

Radiations

SPRING
2013

The official publication of Sigma Pi Sigma



Connecting Worlds
The 2012 Quadrennial Physics Congress





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ON THE COVER

In this issue, we begin our coverage of the 2012 Quadrennial Physics Congress (PhysCon), hosted by Sigma Pi Sigma November 8-10, 2012, in Orlando, FL. Photos by Liz Dart Caron and Ken Cole.

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The three-day gathering dubbed “PhysCon” brought together more than 800 people in Orlando, FL, and inspired a new generation of scientists.

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A student art exhibition and a national physics conference serve as examples where both disciplines were enhanced by the other. — *Carla Poindexter*

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Connect with Sigma Pi Sigma online



LinkedIn
www.linkedin.com/groups/Sigma-Pi-Sigma-physics-honor-142619



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www.facebook.com/groups/2204770077

Correction: On page 26 of the Fall 2012 issue, 11 Sigma Pi Sigma inductees into the University of North Carolina at Charlotte chapter were incorrectly listed under the University of North Carolina - Asheville. The inductees will be reprinted with the correct chapter in the Fall 2013 issue. We apologize for the error.

Connections that count

by Toni Sauncy

It is hard to believe that it has been more than six months since the 2012 Quadrennial Physics Congress (PhysCon), hosted by Sigma Pi Sigma. These 'follow-up months' have been filled with a surplus of ordinary and somewhat tedious tasks (especially when compared to the high level of excitement that permeated the meeting) aimed at properly archiving PhysCon 2012 for posterity. And while the labor of sorting through registration records, organizing workshop documents, captioning hundreds of photos, reading dozens of student-authored reports, and finding a storage place for the on-paper memory of PhysCon 2012 might seem at first glance like a soporific activity, it has been an enlightening experience. Like any other valid scientific endeavor, it is through the examination of the data that we learn.



ABOVE
Sigma Pi Sigma Director Toni Sauncy (center) is flanked by her former students from Angelo State University at the 2012 Quadrennial Physics Congress. Photo by Liz Dart Caron.

The analysis is producing some important lessons. One of the most obvious is confirmative: there is a large number of undergraduate students and their mentors who are strongly interested in a conference that combines world-class science with opportunities to build connections and broaden horizons. With over 800 attendees, a lengthy waiting list, and the office already receiving inquiries about the plans for 2016, the interest in and need for such a unique gathering is undeniable. Registration data reveals that PhysCon 2012 achieved demographic diversity unrealized at many other physics meetings, giving us hope that efforts aimed at inclusivity are working. The roster of attendees included more than 80% undergraduate students with over 30% women and 20% underrepresented minorities. All eighteen of the SPS geographic zones were represented and for the first time, a group of students from an international chapter made the trek.

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SPRING 2013
VOLUME 19, ISSUE 1

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Radiations (ISSN 2160-1119) is the official publication of Sigma Pi Sigma, the physics honor society. Published twice per year by the American Institute of Physics, One Physics Ellipse, College Park, MD 20740-3841. Printed in the USA. Standard postage paid at Mechanicsburg, PA. POSTMASTER: Send address changes to: Radiations Magazine, Sigma Pi Sigma, One Physics Ellipse, College Park, MD 20740-3841.

Sigma Pi Sigma is an organization of the American Institute of Physics. It was founded at Davidson College, Davidson, North Carolina, December 11, 1921. Member, Association of College Honor Societies. Contact us at: email: sps@aip.org; telephone: (301) 209-3007; fax: (301) 209-0839.

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Connecting Worlds

by William DeGraffenreid, California State University, Sacramento

The American Institute of Physics is an organization of 10 physical science societies, representing more than 135,000 scientists, engineers, and educators. Through its Physics Resources Center, AIP delivers valuable services and expertise in education and student programs, science communications, government relations, career services for science and engineering professionals, statistical research in physics employment and education, industrial outreach, and the history of physics and allied fields. AIP publishes *Physics Today*, the most influential and closely followed magazine of the physics community, and is also home to Society of Physics Students and the Niels Bohr Library and Archives. AIP owns AIP Publishing LLC, a scholarly publisher in the physical and related sciences. www.aip.org

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American Physical Society, The Optical Society, Acoustical Society of America, The Society of Rheology, American Association of Physics Teachers, American Crystallographic Association, American Astronomical Society, American Association of Physicists in Medicine, AVS—The Science & Technology Society, American Geophysical Union

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Sigma Pi Sigma, Physics Honor Society, Society of Physics Students, Corporate Associates



Sigma Pi Sigma president William DeGraffenreid opens the 2012 Quadrennial Physics Congress in Orlando, FL. Photo by Ken Cole.

“Whew, what a weekend!” That’s what I remember thinking as I sat on my flight home from last fall’s Quadrennial Physics Congress (PhysCon) in Orlando. The three days were filled with activities: six outstanding plenary speakers, two special lunchtime speakers, six workshops, sixty exhibitors, nearly two hundred undergraduate research posters, an art competition, a special tour of the Kennedy Space Center (alligators, eagles, and launchpads, oh my!), and Club Congress (a killer physics dance party) on Saturday night. Based on the conversations that I had with many of the attendees and others that I overheard while walking around the convention center, I am confident that all the students who attended returned to their home campus with an expanded enthusiasm for their studies and are kick-starting outreach activities in their own departments. I can’t wait to read the annual chapter reports from this year.

