ◆
The Question of China's Size ◆ **Patricia Ebrey**,
University of Washington; Member, School of
Historical Studies

October 8
East Asian Studies Workshop ◆ *The Tumu Incident
(1449) in a Eurasian Context* ◆ **David Robinson**,
Colgate University; Member, School of
Historical Studies

Medieval Seminar ◆ *Imaging a New Profession in
the Twelfth and Thirteenth Centuries: Besançon 457
and the Physician's Task* ◆ **Monica H. Green**,
Arizona State University; Member, School of
Historical Studies

October 14
Historical Studies Lunchtime Colloquium ◆
*Islamic Thought Beyond Denominational Borders:
Challenges and Perspectives* ◆ **Sabine Schmidtke**,
Freie Universität Berlin; Member, School of
Historical Studies

October 17
Seminar on International Relations ◆
*"Improvised Antiquaries": French Officers and the
Challenges (and Opportunities) Offered by Roman
Monuments in Colonial Algeria (1830–1870)* ◆
Bonnie Effros, University of Florida;
Member, School of Historical Studies

October 21
Historical Studies Lunchtime Colloquium ◆
Fever as a Historical Problem ◆ **Christopher
Hamlin**, University of Notre Dame; Member,
School of Historical Studies

October 22
East Asian Studies Workshop ◆ *Russia's Buddhist
Agents: The Role of Buryat Lamas in Inner Asian
Politics of the Nineteenth and Early Twentieth
Centuries* ◆ **Nikolay Vladimirovich
Tsyrempilov**, Russian Academy of Sciences,
Moscow; Member, School of Historical Studies

October 23
Islamicist Seminar ◆ *Yūsuf al-Baṣīr's First
Refutation (Naqḍ) of Abū I-Ḥusayn al-Baṣrī's
Theology in a Yemenī Zaydī Manuscript of the
Seventh/Thirteenth Century* ◆ **Sabine
Schmidtke**, Freie Universität Berlin; Member,
School of Historical Studies, **Hassan Farhang
Ansari**, Freie Universität Berlin; Member,
School of Historical Studies

Art History Seminar ◆ *Art and Identity in
Venetian Crete on the Eve of the Council of Ferrara-
Florence (1438–39)* ◆ **Anastasia Drandaki**,
Benaki Museum, Athens; Member, School of
Historical Studies

October 24
Seminar on International Relations ◆ *The Qing
State and Its Awareness of Eurasian Interconnections,
1789–1806* ◆ **Matthew W. Mosca**, The
College of William & Mary; Member, School
of Historical Studies

October 28
Historical Studies Lunchtime Colloquium ◆
*Menahem, Muhammad, and the Paraclete: Late
Antique Messianism and the Formation of Early
Islamic Kerygma* ◆ **Sean William Anthony**,
University of Oregon; Member, School of
Historical Studies

November 4
Historical Studies Lunchtime Colloquium ◆
Chinese Astronomy in the Age of Dragons ◆ **David
William Pankenier**, Lehigh University;
Member, School of Historical Studies

November 5
Medieval Seminar ◆ *Digging in the Colonial
Archives: French Officers in Algeria and the Evolving
Memory of Rome* ◆ **Bonnie Effros**, University
of Florida; Member, School of Historical
Studies

November 6
Early Modern Workshop ◆ *Relating Duties,
Rights, and Virtues: The Structure of Eighteenth-
Century British Practical Ethics* ◆ **Colin Heydt**,
University of South Florida; Member, School
of Historical Studies

November 7
Seminar on International Relations ◆ *Korean
Migration between China and Korea: Crisis,
Democracy, and Historical Repetition* ◆ **Hyun Ok
Park**, York University; Visitor, Program in
Interdisciplinary Studies

November 11
Historical Studies Lunchtime Colloquium ◆
*Synchronicity and Connectivity in the Seventh-
Century Mediterranean* ◆ **Stefan Esders**, Freie
Universität Berlin; Member, School of
Historical Studies

November 12
East Asian Studies Workshop ◆ *The Consciousness
of the Dead as a Philosophical Problem in Ancient
China* ◆ **Paul R. Goldin**, University of
Pennsylvania; Member, School of Historical
Studies

Medieval Seminar ◆ *The Circulation of Marco
Polo's Travels in French* ◆ **Mark Cruse**, Arizona
State University; Member, School of Historical
Studies

November 13
Eighteenth Century Seminar ◆ *How Imaginary
Meetings Change History: Two Case Studies From
Eighteenth-Century New Spain* ◆ **Matthew B.
Restall**, The Pennsylvania State University;
Member, School of Historical Studies

Art History Seminar ◆ *Xuannan Mediasphere* ◆
Michele Matteini, Reed College; Member,
School of Historical Studies

November 14
Seminar on International Relations ◆ *Buriat
Lamas and the Qing-Russian Imperial Interface* ◆
Nikolay Vladimirovich Tsyrempilov,
Russian Academy of Sciences, Moscow;
Member, School of Historical Studies

Islamicist Seminar ◆ *The Passion of Peter
of Capitolias (d. 715): A Christian Martyrdom
from Early Islamic Palestine* ◆ **Stephen J.
Shoemaker**, University of Oregon; Member,
School of Historical Studies

November 18
Historical Studies Lunchtime Colloquium ◆ *Ideology of Sacrifice and Soldier Motivation in the Ottoman Great War* ◆ **Yücel Yanikdağ**, University of Richmond; Member, School of Historical Studies

November 19
East Asian Studies Workshop ◆ *Liu Xiang and Liu Xin: Two Critical Voices of the Western Han* ◆ **Michael Loewe**, University of Cambridge

November 20
Islamicist Seminar ◆ *Between Theology and Astronomy: al-Kindi and the Rise of Arabic Philosophy* ◆ **Emma Gannagé**, Georgetown University

Early Modern Workshop ◆ *Jacob Sasportas and the Sephardic Diaspora* ◆ **Jacob Dweck**, Princeton University; Member, School of Historical Studies

November 25
Historical Studies Lunchtime Colloquium ◆ *The Role of Learned Medicine in Creating a Unified European Culture in the Twelfth Century* ◆ **Monica H. Green**, Arizona State University; Member, School of Historical Studies

November 26
Medieval Seminar ◆ *The Illustrated* Apollonius*: Transformations of the Medieval Bestseller* ◆ **Anna Boreczky**, National Széchényi Library, Budapest; Member, School of Historical Studies

December 2
Historical Studies Lunchtime Colloquium ◆ *The Problems of Peacemaking in Late Medieval Florence* ◆ **Katherine L. Jansen**, The Catholic University of America; Member, School of Historical Studies

December 3
East Asian Studies Workshop ◆ *Formal Organization in Medieval Chinese Literature* ◆ **David Prager Branner**, Columbia University; Member, School of Historical Studies

Medieval Seminar ◆ *The Compulsory Baptism of Jews in Visigothic Spain under King Sisebut (615): Near Eastern, North African, and Spanish Backgrounds* ◆ **Stefan Esders**, Freie Universität Berlin; Member, School of Historical Studies

December 5
Seminar on International Relations ◆ *The Moscow Correspondents, Soviet Human Rights Activists, and the Problem of the Western Gift* ◆ **Barbara Walker**, University of Nevada, Reno; Member, School of Historical Studies

December 9
Historical Studies Lunchtime Colloquium ◆ *Intellectuals, Illiterates, and Censorship in Late Renaissance Italy* ◆ **Giorgio Caravale**, Università degli Studi di Roma Tre; Member, School of Historical Studies

December 11
Art History Seminar ◆ *"Apollonius Pictus": Possible Readings of Late Antique Art around 1000* ◆ **Anna Boreczky**, National Széchényi Library, Budapest; Member, School of Historical Studies

December 12
Seminar on International Relations ◆ *"You Better Belize It": Historical Narratives* ◆ **Matthew B. Restall**, The Pennsylvania State University; Member, School of Historical Studies

Medieval Seminar ◆ *Instrumenta Pacis in their Notarial Context* ◆ **Katherine L. Jansen**, The Catholic University of America; Member, School of Historical Studies

December 13
Islamicist Seminar ◆ *Maghazi and Imperial Ideology: Ibn Shihab al-Zuhri's Heraclius Tale* ◆ **Sean William Anthony**, University of Oregon; Member, School of Historical Studies

December 16
Historical Studies Lunchtime Colloquium ◆ *The Relations between Caliph and Sultan in the Seljuq Period: A Case Study of the Reign of the Caliph al-Muqtafī* ◆ **Deborah Tor**, University of Notre Dame; Member, School of Historical Studies

December 17
East Asian Studies Workshop ◆ *A Revisionist History of Yuan Architecture* ◆ **Nancy Steinhardt**, University of Pennsylvania

Medieval Seminar ◆ *The Dis-Orderly Women of the Hirsau Reform* ◆ **Alison Beach**, The Ohio State University; Member, School of Historical Studies

December 18
Early Modern Workshop ◆ *Flavors of Natural Theology, 1690–1830* ◆ **Christopher Hamlin**, University of Notre Dame; Member, School of Historical Studies

January 6
Historical Studies Lunchtime Colloquium ◆ *Second Term Introductions* ◆ **Patrick J. Geary**, Professor, School of Historical Studies

January 7
Medieval Seminar ◆ *Second Term Introductions* ◆ **Patrick J. Geary**, Professor, School of Historical Studies

January 13
Historical Studies Lunchtime Colloquium ◆ *Jacob Sasportas, Sabbetai Zevi, and the Jewish Messiah in 1666* ◆ **Yaacob Dweck**, Princeton University; Member, School of Historical Studies

January 14
East Asian Studies Workshop ◆ *Xiongnu and Huns: Archaeological Perspective on Identity and Migration* ◆ **Ursula Birgit Brosseder**, Rheinische Friedrich–Wilhelms–Universität; Member, School of Historical Studies

Early Modern Workshop ◆ *Church Censorship in Eighteenth-Century Italy* ◆ **Giorgio Caravale**, Università degli Studi Roma Tre; Member, School of Historical Studies

January 15
Art History Seminar ◆ Pigments Purs *and the* Corpo da Côr*: Post-Painterly Practice and Transmodernity* ◆ **Irene Small**, Princeton University

January 27
Historical Studies Lunchtime Colloquium ◆ *Revaluating Africa and World War II* ◆ **Judith Ann-Marie Byfield**, Cornell University; Member, School of Historical Studies

January 28
East Asian Studies Workshop ◆ *Astral Origins of the Weaving Maid and Herdboy, or "Wherefore the Star-Crossed Lovers?"* ◆ **David William Pankenier**, Lehigh University; Member, School of Historical Studies

Medieval Seminar ◆ *Pandemic Disease in the Medieval World: Rethinking the Black Death* ◆ **Monica H. Green**, Arizona State University; Member, School of Historical Studies

January 29
Islamicist Seminar ◆ *Court Neopythagoreans and Philosopher Kings in Early Timurid Iran* ◆ **Matthew S. Melvin-Koushki**, University of South Carolina

February 4
East Asian Studies Workshop ◆ *Tales of an Open World: Chinese Gossip, Dutch Plays, Global News* ◆ **Paize Keulemans**, Princeton University

Ancient Studies Seminar ◆ *Two New Inscriptions from Aphrodisias* ◆ **Angelos Chaniotis**, Professor, School of Historical Studies

Medieval Seminar ◆ *Religious Conflicts and Pictorial Propaganda in Byzantium under Michael VIII Palaiologos (1259–1282)* ◆ **Anastasia Drandaki**, Benaki Museum, Athens; Member, School of Historical Studies

February 6
Seminar on International Relations ◆ *Goncharov's "The Frigate Pallada": Russia and Global Imperialism* ◆ **Edyta Bojanowska**, Rutgers, The State University of New Jersey; Member, School of Historical Studies

February 7
Islamicist Seminar ◆ *Conversion and Deceit: The Publication of the First Insider Account on the Nusayri Faith* ◆ **Samer Traboulsi**, University of North Carolina at Asheville

February 10
Historical Studies Lunchtime Colloquium ◆ *A Roman Mirage? French Officers and Classical Archaeology in the Territory of Algeria, 1830–1870* ◆ **Bonnie Effros**, University of Florida; Member, School of Historical Studies

February 11
East Asian Studies Workshop ◆ *The Chaos and Cosmos of Kurosawa Tokiko* ◆ **Laura Nenzi**, University of Tennessee; Member, School of Historical Studies

Medieval Seminar ◆ *Medieval History at Heidelberg: An Overview of Research in Progress* ◆ **Christoph Mauntel**, Universität Heidelberg, **Julia Burkhardt**, Universität Heidelberg, **Klaus Oschema**, Universität Heidelberg, and **Stefan Burkhardt**, Universität Heidelberg

February 12
Islamicist Seminar ◆ *Words Mixed with Secrets (wāzagīhā ī rāz-āmēzag): Esoteric Interpretations of Avestan Passages in the* Pahlavi Wizirgerd ī Dēnīg ◆ **Dan Sheffield**, Princeton University

Early Modern Workshop ◆ *The Politics of Romeyn de Hooghe* ◆ **Henk van Nierop**, University of Amsterdam; Member, School of Historical Studies

February 15
East Asian Studies Roundtable Discussion ◆ *Sources for Tang-Song-Liao-Jin-Yuan History: New Materials and Current Trends* ◆ **Tineke d'Haesselaer**, Princeton University; **Brian Vivier**, University of Pennsylvania; **Sukhee Lee**, Rutgers, The State University of New Jersey; **Stephen West**, Arizona State University; Member, School of Historical Studies

February 18
East Asian Studies Workshop ◆ *Discovering Empire in China* ◆ **Mark Elliott**, Harvard University

Ancient Studies Seminar ◆ *The Temple of Asclepios at Epidauros and Its Chryselephantine Statue: Two Building Accounts* ◆ **Sebastian Prignitz**, Inscriptiones Graecae, Berlin–Brandenburgische Akademie der Wissenschaften; Member, School of Historical Studies

Medieval Seminar ◆ *Lambaesis (Lambessa, Tazzoult) before 1852: Variations on a Theme* ◆ **Bonnie Effros**, University of Florida; Member, School of Historical Studies

February 19
Islamicist Seminar ◆ *Muslim Conversion to Christianity in the Early Islamic Period: A View from the Lives of the Martyrs* ◆ **Christian Sahner**, Princeton University

Art History Seminar ◆ *Group Discussion: Transmission of Visual Knowledge in Medieval and Renaissance European Art, Chinese Art, and Modern Art* ◆ **Yve-Alain Bois**, Professor, School of Historical Studies

February 20
Seminar on International Relations ◆ *Funmilayo Ransome-Kuti and the Women's Tax Revolt in Colonial Nigeria* ◆ **Judith Ann-Marie Byfield**, Cornell University; Member, School of Historical Studies

February 24
Historical Studies Lunchtime Colloquium ◆ *Athens* Maniera Graeca *in the West,* Maniera Latina *in the Byzantine East: Piety, Politics, and Painting in the Thirteenth to Fifteenth Centuries* ◆ **Anastasia Drandaki**, Benaki Museum, Athens; Member, School of Historical Studies

February 25
East Asian Studies Workshop ◆ *The Manchu* Zizhi Tongjian Gangmu *and the Eurasian Transmission of Confucian Historiography* ◆ **Matthew W. Mosca**, The College of William & Mary; Member, School of Historical Studies

Medieval Seminar ◆ *The Suffering of the Barbarian: Cultural Moments in the Last Centuries of Empire* ◆ **Michael Kulikowski**, The Pennsylvania State University

Art History Seminar ◆ *The Painters of My Generation* ◆ **Michele Matteini**, Reed College; Member, School of Historical Studies

March 3
Historical Studies Lunchtime Colloquium ◆ *The Chinese Card Catalogue* ◆ **Jing Tsu**, Yale University; Member, School of Historical Studies

March 4
East Asian Studies Workshop ◆ *Catastrophe, Predictability, and Culture in North China in the Thirteenth Century* ◆ **Stephen West**, Arizona State University; Member, School of Historical Studies

Medieval Seminar ◆ *The Trauma of Reform in Petershausen* ◆ **Alison Beach**, The Ohio State University; Member, School of Historical Studies

March 5
Islamicist Seminar ◆ *Persian Writing on Music Theory* ◆ **Mehrdad Fallahzadeh**, Uppsala University; Member, School of Historical Studies

Early Modern Workshop ◆ *A Cultural Field in the Making: On the Foundations of Risorgimento Moderatism, 1700–1848* ◆ **Roberto Romani**, Università degli Studi di Teramo; Member, School of Historical Studies

March 6
Seminar on International Relations ◆ *Indigenous Sovereignties in Amazonia* ◆ **Manuela Lavinas Picq**, Universidad San Francisco de Quito; Member, School of Social Science

March 10
Historical Studies Lunchtime Colloquium ◆ *Neither Donkey nor Horse: Medicine in the Struggle over China's Modernity* ◆ **Sean Hsiang-lin Lei**, Institute of Modern History, Academia Sinica, Taiwan; Member, School of Historical Studies

March 11
East Asian Studies Workshop ◆ *Xuannan Mediasphere: A Neighborhood and Its Representations in Late Eighteenth-Century Beijing* ◆ **Michele Matteini**, Reed College; Member, School of Historical Studies

Ancient Studies Seminar ◆ *The Reconciliation Inscription of Dikaia* ◆ **Emmanuel Voutiras**, Aristotle University of Thessaloniki; Member, School of Historical Studies

March 12
Workshop on The Future of the Responsibility to Protect ◆ *Introduction* ◆ **Michael van Walt van Praag**, Visiting Professor, School of Historical Studies ◆ *The Future of the Responsibility to Protect* ◆ **Gareth Evans**, The Australian National University ◆ *Discussant* ◆ **Simon Adams**, Global Centre for the Responsibility to Protect ◆ *Discussant* ◆ **William Azumah Awinador-Kanyirige**, Permanent Representative of Ghana to the United Nations ◆ *Discussant* ◆ **Hrair Balian**, The Carter Center Conflict Resolution Program ◆ *Discussant* ◆ **Miek Boltjes**, Kreddha–International Peace Council for States, Peoples, and Minorities ◆ *Discussant* ◆ **Wolfgang Danspeckgruber**, Princeton University ◆ *Discussant* ◆ **Frank Jackson**, Australian National University ◆ *Discussant* ◆ **Edward Luck**, Former Special Adviser to the United Nations Secretary-General on the Responsibility to Protect ◆ *Discussant* ◆ **H. E. Mr. Asoke Mukerji**, Ambassador and Permanent Representative of India to the United Nations ◆ *Discussant* ◆ **Meena Syed**, Political Affairs Permanent Mission of Norway to the United Nations ◆ *Discussant* ◆ **Patrick Travers**, Permanent Mission of Canada to the United Nations ◆ *Discussant* ◆ **Charlotte van Baak**, Permanent Mission of the Kingdom of the Netherlands to the United Nations ◆ *Discussant* ◆ **H. E. Karel J. G. van Oosterom**, Ambassador and Permanent Representative of the Netherlands to the United Nations

Dr. S. T. Lee Fund for Historical Studies Lecture ◆ *Mass Atrocity Crimes After Syria: The Future of the Responsibility to Protect* ◆ **Gareth Evans**, The Australian National University

March 13

Seminar on International Relations ◆ *Ottoman Prisoners of the Great War in Russia* ◆ **Yücel Yanikdağ**, University of Richmond; Member, School of Historical Studies

March 14

Ancient Studies Seminar: Epigraphic Friday ◆ *Observations on the Inscribers and Inscribing of the* Lapis Primus *and* Lapis Secundus ◆ **Stephen Tracy**, The American School of Classical Studies at Athens; Visitor, School of Historical Studies ◆ *Basileis and* Ephetai *in Draco's Law on Homicide (IG I³ 104.12 restored)* ◆ **Gerhard Thür**, Austrian Academy of Sciences; Visitor, School of Historical Studies ◆ *Textual Remarks on an Athenian Honorific Decree Concerning Harbor Taxation (IG I³ 182)* ◆ **Aurélie Carrara**, Harvard University ◆ Ta loipa en toi alloi krotaphoi gegraptai: *Some Side-Edges from Epidauros* ◆ **Sebastian Prignitz**, Inscriptiones Graecae, Berlin–Brandenburgische Akademie der Wissenschaften; Member, School of Historical Studies ◆ *A New Archaic Inscription from Olympia* ◆ **Klaus Hallof**, Berlin–Brandenburgische Akademie der Wissenschaften ◆ *The Cows of Morrylos* ◆ **Emmanuel Voutiras**, Aristotle University of Thessaloniki; Member, School of Historical Studies ◆ *Synchoresis, Parachoresis, and Ekchoresis in Imperial Funerary Inscriptions* ◆ **Kaja Harter-Uibopuu**, Austrian Academy of Sciences; Member, School of Historical Studies ◆ *Epigraphic Tidbits* ◆ **Angelos Chaniotis**, Professor, School of Historical Studies ◆ *The Ash Chest of Tiberius Dama* ◆ **Michael Peachin**, New York University ◆ *A Third-Century Latin Funerary Inscription* ◆ **Michael Kulikowski**, The Pennsylvania State University ◆ *The Cult of a Heroized Youth* ◆ **Christopher Jones**, Harvard University

March 17

Historical Studies Lunchtime Colloquium ◆ *How to Protect your Grave: Funerary Inscriptions from Greco-Roman Asia Minor* ◆ **Kaja Harter-Uibopuu**, Austrian Academy of Sciences; Member, School of Historical Studies

March 18

East Asian Studies Workshop ◆ *Why Hygiene (weisheng) Is Not about Guarding Life: Tuberculosis and Wasting Disorders in Republican China* ◆ **Sean Hsiang-lin Lei**, Institute of Modern History, Academia Sinica, Taiwan; Member, School of Historical Studies

Ancient Studies Seminar ◆ *Bellowing Buffalo and Other Grammars* ◆ **Naphtali Meshel**, Princeton University; Member, School of Historical Studies

Medieval Seminar ◆ *This French Which Is Not One: Francophonie in English Nunneries* ◆ **Jocelyn Wogan-Browne**, Yale University; Member, School of Historical Studies

March 19

Islamicist Seminar ◆ *Medieval Islamic Chivalry (Futuwwa)* ◆ **Deborah Tor**, University of Notre Dame; Member, School of Historical Studies

Art History Seminar ◆ *Paul Klee's Centrifugal Memorial Page: Looking as Reading and Reading as Looking, ca. 1923* ◆ **Annie Bourneuf**, School of the Art Institute Chicago; Member, School of Historical Studies

March 24

Historical Studies Lunchtime Colloquium ◆ *Minimal State Theories and Democracy in Europe: From the 1880s to Hayek* ◆ **Robert Romani**, Università degli Studi di Teramo; Member, School of Historical Studies

March 25

East Asian Studies Workshop ◆ *Going Abroad in Verse: Hakka and Minnanese Songs and Ballads about Overseas Migration (Guofan ge 過番歌) from Late Imperial and Early Republican China* ◆ **Wilt Idema**, Harvard University

Ancient Studies Seminar ◆ *What's In a Line: Medium, Message and Publicity in Greek Verse Inscriptions* ◆ **Sara Kaczko**, Università degli Studi di Roma, La Sapienza; Member, School of Historical Studies

Medieval Seminar ◆ *Hungary's Holy Crown: The Object, Its Uses, and the Historic Constitution* ◆ **Kim Lane Scheppele**, Princeton University; Joint Member, School of Historical Studies and School of Social Science

March 26

Art History Seminar ◆ *Abstract Art and the Crisis of Language* ◆ **Annie Bourneuf**, School of the Art Institute of Chicago; Member, School of Historical Studies

March 27

Seminar on International Relations ◆ *Empire of Security and the Security of Empire* ◆ **Kim Lane Scheppele**, Princeton University; Member, School of Historical Studies

March 28

Islamicist Seminar ◆ *The Perils of Intercession: Secular Power and Spiritual Authority in Sixteenth-Century Egypt* ◆ **Adam Sabra**, University of California, Santa Barbara

March 31

Historical Studies Lunchtime Colloquium ◆ *Reading Images: The Relationship Between Visual Medium and Literary Form in Early Greek Inscriptions* ◆ **Sara Kaczko**, Università degli Studi di Roma, La Sapienza; Member, School of Historical Studies

Dr. S. T. Lee Fund for Historical Studies Lecture ◆ *Maiden Voyage: The Senzaimaru and the Creation of Modern Sino-Japanese Relations* ◆ **Josh Fogel**, York University

April 1

East Asian Studies Workshop ◆ *Crafting Mental Powers in Modern China* ◆ **Jing Tsu**, Yale University; Member, School of Historical Studies

Ancient Studies Seminar ◆ *Logistical Power: The Nile, the Pithom Canal, and the Red Sea under Ptolemy II* ◆ **Sitta von Reden**, Albert-Ludwigs-Universität Freiburg; Member, School of Historical Studies

Medieval Seminar ◆ *From "Apollonius Pictus" to Apollonius von Tyrland: Similarities and Differences between Late Antique and Late Medieval Visual Narratives* ◆ **Anna Boreczky**, National Széchényi Library, Budapest; Member, School of Historical Studies

April 2

Islamicist Seminar ◆ *Between Courage and Cowardice: Fear and Manliness in the Ottoman Great War* ◆ **Yücel Yanikdağ**, University of Richmond; Member, School of Historical Studies

April 24

Early Modern Workshop ◆ *Pineapples in Petersburg, Cabbage Soup on the Equator: A Russian Writer Tours the Colonial World* ◆ **Edyta Bojanowska**, Rutgers, The State University of New Jersey; Member, School of Historical Studies

April 29–30

Workshop on Intellectual Life in Rayy ca. 900–1100: What Difference Did the Seljuqs make? ◆ *The Political Role of Rayy (ca. 900–1100): A Historical Overview* ◆ **Sebastian Hanstein**, Universität Leipzig ◆ *What Difference Did the Seljuqs Make?: The Significance of the Seljuqs in the Context of Islamic History and Civilization* ◆ **Deborah Tor**, University of Notre Dame; Member, School of Historical Studies ◆ *Sunnī (Non-Muʿtazilī) Scholars during the Seljuq Period: Relations between Sunnīs and Shīʿīs in Rayy* ◆ **Hassan Farhang Ansari**, Freie Universität Berlin; Member, School of Historical Studies ◆ *Rayy, Khurasan (the Mashriq), and the Rise of Neo-Ashʾarism* ◆ **Ayman Shihadeh**, University of London ◆ *A Sunnī Muʿtazilite in Early Seljuq Rayy: Abū Muḥammad al-Ḥasan Ibn Mattawayh* ◆ **Jan Thiele**, University of London ◆ *Bringing Arabic Knowledge to Rayy: The Many Sources Used by Abū Hātim al-Rāzī in His Kitāb al-Zinā* ◆ **Cornelius Berthold**, Universität Leipzig ◆ *From Abū Ḥātim al-Rāzī (d. 322/934) to Ḥasan-i Sabbāh (d. 518/1124): Ismāʿīlism in Rayy Before and During the Seljuqs* ◆ **Daniel de Smet**, Centre National de la Recherche Scientifique, Paris ◆ *Representatives of Twelver Shīʿī Theology in Rayy Prior to and During the Seljuq Period* ◆ **Sabine Schmidtke**, Freie Universität Berlin; Member, School of Historical Studies ◆ *Imāmī*

Shīism During the Seljuqid Age: Minority Strategies According to the Kitāb al-naqd ◆ **Leonardo Capezzone**, Università degli Studi di Roma, La Sapienza ◆ *Rayy and the Zaydīs Before and After the Coming of the Seljuqs* ◆ **Aron Zysow**, Independent Scholar

School of Mathematics

September 19
Working Group on Algebraic Number Theory

September 20
Non-Equilibrium Dynamics and Random Matrices ◆ *Universal Current Fluctuations in Non-Equilibrium Systems* ◆ **Bernard Derrida**, École Normale Supérieure

September 23
Computer Science/Discrete Mathematics Seminar I ◆ *Using the DFS Algorithm for Finding Long Paths in Random and Pseudo-Random Graphs* ◆ **Michael Krivelevich**, Tel Aviv University