While we were able to share the excitement of physics with some six hundred undergraduate physics majors,

this is only a small fraction of physics majors in the United States. We want to develop the same enthusiasm in all of those who were not able to attend. This is where Sigma Pi Sigma and the Society of Physics Students have been working very diligently since the Congress. I wanted to take some time to share with you some of our strategies for spreading the word.

A program that has been particularly useful in sharing information about what happens at professional meetings is our Student Reporter program. For many years now, we’ve sent undergraduate students to national physics meetings of organizations such as The American Physical Society, the American Geophysical Union, the American Association of Physics Teachers, and others, to write stories for SPS publications. This year, due to the generosity of a number of people and organizations, we were able to help support several teams of student reporters to attend PhysCon. Each team was assigned to interview and provide reports on speakers, workshops,

or other PhysCon events. The reports are starting to make their way into our publications. We have several excerpts in this issue of *Radiations*, and there are several others in the Society of Physics Student's most recent issue of *The SPS Observer* (head over to www.spsobserver.org to see them).

Even though the Congress is behind us, it continues to live on the Internet. Several of the plenary talks have been archived on our website (www.spscongress.org). You can watch Freeman Dyson's talk, "Living through Four Revolutions," or read the slides that Jocelyn Bell Burnell showed as she discussed "Reflections on the Predicted End of the World in December 2012" (note: all ended well). I encourage you to visit the "Plenary Talks" page to view these and others (www.spscongress.org/physconprogram/speakers).

One of the most exciting things about PhysCon was the geographic representation of the participants. Not only did we have attendees from all corners of the country, we also had a large contingent from Southeast University in China! We expect that all of these students will be anxious to share what they learned at PhysCon with others, and what better place to do that than an SPS Zone Meeting? Having spoken extensively with representatives on the National Council who will be participat-

ing in these regional meetings, I know that the Congress will be discussed. In particular, the material covered in the PhysCon workshops is well suited for such meetings. The workshops covered themes like "Connecting Science and Public Policy," "Connecting Diverse Perspectives in Science," "Connecting Students and Careers," and "Connecting Physics and the Public." By participating in these workshops, students gained a much broader picture of how science, and physics in particular, interacts with the broader world.

So what happens next? In the coming months we'll be working hard to continue harnessing the enthusiasm that PhysCon generated, and it seems that our work will be rather easy. We had a record number of applicants for our SPS Summer Internship program. The National Council has begun discussions on upcoming themes on which to focus our programs in the coming years, and we are already starting to work on the 2016 Congress. For those of you who haven't heard, we will be heading west to San Jose, CA, the heart of the Silicon Valley. The Stanford Linear Accelerator Center has already agreed to open their facility for tours by those attending the Congress.

What shall we do until then? Connect worlds, of course ... 🌐

The Director's Space

continued from page 3

Combing through the data teaches us. It strengthens our resolve to keep looking forward and boosts our confidence that it is possible to make an impact on the face of physics in future generations.

PhysCon 2012 also taught us that coolness spans generations. The photos of so many students waiting in line for a moment to speak with or get autographs from Freeman Dyson, world-class scientist and octogenarian, tell us that wanting to participate in a scientific revolution never goes out of style. Despite the gap in years, the students clearly felt connected to someone who sees the world like they do.

As we continue to glean lessons from the PhysCon experience, we also take pause in this issue of *Radiations* to acknowledge the many Sigma Pi Sigma alumni and others who generously support SPS and Sigma Pi Sigma programs through donations. These generous donations connect the alumni base with the current set of students who benefit from scholarships, awards, internships and programs.

The connections of physicists at all levels make the physics community a great place to be. 🌐



Pictured with *William DeGraffenreid (first row right) at the 2012 Congress are past presidents of Sigma Pi Sigma *Thomas Olsen and Ann Viano (first row), along with *Steve Feller, *Diane Jacobs, and Charles Miner (back row). Photo by Ken Cole.

*Members of the 2012 Quadrennial Physics Congress Planning Committee.



An SPS member from Southeast University in Nanjing, China presents Sigma Pi Sigma Director Toni Saucy with a gift from their chapter at the 2012 Congress. Photo by Liz Dart Caron.

Coe College Chapter Recognizes Dr. John Salzer

by Ugur Akgun, Coe College

The Coe College Sigma Pi Sigma chapter in Cedar Rapids, IA, has recognized Dr. John Salzer with a Sigma Pi Sigma Outstanding Service Award for his outstanding success as an astronomer and educator.

Salzer, Chair of the Indiana University Astronomy Department, graduated from the Coe College Physics Department in 1980. After completing an MS degree in physics from Iowa State University, he got a Ph.D. in Astronomy from the University of Michigan. Salzer completed postdoctoral research positions at Arecibo Observatory in Puerto Rico and at the National Optical Astronomy Observatories in Tucson, AZ. Salzer has earned numerous honors, including being named by President Clinton as a Presidential Faculty Fellow in 1995. Before his current post, he served as professor and department

chair at Wesleyan University in Middletown, CT. Salzer has been a loyal graduate of the Coe physics program in many notable ways including student support, contributions to Peterson Hall, and more.

The award ceremony was held April 21, 2013, during the 34th annual Coe College Physics Banquet. Seven new members were inducted into the Coe chapter that evening as well.

Following the award ceremony, Salzer gave an intriguing talk to more than 50 physics students, alumni and faculty attending the banquet. Salzer's talk covered his recent findings on chemical abundances in galaxies and

star-formation in the nearby universe. Students were fascinated by the latest results from his study that indicated new information about the age of massive, luminous galaxies.

After the banquet, Salzer also hosted a Café Scientifique titled "Expanding Universe." This was the second Café Scientifique organized by the Coe College Physics Department, after last spring's event on the Large Hadron Collider. Salzer discussed the experimental findings on the accelerated expansion of the universe and possibilities for how the known universe will end. The challenging topic initiated a very heated question-



ABOVE

Coe College Alumnus Dr. John Salzer, Chair of the Astronomy Department at Indiana University (IU). Photo courtesy of IU.

and-answer session with the audience, which included the general public.

All members of the Coe College Physics Department and the Sigma Pi Sigma chapter were delighted to listen to Salzer, and to recognize him as model alumnus.



Chapters are encouraged to recognize notable alumni with the Sigma Pi Sigma Outstanding Service Award. For more information, see: www.sigmapisigma.org/awards/outstanding_service.htm.



Congratulations to the Newest Sigma Pi Sigma Chapters

- Bryn Mawr College
- Christopher Newport University
- Gordon College
- Herbert H. Lehman College, The City University of New York
- Lebanon Valley College
- Massachusetts College of Liberal Arts
- Roberts Wesleyan College
- Simpson College

Congratulations to our recently revived Sigma Pi Sigma Chapters

Thanks to the students and advisors who worked to have their Sigma Pi Sigma inductions last spring after a long hiatus, including induction ceremonies at the following institutions:

- SUNY-Albany
- University of Memphis
- California State University – San Luis Obispo

If you would like your refreshed chapter featured in *Radiations*, email us at sigmapisigma@aip.org

2013 Chapter Project Awards

Sigma Pi Sigma Chapter Project Awards recognize chapter efforts to raise public awareness of the honor society, build our student/alumni community, and promote inter-chapter activities. Recipients receive funds to help enhance their induction ceremony. This year's winners are listed here, along with excerpts from their proposals. Learn more and apply at: www.sigmapi sigma.org/awards.



St. John's University, Jamaica, NY

We hope to foster interactions by inviting students, faculty, alumni, and local industrial physicists to our induction ceremony. We will host a panel discussion on career opportunities and challenges for physics graduates and invite students from all science majors to attend. In addition to inducting new members, we'll include an egg drop contest to add some physics and fun into the event.

Creighton University, Omaha, NE

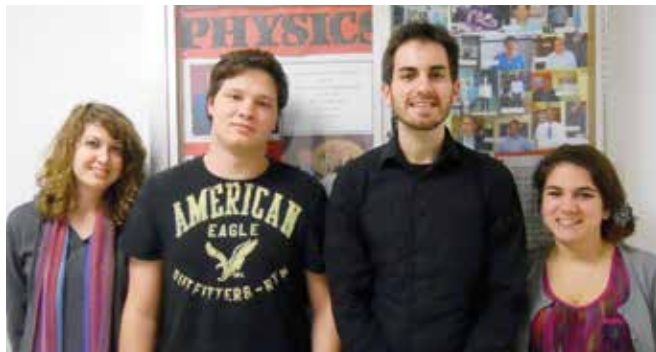
In an effort to raise local awareness of Sigma Pi Sigma and the intriguing world of physics, Creighton University hosted its 40th annual Physics Field Day in the spring of 2013. We invited physics students from local high schools to join in friendly competitions that showcased the extraordinary field of physics.

University of Southern Mississippi, Hattiesburg, MS

In order to recognize the outstanding students in the Department of Physics and Astronomy at the University of Southern Mississippi, our Society of Physics Students chapter hosted an alumnus as a guest speaker for the Sigma Pi Sigma Induction Ceremony held in the spring of 2013.

Lebanon Valley College, Annville, PA

Our newly established chapter will foster fellowship among several generations of graduates at our first induction banquet, by including physics majors, faculty, and alumni. Following dinner, students and alumni will give presentations on their research and work. We will honor hard work, encourage future success, and celebrate the accomplishments of the department as a whole.



Left to right: St. John's University project proposers Ashley Tucker, Daniel Nikolov, Spencer Mamer, and Lauren Grana. Not pictured: Michelle Zur. Photo by Huizhong Xu.



Left to right: Creighton University project proposers Nathan Holman, Jarrod Bang, Kristina Ward, and Lana Zhuludeva. Photo courtesy of Creighton University.