September 24
Computer Science/Discrete Mathematics Seminar II ◆ *Finite Field Restriction Estimates* ◆ **Mark Lewko**, Member, School of Mathematics

Short Talks by Postdoctoral Members ◆ *Stability and Instability of Black Holes* ◆ **Stefanos Aretakis**, Princeton University; Veblen Research Instructor, School of Mathematics ◆ *Self-Avoiding Walks* ◆ **Roland Bauerschmidt**, Member, School of Mathematics ◆ *The Gan-Gross-Prasad Conjecture and Local Relative Trace Formulas* ◆ **Raphaël Beuzart-Plessis**, Member, School of Mathematics ◆ *On Universality for Random Matrices* ◆ **Paul Bourgade**, Member, School of Mathematics ◆ *From One Reeb Orbit to Two* ◆ **Daniel Cristofaro-Gardiner**, Member, School of Mathematics

September 25
Short Talks by Postdoctoral Members ◆ *Edge Behavior of Deformed Wigner Matrices* ◆ **Kevin Schnelli**, Member, School of Mathematics ◆ *Supersymmetric Derivation of the Density of States for the Gaussian Orthogonal Ensemble* ◆ **Mira Shamis**, Member, School of Mathematics ◆ *Growth Rate of Eigenfunctions* ◆ **Peng Shao**, Member, School of Mathematics ◆ *Hamiltonian Dynamics and Morse Theory* ◆ **Doris Hein**, University of California, Santa Cruz; Member, School of Mathematics ◆ *Random Band Matrices as a Model of Quantum Transport* ◆ **Antti Knowles**, New York University; Member, School of Mathematics ◆ *Hamiltonian Local Models for Symplectic Derived Stacks* ◆ **Christopher Brav**, Member, School of Mathematics

September 26
Non-Equilibrium Dynamics and Random Matrices ◆ *Kinetic Transport in Quasicrystals* ◆ **Jens Marklof**, University of Bristol

Princeton/IAS Symplectic Geometry Seminar ◆ *GIT and μ-GIT* ◆ **Dietmar Salamon**, Eidgenössische Technische Hochschule Zürich

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *The Landau-Siegel Zero and Spacing of Zeros of L-Functions* ◆ **Yitang Zhang**, University of New Hampshire

September 30
Computer Science/Discrete Mathematics Seminar I ◆ *Some Provable Bounds for Deep Learning* ◆ **Sanjeev Arora**

Short Talks by Postdoctoral Members ◆ *The Newton Stratification of Shimura Varieties* ◆ **Arno Kret**, Member, School of Mathematics ◆ *G-Valued Flat Deformations and Local Models* ◆ **Brandon Levin**, The University of Chicago; Member, School of Mathematics ◆ *Branching Laws for Representations of Real Reductive Groups* ◆ **Yoshiki Oshima**, Member, School of Mathematics ◆ *Interactive Channel Capacity* ◆ **Gillat Kol**, Member, School of Mathematics ◆ *Cylindrical Contact Homology as a Well-Defined Homology?* ◆ **Joanna Nelson**, Visitor, School of Mathematics ◆ *Depth Complexity and Communication Games* ◆ **Or Meir**, Member, School of Mathematics

October 1
Computer Science/Discrete Mathematics Seminar II ◆ *Small Set Expander Flows* ◆ **Ali Kemal Sinop**, Member, School of Mathematics

Short Talks by Postdoctoral Members ◆ *On Rearrangements of Fourier Series* ◆ **Mark Lewko**, Member, School of Mathematics ◆ *Log-Integrability of Rademacher Fourier Series, with Applications to Random Analytic Functions* ◆ **Alon Nishry**, Member, School of Mathematics ◆ *High Dimensional Expanders* ◆ **Ori Parzanchevski**, Member, School of Mathematics ◆ *Fundamental Groups of Singular Varieties* ◆ **Bhargav Bhatt**, Member, School of Mathematics ◆ *Diffusion in High Sobolev Spaces for Hamiltonian PDEs* ◆ **Oana Pocovnicu**, Member, School of Mathematics ◆ *Value Distribution of Long Dirichlet Polynomials and Applications to the Riemann Zeta-Function* ◆ **Maksym Radziwill**, Member, School of Mathematics ◆ *Continued Fractions in General Relativity* ◆ **Michael Reiterer**, Member, School of Mathematics

October 2
Non-Equilibrium Dynamics and Random Matrices ◆ *Introduction to KPZ* ◆ **Jeremy Quastel**, University of Toronto; Member, School of Mathematics

IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Workshop on Topology: Identifying Order in Complex Systems ◆ *Tracing Medieval Migration through Next Generation Sequencing: Finding Meaningful Models in a Sea of Data* ◆ **Patrick J. Geary**, Professor, School of Historical Studies ◆ *The Topology of Viral Evolution* ◆ **Raúl Rabadan**, Columbia University

October 3
Non-Equilibrium Dynamics and Random Matrices ◆ *Disorder-Generated Multifractals and Random Matrices: Freezing Phenomena and Extremes* ◆ **Yan Fyodorov**, Queen Mary, University of London

Working Group on Algebraic Number Theory

Non-Equilibrium Dynamics and Random Matrices ◆ *Introduction to KPZ II* ◆ **Jeremy Quastel**, University of Toronto; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ◆ *Pairs of p-adic L-Functions for Elliptic Curves at Supersingular Primes* ◆ **Florian Sprung**, Princeton University; Veblen Research Instructor, School of Mathematics

October 4
Princeton/IAS Symplectic Geometry Seminar ◆ *Positive Loops and Orderability in Contact Geometry* ◆ **Peter Weigel**, Purdue University

Short Talks by Postdoctoral Members ◆ *Homotopy Type Theory: What Can Logic Do for Homotopy Theory?* ◆ **Peter LeFanu Lumsdaine**, Member, School of Mathematics ◆ *Exponential-Time Algorithms for NP Problems: Prospects and Limits* ◆ **Andrew Drucker**, Member, School of Mathematics ◆ *Computational Aspects of the Combinatorial Nullstellensatz Method via a Polynomial Approach to Matrix and Hypermatrix Algebra* ◆ **Edinah Gnang**, Member, School of Mathematics ◆ *Approximability of Graph Partitioning Problems* ◆ **Ali Kemal Sinop**, Member, School of Mathematics ◆ *p-adic Versions of BSD* ◆ **Florian Sprung**, Princeton University; Veblen Research Instructor, School of Mathematics ◆ *Determining Algebraic Subgroups from Invariant Dimensions* ◆ **Jun Yu**, Member, School of Mathematics ◆ *Scissors Congruence and K-Theory* ◆ **Inna Zakharevich**, The University of Chicago; Member, School of Mathematics

October 7
Computer Science/Discrete Mathematics Seminar I ◆ *Stanley-Wilf Limits Are Typically Exponential* ◆ **Jacob Fox**, Massachusetts Institute of Technology

Members' Seminar ◆ *Recent Development of Random Matrix Theory* ◆ **Horng-Tzer Yau**, Harvard University; Distinguished Visiting Professor, School of Mathematics

October 8

Computer Science/Discrete Mathematics Seminar II ✦ *Rounding Moment Based SDP Relaxations by Column Selection* ✦ **Ali Kemal Sinop**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ✦ *Macdonald Processes I* ✦ **Alexei Borodin**, Massachusetts Institute of Technology

Security Awareness Seminar ✦ *Information Security* ✦ **Brian Epstein**, Staff, Institute for Advanced Study

October 9

IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Non-Equilibrium Dynamics and Random Matrices ✦ *Macdonald Processes II* ✦ **Alexei Borodin**, Massachusetts Institute of Technology

Mathematical Conversations ✦ *Stochastic Integrable Systems* ✦ **Herbert Spohn**, Technische Universität München; Member, School of Mathematics

October 10

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Nearby Cycles and Local Convolution* ✦ **Luc Illusie**, Université Paris–Sud 11

October 11

Princeton/IAS Symplectic Geometry Seminar ✦ *Finite Energy Foliations and Connect Sums* ✦ **Joel Fish**, Massachusetts Institute of Technology; Member, School of Mathematics

October 14

Computer Science/Discrete Mathematics Seminar I ✦ *Obfuscating Programs against Algebraic Attacks* ✦ **Yael Tauman-Kalai**, Microsoft Research New England

Special Members' Seminar ✦ *The Weil Conjectures, from Abel to Deligne* ✦ **Sophie Morel**, Princeton University ✦ *Hodge Theory, from Abel to Deligne* ✦ **Phillip A. Griffiths**, Professor Emeritus, School of Mathematics

October 15

Computer Science/Discrete Mathematics Seminar II ✦ *Minimal Majority Sequences* ✦ **Noga Alon**, Tel Aviv University; Visiting Professor, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ✦ *Dynamical Phase Transitions, Eigenstate Thermalization, and Schrödinger Cats within the Ferromagnetic Phase of an Infinite-Range Quantum Ising Model* ✦ **David A. Huse**, Princeton University

October 16

IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Non-Equilibrium Dynamics and Random Matrices ✦ *Some Inter-Relations between Random Matrix Ensembles* ✦ **Peter Forrester**, University of Melbourne

October 17

Non-Equilibrium Dynamics and Random Matrices ✦ *Spectral Theory for the q-Boson Particle System* ✦ **Alexei Borodin**, Massachusetts Institute of Technology

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *G-Valued Flat Deformations and Local Models* ✦ **Brandon Levin**, The University of Chicago; Member, School of Mathematics

October 18

Princeton/IAS Symplectic Geometry Seminar ✦ *How Not to Define Cylindrical Contact Homology* ✦ **Michael Hutchings**

October 21

Computer Science/Discrete Mathematics Seminar I ✦ *Fractional Covering Numbers, with an Application to the Levi-Hadwiger Conjecture for Convex Bodies* ✦ **Boaz Slomka**, Tel Aviv University

Members' Seminar ✦ *(Non)-Commutative Geometry of Wire Network Graphs from Triply Periodic CMC Surfaces* ✦ **E. Birgit Kaufmann**, Purdue University; Member, School of Mathematics

October 22

Computer Science/Discrete Mathematics Seminar II ✦ *Matrix Perturbation with Random Noise and Matrix Recovery Problems* ✦ **Van Vu**, Yale University

October 23

IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Non-Equilibrium Dynamics and Random Matrices ✦ *Spectral Properties of the Quantum Random Energy Model* ✦ **Simone Warzel**, Technische Universität München; von Neumann Fellow, School of Mathematics

Mathematical Conversations ✦ *Category Theory: What's It Good For?* ✦ **Inna Zakharevich**, The University of Chicago; Member, School of Mathematics

October 24

Non-Equilibrium Dynamics and Random Matrices ✦ *Diffusion from Deterministic Dynamics* ✦ **Antti Kupiainen**, University of Helsinki; Member, School of Mathematics

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *The Local Gan-Gross-Prasad Conjecture for Tempered Representations of Unitary Groups* ✦ **Raphaël Beuzart-Plessis**, Member, School of Mathematics

October 25

Princeton/IAS Symplectic Geometry Seminar ✦ *Enumeration of Real Rational Curves* ✦ **Penka Georgieva**, Princeton University

October 28

Computer Science/Discrete Mathematics Seminar I

Members' Seminar ✦ *Random Matrices and L-Functions* ✦ **Alex Kontorovich**, Yale University; Member, School of Mathematics

October 29

Computer Science/Discrete Mathematics Seminar II

Mathematical Conversations ✦ *Clothing Surfaces* ✦ **Etienne Ghys**, École Normale Supérieure de Lyon

October 30

Ruth and Irving Adler Expository Lecture in Mathematics ✦ *Dynamics in Dimension 3: Geometry of Birkhoff Sections* ✦ **Etienne Ghys**, École Normale Supérieure de Lyon

Non-Equilibrium Dynamics and Random Matrices ✦ *Gap Probabilities and Applications to Geometry and Random Topology* ✦ **Antonio Lerario**, Purdue University

October 31

Non-Equilibrium Dynamics and Random Matrices ✦ *Linear Statistics of Eigenvalues* ✦ **Kurt Johansson**, KTH Royal Institute of Technology, Stockholm

November 1

Princeton/IAS Symplectic Geometry Seminar ✦ *Volume in Seiberg-Witten Theory and the Existence of Two Reeb Orbits* ✦ **Daniel Cristofaro-Gardiner**, Member, School of Mathematics

November 4

Workshop on Non-Equilibrium Dynamics and Random Matrices

Computer Science/Discrete Mathematics Seminar I ✦ *Approximating Large Frequency Moments with Pick-and-Drop Sampling* ✦ **Vladimir Braverman**, Johns Hopkins University

Lectures on Homological Mirror Symmetry ✦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

November 5

Workshop on Non-Equilibrium Dynamics and Random Matrices

Computer Science/Discrete Mathematics Seminar II ◆ *Learning from Positive Examples* ◆ **Anindya De**, Member, School of Mathematics

Workshop on Non-Equilibrium Dynamics and Random Matrices

Workshop on Topology: Identifying Order in Complex Systems ◆ *Probabilistic Inference in Topological Data Analysis* ◆ **Andrew Blumberg**, The University of Texas at Austin IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Workshop on Topology: Identifying Order in Complex Systems ◆ *Braided Connecting Orbits in Parabolic Equations via Computational Homology* ◆ **Robert Vandervorst**, University of Amsterdam

Workshop on Topology: Identifying Order in Complex Systems ◆ *A Central Limit Theorem for Topology* ◆ **Peter Bubenik**, Cleveland State University

November 7
Workshop on Non-Equilibrium Dynamics and Random Matrices

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Heegner Points and a B-SD Conjecture* ◆ **Wei Zhang**, Columbia University

November 8
Workshop on Non-Equilibrium Dynamics and Random Matrices

Princeton/IAS Symplectic Geometry Seminar ◆ *Tori in Four-Dimensional Milnor Fibres* ◆ **Ailsa Keating**, Massachusetts Institute of Technology

Mathematical Conversations ◆ *The Cosmic Galois Group, a Tale of Geometry, Number Theory, and Physics* ◆ **Pierre Cartier**, Institut des Hautes Études Scientifiques

November 11
Computer Science/Discrete Mathematics Seminar I ◆ *Communication Lower Bounds via Block Sensitivity* ◆ **Toni Pitassi**, University of Toronto

Members' Seminar ◆ *cdh Methods in K-Theory and Hochschild Homology* ◆ **Charles Weibel**, Rutgers, The State University of New Jersey; Member, School of Mathematics

Lectures on Homological Mirror Symmetry ◆ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

November 12
Computer Science/Discrete Mathematics Seminar II ◆ *Hypermatrix Algebra, Its Spectral Decomposition, and Applications* ◆ **Edinah Gnang**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ◆ *Covariance Matrix Estimation for the Cryo-EM Heterogeneity Problem* ◆ **Amit Singer**, Princeton University

November 13
Security Awareness Seminar ◆ *Information Security* ◆ **Brian Epstein**, Staff, Institute for Advanced Study

IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Non-Equilibrium Dynamics and Random Matrices ◆ *A Spectral Gap in $SL^2(R)$ and Applications* ◆ **Jean Bourgain**, IBM von Neumann Professor, School of Mathematics

Mathematical Conversations ◆ *Multiplying Integer Matrices* ◆ **Alex Kontorovich**, Yale University; Member, School of Mathematics

November 14
Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Independence of ℓ and Local Terms* ◆ **Martin Olsson**, University of California, Berkeley

November 15
Princeton/IAS Symplectic Geometry Seminar ◆ *Calabi-Yau Mirror Symmetry: From Categories to Curve-Counts* ◆ **Tim Perutz**, The University of Texas at Austin

November 18
Computer Science/Discrete Mathematics Seminar I ◆ *Efficient Reasoning in PAC Semantics* ◆ **Brendan Juba**, Harvard University

Members' Seminar ◆ *Interacting Brownian Motions in the Kadar-Parisi-Zhang Universality Class* ◆ **Herbert Spohn**, Technische Universität München; Member, School of Mathematics

Lectures on Homological Mirror Symmetry ◆ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

November 19
Computer Science/Discrete Mathematics Seminar II ◆ *Interactive Channel Capacity* ◆ **Gillat Kol**, Member, School of Mathematics

November 20
IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

November 21
Non-Equilibrium Dynamics and Random Matrices ◆ *All-Order Asymptotics in Beta Ensembles in the Multi-Cut Regime* ◆ **Gaetan Borot**, Max-Planck-Institut für Mathematik

Working Group on Algebraic Number Theory

Non-Equilibrium Dynamics and Random Matrices ◆ *Diffusion and Superdiffusion of Energy in One-Dimensional Systems of Oscillators* ◆ **Stefano Olla**, Université Paris–Dauphine

Joint IAS/Princeton University Number Theory Seminar ◆ *Genus of Abstract Modular Curves with Level ℓ Structure* ◆ **Anna Gwenaelle Cadoret**, École Polytechnique; von Neumann Fellow, School of Mathematics

November 22
Princeton/IAS Symplectic Geometry Seminar ◆ *Gopakumar-Vafa Conjecture for Symplectic Manifolds* ◆ **Eleny Ionel**, Stanford University

November 25
Computer Science/Discrete Mathematics Seminar I ◆ *Geometry and Matrix Multiplication* ◆ **Joseph Landsberg**, Texas A&M University

Members' Seminar ◆ *Random Cayley Graphs* ◆ **Noga Alon**, Tel Aviv University; Visiting Professor, School of Mathematics

Lectures on Homological Mirror Symmetry ◆ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

November 26
Computer Science/Discrete Mathematics Seminar II ◆ *Toward Better Formula Lower Bounds: An Information Complexity Approach to the KRW Composition Conjecture* ◆ **Or Meir**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ◆ *Diffusion for the (Markov) Anderson Model* ◆ **Jeffrey Schenker**, Michigan State University; Member, School of Mathematics

December 2
Computer Science/Discrete Mathematics Seminar I ◆ *A Solution to Weaver's KS_2* ◆ **Adam Marcus**, Yale University

Members' Seminar ◆ *From Gromov to the Moon* ◆ **Joel Fish**, Massachusetts Institute of Technology; Member, School of Mathematics

Lectures on Homological Mirror Symmetry ◆ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

December 3
Computer Science/Discrete Mathematics Seminar II ◆ *Multi-Party Interactive Coding* ◆ **Allison Lewko**, Columbia University; Visitor, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ◆ *Polynomial Chaos and Scaling Limits of Disordered Systems* ◆ **Nikolaos Zygouras**, University of Warwick

December 4
Non-Equilibrium Dynamics and Random Matrices ◆ *KPZ Line Ensemble* ◆ **Ivan Corwin**, Clay Mathematics Institute, Columbia University, and Massachusetts Institute of Technology

Workshop on Topology: Identifying Order in Complex Systems ◆ *Some Applications of General Relativity to Non-Gravitational Physics* ◆ **Gary Gibbons**, University of Cambridge

IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Workshop on Topology: Identifying Order in Complex Systems ◆ *Paths and Cycles in Mechanism Design* ◆ **Rakesh Vohra**, University of Pennsylvania

Workshop on Topology: Identifying Order in Complex Systems ◆ *The Criticality Hypothesis: How Brains May Optimize Information Processing* ◆ **John Beggs**, Indiana University

December 5
Non-Equilibrium Dynamics and Random Matrices ◆ *Local Eigenvalue Statistics at the Edge of the Spectrum: An Extension of a Theorem of Soshnikov* ◆ **Alexander Sodin**, Princeton University

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Patching and p-adic Local Langlands* ◆ **Ana Caraiani**, Princeton University; Veblen Research Instructor, School of Mathematics

December 6
Princeton/IAS Symplectic Geometry Seminar ◆ *Feynman Categories, Universal Operations, and Master Equations* ◆ **Ralph Martin Kaufmann**, Purdue University; Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ◆ *KPZ Question and Answer Session* ◆ **Ivan Corwin**, Clay Mathematics Institute, Columbia University, and Massachusetts Institute of Technology; **Jeremy Quastel**, University of Toronto; Member, School of Mathematics; and **Herbert Spohn**, Technische Universität München; Member, School of Mathematics

December 9
Computer Science/Discrete Mathematics Seminar I ◆ *How Cryptosystems Are REALLY Broken* ◆ **Adi Shamir**, Weizmann Institute of Science

Members' Seminar ◆ *Eigenvalues and Eigenvectors of Spiked Covariance Matrices* ◆ **Antti Knowles**, New York University; Member, School of Mathematics

Lectures on Homological Mirror Symmetry ◆ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

December 10
Computer Science/Discrete Mathematics Seminar II ◆ *Simplicial Complexes as Expanders* ◆ **Ori Parzanchevski**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ◆ *Acquiring Knowledge through Information Loss* ◆ **Jürg Fröhlich**, Eidgenössische Technische Hochschule Zürich; Visiting Professor, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ◆ *Exponential Asymptotics, Generalized Borel Summability, and Applications* ◆ **Ovidiu Costin**, The Ohio State University

December 11
Non-Equilibrium Dynamics and Random Matrices ◆ *Rigidity Phenomena in Random Point Sets and Applications* ◆ **Subhroshekhar Ghosh**, Princeton University

IAS/Princeton University Wednesday Seminar on Perfectoid Spaces

Mathematical Conversations ◆ *Selberg Plays Ping-Pong* ◆ **Christopher Brav**, Member, School of Mathematics

December 12
Non-Equilibrium Dynamics and Random Matrices ◆ *Multi-Component KPZ Equations* ◆ **Herbert Spohn**, Technische Universität München; Member, School of Mathematics Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Complex Analytic Vanishing Cycles for Formal Schemes* ◆ **Vladimir Berkovich**, Weizmann Institute of Science; Member, School of Mathematics

December 13
Princeton/IAS Symplectic Geometry Seminar ◆ *Lagrangian Submanifolds of Complex Projective Space* ◆ **Michael Usher**, University of Georgia

December 16
Computer Science/Discrete Mathematics Seminar I ◆ *Bi-Lipschitz Bijection between the Boolean Cube and the Hamming Ball* ◆ **Gil Cohen**, Weizmann Institute of Science

January 21
Computer Science/Discrete Mathematics Seminar II ◆ *Deeper Combinatorial Lower Bounds* ◆ **Siu Man Chan**, Princeton University

Non-Equilibrium Dynamics and Random Matrices ◆ *A Quantitative Brunn-Minkowski Inequality and Estimates on the Remainder in the Riesz Rearrangement Inequality* ◆ **Eric Carlen**, Rutgers, The State University of New Jersey

January 22
Non-Equilibrium Dynamics and Random Matrices ◆ *Exact Formulas for Random Growth off a Flat Interface* ◆ **Daniel Remenik**, Universidad de Chile

Mathematical Conversations ◆ *A New Viewpoint on Analytic Geometry* ◆ **Oren Ben-Bassat**, University of Oxford

January 27
Computer Science/Discrete Mathematics Seminar I ◆ *Unique Games, the Lasserre Hierarchy, and Monogamy of Entanglement* ◆ **Aram Harrow**, Massachusetts Institute of Technology

Members' Seminar ◆ *Rigidity and Flexibility of Schubert Classes* ◆ **Colleen Robles**, Texas A&M University; Member, School of Mathematics

January 28
Computer Science/Discrete Mathematics Seminar II ◆ *Simplicial Complexes as Expanders* ◆ **Ori Parzanchevski**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ◆ *Self-Avoiding Walk in Dimension 4* ◆ **Roland Bauerschmidt**, Member, School of Mathematics

January 29
Non-Equilibrium Dynamics and Random Matrices ◆ *Random Constraint Satisfaction Problems: The Statistical Mechanics Approach and Results* ◆ **Guilhem Semerjian**, École Normale Supérieure, Paris

Mathematical Conversations ◆ *Boltzmann's Entropy and the Time Evolution of Macroscopic Systems* ◆ **Joel Lebowitz**, Rutgers, The State University of New Jersey; Member, School of Mathematics

January 31
Non-Equilibrium Dynamics and Random Matrices ◆ *Tagged Particle Diffusion in One-Dimensional Systems with Hamiltonian Dynamics* ◆ **Abhishek Dhar**, International Centre for Theoretical Sciences, Bangalore, India

February 3
Computer Science/Discrete Mathematics Seminar I ◆ *Local Correctability of Expander Codes* ◆ **Brett Hemenway**, University of Pennsylvania

Princeton/IAS Symplectic Geometry Seminar ◆ *A Remark on the Euler Equations of Hydrodynamics* ◆ **Kai Cieliebak**, Universität Augsburg

Members' Seminar ♦ *Moduli of Super Riemann Surfaces (Joint with E. Witten)* ♦ **Ron Donagi**, University of Pennsylvania; Visitor, School of Natural Sciences

February 4
Computer Science/Discrete Mathematics Seminar II ♦ *Simplicial Complexes as Expanders* ♦ **Ori Parzanchevski**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ♦ *Random Matrix Theory and Zeta Functions* ♦ **Peter Sarnak**, Professor, School of Mathematics

February 5
Goncharov Reading Group

Non-Equilibrium Dynamics and Random Matrices ♦ *Motion of an Invading Heavy Tracer Particle in a Bose Gas* ♦ **Gang Zhou**, California Institute of Technology

February 6
Joint IAS/Princeton University Number Theory Seminar ♦ *Low-Lying Fundamental Geodesics* ♦ **Alex Kontorovich**, Yale University; Member, School of Mathematics

February 7
Non-Equilibrium Dynamics and Random Matrices ♦ *In Search of Explicit Matrices that Behave Like Random Ones* ♦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

Princeton/IAS Symplectic Geometry Seminar ♦ *Cylindrical Contact Homology as a Well-Defined Homology?* ♦ **Joanna Nelson**, Visitor, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ♦ *The Hyperbolic Ax-Lindemann Conjecture* ♦ **Emmanuel Ullmo**, Université Paris-Sud 11

February 10
Computer Science/Discrete Mathematics Seminar I ♦ *Polynomial Bounds for the Grid-Minor Theorem* ♦ **Julia Chuzhoy**, Toyota Technological Institute at Chicago

Marston Morse Lectures ♦ *Arithmetic Hyperbolic 3-Manifolds, Perfectoid Spaces, and Galois Representations I* ♦ **Peter Scholze**, Universität Bonn

Lectures on Homological Mirror Symmetry ♦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

February 11
Computer Science/Discrete Mathematics Seminar II ♦ *Non-Commutative Arithmetic Computation* ♦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ♦ *Log-Integrability of Rademacher Fourier Series and Applications to Random Analytic Functions* ♦ **Alon Nishry**, Member, School of Mathematics

February 12
Goncharov Reading Group ♦ *An Introduction to Hodge Theory* ♦ **Christopher Brav**, Member, School of Mathematics

Marston Morse Lectures ♦ *Arithmetic Hyperbolic 3-Manifolds, Perfectoid Spaces, and Galois Representations II* ♦ **Peter Scholze**, Universität Bonn

Mathematical Conversations ♦ *Games, Strategies, and Computational Complexity* ♦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

February 13
Joint IAS/Princeton University Number Theory Seminar ♦ *Remarks on the Cohomology of the Lubin-Tate Tower* ♦ **Peter Scholze**, Universität Bonn

February 14
Princeton/IAS Symplectic Geometry Seminar ♦ *On Floer Cohomology and Non-Archimedian Geometry* ♦ **Mohammed Abouzaid**, Columbia University

Marston Morse Lectures ♦ *Arithmetic Hyperbolic 3-Manifolds, Perfectoid Spaces, and Galois Representations III* ♦ **Peter Scholze**, Universität Bonn

February 17
Computer Science/Discrete Mathematics Seminar I ♦ *Unifying Known Lower Bounds via Geometric Complexity Theory* ♦ **Joshua Grochow**, University of Toronto

Lectures on Homological Mirror Symmetry ♦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

February 18
Computer Science/Discrete Mathematics Seminar II ♦ *Non-Commutative Arithmetic Computation* ♦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ♦ *3/4-Fractional Superdiffusion in a System of Harmonic Oscillators Perturbed by a Conservative Noise* ♦ **Cédric Bernardin**, Université de Nice Sophia Antipolis