Left to right: University of Southern Mississippi project proposers Amanda Palchak, Erica Bloor, Alyece Willoughby, Steven Kirkup, Austin Andries, and Tyler Reese. Photo by Alina Gearba.



Left to right: Lebanon Valley College project proposers Cedrick McDonald, Gregory Renner, Dr. Ruth Malenda, Hannah Pell, Matt Campbell, Nick Durofchalk, Anthony Hoover, Andrew Burkholder, and Douglas Olinger. Photo courtesy of Dr. Ruth Malenda.

PhysCon & Beyond

Research, Reflection, and Connections


by Liz Dart Caron, Elizabeth Hook, Toni Sauncy, and Tracy Schwab

For most physics majors, the Sigma Pi Sigma Congress is a once-in-an-undergraduate career opportunity. Students come to connect with kindred spirits—peers who share their fascination with uncovering the secrets of the world around us. Not everyone experiences the same rush at the practice of discovery, but the allure of learning about, and perhaps even contributing to, our knowledge of how nature unfolds from the quark to the cosmos is an irresistible hook for the not-so-common breed of humans who deem themselves physics enthusiasts. Put 800 people, mostly undergraduates, who fit this description in the same place, and you've got yourself a party. Add in lectures from some of the discipline's most renowned contributors, and you better get comfortable because no one is going home early.



Above: Past Sigma Pi Sigma President George Miner, University of Dayton '78 (second from left) and David Dunlap, University of Maine '78 (third from left) are pictured along with students, alumni, and PhysCon guests as they tour NASA Kennedy Space Center on Thursday, November 8, 2012. Photo by Michael Duncan.



 Connecting
WORLDS
through science & service
2012
2012 Quadrennial Physics Congress

*"Our chapter had been eagerly anticipating the 2012 Congress because alumni, who attended the 2008 Congress, shared how exciting and unique the conference was for them."
~ students from Grove City College*

"We would be lying if we said we weren't geeking out as our bus drove up to the famous countdown clock, or when we got out on the crawler path leading up to the launch pad."

~ students from the College of William & Mary

Physics Congresses started because Sigma Pi Sigma saw inherent value in convening its members to inform the direction of the society. And it's true. Every four years, the deliverables from that Congress set the tone and direction for the next four years. For Sigma Pi Sigma, this has been invaluable. The individual experience, however, is perhaps the more important takeaway; the newfound energy is what keeps the honor society, and the larger Society of Physics Students, thriving.

The 2012 Quadrennial Physics Congress (dubbed PhysCon 2012) that took place November 8–10 in Orlando,

FL, was the largest meeting of undergraduate physics majors in history. The diversity of attendees exceeded that of typical physics departments, with more than 30% women and nearly 20% minorities.

THE JOURNEY TO CONGRESS

"Our chapter had been eagerly anticipating the 2012 Congress because alumni, who attended the 2008 Congress, shared how exciting and unique the conference was for them," said students from Grove City College.

Long before registration opened, many schools began fundraising and putting together group travel plans. The expense of transporting large groups of students across the country was a challenge, and many chapters had to be very creative with their fundraising. "Rent-a-Student" events, "demos-for-donations," and even bake sales helped chapters feed their Congress kitty. In an act of scientific citizenship, Abilene Christian University partnered with the Abilene Center for Contemporary Arts in an event that raised breast cancer awareness and raised funds for travel.

Congress-goers arrived by plane,

Iconic images from the NASA Kennedy Space Center Tours (photos by Ken Cole unless otherwise noted). Top row: Filling in the famous countdown clock are student members of the SPS National Council and 2012 Congress Planning Committee. Bottom Row, left to right: the KSC visitors complex sign, the Space Shuttle Crawlerway and launch pad, the Space Shuttle Atlantis, and members of the Southeast University SPS chapter (Nanjing, China) in the rocket garden (photo by Liz Dart Caron).



train, bus, and car, hailing from across the US, and some as far away as China. Local students also showed up in abundance, with the largest local representation from the University of Central Florida across town.

Some chapters faced pressing last-minute challenges, as Hurricane Sandy bore down on the East Coast just before the start of the meeting. Students from some schools like Richard Stockton University in New Jersey were forced to forgo travel plans, while other students from St. Peter's College were grateful to make it: "Our flight became the last one from the airport; all the following flights were cancelled. When we left the ground, we knew we had crossed our last hurdle. We were flying to Florida."

THE CONGRESS EXPERIENCE

The opening day was much anticipated by registrants and planners alike. Eighteen dedicated NASA volunteer scientists and educators orchestrated behind-the-scenes tours at NASA's John F. Kennedy Space Center (KSC). The opportunity to tour beyond the fence and explore such iconic structures as the launch pad and the countdown clock was a unique treat.

Aside from the sheer novelty of being at NASA, students explored the infrastructure of the launch facilities and a select group tasked with reporting on their experience went on a VIP tour of select NASA-KSC research labs (see "NASA takes center stage," on page 13).

"We would be lying if we said we weren't geeking out as our bus drove up to the famous shuttle launch countdown clock by the press site, or when we got out on the crawler path leading up to the launch pad," said students from the College of William & Mary.

Once back at the main meeting site, the Caribe Royale Conference Center in Orlando, participants explored prospects full of possibility, as they made their way through the bustling exhibit hall. Serving as the largest networking

Students & Stardust: Experiencing PhysCon 2012

by Lily Udumukwu, University of Miami

PhysCon attendees enjoy a moment of levity during a workshop titled "Connecting Physics and the Public." Photo by Liz Dart Caron



The University of Miami's SPS chapter arrived at the Sigma Pi Sigma 2012 Quadrennial Physics Congress (PhysCon) just in time for what would be a once-in-a-lifetime affair for many of the participating students.

Held in Orlando, FL, the conference brought together people of different backgrounds and social circles, linked by one common interest: a passion for physics. The diverse menu of world-class speakers at the event included a Nobel laureate, an astronaut, a sitcom contributor, and a Fellow from the US Department of State. All were luminaries in physics. All were an honor to experience.

Some students at the Congress embarked on a "behind-the-scenes look" at the NASA Kennedy Space Center on Merritt Island. The tours were specially arranged by Space Center staff, and ours was hosted by a comical (yet committed) retired NASA firefighter. Though he didn't major in science, our host admitted there's something electric about the human drama of the island, a treasured piece of history he's been a part of for many years.

It was not the numbers—more than 800 students, faculty, alumni, and professionals who traveled from as far away as China—that made the most profound impression at the Congress. Instead, it was the gravity of the attendees' accomplishments, imparted in a series of inspirational anecdotes of immeasurable value. It was enthralling. Strangers only the night before engaged in constructive debates over the importance of science to public policy, in workshops that highlighted science's potential to improve our ever-changing society. Omnipresent was the murmur of excitement and intrigue, as a sea of hundreds broke into resounding applause at the conclusion of yet another anticipated guest speaker's talk highlighting his or her esteemed contributions to the world of physics.

Dialogue took place over buttered bagels. Earnest and eager students discussed the secrets of the universe with practicing scientists during "Breakfast with the Scientists." Confident handshakes brought together admissions personnel from top-tier universities and prospective candidates presenting their exceptional resumes at the exhibit hall. In one corner, professors and students huddled around a poster presentation. Off-the-cuff conversations ensued.

Reverberating throughout this unique and incredible meeting was the theme of "Connections." Transcending expertise, school, region, and even language, we were united. At the close of this event, the physics students of UM left as a community with newly formed intangible connections, fueled by Nobel laureate John Mather's parting words: "We are all made of stars." 🌌



Find more articles by SPS Chapter Reporters, along with press coverage and photos at: www.spscongress.org/about/press/.



One of the coolest aspects of the conference was the 'Breakfast with the Scientists' event. It gave students a great opportunity to ask questions about the scientists' specific field of study, the schools where they do research, and personal information about their lives as scientists.
~ students from the University of Central Florida

opportunity at the Congress, the hall was filled with recruiters at 60 booths representing graduate schools, AIP member societies, and other physics-related organizations. They provided eager physics students with information on research, educational, and professional opportunities in fields such as biophysics, astrophysics, medical physics, education, optics, acoustics, high-energy physics, particle physics, and more. Several tables had games set up and were raffling prizes. Some students even got tattooed with QR codes

courtesy of the SPS Jobs site. The event facilitated countless connections, with the potential to impact many lives and careers.

After nearly five hours of animated networking with exhibitors, the scene shifted to a nearby ballroom, where Sigma Pi Sigma President Dr. William DeGraffenreid officially dropped the gavel and welcomed those assembled to the 2012 Quadrennial Physics Congress. Student members of the SPS National Council were given the distinct honor of introducing the plenary

speakers. Dr. John Grunsfeld gave the opening plenary talk, and captivated the audience with personal accounts of his adventures as a "Hubble repairman," having flown on three of the five Space Telescope servicing missions. Over the next two days, seven more plenary speakers tackled a broad range of fascinating topics, including a very well received talk titled "Reflections on the predicted end of the world in December 2012" by Jocelyn Bell Burnell (see the related story on page 15). Another standout was a talk by

Top row: A lively Exhibit Hall paired conference-goers with a wide variety of representatives from graduate schools, national labs, and professional scientific organizations. Left to right: Kate P. Kirby, Executive Officer of The American Physical Society; John Wood and Xiaochao Zheng, the University of Virginia Physics Department; Angela R. Keyser, Executive Director of the American Association of Physicists in Medicine; and Donna Kimball, National Institute of Standards and Technology. Bottom row: Sigma Pi Sigma president Bill DeGraffenreid calls a packed ballroom to order as he opens the Congress. Photos by Liz Dart Caron.