February 19
Goncharov Reading Group ♦ *More on Hodge Theory* ♦ **Christopher Brav**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ♦ *Hartree-Fock Dynamics for Weakly Interacting Fermions* ♦ **Benjamin Schlein**, Rheinische Friedrich-Wilhelms-Universität Bonn; Member, School of Mathematics

Mathematical Conversations ♦ *From the Quantum Hall Effect to Integral Lattices and Braided Tensor Categories* ♦ **Jürg Fröhlich**, Eidgenössische Technische Hochschule Zürich; Visiting Professor, School of Mathematics

February 20
Cross-Disciplinary Informal Talks ♦ *A New Look at the Jones Polynomial of a Knot* ♦ **Edward Witten**, Charles Simonyi Professor, School of Natural Sciences

Cross-Disciplinary Informal Talks ♦ *Duality and Emergent Gauge Symmetry* ♦ **Nathan Seiberg**, Professor, School of Natural Sciences

Cross-Disciplinary Informal Talks ♦ *Emergent Geometry: The Duality between Gravity and Quantum Field Theory* ♦ **Juan Maldacena**, Professor, School of Natural Sciences

Cross-Disciplinary Informal Talks ♦ *On the (Un)reasonable (In)effectiveness of Mathematics in Biology* ♦ **Stanislas Leibler**, Professor, School of Natural Sciences

February 21
Special Seminar ♦ *Families of Lattice Polarized K3 Surfaces with Monodromy* ♦ **Charles Doran**, University of Alberta

Princeton/IAS Symplectic Geometry Seminar ♦ *A Criterion for Generating Fukaya Categories of Fibrations* ♦ **Sheel Ganatra**, Stanford University

February 24
Computer Science/Discrete Mathematics Seminar I ♦ *An Almost-Linear-Time Algorithm for Approximate Max Flow in Undirected Graphs, and Its Multicommodity Generalizations* ♦ **Jonathan Kelner**, Massachusetts Institute of Technology

Members' Seminar ♦ *Zeros of Polynomials via Matrix Theory and Continued Fractions* ♦ **Olga Holtz**, University of California, Berkeley; von Neumann Fellow, School of Mathematics

Lectures on Homological Mirror Symmetry ♦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

February 25
Computer Science/Discrete Mathematics Seminar II ♦ *Fast Matrix Multiplication* ♦ **Yuval Filmus**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ♦ *Nearly Time-Periodic Water Waves* ♦ **Jon Wilkening**, University of California, Berkeley ♦ *Almost Global Solutions for Incompressible Elasticity in 2D* ♦ **Zhen Lei**, Fudan

University; Member, School of Mathematics ✦ *Strong Illposedness of Incompressible Euler in Borderline Spaces* ✦ **Dong Li**, The University of British Columbia

February 26
Goncharov Reading Group ✦ *An Introduction to Algebraic K-Theory* ✦ **Daniel R. Grayson**, University of Illinois at Urbana-Champaign; Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ✦ *An Application of the Renormalization Group Method to the Navier-Stokes System* ✦ **Yakov Sinai**, Princeton University

Mathematical Conversations ✦ *Non-Associative Division Algebras and Projective Geometry* ✦ **Charles Weibel**, Rutgers, The State University of New Jersey; Member, School of Mathematics

February 27
Non-Equilibrium Dynamics and Random Matrices ✦ *Quantum Hall Phases, Plasma Analogy, and Incompressibility Estimates* ✦ **Jakob Yngvason**, Universität Wien ✦ *From High-Dimensional Data to Big Data* ✦ **Han Liu**, Princeton University

Joint IAS/Princeton University Number Theory Seminar ✦ *Sigel Units and Euler Systems* ✦ **Antonio Lei**, McGill University

February 28
Non-Equilibrium Dynamics and Random Matrices ✦ *Many-Body Anderson Localization* ✦ **David A. Huse**, Princeton University

Princeton/IAS Symplectic Geometry Seminar ✦ *Implicit Atlases and Virtual Fundamental Cycles* ✦ **John Pardon**, Stanford University

March 3
Computer Science/Discrete Mathematics Seminar I ✦ *The Green-Tao Theorem and a Relative Szemeredi Theorem* ✦ **Yufei Zhao**, Massachusetts Institute of Technology

Members' Seminar ✦ *Topologies of Nodal Sets of Random Band Limited Functions* ✦ **Peter Sarnak**, Professor, School of Mathematics

Lectures on Homological Mirror Symmetry ✦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

March 4
Computer Science/Discrete Mathematics Seminar II ✦ *Fast Matrix Multiplication* ✦ **Yuval Filmus**, Member, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ✦ *The Dynamical ϕ_3^4 Model: Methodology and Results* ✦ **Martin Hairer**, University of Warwick; Member, School of Mathematics

March 5
Goncharov Reading Group ✦ *Hyperbolic Manifolds* ✦ **Tudor Dan Dimofte**, Long-term Member, School of Natural Sciences

Non-Equilibrium Dynamics and Random Matrices ✦ *The Dynamical ϕ_3^4 Model: Derivation of the Renormalised Equations* ✦ **Martin Hairer**, University of Warwick; Member, School of Mathematics

Princeton/IAS Symplectic Geometry Seminar ✦ *Contact Invariants in Sutured Monopole and Instanton Homology* ✦ **Steven Sivek**, Princeton University

Mathematical Conversations ✦ *From Matrix Multiplication to Digital Sculpting* ✦ **Edinah Gnang**, Member, School of Mathematics

March 6
Non-Equilibrium Dynamics and Random Matrices ✦ *The Dynamical ϕ_3^4 Model: Convergence of Approximations* ✦ **Martin Hairer**, University of Warwick; Member, School of Mathematics

Working Group on Algebraic Number Theory

Princeton/IAS Symplectic Geometry Seminar ✦ *Non-Displaceable Lagrangians via Minimal Model Transitions* ✦ **Chris Woodward**, Rutgers, The State University of New Jersey

Joint IAS/Princeton University Number Theory Seminar ✦ *Small Gaps between Primes* ✦ **James Maynard**, Université de Montréal

March 7
Princeton/IAS Symplectic Geometry Seminar ✦ *New Combinatorial Computations of Embedded Contact Homology* ✦ **Keon Choi**, University of California, Berkeley

March 10
Computer Science/Discrete Mathematics Seminar I ✦ *Two Structural Results for Low Degree Polynomials and Applications* ✦ **Avishay Tal**, Weizmann Institute of Science

Members' Seminar ✦ *Filtering the Grothendieck Ring of Varieties* ✦ **Inna Zakharevich**, The University of Chicago; Member, School of Mathematics

Lectures on Homological Mirror Symmetry ✦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

March 11
Computer Science/Discrete Mathematics Seminar II ✦ *How to Delegate Computations: The Power of No-Signaling* ✦ **Ran Raz**, Weizmann Institute of Science; Visiting Professor, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ✦ *The Sherrington-Kirkpatrick Model and Its Diluted Version I* ✦ **Dmitry Panchenko**, Texas A&M University

March 12
Non-Equilibrium Dynamics and Random Matrices ✦ *The Sherrington-Kirkpatrick Model and Its Diluted Version II* ✦ **Dmitry Panchenko**, Texas A&M University ✦ *The Brownian Motion as the Limit of a Deterministic System of Hard-Spheres* ✦ **Thierry Bodineau**, École Polytechnique, Université Paris-Saclay

Mathematical Conversations ✦ *Correlation of Magic Sequences and Some Ideas from Outer Space* ✦ **Mark Goresky**, Long-term Member, School of Mathematics

March 13
Working Group on Algebraic Number Theory

Non-Equilibrium Dynamics and Random Matrices ✦ *A Rigorous Result on Many-Body Localization* ✦ **John Imbrie**, University of Virginia; Member, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ✦ *Density of Certain Classes of Potentially Crystalline Representations in Local and Global Galois Deformation Rings* ✦ **Matthew Emerton**, The University of Chicago

March 14
Non-Equilibrium Dynamics and Random Matrices ✦ *Choptuik's Critical Spacetime* ✦ **Michael Reiterer**, Member, School of Mathematics

Princeton/IAS Symplectic Geometry Seminar ✦ *Knot Contact Homology and Topological Strings* ✦ **Tobias Ekholm**, Uppsala University ✦ *Moduli of Marked Disks, Open KdV, and Virasoro* ✦ **Jake Solomon**, Hebrew University

March 17
Computer Science/Discrete Mathematics Seminar I ✦ *The Matching Polytope Has Exponential Extension Complexity* ✦ **Thomas Rothvoss**, University of Washington

Members' Seminar ✦ *Criticality for Multicommodity Flows* ✦ **Paul Seymour**, Princeton University

March 18
Computer Science/Discrete Mathematics Seminar II ✦ *Graph Expansion and Communication Complexity of Algorithms* ✦ **Olga Holtz**, University of California, Berkeley; von Neumann Fellow, School of Mathematics

Non-Equilibrium Dynamics and Random Matrices ✦ *On the Boltzmann Equation without Angular Cut-Off* ✦ **Robert Strain**, University of Pennsylvania

March 19

Goncharov Reading Group ✦ *Introduction to Motives* ✦ **Ana Caraiani**, Princeton University; Veblen Research Instructor, School of Mathematics

Non–Equilibrium Dynamics and Random Matrices ✦ *Products of Random Matrices: New Results for Finite and Infinite Size* ✦ **Gernot Akemann**, Universität Bielefeld

Mathematical Conversations ✦ *The Math and Magic of Jorge Luis Borges* ✦ **Olga Holtz**, University of California, Berkeley; von Neumann Fellow, School of Mathematics

March 24

Computer Science/Discrete Mathematics Seminar I ✦ *List Decodability of Randomly Punctured Codes* ✦ **Mary Wootters**, University of Michigan

Princeton/IAS Symplectic Geometry Seminar ✦ *BCFG Drinfeld-Sokolov Hierarchies and ADE LG-Model with Symmetry* ✦ **Yongbin Ruan**, University of Michigan

Members' Seminar ✦ *Gambling, Computational Information, and Encryption Security* ✦ **Bruce Kapron**, University of Victoria; Member, School of Mathematics

March 25

Computer Science/Discrete Mathematics Seminar II ✦ *Circular Encryption in Formal and Computational Cryptography* ✦ **Bruce Kapron**, University of Victoria; Member, School of Mathematics

Special Number Theory Seminar ✦ *Eisenstein Series of Weight 1* ✦ **Kamal Khuri-Makdisi**, American University of Beirut

Non–Equilibrium Dynamics and Random Matrices ✦ *From Classical to Quantum Integrability, and Back* ✦ **Vladimir Kazakov**, École Normale Supérieure, Paris

March 26

Goncharov Reading Group ✦ *Dilogarithms* ✦ **Tudor Dan Dimofte**, Long-term Member, School of Natural Sciences, and **Christopher Brav**, Member, School of Mathematics

Non–Equilibrium Dynamics and Random Matrices ✦ *Some Results on History-Dependent Stochastic Processes* ✦ **Margherita Disertori**, Universität Bonn ✦ *Anomalous Shock Fluctuations in TASEP and Last Passage Percolation Models* ✦ **Patrik Ferrari**, Universität Bonn

Public Lecture ✦ *Univalent Foundations: New Foundations of Mathematics* ✦ **Vladimir Voevodsky**, Professor, School of Mathematics

Mathematical Conversations ✦ *Six Is the New Ten* ✦ **Tudor Dan Dimofte**, Long-term Member, School of Natural Sciences

March 27

Non–Equilibrium Dynamics and Random Matrices ✦ *Some Properties of the One-Dimensional q-Boson Asymmetric Zero-Range Process* ✦ **Tomohiro Sasamoto**, Tokyo Institute of Technology

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *On a Motivic Method in Diophantine Geometry* ✦ **Majid Hadian-Jazi**, University of Illinois at Chicago

March 28

Round Table on Open Problems in Non-Equilibrium Statistical Physics and Related Spectral Problems ✦ **Jürg Fröhlich**, Eidgenössische Technische Hochschule Zürich; Visiting Professor, School of Mathematics ✦ **David A. Huse**, Princeton University ✦ **Michael Aizenmann**, Princeton University

Princeton/IAS Symplectic Geometry Seminar ✦ *Virtual Neighborhood Technique and Its Applications* ✦ **Bai-Ling Wang**, The Australian National University

March 31

Workshop on Non–Equilibrium Dynamics and Random Matrices

Computer Science/Discrete Mathematics Seminar I ✦ *A Polynomial Lower Bound for Monotonicity Testing of Boolean Functions over Hypercube and Hypergrid Domains* ✦ **Rocco Servedio**, Columbia University

April 1

Workshop on Non–Equilibrium Dynamics and Random Matrices

Computer Science/Discrete Mathematics Seminar II ✦ *Byzantine Agreement in Expected Polynomial Time* ✦ **Valerie King**, University of Victoria; Member, School of Mathematics

Special Number Theory Seminar ✦ *Statistical Behavior of Eigenforms on Quaternion Algebras* ✦ **Paul Nelson**, École Polytechnique Fédérale de Lausanne

April 2

Workshop on Non–Equilibrium Dynamics and Random Matrices

Goncharov Reading Group ✦ *Back to the Paper!* ✦ **Inna Zakharevich**, The University of Chicago; Member, School of Mathematics, and **Christopher Brav**, Member, School of Mathematics

April 3

Workshop on Non–Equilibrium Dynamics and Random Matrices

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *A Framework of Rogers-Ramanujan Identities* ✦ **Ken Ono**, Emory University

April 4

Workshop on Non–Equilibrium Dynamics and Random Matrices

Princeton/IAS Symplectic Geometry Seminar ✦ *Towards Viterbo Functoriality for Nonexact Liouville Embeddings* ✦ **Janko Latschev**, Universität Hamburg ✦ *Minimal Discrepancy of Isolated Singularities and Reeb Orbits* ✦ **Mark McLean**, Stony Brook University, The State University of New York

April 7

Computer Science/Discrete Mathematics Seminar I ✦ *Progress on Algorithmic Versions of the Lovasz Local Lemma* ✦ **Aravind Srinivasan**, University of Maryland, College Park

Members' Seminar ✦ *Extracting Rational Vector Spaces from Torsion Groups* ✦ **Bhargav Bhatt**, Member, School of Mathematics

April 8

Computer Science/Discrete Mathematics Seminar II ✦ *Do NP-Hard Problems Require Exponential Time?* ✦ **Andrew Drucker**, Member, School of Mathematics

Special Number Theory Seminar ✦ *L-Functions, Sieves, and the Tate Shafarevich Group* ✦ **Maksym Radziwill**, Member, School of Mathematics

April 9

Goncharov Reading Group ✦ *More on Motives* ✦ **Charles Weibel**, Rutgers, The State University of New Jersey; Member, School of Mathematics

Mathematical Conversations ✦ *On Characters and Words in Groups* ✦ **Ori Parzanchevski**, Member, School of Mathematics

April 10

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Applications of Additive Combinatorics to Diophantine Equations* ✦ **Alexei Skorobogatov**, Imperial College London

April 14

Computer Science/Discrete Mathematics Seminar I ✦ *Local Correctability of Expander Codes* ✦ **Brett Hemenway**, University of Pennsylvania

Members' Seminar ✦ *Toroidal Soap Bubbles: Constant Mean Curvature Tori in S^3 and R^3* ✦ **Emma Carberry**, University of Sydney

Lectures on Homological Mirror Symmetry ✦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

April 15

Computer Science/Discrete Mathematics Seminar II ✦ *IP = PSPACE via Error Correcting Codes* ✦ **Or Meir**, Member, School of Mathematics

Non–Equilibrium Dynamics and Random Matrices ✦ *Duistermaat-Hackamn Measures and Pitman Theorem* ✦ **Philippe Biane**, Université Paris–Est Marne–la–Vallée

April 16

Non–Equilibrium Dynamics and Random Matrices ✦ *Limiting Eigenvalue Distribution of Random Matrices Involving Tensor Product* ✦ **Leonid Pastur**, B. Verkin Institute for Low Temperature Physics and Engineering, National Academy of Sciences of Ukraine

April 17

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Epipelagic Representations and Rigid Local Systems* ✦ **Zhiwei Yun**, Stanford University

April 21

Computer Science/Discrete Mathematics Seminar I ✦ *True Randomness: Its Origin and Expansion* ✦ **Yaoyun Shi**, University of Michigan

Members' Seminar ✦ *A Riemann-Roch Theorem in Bott-Chern Cohomology* ✦ **Jean-Michel Bismut**, Université Paris–Sud 11

Joint IAS/Princeton University Number Theory Seminar ✦ *A Transition Formula for Mean Values of Dirichlet Polynomials* ✦ **Yitang Zhang**, University of New Hampshire

April 22

Computer Science/Discrete Mathematics Seminar II ✦ *Results and Open Problems in the Theory of Quantum Complexity* ✦ **Andris Ambainis**, University of Latvia; von Neumann Fellow, School of Mathematics

Non–Equilibrium Dynamics and Random Matrices ✦ *Free Entropy* ✦ **Philippe Biane**, Université Paris–Est Marne–la–Vallée

April 23

Goncharov Reading Group
Non–Equilibrium Dynamics and Random Matrices ✦ *Nonlinear Brownian Motion and Nonlinear Feynman-Kac Formula of Path-Functions* ✦ **Shige Peng**, Shandong University

April 24

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Torsion in the Coherent Cohomology of Shimura Varieties and Galois Representations* ✦ **George Boxer**, Harvard University

April 28

Computer Science/Discrete Mathematics Seminar I ✦ *Search Games and Optimal Kakeya Sets* ✦ **Yuval Peres**, Microsoft Research

April 29

Computer Science/Discrete Mathematics Seminar II ✦ *A Central Limit Theorem for Gaussian Polynomials and Deterministic Approximate Counting for Polynomial Threshold Functions* ✦ **Anindya De**, Member, School of Mathematics

April 30

Goncharov Reading Group

Non–Equilibrium Dynamics and Random Matrices ✦ *Landau Damping: Gevrey Regularity and Paraproducts* ✦ **Clément Mouhot**, University of Cambridge ✦ *Geometry of Metrics and Measure Concentration in Abstract Ergodic Theory* ✦ **Tim Austin**, New York University

May 1

Joint IAS/Princeton University Number Theory Seminar ✦ *Geometric Structure and the Local Langlands Conjecture* ✦ **Paul Baum**, The Pennsylvania State University

May 2

Joint IAS/Princeton University Number Theory Seminar ✦ *Recovering Elliptic Curves from Their p-Torsion* ✦ **Benjamin Bakker**, New York University

May 7

Goncharov Reading Group

May 8

Joint IAS/Princeton University Number Theory Seminar ✦ *Moments of Zeta Functions Associated to Hyperelliptic Curves* ✦ **Michael Rubinstein**, University of Waterloo

May 13

Computer Science/Discrete Mathematics Seminar II ✦ *A Central Limit Theorem for Gaussian Polynomials and Deterministic Approximate Counting for Polynomial Threshold Functions* ✦ **Anindya De**, Member, School of Mathematics

May 14

Goncharov Reading Group

May 21

Goncharov Reading Group

June 10

Special Number Theory Seminar ✦ *Euler Systems and the Birch-Swinnerton-Dyer Conjecture* ✦ **Sarah Zerbes**, University College London

June 11

Special Number Theory Seminar ✦ *Euler Systems and Bounds for Selmer Groups* ✦ **David Loeffler**, University of Warwick

School of Natural Sciences

ASTROPHYSICS ACTIVITIES

July 8

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *General Discussion* ✦ **Matias Zaldarriaga**, Professor, School of Natural Sciences, and **David Spergel**, Princeton University

July 15

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Dark Matter Harmonics beyond Annual Modulation* ✦ **Ben Safdi**, Princeton University

July 22

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Overview: Joint Likelihood Function of Cluster Number Counts and Weak Lensing Power Spectrum* ✦ **David Spergel**, Princeton University

September 9

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Halo Bias: Nonlinear, Nonlocal, and Stochastic* ✦ **Ravi Sheth**, University of Pennsylvania

September 17

Astrophysics Seminar ✦ *Mega-Maser Cosmology Project* ✦ **Fred K. Y. Lo**, National Radio Astronomy Observatory

September 19

Astrophysics Informal Seminar ✦ *The Galaxy-Halo Connection and the Evolution of the Red Sequence* ✦ **Jeremy Tinker**, New York University

September 23

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Lagrangian Perturbation Theory at 1-Loop Level* ✦ **Naonori Sugiyama**, Princeton University

September 24

Astrophysics Seminar ✦ *The Progenitors of Short Gamma-Ray Bursts and the Electromagnetic Counterparts of Gravitational Wave Sources* ✦ **Edo Berger**, Harvard University

September 26

Astrophysics Informal Seminar ✦ *21cm Fluctuations during the Dark Ages: Accounting for the Relative Velocity of Baryons and CDM* ✦ **Yacine Ali-Haïmoud**, Member, School of Natural Sciences

October 1

Astrophysics Seminar ◆ *Unleashing Feedback: Galaxies and AGN* ◆ **Joseph Silk**, Johns Hopkins University

October 3

Astrophysics Informal Seminar ◆ *Characterization of Exoplanetary Atmospheres and Interiors* ◆ **Nikku Madhusudhan**, Yale University

October 7

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ◆ *Modeling the Hierarchical Evolution of Galaxy Clusters* ◆ **Irina Dvorkin**, Florence and George Wise Observatory, Tel Aviv University

October 8

Astrophysics Seminar ◆ *Aberrations Produced by Telescopes and by Galaxies* ◆ **Paul Schechter**, Massachusetts Institute of Technology

October 10

Astrophysics Informal Seminar ◆ *The Sad Story of the Cosmic EUV Background* ◆ **Matt McQuinn**, University of California, Berkeley

October 15

Astrophysics Seminar ◆ *Insights into the Galaxy from the RAVE Survey* ◆ **Rosemary Wyse**, Johns Hopkins University

October 16–28

Princeton Center for Theoretical Science/Institute for Advanced Study Workshop on the Dark Matter Paradigm: Current Status and Challenges ◆ *Dark Side* ◆ **Cristiano Galbiati**, Princeton University ◆ *Update on the Xenon Experiment* ◆ **Elena Aprile**, Columbia University ◆ *SABRE (Sodium Iodide with Active Background Rejection): A New Experiment to Test the DAMA/LIBRA Result* ◆ **Jingke Xu**, Princeton University ◆ *Overview of Gamma-Ray Radiation from Dark Matter Annihilation* ◆ **Doug Finkbeiner**, Harvard University ◆ *Dark Matter, Solar, and Laboratory Searches for the Axion* ◆ **Karl van Bibber**, University of California, Berkeley ◆ *AMS Results* ◆ **Andrei Kounine**, CERN ◆ *Dwarf Galaxies and Dark Matter* ◆ **Rosemary Wyse**, Johns Hopkins University ◆ *Dark Matter in the Milky Way* ◆ **Jo Bovy**, Member, School of Natural Sciences ◆ *Overview of Dark Matter Direct Detection* ◆ **Neal Weiner**, New York University ◆ *Monojets Versus the Rest of the World* ◆ **Kathryn Zurek**, University of Michigan ◆ *Dark Matter Searches with Fermi LAT* ◆ **Simona Murgia**, University of California, Irvine ◆ *Dark Matter Annihilation in the Galactic Center and Inner Galaxy* ◆ **Dan Hooper**, Fermi National Accelerator Laboratory and the University of Chicago ◆ *Theoretical and Experimental Aspects of Light Dark Matter* ◆ **Rouven Essig**, Stony Brook University, The State University of New York ◆ *Dark Matter Insights from Cosmological Structure Formation* ◆ **Risa Wechsler**, Stanford University ◆ *Update and Future of CDMS* ◆ **Enectali Figueroa-Feliciano**, Massachusetts Institute of Technology ◆ *New Ideas for Axion Detection* ◆ **Peter Graham**, Stanford University ◆ *Self-Interacting Dark Matter* ◆ **Manoj Kaplinghat**, University of California, Irvine ◆ *The Small-Scale Structure of Dark Matter* ◆ **Andrew Zentner**, University of Pittsburgh ◆ *Dark Matter Substructure and Gravitational Lensing* ◆ **Chuck Keeton**, Rutgers, The State University of New Jersey ◆ *The Impact of SIDM on Structure Formation and Direct Detection* ◆ **Mark Vogelsberger**, Harvard University ◆ *Probing Dark Matter Substructure with ALMA* ◆ **Neal Dalal**, University of Illinois ◆ Organizing Committee: **Kfir Blum**, Member, School of Natural Sciences; **Daniel Grin**, The University of Chicago; **Samuel Lee**, Princeton Center for Theoretical Science, Princeton University; **Mariangela Lisanti**, Princeton University; **Tracy Slatyer**, Massachusetts Institute of Technology

October 21

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ◆ *Current Dark Matter Annihilation Bounds from the CMB and Prospects for Neutrino Mass Measurements from ACTpol* ◆ **Neelima Sehgal**, Stony Brook University, The State University of New York

October 22

Astrophysics Seminar ◆ *How the CMB Challenges Standard Cosmology* ◆ **Glenn Starkman**, Case Western Reserve University

October 24

Astrophysics Informal Seminar ◆ *Unveiling the Origin of High-Energy Neutrinos Observed by IceCube* ◆ **Kohta Murase**, Member, School of Natural Sciences

October 29

Astrophysics Seminar ◆ *LSST Project Office and SLAC/Stanford* ◆ **Steven Kahn**, Stanford University

October 31

Astrophysics Informal Seminar ◆ *All-Radiation Backgrounds from Star-Forming Galaxies: A Preview* ◆ **Brian Lacki**, Member, School of Natural Sciences

November 4

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ◆ *Direct Constraints on High-Redshift Star Formation from Observed Chemical Revolution of DLAs* ◆ **Girish Kulkarni**, Max-Planck-Institut für Astronomie

November 5

Astrophysics Seminar ◆ *Black Hole Battery* ◆ **Janna Levin**, Columbia University

November 7

Astrophysics Informal Seminar ◆ *A Census of Distant, Giant Exoplanets* ◆ **Timothy David Brandt**, Member, School of Natural Sciences

November 12

Astrophysics Seminar ◆ *The Hubble Constant and Dark Energy from Cepheids, Supernovae, and Parallax* ◆ **Adam Riess**, Johns Hopkins University

November 14

Astrophysics Informal Seminar ◆ *Gravitational Wave Detection with Atom Interferometry* ◆ **Surjeet Rajendran**, Stanford University

November 18

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ◆ *Bridging the Gap between Theory and Observations of Galaxies across Cosmic Time* ◆ **Yuexing Li**, The Pennsylvania State University

November 19

Astrophysics Seminar ◆ *New Aspects of Core-Collapse Supernova Theory* ◆ **Christian Ott**, California Institute of Technology

November 21

Astrophysics Informal Seminar ◆ *Building HERA from PAPERclips and Supercomputers* ◆ **Aaron Parsons**, University of California, Berkeley

November 26

Astrophysics Seminar ◆ *Science Horizons and Technology Challenges in X-Ray Astronomy beyond Chandra* ◆ **Alexey Vikhlinin**, Harvard-Smithsonian Center for Astrophysics

December 2

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ◆ *Probing the Initial Conditions of the Universe Using Large-Scale Structure* ◆ **Nishant Agarwal**, Carnegie Mellon University

December 3

Astrophysics Seminar ◆ *Massive Gravity and Cosmology* ◆ **Gregory Gabadadze**, New York University

December 5

Astrophysics Informal Seminar ◆ *How Asteroseismology Is Changing Stellar Astrophysics* ◆ **Sarbani Basu**, Yale University

December 11

Astrophysics Seminar ◆ *Feedback Processes in Rapidly Star-Forming Galaxies* ◆ **Todd Thompson**, The Ohio State University

December 12

Astrophysics Informal Seminar ◆ *Detection of Lensing B-Modes in CMB Polarization* ◆ **Duncan Hanson**, McGill University

December 16

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ◆ *New Constraints on the Amplitude of Cosmic Density Fluctuations and Intracluster Gas from the Thermal SZ Signal Measured by Planck and ACT* ◆ **Colin Hill**, Princeton University

January 14

Astrophysics Seminar ✦ *Solar Chemical Anomalies and Late Accretion* ✦ **Wick Haxton**, University of California, Berkley