NASA Takes Center Stage

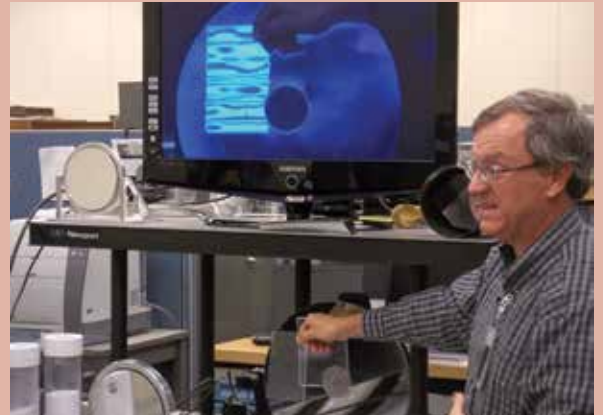
by the Eastern Michigan University Sigma Pi Sigma Chapter

the legendary Freeman Dyson, titled “Living through four Revolutions.” Dyson both delighted and surprised the audience with his candid views on science education during the Q&A session following his speech. A thorough examination of his remarks will be featured in a future issue of *Radiations*, along with ruminations on many of the other plenary talks.

Early Friday morning, conference-goers kicked off their day with a true “breakfast of champions” during the popular “Breakfast with the Scientists” event. More than 70 physical scientists and engineers, including 42 guests from NASA Kennedy Space Center, shared a meal and interacted with conference attendees. Several members of the American Institute of Physics Governing Board also participated in the breakfast and stayed on to experience the remainder of the Congress. Following the event, Michael Duncan, Research Physicist at the Naval Research Laboratory and Chair of the Board of Editors at OSA, The Optical Society, remarked, “it was really great interacting with the students at the Congress. The energy level was high and the excitement was palpable. I had a number of stimulating conversations with students that left me feeling very good about the future of physics.”

Sigma Pi Sigma and the Society of Physics Students have long maintained that undergraduate research is an essential element of the physics degree. Though not required in all academic programs, Sigma Pi Sigma and SPS content that it should be. Such formative experiences as internships, REUs, or on-campus research assistantships provide students with a sense of what it means to practice science, and can even guide students to focus their graduate education on a subfield that interests them. The Congress afforded attendees the opportunity to share the results of their research or outreach projects in two contributed poster sessions. And the work presented by the nearly 200 students was not trivial, with research topics ranging from the modeling of pirate detection to advances in

NASA's Bob Youngquist demonstrates a device for detecting leaks.
Photo by Michael Harrington.



For those of us who have dreamed of going into space ever since we were young children, the NASA John F. Kennedy Space Center (KSC) was the most exciting part of the 2012 Quadrennial Physics Conference. On the press bus during the KSC tours, we were treated to exclusive looks at three exciting labs.

At the Applied Physics lab, we were shown a camera capable of imaging air currents, an ultrasonic leak detector, and a vacuum cleaner designed to suck water out of shuttle tiles, among other pieces of equipment. We visited the LAVA lab, dedicated to the design of a mass spectrometer for the Canadian Space Agency's lunar rover, and heard about difficulties in designing instrumentation capable performing the intended task and surviving the harsh realities of space. After the LAVA lab, we visited the Granular Materials and Regolith Operations lab, where Dr. Phil Metzger told us about his work developing an autonomous mining system and designing methods to build launch pads and roads out of lunar soil.

With the lab tours finished, we set off for launch complex 39A, where Apollo 11 set off for the moon those 43 years ago. This was followed by visits to the Vehicle Assembly Building, the mobile launch pads, the Crawlerway, and most exciting to us, the landing strip where the shuttle and shuttle carrier landed. As we turned the corner into the visitor's center, there was the tail end of Atlantis peeking coyly out from its new home.

Later that evening we heard the first plenary talk, by Dr. John Grunsfeld, who never dreamed of being a physicist—until he was assigned to write a biography on Enrico Fermi—a project which piqued his interest in physics and forever changed his life. Grunsfeld has a PhD in high energy astrophysics and has been on five space shuttle flights. As physicists, one of the most important things we learn in classes is how to troubleshoot. However, when you are working on a sensitive space telescope orbiting the Earth with limited resources and time, troubleshooting is a little different. During the spacewalks in which he repaired the Hubble Space Telescope, Grunsfeld had to work with NASA to come up with new repair methods on the fly, while tethered to the space shuttle. Sometimes it is difficult to apply what we have learned to the real world, but Grunsfeld's stories were able to help bridge that gap.

Many of us never thought we would be a part of PhysCon 2012. The vast size and diversity of the physics community that gathered for the meeting was surprising. Attending the conference was a wonderful experience that gave us many opportunities to develop and bond with each other, as well as develop ties to other chapters and physics professionals. As one scientist impressed upon us, “Make sure that you are always doing what you love. If you do what you love, the rest will fall into place.” 🐉



Take a virtual visit to Kennedy Space Center via Google Maps at:
<http://maps.google.com/intl/en/help/maps/streetview/gallery/nasa/>.



*"As poster award winners walked up to the podium to be recognized, we could see many people nodding their heads as they clapped, remembering how impressed and intrigued they were by the awardee's work."
~ students from Roberts Wesleyan University*

nanotechnology. Posters on outreach and service ranged from innovative public outreach activities to *Astrobites*, an online astronomy research "Readers Digest" for undergraduates written by volunteers. Abstracts for all of the posters are listed in the program, viewable at www.spscongress.org.

The OSA Foundation, the American Physical Society Forum on Physics & Society, and the American Astronomical Society all sponsored awards for students who presented outstanding posters, see page 22 for details.

Continuing a tradition started at

Fermilab in 2008, Sigma Pi Sigma sponsored its second Congress art contest in Orlando. Within several categories related to the conference theme "Connecting Worlds," attendees showcased their artistic flair in the form of paintings, drawings, photographs, and even several three-dimensional works of art. A panel of artists and judges selected category winners, and all conference-goers were invited to vote on the "People's Choice" award. The American Association of Physics Teachers graciously sponsored prizes for the award-winning pieces,

which are showcased on pages 24-25. Serendipitous timing permitted several PhysCon attendees from the nearby University of Central Florida (UCF) to include works of art from their school's STEAM exhibition at the Congress—there is an in-depth look at this collaborative project between the humanities and sciences at UCF beginning on page 26.

The quadrennial congresses of Sigma Pi Sigma have evolved into superb forums to address a wide range of additional professional development topics for students and practic-

First row, left to right: plenary speakers John Grunsfeld, Mercedes Richards, Freeman Dyson, John Mather, Dan Green, David Saltzberg, John Johnson, and Jocelyn Bell Burnell. Second row: Workshop leaders Henry Reich, Anna Quider, James Stith, Roman Czujko, Lee Sawyer, Gary White, Douglas Arion, and Shelly Arnold. Bottom row, inset: workshop leader David Mosher; "Workshop Wizards" in distinctive blue hats helped facilitate group activities and discussions during the six interactive workshops. Photos by Ken Cole and Liz Dart Caron.



ing physicists alike, primarily through thought-provoking, interactive workshops. Beyond the plenary sessions and contributed poster sessions, PhysCon 2012 offered attendees six engaging, interactive workshops. Each workshop was thoughtfully developed with broad ranging, relevant and timely topics, with the goal of providing a uniformly enriching experience for each attendee. These collaborative sessions provided participants with practical and compelling training, group discussions, and hands-on-activities that extended beyond the typical undergraduate curriculum.

The “Connecting Scientists and Science Policy” workshop, for example, highlighted the ongoing need for more advisory roles from real scientists to influence Congressional decisions on science policy. In what proved to be a difficult exercise, participants emulated Congressional committees by scrutinizing a set of actual science projects, and then allocating an overall 8% budget cut based on the U.S. Budget Control Act of 2011. “I now have a lot more respect for the hard decisions about what gets funded and what doesn’t,” said SPS member Maria Rusert, of Georgia State University. On a similar note, all PhysCon attendees were provided with an online form provided by The American Physical Society that helped them write to their Congressional representatives and express their thoughts on the importance of federal science policy.

During the “Connecting Academia and Industry” workshop, registrants brainstormed about products and services that could do well in the marketplace, learning how to bridge from basic research to the commercial world. In the parallel session “Connecting Diverse Perspectives in Science,” facilitators seeded conversations and identified actions that could effectively advance the diversity of the physics community. In other sessions, participants completed self-assessments of physics-related skills and discussed how they apply to entering the workforce, and conducted a group experiment to investigate the probable outcome of rolling non-cubic

Jocelyn Bell Burnell

“The world will not end in 2012” (she was right)

by Toni Saucy

Jocelyn Bell Burnell delivers her plenary talk, “Reflections on the predicted end of the world in December 2012.”

Photo by Ken Cole.



Jocelyn Bell Burnell held a captive audience with her closing address, a physics-rich, humorous account of speculations on the end of the world in 2012. The doomsday predictions stemmed from the last date on the Mayan calendar—December 21, 2012. More specifically, at 11:11 GMT.

The question she explored was how, then, would the world end? Could it be some catastrophic astronomical event or some more geocentric catastrophe? One possibility might be the reversing of the earth’s magnetic field. But the data on that is clear. The earth’s magnetic field appears to be weakening by about 5% each 100 years, and, while we may be headed for a reversal in this direction (a very long time down the road), the Earth will not stop spinning on its axis. Moreover, there is no evidence of any mass extinctions associated with any of the many historical magnetic field reversals, each taking around 5,000 years to complete.

For astronomical possibilities, she considered a solar disaster, but no Earth catastrophes have been recorded during the over 250 million reversals in the Sun’s magnetic field. Concerns about the alignment of planets in our solar system causing devastating gravitational effects and enormous tidal surges were also ruled out, since the gravitational effects of all the planets combined account for a minute fraction of those from our sun, or even the earth’s moon.

Giving proper consideration to other possible astronomical tragedies in her analysis, Burnell ruled out collisions from asteroids, comets or another legendary celestial object, Nibiru. Nibiru, an alleged planet, was “discovered” by ancient Sumerians. According to legend, Nibiru was scheduled to collide with planet Earth in December 2012. With a highly eccentric orbit about our sun, ($>=0.996$), there should have been a “close encounter” around 1588 BCE, but there are no records of any observation that might support that the encounter actually happened. Based on the lack of observations, and despite the fantastic lore, Nibiru is science fiction. With Nibiru out of contention for earth-ending events, Burnell noted that the study of astronomy points to an extreme unlikelihood of collisions with other objects, such as asteroids or comets. There was no scientific rationale for any argument that portended an Earth-shattering event in the year 2012.