January 16

Astrophysics Informal Seminar ✦ *The All-Sky Automated Survey for Supernovae (ASAS-SN): Big Science with Small Telescopes* ✦ **José Prieto**, Princeton University

January 21

Astrophysics Seminar ✦ *Gaps in Galactic Stellar Streams* ✦ **Ray Carlberg**, University of Toronto

January 23

Astrophysics Informal Seminar ✦ *Three Pieces in the Form of a Ring* ✦ **Jihad Touma**, American University of Beirut; Visitor, School of Natural Sciences

January 27

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Not All Approaches to Large-Scale Structure Are Created Equal* ✦ **Svetlin Tassev**, Princeton University

January 28

Astrophysics Seminar ✦ *ALMA Observations of Galaxy Evolution and Nuclear Activity* ✦ **Nick Scoville**, California Institute of Technology

January 30

Astrophysics Informal Seminar ✦ *Supernova Remnants as Galactic Cosmic-Ray Factories* ✦ **Damiano Caprioli**, Princeton University

February 4

Astrophysics Seminar ✦ *Once Upon a Time in Kamchatka: The Extraordinary Search for Natural Quasicrystals* ✦ **Paul Steinhardt**, Princeton University

February 6

Astrophysics Informal Seminar ✦ *ALMA Observations of Strongly Lensed Dusty Star-Forming Galaxies and Prospects for Mapping the Small-Scale Structure of Dark Matter Halos* ✦ **Yashar Hezaveh**, Stanford University

February 10

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Progress and Challenges for CMB Lensing* ✦ **Alexander van Engelen**, Stony Brook University, The State University of New York

February 10–12

Astrophysics Workshop on Ias @ IAS ✦ Day 1 Morning Moderator: **Doron Kushnir**, Member, School of Natural Sciences ✦ *Opening Words* ✦ **Bob Kirshner**, Harvard-Smithsonian Center for Astrophysics ✦ *What Do We Really Know about SNe Ias* ✦ **Craig Wheeler**, The University of Texas at Austin ✦ *White Dwarf Collisions in Triple Systems* ✦ **Boaz Katz**, Long-term Member, School of Natural Sciences ✦

Bolometric Light Curve Session Speakers: **Mark M. Phillips**, Las Campanas Observatory ✦ **Boaz Katz**, Long-term Member, School of Natural Sciences ✦ **Andy Howell**, University of California, Santa Barbara ✦ Day 1 Afternoon Moderator: **Avishay Gal-Yam**, Weizmann Institute of Science ✦ *Nebular Phase* Session Speakers: **Subo Dong**, The Kavli Institute for Astronomy and Astrophysics at Peking University ✦ **Peter Garnavich**, University of Notre Dame ✦ **Keiichi Maeda**, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo ✦ **Paolo Mazzali**, The Astrophysics Research Institute at Liverpool John Moores University ✦ **Jeffrey Silverman**, The University of Texas at Austin ✦ *General* Session Speakers: **Adam Burrows**, Princeton University ✦ **Ken Shen**, University of California, Berkeley ✦ **Maximilian Stritzinger**, Aarhus University, Denmark ✦ Day 2 Morning Moderator: **Eran Ofek**, Weizmann Institute of Science ✦ *Spectra* Session Speakers: **Luc Dessart**, Astrophysics Laboratory of Marseille, France ✦ **Markus Kromer**, Max-Planck-Institut für Astrophysik ✦ **Kate Maguire**, University of Oxford, United Kingdom ✦ Day 2 Afternoon Moderator: **Boaz Katz**, Long-term Member, School of Natural Sciences ✦ *Spectra* Session Speaker (continued): **Stuart Sim**, Queens University Belfast ✦ *The Combustion Physics of Each Model* Session Speakers: **Wolfgang Hillebrandt**, Max-Planck-Institut für Astrophysik ✦ **Doron Kushnir**, Member, School of Natural Sciences ✦ **Alexei Poludnenko**, U.S. Naval Research Laboratory ✦ **Francis Timmes**, Arizona State University ✦ *Special Session 2014J* ✦ **Avishay Gal-Yam**, Weizmann Institute of Science ✦ Day 3 Morning Moderator: **Francis Timmes**, Arizona State University ✦ *Diversity and Bimodality* Session Speakers: **Ryan Foley**, Harvard-Smithsonian Center for Astrophysics ✦ **Saurabh Jha**, Rutgers, The State University of New Jersey ✦ **Peter Nugent**, University of California, Berkeley ✦ *Progenitor's Hunt* Session Speakers: **Carlos Badenes**, University of Pittsburgh ✦ **Eran Ofek**, Weizmann Institute of Science ✦ **Keníichi Nomoto**, The University of Tokyo ✦ Organizers: **Doron Kushnir**, Member, School of Natural Sciences ✦ **Boaz Katz**, Long-term Member, School of Natural Sciences ✦ **Avishay Gal-Yam**, Weizmann Institute of Science ✦ **Eran Ofek**, Weizmann Institute of Science ✦ **Francis Timmes**, Arizona State University

February 11

Astrophysics Seminar ✦ *On the Source of the Dust Extinction in Type Ia Supernovae* ✦ **Mark M. Phillips**, Las Campanas Observatory

February 14

Astrophysics Informal Seminar ✦ *Supernovae and Gamma-Ray Bursts* ✦ **Paolo Mazzali**, Astrophysics Research Institute, Liverpool John Moores University

February 18

Astrophysics Seminar ✦ *Driving the Dynamo via Magnetic Helicity Flux: How Differential Rotation Makes Large-Scale Magnetic Fields* ✦ **Ethan Vishniac**, University of Saskatchewan

February 20

Astrophysics Informal Seminar ✦ *Introducing Clustering Redshifts* ✦ **Brice Menard**, Johns Hopkins University

February 25

Astrophysics Seminar ✦ *Studying the Largest Objects in the Universe Undergoing the Most Energetic Collisions in the Universe with the World's Biggest (Moveable) Telescope* ✦ **Mark Devlin**, University of Pennsylvania

February 27

Astrophysics Informal Seminar ✦ *Small-Scale CMB Cosmology: ACT, Planck, and Beyond* ✦ **Renée Hlozek**, Princeton University

March 3

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Synergies between the Atacama Cosmology Telescope and Planck CMB Observations* ✦ **Erminia Calabrese**, University of Oxford

March 4

Astrophysics Seminar ✦ *Cosmology and Astrophysics with Galaxy Clusters* ✦ **Daisuke Nagai**, Yale University

March 6

Astrophysics Informal Seminar ✦ *Extremes of Compact Object Birth, from the Dimmest to the Super-Luminous* ✦ **Brian Metzger**, Columbia University

March 11

Astrophysics Seminar ✦ *Gamma-Ray Bursts: The Standard Model and Beyond* ✦ **Peter Mészáros**, The Pennsylvania State University

March 13

Astrophysics Informal Seminar ✦ *Firehose and Mirror Instabilities in a Collisionless Shearing Plasma* ✦ **Matthew Kunz**, Princeton University

March 18

Astrophysics Seminar ✦ *Measuring the Cosmic Distance Scale with SDSS-III* ✦ **Daniel Eisenstein**, Harvard University

March 20

Astrophysics Informal Seminar ✦ *Extracting Exoplanet Demographics from the Kepler Survey* ✦ **Tim Morton**, Princeton University

March 25

Astrophysics Seminar ✦ *IceCube's Neutrinos: A New Era in Neutrino and Cosmic-Ray Astrophysics* ✦ **Eli Waxman**, Weizmann Institute of Science

March 27

Astrophysics Informal Seminar ⬥ *Discharging Black Holes in Massive Electrodynamics and Disappearing Black Holes in Massive Gravity* ⬥ **Mehrdad Mirbabayi**, Member, School of Natural Sciences

March 31

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ⬥ *The Search for Relic Neutrinos* ⬥ **Mariangela Lisanti**, Princeton University

April 1

Astrophysics Seminar ⬥ *Lensing by Galaxies, Filaments, and Voids* ⬥ **Bhuvnesh Jain**, University of Pennsylvania

April 3

Astrophysics Informal Seminar ⬥ *Reexamining Astrophysical Constraints on the Dark Matter Model* ⬥ **Alyson Brooks**, Rutgers, The State University of New Jersey

April 7

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ⬥ *Back to the 80s* ⬥ **Matias Zaldarriaga**, Professor, School of Natural Sciences

April 8

Astrophysics Seminar ⬥ *Galaxy Evolution and the Growth of Supermassive Black Holes* ⬥ **Meg Urry**, Yale University

April 10

Astrophysics Informal Seminar ⬥ *The Origin of Retrograde Hot Jupiters* ⬥ **Smadar Naoz**, Harvard–Smithsonian Center for Astrophysics

April 14

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ⬥ *Primordial Power Spectrum Pre- and Post-BICEP* ⬥ **Grigor Aslanyan**, The University of Auckland

April 15

Astrophysics Seminar ⬥ *Observations of Star-Forming Galaxies in the Heart of the Reionization Era* ⬥ **Richard Ellis**, California Institute of Technology

April 17

Astrophysics Informal Seminar ⬥ *What We Can(not) Learn from Dark Matter Direct-Detection Experiments* ⬥ **Vera Gluscevic**, Member, School of Natural Sciences

April 22

Astrophysics Seminar ⬥ *The Vast Polar Structures around the Milky Way and Andromeda, and the Implications Thereof for Fundamental Physics* ⬥ **Pavel Kroupa**, Helmholtz–Institut für Strahlen– und Kernphysik, Universität Bonn

April 24

Astrophysics Informal Seminar ⬥ *Quantitative Predictions for Galaxy Formation* ⬥ **Andrew Benson**, Carnegie Observatories, Carnegie Institution of Washington

April 28

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ⬥ *Cosmology Results from the Pan-STARRs Supernova Survey* ⬥ **Dan Scolnic**, Johns Hopkins University and the University of Chicago

April 29

Astrophysics Seminar ⬥ *Probing Cosmic Acceleration with the Dark Energy Survey* ⬥ **Joshua A. Frieman**, Fermi National Accelerator Laboratory and the University of Chicago

May 1

Astrophysics Informal Seminar ⬥ *500 Days on Mars: Initial Results from the Curiosity Rover Mission* ⬥ **Kevin Lewis**, Princeton University

May 6

Astrophysics Seminar ⬥ *Confirming and Constraining Kepler Planets via Transit Timing Variations* ⬥ **Matt Holman**, Harvard-Smithsonian Center for Astrophysics

May 8

Astrophysics Informal Seminar ⬥ *Signatures of Massive Galaxy Mergers at $z < 1$* ⬥ **Sean T. McWilliams**, West Virginia University

May 12

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ⬥ *Origin of Probabilities and Their Application to the Multiverse: Toward a Resolution of Cosmological Measure Problems* ⬥ **Andreas Albrecht**, University of California, Davis

May 13

Astrophysics Seminar ⬥ *Quantum Information in Experiments: There and Back Again* ⬥ **Shlomi Kotler**, National Institute of Standards and Technology, Boulder

May 15

Astrophysics Informal Seminar ⬥ *Liquid Crystals of Stars and Black Holes at the Centers of Galaxies* ⬥ **Bence Kocsis**, Member, School of Natural Sciences

June 2

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ⬥ *A Balloon-Borne Polarimeter for Cosmic Microwave Background Observation* ⬥ **Sasha Rahlin**, Princeton University

June 16

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ⬥ *Bayesian Inference for Radio Observations (BIRO)—Or, Facing What the CLEANers Sweep Under the Rug* ⬥ **Michelle Lochner**, University of Cape Town and University College London

HIGH ENERGY THEORY ACTIVITIES

September 11

Informal High Energy Theory Seminar ⬥ *The Local Callan-Symanzik Equation: Structure and Applications* ⬥ **Boaz Keren-Zur**, École Polytechnique Fédérale de Lausanne

September 18

Physics Group Meeting ⬥ *Large N Chern-Simons Theories with Fundamental Matter and Their Duals* ⬥ **Shiraz Minwalla**, Tata Institute of Fundamental Research, Mumbai; Junior Visiting Professor, School of Natural Sciences

September 19

Future Colliders Seminar ⬥ *Ask Not What A 100 TeV pp Collider Can Do for You, Ask What You Can Do for A 100 TeV pp Collider* ⬥ **Nima Arkani-Hamed**, Professor, School of Natural Sciences

September 23

High Energy Theory Seminar ⬥ *Topological Order and Long-Range Entanglement—Can Elementary Particles Emerge from Qubits?* ⬥ **Xiao-Gang Wen**, Perimeter Institute for Theoretical Physics

September 24

Informal High Energy Theory Seminar ⬥ *How Perturbative Field Theory Could Have Been Discovered in Einstein's Gravity* ⬥ **Barak Kol**, Racah Institute of Physics

September 25

Physics Group Meeting ⬥ *Bootstrapping the O(N) Vector Models* ⬥ **David Simmons-Duffin**, Member, School of Natural Sciences

September 26

Future Colliders Seminar ⬥ *Unbroken SU(2) at a 100 TeV Collider* ⬥ **Anson Hook**, Member, School of Natural Sciences; **Andrey Katz**, Harvard University

October 2

Physics Group Meeting ⬥ *The 4d Superconformal Bootstrap: Chiral Algebras in 4d Superconformal Field Theory (Part I)* ⬥ **Leonardo Rastelli**, Stony Brook University, The State University of New York; Member, School of Natural Sciences

October 4

High Energy Theory Seminar ⬥ *The 4d Superconformal Bootstrap: Chiral Algebras in 4d Superconformal Field Theory (Part II)* ⬥ **Christopher Beem**, Member, School of Natural Sciences

October 7

High Energy Theory Seminar ◆ *Spacetime S-Matrix and Flux-Tube S-Matrix* ◆ **Pedro Vieira**, Perimeter Institute for Theoretical Physics

October 9

Informal Phenomenology Seminar ◆ *What's Wrong with Goldstone?* ◆ **Hitoshi Murayama**, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo

October 16

Physics Group Meeting ◆ *Scattering of Massless Particles: Scalars, Gluons, and Gravitons* ◆ **Song He**, Member, School of Natural Sciences

October 18

High Energy Theory Seminar ◆ *Amplitudes, Regulators, and the Elliptic Dilogarithm: Physics and Arithmetic of the Sunset Diagram in Two Dimensions* ◆ **Pierre Vanhove**, Institut des Hautes Études Scientifiques

October 21

High Energy Theory Seminar ◆ *Axion Detection with NMR* ◆ **Peter Graham**, Stanford University

October 23

Physics Group Meeting ◆ *Localization and Super Renyi Entropy* ◆ **Tatsuma Nishioka**, Member, School of Natural Sciences

October 28

High Energy Theory Seminar ◆ *The Geometry of the Quantum Hall Effect* ◆ **Dam Thanh Son**, The University of Chicago

October 29

High Energy Theory Seminar ◆ *Hilbert Series for the Coulomb Branch of N=4 Supersymmetric Gauge Theories in Three Dimensions* ◆ **Amihay Hanany**, Imperial College London

October 30

Physics Group Meeting ◆ *Global Properties of Supersymmetric Theories and the Lens Space* ◆ **Brian M. Willett**, Member, School of Natural Sciences

October 31

Supergravity Seminar ◆ *Ultraviolet Properties of Half-Maximal Supergravity* ◆ **Scott Davies**, University of California, Los Angeles

November 1

High Energy Theory Seminar ◆ *First Results from the LUX Dark Matter Experiment* ◆ **Daniel McKinsey**, Yale University

November 5

Physics Group Meeting ◆ *Discussion on State Dependence and Black Hole Interiors* ◆ **Group Discussion**

November 6

Physics Group Meeting ◆ *5d Super-Yang-Mills and 4d Non-Lagrangian Theories* ◆ **Kazuya Yonekura**, Member, School of Natural Sciences

November 8

High Energy Theory Seminar ◆ *Comments on Holographic Finite Density Matter* ◆ **Andrei Parnachev**, Universiteit Leiden

November 11

High Energy Theory Seminar ◆ *(0,2) Trialities* ◆ **Abhijit Gadde**, California Institute of Technology

November 14

Informal High Energy Theory Seminar ◆ *On Heavy Supersymmetry* ◆ **Timothy Cohen**, Stanford University

November 20

Physics Group Meeting ◆ *All You Ever Wanted to Know about LHC Experiments, but Were Afraid to Ask* ◆ **Raffaele Tito D'Agnolo**, Member, School of Natural Sciences

December 2

High Energy Theory Seminar ◆ *Higher Symmetry, Topological Quantum Field Theory, and Gapped Phases of Matter* ◆ **Anton Kapustin**, California Institute of Technology

December 4

Physics Group Meeting ◆ *Computing Three-Point Functions for Short Operators* ◆ **Till Bargheer**, Member, School of Natural Sciences

December 11

Physics Group Meeting ◆ *Split Dirac Supersymmetry and a Higgsino LSP* ◆ **Graham Kribs**, University of Oregon; Member, School of Natural Sciences

December 13

High Energy Theory Seminar ◆ *New Predictions for Dark Matter Direct-Detection Experiments* ◆ **Ben Safdi**, Princeton University

December 16

High Energy Theory Seminar ◆ *de Sitter Holography and Wavefunctionals* ◆ **Dionysios Anninos**, Stanford University

January 13

High Energy Theory Seminar ◆ *Covariant Map between RNS and Pure Spinor Superstring Formalisms* ◆ **Nathan Berkovits**, Universidade Estadual Paulista Júlio de Mesquita Filho, São Paulo

January 27

High Energy Theory Seminar ◆ *Cluster Polylogarithms for Scattering Amplitudes* ◆ **Marcus Spradlin**, Brown University

January 30

Future Colliders Seminar ◆ *Experimental Challenges at the Future Circular Colliders* ◆ **Marco Zanetti**, Massachusetts Institute of Technology

February 10

High Energy Theory Seminar ◆ *Lattice N=4 Super-Yang-Mills* ◆ **Joel Giedt**, Rensselaer Polytechnic Institute

February 12

Physics Group Meeting ◆ *Fuchsian Differential Equations for Feynman Integrals* ◆ **Johannes Henn**, Long-term Member, School of Natural Sciences

February 14

High Energy Theory Seminar ◆ *Anomaly-Induced Transport and Chiral Part Cardy Formula* ◆ **Loganayagam Ramalingam**, Member, School of Natural Sciences

February 20

School of Mathematics Cross-Disciplinary Informal Talks ◆ *A New Look at the Jones Polynomial of a Knot* ◆ **Edward Witten**, Charles Simonyi Professor, School of Natural Sciences

February 20

School of Mathematics Cross-Disciplinary Informal Talks ◆ *Duality and Emergent Gauge Symmetry* ◆ **Nathan Seiberg**, Professor, School of Natural Sciences

February 20

School of Mathematics Cross-Disciplinary Informal Talks ◆ *Emergent Geometry: The Duality Between Gravity and Quantum Field Theory* ◆ **Juan Maldacena**, Professor, School of Natural Sciences

February 24

High Energy Theory Seminar ◆ *Massive Gravity: A Status Report* ◆ **Rachel Rosen**, Columbia University

February 28

High Energy Theory Seminar ◆ *Conformal Field Theory and Quantized Spacetime* ◆ **Herman Verlinde**, Princeton University

March 5

Physics Group Meeting ◆ *Riemann-Hilbert Equations for Exact Planar Spectrum of N=4 SYM* ◆ **Vladimir Kazakov**, École Normale Supérieure, Paris; Member, School of Natural Sciences

March 17

High Energy Theory Seminar ◆ *Indirect Detection of Wino Dark Matter: Multichannel Detection Study* ◆ **Ilias Cholis**, Fermilab

March 19

Physics Group Meeting ◆ *Introduction to Local Quantum Physics* ◆ **Jürg Fröhlich**, Visiting Professor, School of Mathematics

March 26

Physics Group Meeting ✦ *3d N=2 from 4d N=4* ✦ **Masahito Yamazaki**, Member, School of Natural Sciences

March 28

High Energy Theory Seminar ✦ *Regge Theory: Old and New* ✦ **Simon Caron-Huot**, Niels Bohr Institute, University of Copenhagen; Member, School of Natural Sciences

March 31

High Energy Theory Seminar ✦ *Implications of Inflationary Gravity Waves for the QCD Axion* ✦ **Scott Thomas**, Rutgers, The State University of New Jersey

April 2

Physics Group Meeting ✦ *Causal Partitions in AdS/CFT* ✦ **Veronika Hubeny**, Durham University; Member, School of Natural Sciences

April 11

High Energy Theory Seminar ✦ *Effective Actions for Anomalous Hydrodynamics* ✦ **Mukund Rangamani**, Durham University; Member, School of Natural Sciences

April 14

High Energy Theory Seminar ✦ *BTZ/CFT* ✦ **Raman Sundrum**, University of Maryland

April 16

Physics Group Meeting ✦ *From the OPE to BFKL* ✦ **Amit Sever**, Member, School of Natural Sciences

April 23

Physics Group Meeting ✦ *Fractional Quantum Hall Effect in Graphene* ✦ **Ravindra Bhatt**, Princeton University; Member, School of Natural Sciences

April 25

High Energy Theory Seminar ✦ *Anomalies and the S-Matrix* ✦ **Yu-tin Huang**, Member, School of Natural Sciences

April 30

Physics Group Meeting ✦ *Gauge Theories and Quantum Integrability* ✦ **Vasily Pestun**, Member, School of Natural Sciences

May 7

Physics Group Meeting ✦ *"Total Cross-Sections" and a Froissart Bound in Conformal Field Theories* ✦ **Simon Caron-Huot**, Niels Bohr Institute, University of Copenhagen; Member, School of Natural Sciences

May 9

High Energy Theory Seminar ✦ *Naturalness after the First Run of the LHC* ✦ **Marco Farina**, Cornell University

May 14

Physics Group Meeting ✦ *Gravitational Waves and the Scale of Inflation* ✦ **Mehrdad Mirbabayi**, Member, School of Natural Sciences

May 21

Physics Group Meeting ✦ *Proof of a Quantum Bousso Bound* ✦ **Horacio Casini**, Centro Atómico Bariloche, Argentina

May 23

High Energy Theory Seminar ✦ *M2 Brane Junction and Four-Dimensional Line Operator* ✦ **Dan Xie**, Member, School of Natural Sciences

June 16–20

Prospects in Theoretical Physics: String Theory ✦ *The Amplituhedron* ✦ **Nima Arkani-Hamed**, Professor, School of Natural Sciences ✦ *Introduction to Higher Spin AdS/CFT* ✦ **Simone Giombi**, Princeton University ✦ *Applications of String Theory* ✦ **Steven Gubser**, Princeton University ✦ *O(N) Models, RG, and AdS/CFT* ✦ **Igor Klebanov**, Princeton University ✦ *Causality Constraints on Graviton Three-Point Amplitudes* ✦ **Juan Maldacena**, Professor, School of Natural Sciences ✦ *Topological String Theory* ✦ **Hirosi Ooguri**, California Institute of Technology ✦ *Self-Destructive Manifolds and the Cosmological Constant* ✦ **Alexander Polyakov**, Princeton University ✦ *Supersymmetric Quantum Field Theories* ✦ **Nathan Seiberg**, Professor, School of Natural Sciences ✦ *CFT/AdS and the Black Hole Interior* ✦ **Herman Verlinde**, Princeton University ✦ *String Compactification* ✦ **Martijn Wijnholt**, Ludwig-Maximilians-Universität München ✦ *The Gopakumar-Vafa Formula* ✦ **Edward Witten**, Charles Simonyi Professor, School of Natural Sciences

June 25

Strings 2014 Parallel Sessions: ✦ *Quantum Entanglement and Local Operators* ✦ **Tadashi Takayanagi**, Yukawa Institute for Theoretical Physics, Kyoto University; ✦ *Sphere Partition Functions, the Zamolodchikov Metric, and Surface Operators* ✦ **Jaume Gomis**, Perimeter Institute for Theoretical Physics ✦ *A Holographic Perspective on the Kibble-Zurek Mechanism* ✦ **Paul Chesler**, Harvard University ✦ *A Toy Model for the Kerr/CFT Correspondence* ✦ **Monica Guica**, University of Pennsylvania ✦ *Mock Modular Moonshine for M22 and M23* ✦ **Shamit Kachru**, Stanford University ✦ *Entanglement Negativity in Conformal Field Theory* ✦ **Erik Tonni**, Scuola Internazionale Superiore di Studi Avanzati, Trieste ✦ *RR Charge and Gamma Class* ✦ **Sungjay Lee**, The University of Chicago ✦ *Probing the Structure of Quantum Phases of Matter with Holography* ✦ **Sera Cremonini**, University of Cambridge and Texas A&M ✦ *BTZ/CFT* ✦ **Raman Sundrum**, University of Maryland ✦ *Singularities and Gauge Theory Phases* ✦ **Mboyo Esole**, Harvard University ✦ *Holographic Entanglement* ✦ **Veronika Hubeny**, Durham University ✦ *N=4 Scattering Amplitudes and the Regularized Grassmanian* ✦ **Matthias Staudacher**, Humboldt–Universität zu Berlin ✦ *String Theory of the Regge Intercept* ✦ **Simeon Hellerman**, Institute for the Physics and Mathematics of the Universe, Kashiwa, Japan ✦ *Recent Progress on the Abelian Sector of F-Theory* ✦ **Denis Klevers**, University of Pennsylvania ✦ *Toda CFT from Six Dimensions* ✦ **Clay Cordova**, Harvard University ✦ *State Dependent Operators and the Information Paradox* ✦ **Suvrat Raju**, Tata Institute of Fundamental Research, Mumbai ✦ *Amplitudes and the Scattering Equations, Proofs, and Polynomials* ✦ **Louise Dolan**, University of North Carolina, Chapel Hill ✦ *Higher-Rank Fields, Currents, and Higher Spin Holography* ✦ **Mikhail Vasiliev**, Lebedev Physical Institute of the Russian Academy of Sciences ✦ *Mordell-Weil Torsion and Matter Spectra in F-Theory* ✦ **Timo Weigand**, Heidelberg University ✦ *Monte Carlo Approach to String/M-Theory* ✦ **Masanori Hanada**, Kyoto University and Stanford University ✦ *Scattering Amplitudes at Strong Coupling beyond the Area Paradigm,* **Benjamin Basso**, École Normale Supérieure, Paris ✦ *The Exact Renormalization Group and Higher Spin Holography* ✦ **Rob Leigh**, University of Illinois at Urbana-Champaign ✦ *B-Modes and the Nature of Inflation* ✦ **Daniel Baumann**, University of Cambridge ✦ *Quantum Black Holes and Quantum Holography* ✦ **Atish Dabholkar**, Laboratoire de Physique Théorique et Hautes Energies, Universités Paris VI–VII ✦ *Four-Point Scattering from Amplituhedron* ✦ **Jaroslav Trnka**, California Institute of Technology ✦ *Meromorphic Functions and the Topology of Giants* ✦ **Jeff Murugan**, University of Cape Town ✦ *Moduli, a 0.1-1 keV Cosmic Axion Background, and the Galaxy Cluster Soft Excess* ✦ **Joseph Conlon**, University of Oxford

July 14

High Energy Theory Seminar ✦ *Effective String Theory Simplified* ✦ **Jonathan Maltz**, Stanford University

SIMONS CENTER FOR SYSTEMS BIOLOGY ACTIVITIES

July 2

The Simons Center for Systems Biology Seminar ✦ *p53 and Control of Epigenetic Silencing of Mammalian "Repeatome"* ✦ **Andrei V. Gudkov**, Roswell Park Cancer Institute

July 3

The Simons Center for Systems Biology Seminar ✦ *Understanding the Genetic Etiologies of Complex Diseases through Variants with Large Effects* ✦ **Teng Ting Lim**, Harvard University

July 3

The Simons Center for Systems Biology Seminar ✦ *Polygenic Inheritance Elucidates Genetic Architecture of Common Traits and Diseases* ✦ **Ying Leong Chan**, Harvard University

October 1–3

Visit by Erez Braun of Technion–Israel Institute of Technology

October 30

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Sergio Lukic**, Member, School of Natural Sciences

November 1

The Simons Center for Systems Biology Seminars ✦ *Using Sequences to Understand Proteins* ✦ **Lucy Colwell**, Member, School of Natural Sciences ✦ *Forces on Viral Evolution* ✦ **Benjamin Greenbaum**, Mount Sinai School of Medicine ✦ *Geometry and Dimension in Living Information Systems* ✦ **Tsvi Tlusty**, Member, School of Natural Sciences

November 13

Rockefeller Group Visit ✦ *The CRISPR System of Bacteria* ✦ **Luciano Marraffini**, The Rockefeller University ✦ *Modelling Heritability* ✦ **Olivier Rivoire**, CNRS and Université Joseph Fourier

November 22–December 2

Visit by Arvind Murugan of Harvard University

December 5–7

Visit by Asaf Gal of Technion–Israel Institute of Technology

December 9

The Simons Center for Systems Biology Seminar ✦ *TRAIN: p53, along with DNA Methylation & Interferon Response, Maintains the Control of Repeats* ✦ **Katya Leonova**, Roswell Park Cancer Institute

December 10

New Jersey Technology Council Life Science and Technology Meeting ✦ *"Immune Profiling"—Advanced Sequencing Technologies in Breakthrough Diagnostics and Disease Monitoring* ✦ **Harlan Robins**, Fred Hutchinson Cancer Research Center

The Simons Center for Systems Biology Seminar ✦ *Dynamical Effects in Development of Drosophila Embryo* ✦ **Dimitri Krotov**, Princeton University

The Simons Center for Systems Biology Seminar ✦ *A System Architecture for Learning Robots* ✦ **Adam Haber**, University of New South Wales

December 17

The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Jonathan Dworkin**, Columbia University

December 18

Rockefeller Group Visit ✦ *The Fly Olfactory System* ✦ **Vanessa Ruta**, The Rockefeller University ✦ *Correlated Evolution of Protein Residues* ✦ **Tiberiu Tesileanu**, Member, School of Natural Sciences

January 8

The Simons Center for Systems Biology Seminar ✦ *Genetic Methods for Measuring the Composition of Bacterial Communities* ✦ **Mikhail Tikhonov**, Princeton University

January 15

Rockefeller Group Visit ✦ *The Social Behavior of Ants* ✦ **Daniel Kronauer**, The Rockefeller University

January 30

The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ *Neutral Networks, Power Grids, and Coarse-Grained Models of DNA* ✦ **Petr Sulc**, University of Oxford

January 31

Joint Lab Meeting with Paul Steinhardt, Princeton University ✦ *Geometry and Dimension in Living Information Systems* ✦ **Tsvi Tlusty**, Member, School of Natural Sciences ✦ *Forces on Viral Evolution* ✦ **Benjamin Greenbaum**, Icahn School of Medicine at Mount Sinai

February 19

Rockefeller Group Visit ✦ *The Memory and Decision-Making of Flies* ✦ **Gaby Maimon**, The Rockefeller University ✦ *Low-Dimensional Approximation of Microbial Behavior, and Heritability and Life-Stages of Behavior* ✦ **David Jordan**, The Rockefeller University

March 5

Rockefeller Group Visit ✦ *A New Perspective on Tolerance to Antibiotics* and *A Dynamical View of Mammalian Cell Interdivision Time* ✦ **Nathalie Questembert-Balaban**, The Hebrew University of Jerusalem ✦ *Scheduling Self-Replication* ✦ **Rami Pugatch**, Member, School of Natural Sciences

March 28

The Simons Center for Systems Biology panNET Meeting ✦ *iPS Models of Pancreatic Cancer* ✦ **Ken Zaret**, University of Pennsylvania ✦ *Global Gene-Expression Analysis of Pancreatic Neuroendocrine Tumors* ✦ **Chang Chan**, Rutgers Cancer Institute of New Jersey ✦ *Complement and Metastasis of Pancreatic Neuroendocrine Tumors* ✦ **Chris Harris**, Verto Institute

April 9

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **William Jacobs**, University of Cambridge

April 16

Rockefeller Group Visit ✦ *Temporal Aspects of Olfactory Coding* ✦ **Dmitry Rinberg**, New York University ✦ *Developmental Plasticity* ✦ **Shay Stern**, The Rockefeller University

April 29

Governor's Conference on Effective Partnering in Cancer Research ✦ *Lgr5 Stem Cells in Self-Renewal and Cancer* ✦ **Hans Clevers**, Hubrecht

Institute ✦ *Pancreatic Cancer Organoids Resolve Fundamental Questions and Identify Therapies* ✦ **David Tuveson**, Cold Spring Harbor Laboratory ✦ *Mobilizing the Immune System against Cancer* ✦ **Suzanne L. Topalian**, Johns Hopkins University School of Medicine ✦ *The Changing Paradigm of Clinical Drug Development* ✦ **Patricia M. LoRusso**, Barbara Ann Karmanos Cancer Institute ✦ *Uncovering the Evolutionary History of Tumors through the Analysis of Their Genome* ✦ **Raul Rabadan**, Columbia University College of Physicians and Surgeons ✦ *TP53 Mutations: from Gene to Public Health* ✦ **Pierre Hainaut**, Université de Grenoble

May 14

Rockefeller Group Visit ✦ *Collective Gliding Mobility of* Myxococcus Xanthus ✦ *Postural Dynamics of Walking* Drosophila ✦ **Joshua W. Shaevitz**, Princeton University ✦ *Why Do Simple Models Work?* ✦ **Benjamin Machta**, Princeton University

School of Social Science

September 26

Social Science Thursday Lunch Seminar ✦ *The Re-Enchantment of Deep Time: Lady Mungo's Questions for History and Science* ✦ **Ann McGrath**, The Australian National University; Member, School of Social Science

September 27

Ethnography and Theory Reading Group ✦ Organizational Meeting

September 30

Unthematic Seminar Reading Group ✦ Organizational Meeting

Guest Lecture ✦ *The Future of a Very Old Name?* ✦ **François Hartog**, École des Hautes Études en Sciences Sociales, Paris

October 2

Environmental Turn and the Human Sciences Seminar ✦ Organizational Meeting

October 3

Social Science Thursday Lunch Seminar ✦ *Sexualism: On Secularization and Gender Equality* ✦ **Joan Wallach Scott**, Harold F. Linder Professor, School of Social Science

October 10

Social Science Thursday Lunch Seminar ✦ *Religion after the State: The Creation of a Muslim Minority in South Sudan* ✦ **Noah Salomon**, Carleton College; Member, School of Social Science

October 11

Ethnography and Theory Reading Group ✦ **Nikhil Anand**, University of Minnesota; Member, School of Social Science, and **Omar Dewachi**, American University of Beirut; Visitor, School of Social Science

October 16

Environmental Turn and the Human Sciences Seminar ✦ Discussion of readings by Dipesh Chakrabarty, Stephen H. Schneider, and Will Steffen

October 17

Social Science Thursday Lunch Seminar ✦ *Where the Wild Things Aren't: City Zoos and the Culture of Nature* ✦ **David I. Grazian**, University of Pennsylvania; Member, School of Social Science

October 23

Unthematic Seminar Reading Group ✦ **Kim Lane Scheppele**, Princeton University; Joint Member, School of Social Science and School of Historical Studies

October 24

Social Science Thursday Lunch Seminar ✦ *Space, Place, Position, Location* ✦ **Wendy Griswold**, Northwestern University; Member, School of Social Science

October 30

Environmental Turn and the Human Sciences Seminar ✦ Discussion of readings by Ian Baucom, Richard White, Joseph P. Masco, The University of Chicago; Member, School of Social Science, and Sverker Sörlin, KTH Royal Institute of Technology, Stockholm; Member, School of Social Science

October 31

Social Science Thursday Lunch Seminar ✦ *Dead as Dirt: Environmental History and the Human Corpse* ✦ **Ellen Stroud**, Bryn Mawr College; Member, School of Social Science

November 1

Ethnography and Theory Reading Group ✦ **Joseph D. Hankins**, University of California, San Diego; Member, School of Social Science, and **Manuela Lavinas Picq**, Universidad San Francisco de Quito; Member, School of Social Science

November 7

Social Science Thursday Lunch Seminar ✦ *Is Development in Africa Impossible? Pharmaceutical Manufacturing in Kenya, Uganda, and Tanzania* ✦ **Nitsan Chorev**, Brown University; Member, School of Social Science

November 11

Unthematic Seminar Reading Group ✦ Discussion of reading by Joseph D. Hankins, University of California, San Diego; Member, School of Social Science

November 13

Environmental Turn and the Human Sciences Seminar ✦ Discussion of readings by Nikhil Anand, University of Minnesota; Member, School of Social Science, and Joseph D. Hankins, University of California, San Diego; Member, School of Social Science

November 14

Social Science Thursday Lunch Seminar ✦ *The Formation of Environmental Expertise: Before and After 1948* ✦ **Sverker Sörlin**, KTH Royal Institute of Technology, Stockholm; Member, School of Social Science

November 21

Social Science Thursday Lunch Seminar ✦ *The Problem of Emergence* ✦ **John F. Padgett**, The University of Chicago; Member, School of Social Science

November 25

Unthematic Seminar Reading Group ✦ **Henning Trüper**, Centre de Recherches Historiques, École des Hautes Études en Sciences Sociales, Paris; Member, School of Social Science

December 4

Environmental Turn and the Human Sciences Seminar ✦ Discussion of readings by Manuela Lavinas Picq, Universidad San Francisco de Quito; Member, School of Social Science, and Ellen Stroud, Bryn Mawr College; Member, School of Social Science

December 5

Social Science Thursday Lunch Seminar ✦ *Counter-Constitutions: Potencies and Potentials of a Relic* ✦ **Kim Lane Scheppele**, Princeton University; Joint Member, School of Social Science and School of Historical Studies

December 6

Ethnography and Theory Reading Group ✦ Discussion of readings by David I. Grazian, University of Pennsylvania; Member, School of Social Science, and Elizabeth Anne Davis, Princeton University; Member, School of Social Science

December 11

Environmental Turn and the Human Sciences Seminar ✦ Discussion of readings by Dale Jamieson, New York University; Member, School of Social Science, and Richard York, University of Oregon; Member, School of Social Science

December 12

Social Science Thursday Lunch Seminar ✦ *Orientalism as a "Philology of the Real": On the Objects of Semitic Studies, ca. 1860–1930* ✦ **Henning Trüper**, Centre de Recherches Historiques, École des Hautes Études en Sciences Sociales, Paris; Member, School of Social Science

January 13

Unthematic Seminar Reading Group ✦ Discussion of reading by Yvonne Chiu, The University of Hong Kong; Member, School of Social Science

January 16

Social Science Thursday Lunch Seminar ✦ *Saving Distant Strangers* ✦ **Jeffrey Flynn**, Fordham University; Member, School of Social Science

January 17

Unthematic Seminar Reading Group ✦ **Elizabeth Popp Berman**, University at Albany, State University of New York; Member, School of Social Science

January 22

Environmental Turn and the Human Sciences Seminar ✦ Discussion of reading by Wendy Griswold, Northwestern University; Member, School of Social Science

January 23

Social Science Thursday Lunch Seminar ✦ *Secrecy and Evidence in the Cyprus Conflict: Bones, Films, Theories* ✦ **Elizabeth Anne Davis**, Princeton University; Member, School of Social Science

January 30

Social Science Thursday Lunch Seminar ✦ *Elections, Uncertainty, and Economic Outcomes* ✦ **Brandice Canes-Wrone**, Princeton University; Member, School of Social Science

February 6

Social Science Thursday Lunch Seminar ✦ *Infrastructures of Commitment: Biopolitics and the State of Water Pipes in Mumbai* ✦ **Nikhil Anand**, University of Minnesota; Member, School of Social Science

February 11

Unthematic Seminar Reading Group ✦ Discussion of readings by Angel Adams Parham, Loyola University, and Danielle Allen, UPS Foundation Professor, School of Social Science

February 19

Environmental Turn and the Human Sciences Seminar ✦ Discussion of readings by David I. Grazian, University of Pennsylvania; Member, School of Social Science, and Joseph P. Masco, The University of Chicago; Member, School of Social Science

February 20

Social Science Thursday Lunch Seminar ✦ *Whose Time is It? A Global History of Unifying Clocks, Calendars, and Social Times, 1870s–1940s* ✦ **Vanessa Ogle**, University of Pennsylvania; Member, School of Social Science

February 26

Unthematic Seminar Reading Group ✦ **Cristina Beltrán**, New York University; Member, School of Social Science

February 27

Social Science Thursday Lunch Seminar ◆ *Conspiring with the Enemy: The Ethics of Cooperation in Warfare* ◆ **Yvonne Chiu**, The University of Hong Kong; Member, School of Social Science

March 5

Environmental Turn and the Human Sciences Seminar ◆ Discussion of readings by Mark Greif, The New School; Member, School of Social Science, and Sverker Sörlin, KTH Royal Institute of Technology, Stockholm; Member, School of Social Science

March 6

Social Science Thursday Lunch Seminar ◆ *Race, Representation, and Right-Wing Aesthetics* ◆ **Cristina Beltrán**, New York University; Member, School of Social Science

March 7

Ethnography and Theory Reading Group ◆ Discussion of readings by Elizabeth Anne Davis, Princeton University; Member, School of Social Science, and Didier Fassin, James D. Wolfensohn Professor, School of Social Science

March 10

Unthematic Seminar Reading Group ◆ **Noah Salomon**, Carleton College; Member, School of Social Science

March 13

Social Science Thursday Lunch Seminar ◆ *Fossil Fuel Use and the Displacement Paradox* ◆ **Richard York**, University of Oregon; Member, School of Social Science

March 19

Environmental Turn and the Human Sciences Seminar ◆ Discussion of readings by Naomi Oreskes and Erik M. Conway, Aaron M. McCright and Riley E. Dunlap, and Myanna Lahsen

March 25

Unthematic Seminar Reading Group ◆ **Jeffrey Flynn**, Fordham University; Member, School of Social Science

March 27

Social Science Thursday Lunch Seminar ◆ *Is Moral Status Self-Extending?* ◆ **Mark Greif**, The New School; Member, School of Social Science

April 2

Environmental Turn and the Human Sciences Seminar ◆ Discussion of readings by Anna Lowenhaupt Tsing and Mario Diani

April 3

Social Science Thursday Lunch Seminar ◆ *What Kind of a (Social) Science is Economics?* ◆ **Dani Rodrik**, Albert O. Hirschman Professor, School of Social Science

April 10

Social Science Thursday Lunch Seminar ◆ *Thinking Like an Economist: On Expertise and the U.S. Policy Process* ◆ **Elizabeth Popp Berman**, University at Albany, State University of New York; Member, School of Social Science

April 11

Ethnography and Theory Reading Group ◆ Discussion of readings by Nitsan Chorev, Brown University; Member, School of Social Science and Jeffrey Flynn, Fordham University; Member, School of Social Science

April 15

Unthematic Seminar Reading Group ◆ **Yvonne Chiu**, The University of Hong Kong; Member, School of Social Science

April 16

Environmental Turn and the Human Sciences Seminar ◆ Discussion of readings by Didier Fassin, James D. Wolfensohn Professor, School of Social Science, and Nikhil Anand, University of Minnesota; Member, School of Social Science

April 17

Social Science Thursday Lunch Seminar ◆ *For Love and Money: The Disposition of Anthropology's Sympathetic Imagination* ◆ **Joseph D. Hankins**, University of California, San Diego; Member, School of Social Science

April 24

Social Science Thursday Lunch Seminar ◆ *Cosmopolitan Amazons: Disentangling Modernity from the State* ◆ **Manuela Lavinas Picq**, Universidad San Francisco de Quito; Member, School of Social Science

May 1

Social Science Thursday Lunch Seminar ◆ *Love in the Anthropocene* ◆ **Dale Jamieson**, New York University; Member, School of Social Science (joint work with Bonnie Nadzam)

Ethnography and Theory Reading Group ◆ Discussion of readings by Sverker Sörlin, KTH Royal Institute of Technology, Stockholm; Member, School of Social Science, and Joseph P. Masco, The University of Chicago; Member, School of Social Science

May 5–7

Ethnography and Policing Workshop ◆ Organized by **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

May 7

Environmental Turn and the Human Sciences Seminar ◆ Discussion of readings by Joseph P. Masco, The University of Chicago; Member, School of Social Science, and Ann McGrath, The Australian National University; Member, School of Social Science

May 8

Social Science Thursday Lunch Seminar ◆ *Six Ways of Looking at the Anthropocene* ◆ **Joseph P. Masco**, The University of Chicago; Member, School of Social Science

May 20

Unthematic Seminar Reading Group ◆ **Brandice Canes-Wrone**, Princeton University; Member, School of Social Science

May 27–28

Public Ethnography Workshop ◆ Organized by **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

Director's Office Events

September 23

Institute Welcome Reception

September 27–28

Dreams of Earth and Sky, A Celebration for Freeman Dyson in Honor of His Ninetieth Birthday and Sixtieth Year at the Institute for Advanced Study

September 29

AMIAS Family Barbecue

October 11–12

Edward T. Cone Concert Series ◆ *Sight and Sound* ◆ **Cassatt String Quartet: Muneko Otari**, violin; **Jennifer Leshnower**, violin; **Sarah Adams**, viola; and **Nicole Johnson**, cello

Edward T. Cone Concert Series Talk ◆ **Muneko Otari**, **Jennifer Leshnower**, **Sarah Adams**, **Nicole Johnson**, and **Sebastian Currier**, Artist-in-Residence

October 18

Public Policy Lecture ◆ *What Rules Should Govern Drones and the Broader "War" on Terror* ◆ **Ken Roth**, Executive Director, Human Rights Watch

October 20

Princeton Symphony Orchestra Concert ◆ *American Brass* ◆ **Jerry Bryant**, trumpet; **Donald Batchelder**, trumpet; **Judy-Yin-Chi Lee**, horn; **Vernon Post**, trombone; and **Andrew Bove**, tuba

October 25

Public Lecture ◆ *The Past, Present, and Future of Economic Convergence* ◆ **Dani Rodrik**, Albert O. Hirschman Professor, School of Social Science

October 30

Friends Forum ◆ *Ellsworth Kelly's Dream of Anonymity* ◆ **Yve-Alain Bois**, Professor, School of Historical Studies

November 8
AMIAS Lecture ✦ *Age of Networks* ✦ **Jennifer Chayes**, Managing Director of Microsoft Research New England and New York City

AMIAS Lecture ✦ *How Should We Think About Freedom?* ✦ **Quentin Skinner**, Barber Beaumont Professor of the Humanities, Queen Mary, University of London

November 10
Princeton Symphony Orchestra Concert ✦ *Baroque and Blue* ✦ **Chelsea Knox**, flute; **Renate Rohlfing**, piano

November 13
Public Lecture ✦ *Rethinking Barbarian Invasions Through Genomic History* ✦ **Patrick J. Geary**, Professor, School of Historical Studies

November 15
Friends Culture and Cuisine ✦ *The Rise and Fall of French Cuisine in the United States* ✦ **Paul Freedman**, Chester D. Tripp Professor of History, Yale University

November 16
Science for Families ✦ *The Smallest Particles* ✦ **Robbert Dijkgraaf**, Director and Leon Levy Professor, Institute for Advanced Study

November 19
Artists Present ✦ *Life Forms* ✦ **Judy Fox**, Sculptor

November 20
Friends Fireside Chat ✦ *The Business Case for Diversity* ✦ **Luke Visconti**, C.E.O., DiversityInc

November 22–23
Edward T. Cone Concert Series ✦ *Musical Geographies* ✦ **Lara St. John**, violin; **Martin Kennedy**, piano

Edward T. Cone Concert Series Talk ✦ **Lara St. John**, **Martin Kennedy**, and **Sebastian Currier**, Artist-in-Residence

December 4
Public Lecture ✦ *What's Next?* ✦ **Nathan Seiberg**, Professor, School of Natural Sciences

December 9
Art History Lecture ✦ *Orientations in Renaissance Art* ✦ **Alexander Nagel**, Professor of Fine Arts, New York University

December 11
Friends Forum ✦ *Looking Beyond Technological Fixes: A Sociological Perspective on Climate Change* ✦ **Richard York**, Friends of the Institute Member, School of Social Science

December 16
Children's Holiday Party

December 20
Institute Community Holiday Party

January 11
Princeton Symphony Orchestra BRAVO! Family Concert ✦ *Strings*

January 27
Term II Member Welcome Dinner

January 28
Artists Present ✦ *The Brothers Vonnegut* ✦ **Ginger Strand**, Writer

February 4
Art History Lecture ✦ *Malevich's Nervous System* ✦ **Briony Fer**, History of Art Professor, University College London

February 7–8
Edward T. Cone Concert Series ✦ *The Brahms-Ligeti Connection* ✦ **Nunc Ensemble: Miranda Cuckson**, violin; **Michael Atkinson**, horn; **Blair McMillen**, piano

Edward T. Cone Concert Series Talk ✦ *The Brahms-Ligeti Connection* ✦ **Miranda Cuckson**, violin; **Michael Atkinson**, horn; **Blair McMillen**, piano; **Sebastian Currier**, Artist-in-Residence

February 22
Midwinter Party for Faculty, Members, and Staff

February 24
Art History Lecture ✦ *Paul Klee, Wilhelm Hausenstein, and the "Problem of Style"* ✦ **Charles Mark Haxthausen**, Robert Sterling Clark Professor of Art History, Williams College

February 26
Friends Forum ✦ *Music and Image* ✦ **Sebastian Currier**, Artist-in-Residence

March 9
Princeton Symphony Orchestra Concert ✦ **Roomful of Teeth Vocal Ensemble**

March 12
S. T. Lee Public Lecture ✦ *After Syria: The Future of the Responsibility to Protect* ✦ **Gareth Evans**, Chancellor of the Australian National University and former Foreign Minister of Australia

March 25
Artists Present ✦ *Seeing the Unseen: Films on Death, Decay, and Sex* ✦ **Pawel Wojtasik**, Filmmaker

March 26
Public Lecture ✦ *Univalent Foundations: New Foundations in Mathematics* ✦ **Vladimir Voevodsky**, Professor, School of Mathematics

March 31
S. T. Lee Public Lecture ✦ *Maiden Voyage: The Senzaimaru and the Creating of Modern Sino-Japanese Relations* ✦ **Joshua A. Fogel**, Professor, York University

April 5
American Repertory Ballet ✦ *Family Program*

April 11
Friends Culture and Cuisine ✦ *Food of Life: Ancient Persian and Modern Iranian Cooking and Ceremonies* ✦ **Najmieh Batmanglij**, Iranian-American Chef and Author

April 15
Art History Lecture ✦ *Neither Breakthrough nor Breakdown* ✦ **Aden Kumler**, Associate Professor of Art History, The University of Chicago

April 16
Friends Forum ✦ *The Moral Challenge to Europe* ✦ **Kim Lane Scheppele**, Joint Member, School of Historical Studies and School of Social Science

April 26
Science for Families ✦ *Stars and Supernovae* ✦ **Boaz Katz**, Member, School of Natural Sciences

April 30
AMIAS End of Term Social

May 2
Public Lecture ✦ *Climate, Conflict, and Historical Method* ✦ **Nicola Di Cosmo**, Luce Foundation Professor, School of Historical Studies

May 9
AMIAS Public Lecture ✦ *(dis)honesty* ✦ **Dan Ariely**, James B. Duke Professor of Psychology and Behavioral Economics, Duke University

May 28
Friends Annual Meeting and Picnic

May 30
Staff Picnic

ACKNOWLEDGMENTS

(for the year ended June 30, 2014)

THE INSTITUTE FOR ADVANCED STUDY IS INDEBTED TO ITS FOUNDERS and to all of its subsequent benefactors for providing a strong financial foundation from which to pursue its mission of fundamental research in the sciences and humanities without pressure for immediate results. We are deeply grateful to the Simons Foundation and the Charles and Lisa Simonyi Fund for Arts and Sciences for their $100 million challenge grant, the largest gift to the Institute since those made by its Founders, Louis Bamberger and Caroline Bamberger Fuld. This challenge grant serves as the basis for the $200 million Campaign for the Institute, intended to strengthen its position for future generations of scholars and scientists.

Centennial Council

We especially wish to recognize members of the Centennial Council, whose level of annual support or lifetime giving places them among our most generous individual donors.

Anonymous (2)

Jeffrey P. Bezos

Mr.[+] and Mrs. Richard B. Black

Addie and Harold Broitman

Mrs. Ann Lee Saunders Brown

Helen and Martin[+] Chooljian

Neil Chriss[+] and Natasha Herron Chriss

Roger W. Ferguson, Jr.[+]
and Annette L. Nazareth

Robert[+] and Luisa Fernholz

Mr. John S. Hendricks[+]
and Mrs. Maureen D. Hendricks

Vera Sharpe Kohn[†]

Dr.[+] and Mrs. Spiro Latsis

Dr. Lee Seng Tee

Sarah and Martin[+] L. Leibowitz

Mr. and Mrs. Robert W. Loughlin

Nancy[+] and Duncan MacMillan

David F. Marquardt[+]

Hamish Maxwell[+†]

[+] *Current Institute for Advanced Study Trustee
or Trustee Emeritus*
[†] *Deceased*

Robert B. Menschel

Annette Merle-Smith

Nancy B. Peretsman[+] and Robert W. Scully

Elena Petronio

David M. Rubenstein[+]

Eric[+] and Wendy Schmidt

James[+] and Marilyn Simons

Dr.[+] and Mrs. Charles Simonyi

Mr.[+†] and Mrs. Ladislaus von Hoffmann

Shelby White[+]

James[+] and Elaine Wolfensohn

Campaign for the Institute

All gifts, grants, and pledges of capital and operating support made by individuals, foundations, and corporations for the Institute's core activities are counted on a dollar-for-dollar basis against the $100 million Simons and Simonyi Challenge, and help the Institute meet its $200 million goal.

**MAJOR DONORS
TO THE CAMPAIGN
FOR THE INSTITUTE**

Anonymous (2)

American Council of Learned Societies

Victoria and Hank Bjorklund

Mr. and Mrs. Richard B. Black

Helen and Martin Chooljian

Neil Chriss and Natasha Herron Chriss

Cathryn Clary

Harry and Helen Cohen Charitable
Foundation

The Edward T. Cone Foundation

The Gladys Krieble Delmas Foundation

Roger W. Ferguson, Jr.
and Annette L. Nazareth

Fernholz Foundation

Gerda Henkel Stiftung

Debora Russo Haines, Esq.
and John R. Haines

John and Maureen Hendricks Charitable
Foundation

Bob and Lynn Johnston

Dr. and Mrs. Spiro J. Latsis

Dr. Lee Seng Tee

Joseph Lehner[†]

Sarah and Martin L. Leibowitz

Leon Levy Foundation

Nancy and Duncan MacMillan

The MacMillan Family Foundation Inc.

David F. Marquardt

Fowler Merle-Smith Family Charitable
Lead Trust

Microsoft Matching Gifts Program

The Ambrose Monell Foundation

The New York Community Trust,
Maxwell Family Fund

The New York Community Trust,
Scheide Fund

Novartis International AG

Elena Petronio

Riksbankens Jubileumsfond

Rita Allen Foundation

The Rockefeller Foundation

The Jeannie Tseng and Colin Rust
Charitable Fund of the Vanguard
Charitable Endowment Program

MAJOR DONORS
TO THE CAMPAIGN
FOR THE INSTITUTE *(continued)*

The Scully Peretsman Foundation

Simons Foundation

The Charles and Lisa Simonyi Fund for
 Arts and Sciences

Spencer Foundation

Starr Foundation

Peter Svennilson

Fritz Thyssen Stiftung

The Tomalla Foundation for Gravity
 Research

Drs. Marilyn and Scott Tremaine

Alexander von Humboldt Foundation

The Wolfensohn Family Foundation

Mr. Brian F. Wruble
 and Ms. Kathleen W. Bratton

OTHER DONORS TO THE CAMPAIGN
FOR THE INSTITUTE

*The following donors made gifts or pledges
to the Friends Endowment.*

Catherine G. Fleming

Tina and Bill Greenberg

Debora Russo Haines, Esq.
 and John R. Haines

Robert and Cynthia Hillas Charitable Gift
 Fund of the Fidelity Charitable Gift Fund

Pamela and Brian Hughes

Bob and Lynn Johnston

Florence and Steven Kahn

The John J. Kerr, Jr. and Nora Wren Kerr
 Charitable Gift Fund of the
 Fidelity Charitable Gift Fund

John and Ann McGoldrick

Elena Petronio

Carolyn and George Sanderson

*The following donors made gifts or pledges to
the Artist-in-Residence Endowment.*

Loretta A. Brooks

William Garrett

Gary Irvine

Amy Ramsey and William Crow

Reichelderfer–Blair Fund of the Princeton
 Area Community Foundation

*The following donors made gifts or pledges to
other endowment funds.*

Anonymous

The Birkelund Fund
 in memory of Ike Kohn

The Gladys Krieble Delmas Foundation
 in recognition of Giles Constable

Elizabeth S. Ettinghausen

Harold and Catherine Falk

Inga Karliner and John Thaler

Sigurdur Helgason

Theodore P. Hurwitz
 in memory of John Bahcall

Helene L. Kaplan

Zheindl Lehner
 in memory of Joseph Lehner

Christoph Rode

Eugene R. Speer

Pat Kelsh Woolf Account of the Fidelity
 Charitable Gift Fund

*The following donors made gifts or grants of
operating support to the Institute.*

Anonymous (3)

Anonymous
 in honor of Joan Scott

AmazonSmile Foundation

Helena and Peter Bienstock

Ms. Constance R. Caplan

Carnegie Corporation of New York

Linda L. Cooper
 in honor of Helen Goddard

Enes Dedovic

Mikhail Grinberg Giving Account of the
 Fidelity Charitable Gift Fund

Carmela Vircillo Franklin

Aristides W. Georgantas

Tina and Bill Greenberg
 in memory of the mother of Florence Kahn

Vartan Gregorian

Professor Benedict H. Gross
 and Dr. Jill P. Mesirov

James F. Hawkins

Matthew Jenkins

Peter R. Kann

Samuel H. Kress Foundation

Labrador Advisors LLC

Libra Services Limited

Norman and Armena Macartney

Steve J. Mariotti

Alexander S. Onassis Public Benefit
 Foundation

Tari Pantaleo

Pew Charitable Trusts

Pfizer Foundation

Peter W. Riola
 in memory of Martha Stacy Riola

Scott Seramur

Harold T. and Vivian Shapiro
 *in honor of the ninetieth birthday of
 Professor Emeritus Peter Paret*

Society for the Promotion of Hellenic
 Studies

Marissa and Jesse Treu

Punam and Tanmay Vachaspati

Peeranut Visetsuth

The Whitman Family Foundation

John Wu

Other Major Donors

*The Institute is also grateful to the following
foundations, government agencies, institutions,
and other organizations for their generous
support of fundamental research and outreach
activities:*

Carnegie Corporation of New York

Computing Research Association

Deutsches Elektronen–Synchrotron

European Research Council

Math for America

Mills College

National Aeronautics and Space
 Administration

National Endowment for the
 Humanities

National Radio Astronomy Observatory

National Science Foundation

National Security Agency

Princeton University

Alfred P. Sloan Foundation

Smithsonian Institute Astrophysical
 Observatory

Space Telescope Science Institute

U.S.–Israel Binational Science
 Foundation

Unites States Department of Energy

West Virginia University Research
 Corporation

Friends of the Institute

Our sincere gratitude is extended to the Friends of the Institute, whose unrestricted gifts make a great difference. We welcome new Friends and express particular appreciation to members of the Founders', Chairman's, Director's, and 25th Anniversary Circles.

FOUNDERS' CIRCLE

Helen and Martin Chooljian
Neil Chriss and Natasha Herron Chriss
Jonathan and Anna Horner
Rosanna W. Jaffin
Louise and John Steffens

CHAIRMAN'S CIRCLE

Mrs. Ann Lee Saunders Brown
Melanie and John Clarke
Morton and Donna Collins
Arthur and Janet Eschenlauer
Carl and Toby Feinberg
Debora Russo Haines, Esq.
  and John R. Haines
John J. and Nora Wren Kerr
Vera Sharpe Kohn
Deborah R. Lunder
  and Dr. Alan Ezekowitz
Elinor Lunder
Nancy and Duncan MacMillan
Annette Merle-Smith
Elena Petronio
John Rassweiler
Philip W. Riskin Charitable Foundation
  Inc.

DIRECTOR'S CIRCLE

Elizabeth Harkins Baughan
Mark Baumgartner*
Donald and Shari Black
Antonio Elmaleh and Anne Williams
Rachel D. Gray
Thomas and Archer Harvey
Cynthia and Robert Hillas
Bob and Lynn Johnston
Landon and Sarah Jones
Mr. and Mrs. Robert W. Loughlin
Jane and Robert MacLennan
Charles W. McCutchen
John and Ann McGoldrick
Michael and Pamela Morandi
Harold T. and Vivian Shapiro
Fritz Stern Fund II of the Princeton
  Area Community Foundation
Nancy and James Utaski
Louise and John Wellemeyer

* *New Friend*
† *Deceased*

25TH ANNIVERSARY CIRCLE

Georg and Joyce Albers-Schonberg
Bijan Ardehali and Jennifer Wolffert
The Len and Laura Berlik Foundation,
  Inc.
Helena and Peter Bienstock
Harold and Addie Broitman
Ashvin B. Chhabra
  and Daniela Bonafede-Chhabra
Vicky and Brad Corrodi
Audrey and David Egger
Dana† and Janet† Fearon
Robert and Luisa Fernholz
Emily and Johan Firmenich
Lor and Michael Gehret
Tina and Bill Greenberg
Gregory and Lisa Hopper*
Brandon and Lynette Hull
Steven and Florence Kahn
Russell and Helene Kulsrud
Peter Lighte and Julian Grant
Kevin and Tamara MacMillan*
Jackie and Cy Meisel
J.A. Padhoven Fund of the Princeton
  Area Community Foundation
John and Caroline Pallat
Michael and Melanie Rauch
Tilden Reeder and Cynthia Groya
Sanderson Family Fund of the
  Princeton Area Community
  Foundation
Dr. Elliott and Ruth Sigal
Caroline and Helmut Weymar
Evan and Rosalie Wolarsky

FRIENDS

Anonymous
Alexander Ackley, Jr.*
Mr. and Mrs. Ernest J. Anastasio
Stephen Anderson and Clara F.
  Richardson
Robert Aresty
Dr. and Mrs. David Atkin
Joan Bartl
Leonard E. Baum
Jane Crawford Baumgardner*
Robert and Susan Beckman
John and Marsha Beidler*
Vicky and Dick Bergman
Toni Besselaar

Elisabeth A. Bish
Ted and Jane Boyer
Mark Branon M.D. and Sarah Branon
Georgianna Brennan
Mrs. James E. Burke
Pernilla and James Burke
Mr. and Mrs. Norman (Pete) Callaway
Cedar Fund of the Princeton Area
  Community Foundation
Lena Chang, Ph.D.
Dr. and Mrs. Paul H. Chew
Maryann Chibbaro*
Charles and Cindy Clark
Mr. Elliot Cohen
Michael Curtis and Judith Brodsky
Patti and Eliot Daley
Jan and Elly de Boer
Rysia de Ravel
Pepper and Liza deTuro*
Hans and Katja De Ruyter
Stephen F. DeAngelis and Beverly
  Brossoie*
James and Thalia Deneen
Peter Dougherty and Elizabeth Hock
Marlene and Aiden Doyle
Jean and Jon Durbin*
Erin Enright and Stuart Essig*
Ruth Fath
Sean and Ana Fieler*
Martin and Jane Fransson*
Ira and Karen Fuchs
David H. Fulmer, M.D.
  and Carol Ann Fulmer
John S. Furlong*
Steve and Linda Gecha
Evelyn and Robert Geddes
Aristides W. Georgantas
Alix Gerry*
Ann and Lee Gladden
Dr. Mark Glasgold
Chad Goerner
Fred and Selma Goldstein
B.F. Graham
Dr. and Mrs. Milton H. Grannatt
Nadivah and David Greenberg
Mr. and Mrs. Peter Hagan
Joan and Jack Hall
George H. Hansen M.D.*
T. Randolph Harris and Barbara A. Sloan
Norman R. Harvey
H. James and Carol P. Herring
Jamie and Kathy Herring
David R. and Kristina H. Hill*

Zaki and Liz Hosny

Pamela and Brian Hughes

Alexander Jones and Catherine Haines

Wolf Joffe

Robert Wood Johnson Jr. Fund of the Princeton Area Community Foundation

Lawrence and Deborah Jordan

Charles and Susan Kalmbach

Dr. Allen H. Kassof

Howard Keller and Helen Keller

Quentin and Peggy Kelly

Avedis and Laura Khachadurian

Ludwig M. Koerte

Joseph and Lorraine Koffman

Gail Kohn

Ugur and Ayse Koyluoglu

Sam and Casey Lambert

Jonah T. and Amy B. Lansky

Randall Larrimore and Cathy Cutright*

Jeffrey and Yuki Moore Laurenti

Perry Leavell and Barbara Oberg

Richard J. and Neil Ann S. Levine

Maxine and Fraser Lewis

Walter H. Lippincott

Marco Londei and Liqun Wang*

Peter† and Marlene Lucchesi

Dr. and Mrs. Gregory Lutz

William C. Martin

Michael and Cecilia Mathews

Susan G. Anable and John F. McCarthy, III

Mr. and Mrs. James R. McKinney

Chris and Andrea Mecray

John and Dorothy Meggitt

Meg Brinster Michael

Professor Richard Miles and Dr. Susan McCoy

Dr. Salvatore A. Monaco

Caroline and Roger Moseley

Stephen Moseley and Whitney Ross

Alexander Moskwa, M.D. and Elaine Elliott-Moskwa, Ph.D.

Sean and Hilary Murray

Drs. Robyn and Daniel Notterman*

Dr. Ferris Olin

Steve and Mimi Omiecinski

Mary and Bill O'Shaughnessy

Dr. and Mrs. C. Papastephanou

Jean and Larry Parsons

John and Dee Patberg

Fayne Petok

Woody and Jacquie Phares

C. Mark Pirrung

George Pitcher

Dorothy and Charles Plohn, Jr.

Reichelderfer–Blair Fund of the Princeton Area Community Foundation

Millard McAdoo Riggs, Jr.

Charles Rippin

Richard and Meta Robertson

Nancy and Will Robins*

Aldo and Debbi Roldan*

Kermit and Priscilla Roosevelt

James Marrow and Emily Rose

Irwin and Cecilia Rosenblum*

Mr. and Mrs. Dudley Ryan

Bernard and Ingrid Saint-Donat

Jeri and Scott Schaefer

John P. Schmidt

Eduardo and Anne Marie Schur

Boot and Lauren Seem

Ruby and Dinesh Sharma

Robert and Mollie Sheppard

Josh and Mariah Silva

Bruce Smith*

David E. Smith

Inge and Sundaresa Srinivasan

Ellen and Albert Stark Foundation Fund of the Princeton Area Community Foundation

Caren Sturges

Marissa and Jesse Treu

Gail and Richard† Ullman

Taysen Van Itallie and Jane Scott

Drs. Welmoet and Daniel P. Van Kammen*

Professor Erik Vanmarcke and Marilyn Durkee

Martha and George Vaughn

Jay and Harriet Vawter

Marue E. Walizer*

Theodore and Fong Wei Fund of the Princeton Area Community Foundation

Philip and Elizabeth Wey

Laura and Roscoe White

Sharon and Russ White

Ralph R. Widner

Robert and Kathleen Zatta*

Mr. and Mrs. Steven Zipperstein

CONTRIBUTIONS TO FRIENDS

Barbara Chancellor

Dr. Rebecca F. Notterman

Carl D. Reimers

MATCHING GIFTS TO FRIENDS

Becton Dickinson

Exxon Mobil Foundation

Goldman Sachs & Co. Matching Gift Program

W. W. Norton & Company, Inc.

Current and Former Members and Visitors

We are grateful to our Faculty and Faculty Emeriti and current and former Members, Visitors, and Research Assistants for their valuable financial support.

OPPENHEIMER CIRCLE

Anonymous (2)

Stephen L. Adler

Joseph Blasi, Nancy Bonus, and Teddy Bonus Blasi

The Blunt Trust

Christian Borgs

Prof. Sir David Cannadine

Sun-Yung A. Chang and Paul C. Yang

Jennifer Chayes

Stanley and Regine Corngold

Lily Harish-Chandra

A. J. Hildebrand

Nancy Hingston and Jovi Tenev

Christopher Jones

Mikhail Kogan

Rob Kusner
  in memory of David B. Kusner

Henry J. Landau and Julia Landau
  in memory of Harry Woolf

William E. Lang

The Steven A. Mansbach and Julia E. Frane Charitable Fund of the Schwab Fund for Charitable Giving

Fouad J. Masrieh

Katsuhiro Minemura

Reba K. Orszag Gift Fund of the Fidelity Charitable Gift Fund
  in memory of Steven A. Orszag

Karl and Anne Morrison

John Polking

Gopal and Indu Prasad

Marcel Roethlisberger

Paul J. Sally, Jr. †

William Sewell

Eugene Sorets

Thomas and Bridget Spencer

Stephen Tracy and June Allison

Loring W. Tu Charitable Gift Fund of the Fidelity Charitable Gift Fund

Karen Uhlenbeck and Bob Williams
  in memory of Lesley Sibner

Inkyung Yi

Zhou Zou

AYDELOTTE CIRCLE

Anonymous

Fernande Auslander

in memory of Louis Auslander

Robert L. Bryant and Réymundo A. Garcia

Raffaella Cribiore

H. A. Drake

Koichiro Harada

The Maurice H. Heins Living Trust

Richard V. Kadison
in honor of the ninetieth birthday of Professor Emeritus Freeman Dyson

Joshua T. Katz

Dr. and Mrs. John Ying-Kuen Kwan

Erika Michael
in memory of Ernest A. Michael

Doug Niebur
in memory of Atle Selberg

Andrew P. Ogg

Siobhan Roberts

Paul Rorem and Kate Skrebutenas

Konstantin Sonin
in honor of Eric Maskin

Tsuneo Tamagawa

Laurence Taylor

Lou van den Dries

Dr. John H. Walter

FLEXNER CIRCLE

Anonymous (2)

John Baines

Vladimir Berkovich

Joan and Joseph Birman Foundation

David Brydges

Calabi Fund of The Philadelphia Foundation

Chaitin Charitable Fund at Schwab Charitable Fund

Charles W. Curtis

Professor Peter L. Duren

Dr. George A. Elliott

Glenn and Sara Ellison

Mehrdad Fallahzadeh

Dr. Paul Forman

Ruth and Murray Gerstenhaber

Kristen Ghodsee
in honor of Joan Scott's retirement

Prof. A. Graeser

Robert Guralnick

Thomas Hegghammer
in honor of Patricia Crone

Ron Irving

Hsu-Tung Ku and Mei-Chin Ku

Judy Lieberman

Helmut Maier

Wijnand W. Mijnhardt

Maria Teresa Marabini Moevs

Minoru Murai

Knut W. Nörr

Fritz Rohrlich

Isabelle Schulte-Tenckhoff

Freydoon Shahidi

Maxine Singer

A. Mark Smith
in memory of Marshall Clagett

Ronald J. and Sharon M. Stern

Mary Lee Townsend

Hung-Sheng Tsao and Sou-Tung Chiu-Tsao

Punam and Tanmay Vachaspati

Vijay K. Vadakkekurputh
on behalf of V. K. Balachandran

Howard D. Weinbrot

Hung-Hsi Wu

DONORS

Anonymous (32)

Anonymous (2)
in honor of Nicola Di Cosmo

Anonymous
in honor of Heinrich von Staden

Anonymous
in honor of Michael Walzer

William Abikoff

Diane Cole Ahl and Kenneth Ahl
in honor of Irving Lavin

John Ahner

Robert Amdur

Susan Ames

Nathanael Andrade

Professor Bulent Atalay

Francis Giles Auchmuty

Vivian and Nils Baas

John Ball

José Barros Neto

Steve Batterson

Rainer Bauböck
in memory of Albert O. Hirschman

Gail Bederman

Marcel Benabou

Paul Benacerraf

Regina Bendix

Alan E. Bernstein

Elizabeth Bernstein

Dr. Herbert J. Bernstein

Jeremy Bernstein

Henry and Leigh Bienen

Thomas Bisson

David Bjelajac

David Blank
in honor of Christian Habicht

Philip Bond

Larissa Bonfante

James J. Bono

Constance Brittain Bouchard

Alan C. and Pamela Bowen

William N. Brandt

Susan J. Brison

John B. Bronzan

Christer Bruun

Nicholas Buchdahl

J. Christoph Bürgel

Daniela L. Caglioti

Yves Capdeboscq

Vicki Caron

Bill Casselman

Filippo Cesarano

Dr. John W. Chambers

H. F. Chau

Huaiyu Chen

Maria Chudnovsky and Daniel Panner

Forrest D. Colburn

Joan Breton Connelly

Linda L. Cooper
in honor of Helen Goddard

Drs. Maria and Bruno Coppi

Joseph E. Davis

John Manuel de Figueiredo
in memory of Rui J.P. de Figueiredo, Sr.

Mayke de Jong

Percy Deift

The Harold G. and Nancy A. Diamond Gifts Fund of the T. Rowe Price Program for Charitable Giving

Laurence Dickey

Lajos Diósi

Walter Dittrich

Robert S. Doran
in memory of Paul J. Sally

Vladimir Drinfeld

Andrew Drucker

Pierre du Prey

Vincent Dubois

Bruce Eastwood

Allan Edmonds

Robert D. Edwards

Richard Ehrenborg
in honor of Robert MacPherson and Mark Goresky

Christiane Eisenberg

Dyan Elliott

David Eng and Teemu Ruskola

T. Evergates

Michele Faraguna

Graham Farmelo

Alex J. Feingold
in honor of Edward Witten

Lisa Florman

Carlos Forment

John Freed

Peter G. O. Freund

Carlos A. P. Galvão

David J. Garrow

Robert Geraci

Dr. Israel Gershoni

Sharon E.J. Gerstel

Marian Gidea

Carol Gluck

Peter B. Golden

Paul R. Goldin

Daniel and Ryoko Goldston

Richard J. Gonsalves

Roe W. Goodman

Cameron Gordon

Neve Gordon

Ulrich Görtz

Andrew P. Gould

Bruce Grant
in memory of Albert O. Hirschman

Bernard Grossman

[†] *Deceased*

Erich Gruen
Paul A. Hanle
Günter Harder
Joel Hass and Abigail Austin Thompson
Charles W. Haxthausen
Helmut Heit
Vittorio Hosle
Ryoshi Hotta
Robert C. Howell
James Humphreys
Hermann Hunger
Susan Huntingdon
Luc Illusie
Bruce W. Jordan
Seva Joukhovitski
Padma Kaimal
Vadim Kaloshin
Shmuel Kaniel
Goro C. Kato, V.L.S.
Takahiro Kawai
Dennis Kehoe
Woong-Tae Kim
Ryuichiro Kitano
H. Klingen
Ronald J. Knill
Karin Knorr Cetina
Jürgen Kocka
Christopher Kolda
Denis Kozlov
Robert Krasny
Derek Krueger
Anna Krylova
John Labute
Michele Lamont
   in memory of Albert O. Hirschman
Paul Langacker
Menachem and Abby Lazar
Sharon Lazarov
   in memory of Connor Lazarov
Robert and Nancy Lee Fund of the Fidelity
   Charitable Gift Fund
Renee Levine Melammed
Joan and Anthony Licata
Ming Chit Liu
Elio Lo Cascio
Brandon C. Look
George Losoncy
Steve Lubow
Andrew MacFadyen
Jamal T. Manassah
Rachel Mandelbaum
Dr. Michael McCord
Clinton McCrory
Patrick McGuinn
David McNeill
Michael McVaugh
Brigitte Meijns
John R. Melville-Jones
Roberto J. Miatello
Joel Migdal
   in memory of Marcy Migdal
Margaret M. Miles
   in memory of Finley A. Hooper
Henry and Judith Millon

Farshid Minbashian
Carlos Julio Moreno
Dr. Benjamin Muckenhoupt
William Mulligan
Melvyn B. Nathanson
Andrew Neitzke
Y. Jack Ng
Martti Nissinen
Yong-Geun Oh
Peter Orlik
Sherry B. Ortner
Akos Ostor
Leonard Parker
François Paschoud
Marcus Payk
Michael G. Peletz
James V. Peters
Carl F. Petry
David A. Pietz
Dr. Randall A. Poole
D.T. Potts
Martin Powers
Drazen Prelec and Danica Mijovic-Prelec
William L. Pressly
D. Ramachandran
Orest Ranum
Claudia Rapp
   in honor of Glen Bowersock
Richard T. Rapp
Margaret A. Readdy
   in honor of Robert MacPherson
   and Mark Goresky
Theodore Reff
Juhyung Rhi
Carl Riehm
James B. Rives
Joseph Roitberg
Dr. John C. Rouman
Zeev Rudnick
Cihan Saclioglu
Stuart Samuel
John Schrecker
Alexia Schulz
Gerald W. Schwarz
Erhard Seiler
   in memory of Arthur S. Wightman
Ron and Hila Sela
Rodney Y. Sharp
Dr. Stephen S. Shatz
Agnes Sherman
Allan J. Silberger
Yakov Sinai
Michael F. Singer
Dr. Jonathan Skaff
Robert C. Sleigh, Jr.
Neal Snyderman
Robert Socolow Fund of the Jewish
   Communal Fund
Philip M. Soergel
   in honor of Giles Constable
Charles M. Sommerfield
Grace Marmor Spruch
   in memory of Larry Spruch
Dr. Aravind Srinivasan

Bhama Srinivasan
Rosemary Stanfield-Johnson
   in honor of Patricia Crone
Harold M. Stark Charitable Fund of the
   Fidelity Charitable Gift Fund
Jim Stasheff
Clarence F. Stephens
George Sterman
Gerald Stourzh
Barry and Winnifred Sullivan
R. Richard Summerhill, Ph.D.
Xiaodong Sun
Yuji Tachikawa
Earl J. Taft
Cynthia Talbot
William Thalmann
   in honor of Heinrich von Staden
Gerhard Thür
Ralph Tindell
Stuart and Clemencia Turner
Martin M. Tweedale
Salil Vadhan
E. P. J. van den Heuvel
Philip and Arachne van der Eijk
Frans van Liere
Jiri Vanicek
   in honor of Arnold J. Levine
William A. Veech and Kathryn L. Veech
Jonathan Wahl
The Walsh Charitable Fund of the Ayco
   Charitable Foundation
Aihe Wang
Ping Wang
Seth L. Warner
Arthur G. Wasserman
   in memory of Connor Lazarov
Kenneth M. Watson
Brian Wecht
David Weinberg
Volker Weispfenning
Raymond Wells
Marit Werenskiold
Robert L. Wilson
Deva Woodly
Don Wyatt
York-Peng and Cynthia Yao
Mitsuru Yasuhara
M. Crawford Young
Paul Zanker
Eduard Zehnder
Froma and George Zeitlin

Matching Gifts to Former IAS Members and Visitors

Goldman Sachs & Co. Matching Gift Program
Microsoft Matching Gifts Program (2)
SIG: Susquehanna International Group

Einstein Legacy Society

The Einstein Legacy Society was established in 1996 to honor those who have made a planned gift to the Institute for Advanced Study, or informed the Institute of a bequest intention or other provision in their estate plans. The Society takes its name from Albert Einstein, Institute Faculty member, 1933–55. Einstein Legacy Society Members include Trustees, Faculty and Faculty Emeriti, Friends, former Members and Visitors, Staff, and other supporters.

Anonymous (3)
Richard B. Black
Enrico Bombieri
Addie and Harold Broitman
Joseph E. Brown
Robert Butow
Claude Calame
Helen and Martin Chooljian
Getzel M. Cohen
Giles Constable
John W. Dawson Jr.
Hedwig C.H. Dekker
   in memory of Professor Jacob C.E. Dekker
Professor William Doyle, FBA
Masaaki Eguchi
Janet and Arthur Eschenlauer
Carl Faith†
Graham Farmelo
Carl and Toby Feinberg
Dr. Cloudy (Klaus-Dietrich) Fischer
Dr. Paul Forman‡
Lor and Michael Gehret
Peter and Helen Goddard
Rachel D. Gray
Betty W. (Tina) Greenberg
Phillip A. Griffiths
Robert M. Guralnick
Ralph E. Hansmann
Morton E. Harris
James F. Hawkins
Sigurdur Helgason
Rosanna W. Jaffin
Akio Kawauchi
Tatsuo Kimura
George Labalme Jr.
Dr. Florian Langenscheidt
Robert Langlands
Walter Lippincott ‡
Mr. and Mrs. Robert W. Loughlin
Robert MacPherson and Mark Goresky
Steve Mariotti‡
Hamish Maxwell†
Loris and Bruce McKellar
Annette Merle-Smith
Lloyd† and Dorothy Moote
Alexander P.D. Mourelatos
Albert Nijenhuis
Elena Petronio
John H. Rassweiler
Millard M. Riggs
Barbara Heard Roberts
Daniel H. Saracino

Richard Donald Schafer
N.J. Slabbert
Chuu-Lian Terng and Richard S. Palais
Franklin K. Toker
Grazia Tonelli
Marilyn and Scott Tremaine
Professor and Mrs. V.S. Varadarajan
Professor C. Franciscus Verellen
   and Mrs. Isabelle M. Verellen
Morton G. White
Brian F. Wruble

Gifts-in-Kind

Professor Danielle S. Allen
Dr. John Baines
Dr. Dirk Baltzly
Dr. Leonid A. Beliaev
Bloomberg Philanthropies
Dr. Karen I. Blu
G. W. Bowersock
Dr. Ursula B. Brosseder
Professor Mehmet Bulut
Mr. Dan Burt
Professor Angelos Chaniotis
William J. Connell
Joan Breton Connelly
Dr. Frank Costigliola
Mark Cruse
Professor María Paz de Hoz
Dr. Anastasi Drandaki
Sir John and Lady Elliott
Mehrdad Fallahzadeh
Graham Farmelo
Professor Didier Fassin
Lisa Florman
Robert E. Frye
Lor and Michael Gehret
Dr. Lionel Gossman
Dr. Danielle Gourevitch
Terry Grabar
Dr. Wendy Griswold
Professor and Mrs. Christian Habicht
Dr. Rudolf Haensch
Dr. Yannis Hamilakis
James Hankins
Kimberly Hart
Kaja Harter-Uibopuu
Dr. Colum P. Hourihane
Professor Jonathan I. Israel
Christopher P. Jones
Dr. Mark Jurdjevic
Dr. Marina Koumanoudi
Dr. Denis Kozlov
Thomas Kühne
W. R. Laird
Professor Irving Lavin
Dr. Vasileios Marinis
Joel Migdal
Professor David Moon
Professor Shmuel Moreh
Professor Tatsuo Nakami
Professor Paul Paret
Professor Peter Paret
Professor Marcus G. Plested

D.T. Potts
Dr. Sebastian Prignitz
Dr. Adele Reinhartz
Dr. Gil H. Renberg
Dr. Sabine Schmidtke
Professor Joan W. Scott
Mr. Ronald Smeltzer
Fritz Stern
Dr. Giovanni Tarantino
Gerhard Thür
Grazia Tonelli
Frans van Liere
Steven Vanderputten
Dr. Sitta von Reden
Professor Heinrich von Staden
Aihe Wang
Lucius Wilmerding
Mr. Brian F. Wruble
   and Ms. Kathleen W. Bratton
Dieter Wuttke
Dr. Niza Yanay
Chen-Pang Yeang

Professorships, Memberships, and Other Dedicated Funds

The Institute expresses its continuing gratitude to donors who have provided support through these endowed funds and through gifts and pledges of operating support.

ENDOWED PROFESSORSHIPS

Richard Black Professorship
Robert and Luisa Fernholz Professorship
Albert O. Hirschman Professorship
IBM von Neumann Professorship
George F. Kennan Professorship
Leon Levy Professorship
Harold F. Linder Professorship
Luce Foundation Professorship in East Asian
   Studies
Herbert H. Maass Professorship
Andrew W. Mellon Professorship
Charles Simonyi Professorship
UPS Foundation Professorship
Hermann Weyl Professorship
James D. Wolfensohn Professorship in Social
   Science

ENDOWED AND ANNUAL[1] MEMBER SUPPORT

American Council of Learned Societies
   Frederick Burkhardt Fellowship
AMIAS Membership
John N. Bahcall Fellowship
The Bell Companies Fellowship
Addie and Harold Broitman Membership in
   Biology
Charles L. Brown Membership in Biology

‡ *Indicates a new member of the Einstein Legacy Society*

[1] *Annual gifts from July 1, 2013–June 30, 2014*

† *Deceased*

ENDOWED AND ANNUAL[1] MEMBER SUPPORT
(continued)

S.S. Chern Foundation for Mathematics Research Fund

Martin A. and Helen Chooljian Founders' Circle Member

Martin A. and Helen Chooljian Membership

Martin A. and Helen Chooljian Membership in Biology

Neil Chriss and Natasha Herron Chriss Founders' Circle Visiting Professor

Edward T. Cone Membership in Music Studies

Corning Glass Works Foundation Fellowship

George William Cottrell, Jr., Membership

Roger Dashen Membership

The Gladys Krieble Delmas Foundation Membership

Deutsche Bank Membership

Elizabeth and J. Richardson Dilworth Fellowship

Willis F. Doney Membership

The Ellentuck Fund

European Commission Marie Curie Fellowship

Roger W. Ferguson, Jr., and Annette L. Nazareth Membership

Fernholz Foundation

The Fiftieth Anniversary Fellowship in Social Science

Richard B. Fisher Membership

Friends of the Institute for Advanced Study Membership

Fund for Historical Studies

Fund for Mathematics

Fund for Natural Sciences

Fund for Social Science

Felix Gilbert Membership

Marvin L. Goldberger Membership

Hetty Goldman Membership

Florence Gould Foundation Fund

Agnes Gund and Daniel Shapiro Membership

Ralph E. and Doris M. Hansmann Membership

Maureen and John Hendricks Visiting Professorship

Gerda Henkel Stiftung Membership

The Herodotus Fund

IBM Einstein Fellowships

Rosanna and Charles Jaffin Founders' Circle Member

W. M. Keck Foundation Fund

Hans Kohn Membership

Martin L. and Sarah F. Leibowitz Membership

William D. Loughlin Membership

Anneliese Maier Research Award

The Andrew W. Mellon Foundation Fund

The Andrew W. Mellon Foundation Fellowships for Assistant Professors

The Ambrose Monell Foundation

National Aeronautics and Space Administration

NASA Einstein Fellowship Program

National Endowment for the Humanities

National Radio Astronomy Observatory Jansky Fellowship

National Science Foundation

Natural Sciences Membership Fund

Otto Neugebauer Fund

Patrons' Endowment Fund

Giorgio and Elena Petronio Fellowship

Giorgio and Elena Petronio Fellowship II

Eric and Wendy Schmidt Membership in Biology

Charles Simonyi Endowment Fund

Space Telescope Science Institute Hubble Fellowship

The Starr Foundation East Asian Studies Endowment Fund

Louise and John Steffens Founders' Circle Member

Frank and Peggy Taplin Membership

United States Department of Energy

U.S.–Israel Binational Science Foundation

The Oswald Veblen Fund

Edwin C. and Elizabeth A. Whitehead Fellowship

Wolfensohn Family Membership

The James D. Wolfensohn Fund

Zurich Financial Services Membership

OTHER DEDICATED ENDOWMENTS AND FUNDS

Ruth and Irving Adler Expository Lectures in Mathematics Fund

Adler Family Fund

Artist-in-Residence Endowment

The Broitman Foundation Fund

Edward T. Cone Concert Series Endowment

R. Llewelyn Davies Fund

Gladys Krieble Delmas Endowment

Paul Dirac Fund

Ky Fan and Yu-Fen Fan Endowment

Friends of the Institute for Advanced Study Endowment

Professor Harish-Chandra Endowment

IAS Land Endowment

Robert and Lynn Johnston Fund

Kresge Challenge Fund

Dr. S.T. Lee Fund for Historical Studies

Leon Levy Book Fund

Mary Marquand Endowment

Marston Morse Memorial Fund

New Initiatives Fund

Erwin Panofsky Fund

Nancy Peretsman and Robert Scully Endowment

Public Policy Lecture Series Endowment

Raymond and Beverly Sackler Colloquia in the School of Natural Sciences

Henry Schaerf Memorial Fund

Mr. and Mrs. William H. Scheide Artist-in-Residence Endowment

Simons Center for Systems Biology Endowment

Simons Foundation Endowment Fund

Charles and Lisa Simonyi Endowment Fund

Karoly Simonyi Memorial Endowment Fund

The Sivian Fund

The Starr Foundation Biology Endowment

Leo Usdan Fund

Shelby White and Leon Levy Archives Endowment

Wolf Foundation Prize Endowment

[1] *Annual gifts from July 1 2013–June 30, 2014*

† *Deceased*

ADMINISTRATION, 2013–2014

Robbert Dijkgraaf
Director and Leon Levy Professor

Karen Cuozzo
Executive Assistant to the Director

Sile Bao
Special Assistant to the Director

John Masten
Associate Director for Finance and
Administration

Mark Baumgartner
Chief Investment Officer
From January 6, 2014

Anthony Bordieri, Jr.
Manager of Facilities

Michael Ciccone
Manager of Administrative Services

Michael Klompus
Manager of Human Resources

Mary Mazza
Comptroller

Michel Reymond
Chef/Manager, Dining Services

Michael Gehret
Associate Director for Development and
Public Affairs
Through March 19, 2014

Frederick M. Van Sickle
Chief Development Officer
Associate Director for Development and
Public Affairs
From May 1, 2014

Christine Ferrara
Senior Public Affairs Officer

Catherine Fleming
Senior Development Officer

Pamela Hughes
Senior Development Officer

Kelly Devine Thomas
Senior Publications Officer

Library Administration

Momota Ganguli
Librarian, Mathematics and Natural Sciences

Marcia Tucker
Librarian, Historical Studies and Social
Science (also Coordinator of Information
Access for Computing, Telecommunications,
and Networking Administration)

Christine Di Bella
Archivist

School Administration

Mary Jane Hayes
Administrative Officer
School of Mathematics

Donne Petito
Administrative Officer
School of Social Science

Michelle Sage
Administrative Officer
School of Natural Sciences

Suzanne P. Christen
Executive Director and Administrator
The Simons Center for Systems Biology
School of Natural Sciences

Marian Gallagher Zelazny
Administrative Officer
School of Historical Studies

Programs

Catherine E. Giesbrecht
Program Officer
IAS/Park City Mathematics Institute

Arlen K. Hastings
Executive Director, Science Initiative Group

Computing, Telecommunications, and Networking Administration

Jeffrey Berliner
Manager of Computing

Brian Epstein
Computer Manager
Network and Security

Kevin Kelly
Computer Manager
School of Mathematics

Jonathan Peele
Computer Manager
Information Technology Group

James Stephens
Computer Manager
School of Natural Sciences

Edna Wigderson
Manager
Databases and Integration

PRESENT AND PAST DIRECTORS

(in order of service as of June 30, 2014)

Abraham Flexner · Frank Aydelotte

J. Robert Oppenheimer · Carl Kaysen · Harry Woolf

Marvin L. Goldberger · Phillip A. Griffiths · Peter Goddard · Robbert Dijkgraaf

PRESENT AND PAST FACULTY

(2013–2014 Faculty and Faculty Emeriti are in black)

Stephen L. Adler · James W. Alexander · Andrew E. Z. Alföldi · Danielle S. Allen

Nima Arkani-Hamed · Michael F. Atiyah · John N. Bahcall · Arne K. A. Beurling ·Yve-Alain Bois

Enrico Bombieri · Armand Borel · Jean Bourgain · Glen W. Bowersock

Caroline Walker Bynum · Luis A. Caffarelli · Angelos Chaniotis · Harold F. Cherniss · Marshall Clagett

Giles Constable · Patricia Crone · José Cutileiro · Roger F. Dashen · Pierre Deligne

Nicola Di Cosmo · Freeman J. Dyson · Edward M. Earle · Albert Einstein · John H. Elliott

Didier Fassin · Patrick J. Geary · Clifford Geertz · Felix Gilbert · James F. Gilliam · Peter Goddard

Kurt Gödel · Hetty Goldman · Peter Goldreich · Oleg Grabar · Phillip A. Griffiths · Christian Habicht

Harish-Chandra · Ernst Herzfeld · Albert O. Hirschman · Helmut Hofer · Lars V. Hörmander · Piet Hut

Jonathan Israel · Ernst H. Kantorowicz · George F. Kennan · Robert P. Langlands · Irving Lavin

Tsung-Dao Lee · Stanislas Leibler · Arnold J. Levine · Elias A. Lowe · Robert MacPherson

Juan Maldacena · Avishai Margalit · Eric S. Maskin · Jack F. Matlock, Jr. · Millard Meiss

Benjamin D. Meritt · John W. Milnor · David Mitrany · Deane Montgomery · Marston Morse

J. Robert Oppenheimer · Abraham Pais · Erwin Panofsky · Peter Paret · Tullio E. Regge

Winfield W. Riefler · Dani Rodrik · Marshall N. Rosenbluth · Peter Sarnak · Joan Wallach Scott

Nathan Seiberg · Atle Selberg · Kenneth M. Setton · Carl L. Siegel ·Thomas Spencer · Walter W. Stewart

Bengt G. D. Strömgren · Richard Taylor · Homer A. Thompson · Scott Tremaine · Kirk Varnedoe

Oswald Veblen · Vladimir Voevodsky · John von Neumann · Heinrich von Staden

Michael Walzer · Robert B. Warren · André Weil · Hermann Weyl · Morton White · Hassler Whitney

Avi Wigderson · Frank Wilczek · Edward Witten · Ernest Llewellyn Woodward

Chen Ning Yang · Shing-Tung Yau · Matias Zaldarriaga

Institute for Advanced Study— Louis Bamberger and Mrs. Felix Fuld Foundation

Financial Statements
June 30, 2014 and 2013

(With Independent Auditors' Report Thereon)

Independent Auditors' Report

The Board of Trustees
Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation:

We have audited the accompanying financial statements of Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation (the Institute), which comprise the statements of financial position as of June 30, 2014 and 2013, and the related statements of activities and cash flows for the years then ended, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with U.S. generally accepted accounting principles; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditors' judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation as of June 30, 2014 and 2013, and the changes in its net assets and its cash flows for the years then ended in accordance with U.S. generally accepted accounting principles.

KPMG LLP

November 6, 2014

Assets		2014	2013
Cash and cash equivalents	$	3,287,954	5,457,600
Accounts receivable and other assets		1,564,127	1,029,779
Grants receivable		2,003,544	3,138,227
Contributions receivable—net		25,279,921	33,261,877
Unamortized debt issuance costs—net		570,689	625,490
Funds held by bond trustee		2,286,964	2,281,080
Beneficial interest in remainder trust		2,559,277	2,721,332
Land, buildings and improvements, equipment and rare book collection—net		82,274,435	74,496,930
Investments		738,283,288	671,372,318
Total assets	$	858,110,199	794,384,633

Liabilities and Net Assets

Liabilities:			
Accounts payable and accrued expenses	$	7,846,617	7,875,196
Deferred revenue		3,745,905	5,316,308
Liabilities under split–interest agreements		2,347,588	2,245,464
Postretirement benefit obligation		15,086,961	13,175,092
Asset retirement obligation		1,035,257	1,005,070
Bond swap liability		4,275,176	4,475,949
Note payable		219,614	289,954
Long-term debt, net of discount		63,656,953	66,050,034
Total liabilities		98,214,071	100,433,067
Net assets:			
Unrestricted		384,445,157	364,283,394
Temporarily restricted		173,035,092	147,257,386
Permanently restricted		202,415,879	182,410,786
Total net assets		759,896,128	693,951,566
Total liabilities and net assets	$	858,110,199	794,384,633

See accompanying notes to financial statements.

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating revenues, gains, and other support:				
Private contributions and grants	$ —	8,780,594	—	8,780,594
Government grants	—	6,340,907	—	6,340,907
Endowment spending policy	20,673,193	16,650,307	—	37,323,500
Auxiliary activity	6,688,932	—	—	6,688,932
Net assets released from restrictions— satisfaction of program restrictions	31,771,808	(31,771,808)	—	—
Total operating revenues, gains, and other support	59,133,933	—	—	59,133,933
Expenses:				
School of Mathematics	11,349,539	—	—	11,349,539
School of Natural Sciences	11,404,746	—	—	11,404,746
School of Historical Studies	7,832,661	—	—	7,832,661
School of Social Science	4,507,979	—	—	4,507,979
Libraries and other academic	8,598,160	—	—	8,598,160
Administration and general	13,850,905	—	—	13,850,905
Auxiliary activity	8,004,591	—	—	8,004,591
Total expenses	65,548,581	—	—	65,548,581
Change in net assets from operations, including depreciation	(6,414,648)	—	—	(6,414,648)
Other revenues, gains, and other support:				
Private contributions and grants	204,916	1,246,501	20,005,093	21,456,510
Endowment change after applying spending policy	26,176,791	24,531,205	—	50,707,996
Change in fair value of bond swap liability	200,773	—	—	200,773
Loss on sale of plant assets	(6,069)	—	—	(6,069)
Change in net assets	20,161,763	25,777,706	20,005,093	65,944,562
Net assets—beginning of year	364,283,394	147,257,386	182,410,786	693,951,566
Net assets—end of year	$ 384,445,157	173,035,092	202,415,879	759,896,128

See accompanying notes to financial statements.

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating revenues, gains, and other support:				
Private contributions and grants	$ —	8,917,535	—	8,917,535
Government grants	—	7,266,639	—	7,266,639
Endowment spending policy	18,589,144	16,090,456	—	34,679,600
Auxiliary activity	5,894,135	—	—	5,894,135
Net assets released from restrictions— satisfaction of program restrictions	32,274,630	(32,274,630)	—	—
Total operating revenues, gains, and other support	56,757,909	—	—	56,757,909
Expenses:				
School of Mathematics	10,912,238	—	—	10,912,238
School of Natural Sciences	11,643,841	—	—	11,643,841
School of Historical Studies	7,582,420	—	—	7,582,420
School of Social Science	4,330,501	—	—	4,330,501
Libraries and other academic	8,185,287	—	—	8,185,287
Administration and general	9,510,608	—	—	9,510,608
Auxiliary activity	7,073,128	—	—	7,073,128
Total expenses	59,238,023	—	—	59,238,023
Change in net assets from operations, including depreciation	(2,480,114)	—	—	(2,480,114)
Other revenues, gains, and other support:				
Private contributions and grants	733,147	396,250	9,347,403	10,476,800
Endowment change after applying spending policy	17,240,968	12,050,043	—	29,291,011
Change in fair value of bond swap liability	2,022,672	—	—	2,022,672
Gain on sale of plant assets	243,824	—	—	243,824
Change in net assets	17,760,497	12,446,293	9,347,403	39,554,193
Net assets—beginning of year	346,522,897	134,811,093	173,063,383	654,397,373
Net assets—end of year	$ 364,283,394	147,257,386	182,410,786	693,951,566

See accompanying notes to financial statements.

	2014	2013
Cash flows from operating activities:		
Change in net assets	$ 65,944,562	39,554,193
Adjustments to reconcile change in net assets to net cash used		
in operating activities:		
Depreciation	5,126,046	4,813,656
Contributions restricted for endowment and plant	(28,872,055)	(25,585,914)
Net realized and unrealized gains	(90,373,231)	(66,212,269)
Change in fair value of bond swap liability	(200,773)	(2,022,672)
Loss (gain) on sale of plant assets	6,069	(243,824)
Amortization of debt issuance costs	54,801	48,806
Amortization of bond discount	21,919	20,550
Changes in assets/liabilities:		
Accounts receivable, grants receivable, and other assets	600,335	2,029,311
Contributions receivable	7,981,956	17,218,476
Beneficial interest in remainder trust	162,055	112,776
Accounts payable and accrued expenses	(28,579)	1,584,021
Deferred revenue	(1,570,403)	(2,039,466)
Postretirement benefit obligation	1,911,869	(1,886,150)
Asset retirement obligation	30,187	11,627
Net cash used in operating activities	(39,205,242)	(32,596,879)
Cash flows from investing activities:		
Proceeds from sale of plant assets	217,377	1,396,406
Purchase of plant assets	(13,126,997)	(10,918,721)
Proceeds from sale of investments	350,126,682	289,709,193
Purchase of investments	(326,664,421)	(287,078,939)
Net cash provided by (used in) investing activities	10,552,641	(6,892,061)
Cash flows from financing activities:		
Contributions restricted for endowment and plant	28,872,055	25,585,914
Increase in liabilities under split–interest agreements	102,124	21,278
Debt issuance costs on 2012 Taxable Bonds	—	(206,950)
Discount on 2012 Taxable Bonds	—	(92,311)
Proceeds from issuance of 2012 Taxable Bonds	—	17,320,000
Advance refunding of 2001 Series A Bonds	—	(1,940,000)
Principal payments on long-term debt	(2,415,000)	(2,000,000)
Principal payments on note payable	(70,340)	(68,954)
Decrease in funds held by bond trustee	(5,884)	126,428
Net cash provided by financing activities	26,482,955	38,745,405
Net decrease in cash and cash equivalents	(2,169,646)	(743,535)
Cash and cash equivalents—beginning of year	5,457,600	6,201,135
Cash and cash equivalents—end of year	$ 3,287,954	5,457,600
Supplemental data:		
Interest paid	$ 2,022,055	1,884,445

See accompanying notes to financial statements.

(1) Organization and Summary of Significant Accounting Policies

Organization

The Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation (the Institute), an independent, private institution devoted to the encouragement, support, and patronage of learning, was founded in 1930 as a community of scholars where intellectual inquiry could be carried out in the most favorable circumstances.

Focused on mathematics and classical studies at the outset, the Institute today consists of the School of Historical Studies, the School of Mathematics, the School of Natural Sciences and the School of Social Science. Each school has a small permanent faculty, and some 190 fellowships are awarded annually to members visiting the Institute from other research institutions and universities throughout the world.

The Founders' original letter to the first Trustees described the objectives of the Institute as follows: "The primary purpose is the pursuit of advanced learning and exploration in fields of pure science and high scholarship to the utmost degree that the facilities of the institution and the ability of the faculty and students will permit."

Summary of Significant Accounting Policies

Basis of Presentation
The accompanying financial statements, which are presented on the accrual basis of accounting, have been prepared to focus on the Institute as a whole and to present net assets and revenues, expenses, gains, and losses based on the existence or absence of donor-imposed restrictions. Accordingly, net assets and changes therein are classified as follows:

- Permanently restricted net assets—net assets subject to donor-imposed stipulations that they be maintained permanently by the Institute. Generally, the donors of these assets permit the Institute to use all or part of the income earned on related investments for general or specific purposes.

- Temporarily restricted net assets—net assets subject to donor-imposed stipulations that will be met by actions of the Institute and/or by the passage of time.

- Unrestricted net assets—net assets not subject to donor-imposed stipulations. Unrestricted net assets may be designated for specific purposes by action of the board of trustees.

Revenues are reported as increases in unrestricted net assets unless use of the related asset is limited by donor-imposed restrictions. Expenses are reported as decreases in unrestricted net assets. Expiration of donor-imposed stipulations that simultaneously increase unrestricted net assets and decrease temporarily restricted net assets are reported as net assets released from restrictions.

(a) Contributions and Grants
Contributions and grants, including unconditional promises to give, are recognized initially at fair value as revenues in the period received. Conditional promises to give are not recognized until they become unconditional, that is when the conditions on which they depend are substantially met. Contributions of assets other than cash are recorded at their estimated fair value. Pledges of contributions to be received after one year are discounted at a risk-adjusted discount rate. The discount rates range from 0.11% to 1.62%. Amortization of discount is recorded as additional contribution revenue in accordance with donor-imposed restrictions, if any, on the contributions. The inputs to the fair value estimate are considered Level 3 in the fair value hierarchy.

Contributions of long-lived assets are reported as unrestricted revenue. Contributions restricted for the acquisition of grounds, buildings, and equipment are reported as temporarily restricted revenues. These contributions are reclassified to unrestricted net assets upon acquisition of the assets.

(b) Cash and Cash Equivalents
Cash and cash equivalents consist of cash on hand and all highly liquid investments with an original maturity of three months or less, except for those managed as a component of the Institute's investment portfolio.

(c)   *Investments*
Investments in marketable securities are reported in the financial statements at fair value based on published market quotations. Investments in limited partnerships and hedge funds are reported in the financial statements at estimated fair value using net asset value (NAV) or its equivalent as a practical expedient, based upon values provided by external investment managers or general partners, unless it is probable that all or a portion of the investment will be sold for an amount different from NAV. The Institute reviews and evaluates the values provided by external investment managers and general partners and agrees with the valuation methods and assumptions used in determining the fair value of funds. These estimated fair values may differ significantly from the values that would have been used had a ready market for these securities existed. As of June 30, 2014 and 2013, the Institute had no plans or intentions to sell investments at amounts different from NAV.

The statements of activities recognize unrealized gains and losses on investments as increases and decreases, respectively, in unrestricted net assets unless their use is temporarily or permanently restricted by explicit donor stipulation or law. Gains and losses on the sale of investment securities are calculated using the specific identification method.

The Institute regularly offers first mortgages on primary residences to full-time faculty and senior administrative employees who have met certain requirements stipulated by the board of trustees.

(d)   *Fair Value Measurements*
Fair value is defined as the exchange price that would be received for an asset or paid to transfer a liability (an exit price) in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date. The fair value hierarchy requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. A financial instrument's level within the fair value hierarchy is based on the lowest level of any input that is significant to the fair value measurement. The three levels of inputs used to measure fair value are as follows:

•   Level 1: Quoted prices in active markets for identical assets or liabilities.

•   Level 2: Observable inputs other than Level 1 prices such as quoted prices for similar assets or liabilities; quoted prices in markets that are not active; or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities and certain alternative investments that can be redeemed at or near the statement of financial position date.

•   Level 3: Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the asset or liabilities and certain alternative investments that are not redeemable in the near term.

Fair value estimates are made at a specific point in time, based on available market information and judgments about the financial asset, including estimates of timing, amount of expected future cash flows, and the credit standing of the issuer. In some cases, the fair value estimates cannot be substantiated by comparison to independent markets. In addition, the disclosed fair value may not be realized in the immediate settlement of the financial asset and does not reflect any premium or discount that could result from offering for sale at one time an entire holding of a particular financial asset. Potential taxes and other expenses that would be incurred in an actual sale or settlement are not reflected in amounts disclosed.

Because the net asset value reported by limited partnerships and hedge funds is used as a practical expedient to estimate fair value of the Institute's interest therein, classification of such investments in the fair value hierarchy as Level 2 or 3 is based on the Institute's ability to redeem its interest at or near the statement of financial position date. If the interest can be redeemed in the near term (generally within 90 days), the investment is classified as Level 2.

(e)   *Plant Assets and Depreciation*
Proceeds from the sale of plant assets, if unrestricted, are transferred to operating funds, or, if restricted, to amounts temporarily restricted for plant acquisitions. Depreciation is provided over the estimated useful lives of the respective assets on a straight-line basis (buildings and capital improvements 20–40 years, equipment 3–6 years).

(f)   *Deferred Revenue*
Amounts received on conditional grants are recorded initially as deferred revenue and are reported as revenues when expended in accordance with the terms of the condition.

(g) *Split-Interest Agreements*

The Institute is the beneficiary of various unitrusts, pooled income funds, and a gift annuity fund. The Institute's interest in these split–interest agreements is reported as a contribution in the year received and is calculated as the difference between the fair value of the assets contributed to the Institute and the estimated liability to the beneficiary. This liability is computed using actuarially determined rates and is adjusted annually to reflect changes in the life expectancy of the donor or annuitant, amortization of the discount, and other changes in the estimates of future payments. The assets held by the Institute under these arrangements are recorded at fair value as determined by quoted market prices and are included as a component of investments.

(h) *Unamortized Debt Issuance Costs*

Debt issuance costs represent costs incurred in connection with debt financing. Amortization of these costs is provided on the effective interest method extending over the remaining term of the applicable indebtedness. Debt issuance costs at June 30, 2014 and 2013 were net of accumulated amortization of $966,014 and $911,213, respectively.

(i) *Other Revenues, Gains, and Other Support*

A portion of long-term investment income and gains and losses is allocated to operating revenue each year in accordance with the Institute's spending policy for investments held for endowment and similar purposes, as more fully discussed in note 4. All other investment income earned and gains and losses on investments held for long-term purposes, change in fair value of bond swap liability, and nonrecurring revenue and expenses are considered other revenues, gains and other support in the statements of activities. Private contributions and grants budgeted for operations are included in operating revenues, gains, and other support. All other private contributions and grants are considered other revenues, gains, and other support.

(j) *Asset Retirement Obligation*

The Institute recognizes the fair value of a liability for legal obligations associated with asset retirements in the period in which the obligation is incurred, if a reasonable estimate of the fair value of the obligation can be made. When the liability is initially recorded, the Institute capitalizes the cost of the asset retirement obligation by increasing the carrying amount of the related long-lived asset. The liability is accreted to its present value each period and the capitalized cost associated with the retirement obligation is depreciated over the useful life of the related asset. Upon settlement of the obligation, any difference between the cost to settle the asset retirement obligation and the liability recorded is recognized as a gain or loss in the statements of activities.

(k) *Fund Raising Expenses*

Fund raising expenses incurred by the Institute amounted to $1,955,984 and $1,582,457 for the years ended June 30, 2014 and 2013, respectively. This amount is included in administration and general expenses in the accompanying statements of activities.

(l) *Functional Allocation of Expenses*

The costs of providing program services and support services of the Institute have been summarized on a functional basis in the statements of activities. Accordingly, certain operating costs have been allocated among the functional categories.

(m) *Tax Status*

The Institute is exempt from federal income taxes pursuant to Section 501(c)(3) of the Internal Revenue Code (the Code) and is listed in the Internal Revenue Service Publication 78. The Institute has been classified as a public charity under Section 509(a) of the Code.

There are certain transactions that could be deemed unrelated business income and would result in a tax liability. Management reviews transactions to estimate potential tax liabilities using a threshold of more likely than not. It is management's estimation that there are no material tax liabilities that need to be recorded.

(n) *Use of Estimates*

The preparation of financial statements in conformity with U.S. generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Estimates also affect the reported amounts of revenues and expenses during the reported period. Actual results could differ from those estimates.

(2)   Contributions Receivable

Unconditional promises to give at June 30, 2014 and 2013 were as follows:

		2014	2013
Unconditional promises to give:			
Less than one year	$	7,955,522	11,370,002
One to five years		18,110,308	23,597,845
		26,065,830	34,967,847
Discount on promises to give		(785,909)	(1,705,970)
Total	$	25,279,921	33,261,877

At June 30, 2014, 97% of gross contributions receivable and 59% of contributions revenue are from four donors. At June 30, 2013, 98% of gross contributions receivable and 31% of contributions revenue are from four donors.

During fiscal 2011, the Institute received two conditional pledges totaling $100 million to enhance the Institute's endowment fund. The pledges are conditioned on the Institute raising an additional $100 million in cash or pledges from third-party donors in the period January 1, 2011 through June 30, 2015. The conditional pledge payments began in June 2011 and will continue through June 30, 2015. As of June 30, 2014 and 2013, the Institute has recorded revenue totaling approximately $58 million and $49 million, respectively, relating to these conditional pledges.

(3)   Investments, Funds Held by Bond Trustee, and Beneficial Interest in Remainder Trust

(a)   Overall Investment Objective
The overall investment objective of the Institute is to invest its assets in a prudent manner that will achieve a long-term rate of return sufficient to fund a portion of its annual operating activities and capital preservation. The Institute diversifies its investments among various managers and investment opportunities. Substantially all of the investments are pooled with each individual fund subscribing to or disposing of units on the basis of the market value per unit, determined on a quarterly basis. Major investment decisions are authorized by the Board's Investment Committee, which oversees the Institute's investment program in accordance with established guidelines.

(b)   Allocation of Investment Strategies
In addition to traditional stocks and fixed-income securities, the Institute may also hold shares or units in traditional institutional funds as well as in alternative investment funds involving hedged strategies, private equity, and real asset strategies. Hedged strategies involve funds whose managers have the authority to invest in various asset classes at their discretion, including the ability to invest long and short. Funds with hedged strategies generally hold securities or other financial instruments for which a ready market exists and may include stocks, bonds, put or call options, swaps, currency hedges, and other instruments, and are valued accordingly. Private equity funds employ buyout and venture capital strategies and focus on investments in turn-around situations. Real asset funds generally hold interests in public real estate investment trusts (REITS) or commercial real estate through sole-member entities. Private equity and real asset strategies therefore often require the estimation of fair values by the fund managers in the absence of readily determinable market values. Because of the inherent uncertainties of valuation, these estimated fair values may differ significantly from values that would have been used had a ready market existed, and the differences could be material. Such valuations are determined by fund managers and generally consider variables such as operating results, compa-rable earnings multiples, projected cash flows, recent sales prices, and other pertinent information, and may reflect discounts for the illiquid nature of certain investments held.

The following tables summarize the Institute's investments and other assets at fair value by major category in the fair value hierarchy as of June 30, 2014 and 2013, as well as related strategy, liquidity, and funding commitments:

		June 30, 2014		
	Level 1	Level 2	Level 3	Total
Investments:				
Long-term investment strategies:				
Hedge funds—onshore:				
Emerging markets	$ —	—	1,519,295	1,519,295
Equities—long bias	—	7,580,025	—	7,580,025
Equities—long/short	—	—	4,936,757	4,936,757
Multiple strategies	—	—	60,426,517	60,426,517
Total	—	7,580,025	66,882,569	74,462,594
Hedge funds—offshore:				
Commercial mortgage backed	—	—	8,259,150	8,259,150
Distressed/high-yield	—	—	9,563,493	9,563,493
Emerging markets	—	—	41,744	41,744
Equities—long bias	—	8,581,558	—	8,581,558
Equities—long/short	—	26,455,377	65,332,156	91,787,533
Event driven strategies	—	10,040,460	—	10,040,460
Fixed income arbitrage	—	—	28,624,392	28,624,392
Global asset allocation	—	29,243,336	—	29,243,336
Multiple strategies	—	68,839,588	120,709,432	189,549,020
Quantitative/CTA	—	7,378,670	—	7,378,670
Quantitative equity long short	—	16,663,265	—	16,663,265
Fixed income—relative value	—	—	12,370,566	12,370,566
Bio tech/health care	—	8,964,222	—	8,964,222
Total	—	176,166,476	244,900,933	421,067,409
Limited partnerships	—	—	152,438,300	152,438,300
Cash and cash equivalents	77,329,844	—	—	77,329,844
Other investments:				
Assets held under split-interest agreements:				
Cash and cash equivalents	—	—	(38,153)	(38,153)
Fixed income securities	—	—	4,393,952	4,393,952
Mortgages from faculty and staff	—	—	8,629,342	8,629,342
Total investments	$ 77,329,844	183,746,501	477,206,943	738,283,288
Other assets:				
Beneficial interest in remainder trust	$ —	—	2,559,277	2,559,277
Funds held by bond trustee:				
U.S. government obligations	2,286,964	—	—	2,286,964
Total other assets	$ 2,286,964	—	2,559,277	4,846,241

| | June 30, 2013 | | | |
	Level 1	Level 2	Level 3	Total
Investments:				
Long-term investment strategies:				
Hedge funds—onshore:				
Emerging markets	$ —	—	1,524,829	1,524,829
Equities—long bias	—	11,985,284	—	11,985,284
Multiple strategies	—	—	58,204,806	58,204,806
Total	—	11,985,284	59,729,635	71,714,919
Hedge funds—offshore:				
Commercial mortgage backed	—	—	9,730,472	9,730,472
Distressed/high-yield	—	—	11,541,391	11,541,391
Emerging markets	—	—	8,477,358	8,477,358
Equities—long bias	—	15,948,000	—	15,948,000
Equities—long/short	—	26,682,915	32,056,785	58,739,700
Event driven strategies	—	10,073,922	—	10,073,922
Fixed income arbitrage	—	—	27,630,277	27,630,277
Global asset allocation	—	25,458,338	—	25,458,338
Multiple strategies	—	63,087,904	143,921,877	207,009,781
Quantitative/CTA	—	5,655,609	—	5,655,609
Quantitative equity long short	—	10,430,293	—	10,430,293
Fixed income—relative value	—	—	11,186,073	11,186,073
Bio tech/health care	—	—	11,253,449	11,253,449
Total	—	157,336,981	255,797,682	413,134,663
Limited partnerships	—	—	117,080,539	117,080,539
Cash and cash equivalents	56,560,492	—	—	56,560,492
Other investments:				
Assets held under split-interest agreements:				
Cash and cash equivalents	17,240	—	—	17,240
Fixed income securities	—	—	4,077,332	4,077,332
Mortgages from faculty and staff	—	—	8,787,133	8,787,133
Total investments	$ 56,577,732	169,322,265	445,472,321	671,372,318
Other assets:				
Beneficial interest in remainder trust	$ —	—	2,721,332	2,721,332
Funds held by bond trustee:				
U.S. government obligations	2,281,080	—	—	2,281,080
Total other assets	$ 2,281,080	—	2,721,332	5,002,412

The following tables present the Institute's activities for the years ended June 30, 2014 and 2013 for investments classified in Level 3:

2014

Level 3 roll forward	Hedge funds	Limited partnerships	Assets held under split-interest agreements Fixed income securities	Mortgages from faculty and staff	Beneficial interest in remainder trust	Total
Fair value at June 30, 2013	$ 315,527,317	117,080,539	4,077,332	8,787,133	2,721,332	448,193,653
Acquisitions	51,687,782	19,884,690	—	761,000	—	72,333,472
Dispositions	(79,732,383)	(20,656,601)	(376,571)	(918,791)	—	(101,684,346)
Transfers in/out of Level 3	(11,253,449)	—	—	—	—	(11,253,449)
Net realized and unrealized gains	35,554,235	36,129,672	655,038	—	(162,055)	72,176,890
Fair value at June 30, 2014	$ 311,783,502	152,438,300	4,355,799	8,629,342	2,559,277	479,766,220

2013

Level 3 roll forward	Hedge funds	Limited partnerships	Assets held under split-interest agreements Fixed income securities	Mortgages from faculty and staff	Beneficial interest in remainder trust	Total
Fair value at June 30, 2012	$ 298,017,349	106,164,790	3,798,033	6,757,395	2,834,108	417,571,675
Acquisitions	27,000,000	22,940,621	25,000	2,832,400	—	52,798,021
Dispositions	(38,172,394)	(29,906,189)	(141,897)	(802,662)	—	(69,023,142)
Transfers in/out of Level 3	(1,112,006)	—	—	—	—	(1,112,006)
Net realized and unrealized gains	29,794,368	17,881,317	396,196	—	(112,776)	47,959,105
Fair value at June 30, 2013	$ 315,527,317	117,080,539	4,077,332	8,787,133	2,721,332	448,193,653

The Institute's accounting policy is to recognize transfers between levels of the fair value hierarchy on the date of the event or change in circumstances that caused the transfer. There were no transfers between investments classified as Level 1 and Level 2 for the years ended June 30, 2014 or 2013. During fiscal year 2014, approximately $11 million was transferred from Level 3 to Level 2 due to expiration of lock-up restrictions. During fiscal year 2013, approximately $15 million was transferred into Level 3 from Level 2 and $16.1 million was transferred from Level 3 to Level 2 due to the expiration of lock-up restrictions.

Private equity and venture capital investments are generally made through limited partnerships. Under the terms of such agreements, the Institute may be required to provide additional funding when capital or liquidity calls are made by fund managers. These partnerships have a limited existence, and they may provide for annual extensions for the purpose of disposing portfolio positions and returning capital to investors. However, depending on market conditions, the inability to execute the fund's strategy, or other factors, a manager may extend the terms of a fund beyond its originally anticipated existence or may wind the fund down prematurely. The Institute cannot anticipate such changes because they generally arise from unforeseeable events, but should they occur they could reduce liquidity or originally anticipated investment returns. Accordingly, the timing and amount of future capital or liquidity calls in any particular future year are uncertain. As of June 30, 2014, the Institute is obligated under certain limited partnership agreements to advance additional funding in the amount of $69,072,434, which is anticipated to be called over the next 10 years.

Investment liquidity as of June 30, 2014 is aggregated below based on redemption or sale period:

	Investment fair values
Investment redemption or sale period:	
Daily	$ 77,329,844
Monthly	53,285,271
Quarterly	100,647,430
Semi-annually	29,813,799
Annually	82,127,294
Subject to rolling lock ups or other restrictions	217,028,018
Illiquid	178,051,632
Total as of June 30, 2014	$ 738,283,288

(c) Funds Held by Bond Trustee

Funds held by bond trustee represent the balance of the proceeds from the 2006 and 2008 New Jersey Educational Facilities Authority (NJEFA or the Authority) bonds and the 2012 taxable bonds that have not yet been expended for construction purposes or debt service payments. These funds are being held in trust by The Bank of New York. Such funds are invested in U.S. government obligations with maturities of less than one year.

(d) Redemption Restrictions—Hedge Funds

At June 30, 2014, the Institute had hedge fund investments of approximately $495,530,000, of which approximately $124,207,000 was restricted from redemption for lock-up periods. At June 30, 2013, the Institute had hedge fund investments of approximately $484,849,500, of which approximately $108,259,000 was restricted from redemption for lock-up periods. Some of the investments with redemption restrictions allow early redemption for specified fees. The terms and conditions upon which an investor may redeem an investment vary, usually with the majority requiring 30 to 180 days' notice after the initial lock-up period.

The expirations of redemption lock-up periods are summarized in the table below:

	Amount
Fiscal year:	
2015	$ 81,978,782
2016	21,335,212
2017 and thereafter	20,893,079
Total	$ 124,207,073

(e) Redemption Restrictions—Limited Partnerships

At June 30, 2014 and 2013, the Institute had limited partnership investments of approximately $152,438,300 and $117,080,500, respectively, which were restricted from redemption for lock-up periods. Some of the investments with redemption restrictions allow early redemption for specified fees. The terms and conditions upon which an investor may redeem an investment vary, usually with the majority requiring 30 to 180 days' notice after the initial lock-up period.

The expirations of redemption lock-up periods are summarized in the table below:

	Amount
Fiscal year:	
2016	$ 16,794,642
2017	13,329,663
2018	54,177,337
2019	7,487,389
2020	4,464,324
2021 and thereafter	56,184,945
Total	$ 152,438,300

(f) *Contingencies*

The Institute has an investment in the Ariel Fund Limited (the Fund), which on June 30, 2014 and 2013 had a fair value of approximately $8,053,900 and $8,659,500, respectively. During fiscal year 2009, the fund became subject to the oversight of a receiver appointed by the Attorney General of New York for the principal purposes of marshalling and preserving the assets of the Fund, for ultimate distribution of the proceeds to the respective investors of the Fund. During fiscal years 2014 and 2013, the Institute received distributions of $1,592,159 and $5,065,963, respectively, from the receiver. There is a potential for litigation to recover amounts from investors who have received previous distributions from the Fund. Management does not expect this to have a significant impact on the Institute's financial statements.

(4) Investment Return and Endowment Spending Policy

Investment return consists of interest, dividends, and realized and unrealized gains and losses on investments. Each year, the Institute includes a portion of its endowment return in its operating budget, with the amount of such planned support determined using its spending policy. The policy of the Institute is to distribute for current spending a percentage of the fair value of pooled investments which is determined by the Board of Trustees annually. The spending rate for operating and capital purposes was 6.9% and 6.7% for 2014 and 2013, respectively.

The following tables summarize the investment return and its classification in the statements of activities for the years ended June 30, 2014 and 2013:

	2014		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	$ (1,003,764)	(1,337,971)	(2,341,735)
Net realized and unrealized gains	47,853,748	42,519,483	90,373,231
Total investment return	46,849,984	41,181,512	88,031,496
Endowment spending policy for use in operations	20,673,193	16,650,307	37,323,500
Endowment change after applying spending policy	$ 26,176,791	24,531,205	50,707,996

	2013		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	$ (1,102,987)	(1,138,671)	(2,241,658)
Net realized and unrealized gains	36,933,099	29,279,170	66,212,269
Total investment return	35,830,112	28,140,499	63,970,611
Endowment spending policy for use in operations	18,589,144	16,090,456	34,679,600
Endowment change after applying spending policy	$ 17,240,968	12,050,043	29,291,011

Total investment management and advisory fees were $2,147,159 and $2,355,295 for the years ended June 30, 2014 and 2013, respectively.

(5) Endowment

The Institute's endowment consists of approximately 100 individual funds established for a variety of purposes including both donor-restricted endowment funds and funds designated by the Board of Trustees to function as endowments. Net assets associated with endowments, including funds designated by the Board of Trustees to function as endowments, are classified and reported based on the existence or absence of donor-imposed restrictions.

(a) Interpretation of Relevant Law

The Institute has interpreted the New Jersey-enacted version of the Uniform Prudent Management of Institutional Funds Act (UPMIFA) as allowing the Institute to appropriate for expenditure or accumulate so much of a donor-restricted endowment fund as the Institute determines is prudent for the uses, benefits, purposes, and duration for which the endowment fund is established, subject to the intent of the donor as expressed in the gift instrument. Unless stated otherwise in the gift instrument, the assets in a donor-restricted endowment fund are donor-restricted assets until appropriated for expenditure by the Board of Trustees of the Institute. As a result of applicable accounting guidance, the Institute classifies as permanently restricted net assets (a) the original value of gifts donated to the permanent endowment, (b) the original value of subsequent gifts to the permanent endowment, and (c) accumulations to the permanent endowment made in accordance with the direction of the applicable donor gift instrument at the time the accumulation is added to the fund. The remaining portion of the donor-restricted endowment fund that is not classified as permanently restricted net assets is classified as temporarily restricted net assets until those amounts are appropriated for expenditure in a manner consistent with the standard of prudence prescribed by UPMIFA.

From time to time, the fair value of assets associated with individual donor-restricted endowments may fall below the original corpus the fund included in permanently restricted net assets due to unfavorable market fluctuations subsequent to the investment of the gift. Deficiencies of this nature, which are reported in unrestricted net assets, totaled approximately $1,968,000 and $2,048,000, at June 30, 2014 and 2013, respectively. Subsequent gains that restore the fair value of the assets of the donor-restricted endowment fund are classified as an increase in unrestricted net assets.

Endowment net assets consisted of the following at June 30, 2014 and 2013:

				2014		
		Unrestricted	**Temporarily restricted**	**Permanently restricted**		**Total**
Donor restricted	$	(1,968,353)	172,496,180	202,415,879		372,943,706
Board designated		368,315,514	—	—		368,315,514
	$	366,347,161	172,496,180	202,415,879		741,259,220

				2013		
		Unrestricted	**Temporarily restricted**	**Permanently restricted**		**Total**
Donor restricted	$	(2,047,596)	146,712,480	182,410,786		327,075,670
Board designated		355,474,109	—	—		355,474,109
	$	353,426,513	146,712,480	182,410,786		682,549,779

Changes in endowment net assets for the fiscal years ended June 30, 2014 and 2013 were as follows:

		Unrestricted	Temporarily restricted	Permanently restricted	Total
Net assets, June 30, 2012	$	328,931,009	134,281,483	173,063,383	636,275,875
Dividends and interest income, net		(1,102,987)	(895,195)	—	(1,998,182)
Realized and unrealized gains		36,933,099	29,020,398	—	65,953,497
Contributions		792,859	396,250	9,347,403	10,536,512
Appropriation for expenditure— operations		(18,589,144)	(16,090,456)	—	(34,679,600)
Amounts added back to the board-designated endowment		6,461,677	—	—	6,461,677
Net assets, June 30, 2013	$	353,426,513	146,712,480	182,410,786	682,549,779
Dividends and interest income, net		(1,003,764)	(911,309)	—	(1,915,073)
Realized and unrealized gains		47,853,748	42,098,815	—	89,952,563
Contributions		243,528	1,246,501	20,005,093	21,495,122
Appropriation for expenditure— operations		(20,673,193)	(16,650,307)	—	(37,323,500)
Appropriation for expenditure— capital and other		(13,499,671)	—	—	(13,499,671)
Net assets, June 30, 2014	$	366,347,161	172,496,180	202,415,879	741,259,220

(b) *Return Objectives and Risk Parameters*

The Institute has adopted investment and spending policies for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment while seeking to maintain the purchasing power of the endowment assets.

(c) *Strategies Employed for Achieving Objectives*

The Institute manages its investments in accordance with a total return concept and the goal of maximizing returns within acceptable levels of risk. The Institute relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (dividends and interest). The Institute's spending policy is designed to provide a stable level of financial support and to preserve the real value of its endowment.

(6) Physical Plant

Physical plant and equipment are stated at cost at date of acquisition, less accumulated depreciation.

A summary of plant assets at June 30, 2014 and 2013 follows:

		2014	2013
Land	$	377,470	377,470
Land improvements		2,187,449	2,114,955
Buildings and improvements		122,142,553	111,142,832
Equipment		32,485,104	31,123,609
Rare book collection		203,508	203,508
Joint ownership property		4,528,124	4,492,555
		161,924,208	149,454,929
Accumulated depreciation		(79,649,773)	(74,957,999)
Net book value	$	82,274,435	74,496,930

(7) Long-Term Debt

A summary of long-term debt at June 30, 2014 and 2013 follows:

		2014	2013
2006 Series B—NJEFA	$	25,500,000	26,500,000
2006 Series C—NJEFA		17,000,000	17,500,000
2008 Series C—NJEFA		4,455,000	4,975,000
2012 Taxable		16,925,000	17,320,000
Less unamortized bond discount		(223,047)	(244,966)
Total long-term debt	$	63,656,953	66,050,034

Interest expense on long-term debt for the years ended June 30, 2014 and 2013 was $1,774,657 and $1,600,692, respectively.

(a)   *2001 Series A*

In May 2001, the Institute received proceeds of the Authority offering of $11,000,000 Revenue Bonds, 2001 Series A of the Institute for Advanced Study Issue. Proceeds were used for the construction of Bloomberg Hall and additional capital projects. These bonds were partially refunded through the 2006 Series B Revenue bonds detailed below. During the year ending June 30, 2013, the remaining outstanding bonds from this issue were refunded through the 2012 Taxable bonds detailed below.

(b)   *2006 Series B*

In July 2006, the Institute received proceeds of the Authority offering of $29,600,000 Revenue Bonds, 2006 Series B of the Institute for Advanced Study Issue. The 2006 Series B Bonds were issued to finance the advance refunding of the outstanding 1997 Series G Bonds, the partial advance refunding of the 2001 Series A Bonds, and to pay a portion of certain costs incidental to the sale and issuance of the 2006 Series B Bonds.

(c)   *2006 Series C*

In March 2007, the Institute received proceeds of the Authority offering of $20,000,000 Revenue Bonds, 2006 Series C of the Institute for Advanced Study Issue. Proceeds are being used to finance the costs of construction, renovating and equipping certain educational facilities of the Institute, to fund capitalized interest on the 2006 Series C Bonds during the renovation and construction, and to pay certain costs incidental to the sale and issuance of the 2006 Series C Bonds.

(d)   *2008 Series C*

In March 2008, the Institute received proceeds of the Authority offering of $11,255,000 Revenue Bonds, 2008 Series C of the Institute for Advanced Study Issue. The 2008 Series C Bonds were issued to finance the advance refunding of outstanding 1997 Series F Bonds, the advance refunding of outstanding 1997 Series G, and to pay a portion of certain costs incidental to the sale and issuance of the 2008 Series C Bonds.

(e)   *2012 Taxable*

In December 2012, the Institute received proceeds of $17,320,000 Taxable Bonds, 2012 Series of the Institute for Advanced Study Issue, which were issued at a discount of approximately $92,000. The 2012 Taxable Bonds were used to finance the advance refunding of outstanding 2001 Series A Bonds, to fund renovations to the Members Housing facility and the costs of renovation and equipping certain educational facilities of the Institute, and to pay certain costs incidental to the sale and issuance of the 2012 Taxable Bonds.

(f)   *Interest Rates*

The 2006 Series B and C Bonds bear interest at variable rates. The bonds were issued in the weekly mode with weekly rates determined by Lehman Brothers Inc, as Remarketing Agent and paid monthly. The maximum interest rate on the 2006 Bonds shall be twelve percent (12%) per annum. The 2006 bonds are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2036. The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute. On September 18, 2008, the Institute entered into a contract with JPMorgan Chase Bank to take over as Remarketing Agent, replacing Lehman Brothers Inc.

The 2008 Series C Bonds bear interest at rates ranging from 3% to 5% per annum, payable semi-annually, are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2021.

The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute.

The 2012 Taxable bonds bear interest at rates ranging from 0.388% to 3.892% per annum, payable semi-annually, are subject to redemption at various prices and require principal payments and sinking fund installments through December 1, 2042. The obligation to make the interest payments on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation to the Institute.

(g) *Bond Swap Agreement*

On December 22, 2008, the Institute entered into a swap agreement with Wells Fargo Bank covering $28,800,000 of outstanding Series B Bonds that required the Institute to pay a fixed rate of 3.7702% to Wells Fargo Bank in exchange for Wells Fargo Bank agreeing to pay the Institute a variable rate equal to 67% of the USD-LIBOR-BBA rate with a term of three months, payable monthly, on an identical notional amount. The effective date of the swap was December 22, 2008 and the termination date of the swap agreement coincides with the maturity of the bonds, which is July 1, 2031.

The Institute entered into this swap agreement with the intention of lowering its effective interest rate. At June 30, 2014 and 2013, the fair value of the interest rate swap was ($4,275,176) and ($4,475,949), respectively. The unrealized gain (loss) recognized during the year ended June 30, 2014 and 2013 in the amount of $200,773 and $2,022,672, respectively, is reported in the statements of activities in change in fair value of bond swap liability. The swap agreement utilizes Level 2 inputs to measure fair value. The fair value of the interest rate swap was determined using pricing models developed based on the LIBOR swap rate and other market data. Under the swap agreement, the Institute may be required to post collateral to the counterparty if certain triggering events (rates and dollar thresholds) are met. As of June 30, 2014 and 2013, there was no requirement to post collateral imposed by the swap counterparty.

The bonds are repayable as follows at June 30, 2014:

	Amount
Year ending June 30:	
2015	$ 2,440,000
2016	2,575,000
2017	2,605,000
2018	2,845,000
2019	3,280,000
2020 through 2037	50,135,000
Total	$ 63,880,000

The 2006 Series B, 2006 Series C, and 2008 Series C bonds are secured by a pledge of revenues pursuant to the respective Loan Agreements.

(h) *Line of Credit*

As of June 30, 2014 and 2013, the Institute had unsecured loan agreements representing a line of credit. As of June 30, 2014 and 2013, the agreements provide for borrowings up to $50,000,000 and are available through April 2016. Interest payments are due on demand and interest accrues at the LIBOR rate plus 90 basis points, which was 1.54% as of June 30, 2014. There were no borrowings in fiscal year 2014 or 2013 against the lines of credit. No interest expense was incurred for the years ended June 30, 2014 and 2013.

(8) Pension Plans and Other Postretirement Benefits

Separate voluntary defined contribution retirement plans are in effect for faculty members and eligible staff personnel, both of which provide for annuities, which are funded, to the Teachers Insurance and Annuity Association and/or the College Retirement Equities Fund. Contributions are based on the individual participant's compensation in accordance with the formula set forth in the plan documents on a nondiscriminatory basis. Contributions for the years ended June 30, 2014 and 2013 totaled approximately $2,318,400 and $2,285,200, respectively.

In addition to providing pension benefits, the Institute provides certain health care and life insurance benefits for retired employees and faculty. Substantially, all of the Institute's employees may become eligible for these benefits if they meet minimum age and service requirements. The Institute accrues these benefits over a period in which active employees become eligible under existing benefit plans.

The following table provides a reconciliation of the change in benefit obligation of the plan at June 30, 2014 and 2013. There are no plan assets at June 30, 2014 and 2013.

		2014	2013
Postretirement benefit obligation:			
Retirees	$	4,976,817	4,769,377
Fully eligible active plan participants		1,911,518	1,713,694
Other active plan participants		8,198,626	6,692,021
Postretirement benefit obligation	$	15,086,961	13,175,092
Change in benefit obligation:			
Benefit obligation at beginning of year	$	13,175,092	15,061,242
Service cost		615,504	710,624
Interest cost		624,254	604,718
Benefits paid		(352,809)	(376,897)
Actuarial gain		1,024,920	(2,824,595)
Benefit obligation at end of year	$	15,086,961	13,175,092
Components of net periodic benefit cost:			
Service cost	$	615,504	710,624
Interest cost		624,254	604,718
Amortization of net gain		1,024,920	(2,824,595)
Net periodic postretirement benefit (credit) cost	$	2,264,678	(1,509,253)

	2014	2013
Benefit obligation weighted average assumptions at June 30, 2014 and 2013:		
Discount rate	4.35%	4.81%
Periodic benefit cost weighted average assumptions for the years ended June 30, 2014 and 2013:		
Discount rate	4.81%	4.08%

The healthcare trend rate is assumed to be 3% in fiscal 2014, trending up to an ultimate rate of 5% in 2026 and thereafter.

The effects of a 1% increase or decrease in trend rates on total service and interest cost and the postretirement benefit obligation are as follows:

		2014		2013	
		Increase	Decrease	Increase	Decrease
Effect on total service and interest cost	$	383,514	(255,447)	370,416	(251,224)
Effect on the postretirement benefit obligation		3,834,620	(2,625,796)	3,042,465	(2,098,726)

Projected payments for each of the next five fiscal years and thereafter through 2023 are as follows:

	Amount
Year ending June 30:	
2015	$ 416,000
2016	426,000
2017	450,000
2018	473,000
2019	492,000
2020 through 2024	2,905,000

The Institute funds claims as they are incurred. The Institute does not expect to contribute any amounts in fiscal 2014, except as needed to provide for benefit payments.

(9) Temporarily and Permanently Restricted Assets

Restricted net assets are available for the following purposes at June 30, 2014 and 2013:

	2014	2013
Temporarily restricted net assets are restricted to:		
School of Mathematics	$ 34,256,552	30,982,319
School of Natural Sciences	17,484,612	12,388,448
School of Historical Studies	40,181,870	35,601,130
School of Social Science	59,936,776	55,029,995
Libraries and other academic	5,848,752	4,880,138
Administration and general	15,326,530	8,375,356
	$ 173,035,092	147,257,386
Permanently restricted net assets are restricted to:		
Investments to be held in perpetuity, the income from which is expendable to support academic services	$ 202,415,879	182,410,786

(10) Disclosures About Fair Value of Financial Instruments

The carrying amount of the Institute's financial instruments not carried at fair value approximates fair value due to the short maturity, except for long-term indebtedness. The inputs fall within Level 3 of the fair value hierarchy. The estimated fair value of the Institute's long-term indebtedness, based on the discounted future cash payments to be made using observable inputs that fall within Level 2 of the fair value hierarchy, was approximately $67,700,000 and $68,300,000 at June 30, 2014 and 2013, respectively.

(11) Subsequent Events

The Institute evaluated events subsequent to June 30, 2014 through November 6, 2014, the date on which the financial statements were issued and determined there were no subsequent events required to be disclosed.

DO NOT ERASE