On a serious note, such misinformation and lack of understanding can be detrimental. Despite all logic and observed fact, many people fall victim to irrational fear, underscoring a need for enhancing numerical and scientific literacy in society. Based on the ease with which a sound piece of science can be twisted into an incredible—and scary—idea, the call for science in society is clear. 🦋



Listen to Dr. Bell Burnell’s plenary talk online at:
www.spscongress.org/physconprogram/speakers.
Audio and video recordings of several other plenary talks are also available.



"The workshops were informative, enjoyable, and thought-provoking. Students from our group were represented in all of the different workshops, so we got to discuss our various experiences with one another and learn even more."

~ students from the University of Wisconsin-River Falls.

die in an exploration of science outreach.

New to the Congress lineup in 2012 was a Friday-night dance party dubbed "Club Congress," sponsored by The American Physical Society. With a live DJ taking song requests and a theatrical liquid nitrogen ice cream vendor creating delicious refreshments in real-time, hundreds of high-spirited physics students transformed the center of a staid ballroom into a thumping and jiving dance floor, which was packed to capacity all night. This less-formal party atmosphere provided

a space for newly made friends and Sigma Pi Sigma alumni to get to know each other better, reminisce on their school days and recent adventures, and celebrate their time together.

But the most impactful aspects of PhysCon could not be planned or organized. In the words of the student attendees:

"As a whole, the Congress was compelling for one simple reason: it reminded and reinforced our drive to join a professional scientific community." -students from the College of Wooster.

"Having the opportunity to talk with the physicists invited to give talks was amazing, but simply talking to physics students from around the country helped to open our eyes to the larger physics community." -students from Idaho State University

"For us, attending the conference was like meeting a long-lost family. The love, support, and friends that we made during the conference will stay with us forever." -students from St. Peter's College. 🍷

Top row: The "Club Congress" event featuring DJ Adam provided a party atmosphere and infused PhysCon with a high level of energy and excitement. Bottom row, left to right: Bill Sullivan of Three20h makes mass liquid nitrogen ice cream, Sigma Pi Sigma Director Toni Sauncy enjoys a moment of levity with AIP Executive Director Fred Dylla and his wife Linda Dylla, Students from Rhodes College join in a line dance, Sigma Pi Sigma president Bill DeGraffenreid and outgoing SPS President David Donnelly enjoy the festivities. Photos by Liz Dart Caron.



Epilogue: Congress Recommendations

Historically, a primary motivation for convening the Quadrennial Congresses of Sigma Pi Sigma is to generate recommendations from its membership. These recommendations arise from the meeting after a variety of timely and relevant topics are considered and discussed during workshops and breakout groups. The recommendations help to prioritize initiatives and move the society forward to best serve the community of physics and beyond. In 2004, recommendations included expansion of diversity efforts and development of an official statement on ethics. In 2008, attendees made broader recommendations, including the call to promote science policy initiatives, expand outreach efforts, and encourage scientific citizenship among chapters.

In 2012, the voting process was accomplished with the help of technology. Attendees were asked to vote as a chapter, via a smartphone app or online, after a time set aside for chapter-based discussions. Instead of developing recommendations based on every workshop, which was part of the process at the 2004 and 2008 Congresses, attendees were asked to prioritize a list of important focus areas for the societies, as follows:

Please consider the six topics below. As a chapter, which do you consider to be the most important areas of service for SPS and Sigma Pi Sigma as student-focused societies?

1. Service in the area of science policy.
2. Service in the area of addressing diversity issues in physics.
3. Service in the area of connections between academia and industry.
4. Service in the area of connecting physics and technologies.
5. Service in the area of connecting students with careers.
6. Service in the area of supporting society outreach and communicating with the public.

Eighty-one chapters voted, with the most votes indicating that SPS and Sigma Pi Sigma should focus on service in the area of supporting outreach and communicating with the public. The second-most supported focus was on connecting students with careers. Over the next several years, the SPS National Council will consider these recommendations as SPS and Sigma Pi Sigma move forward. 🐞



"Connecting Worlds through Technology" was not just the title of a PhysCon workshop. In a first for Sigma Pi Sigma, Quadrennial Physics Congress participants prioritized areas of focus for the society using their smartphones and tablets, with a voting mechanism developed in the conference's "GuideBook" app. Those without the app were able to simultaneously submit their votes online via the Guidebook website, or in a few cases, by filling out paper forms which were manually added to the data. Results were tabulated within minutes and shared with attendees during the closing banquet.

Watch "Connecting Worlds: SPS and PhysCon 2012" on YouTube

Learn about the programs, impact, and importance of the Society of Physics Students firsthand, from attendees of the 2012 Quadrennial Physics Congress (PhysCon), held in Orlando, FL, November 8-10, 2012: <http://www.youtube.com/user/SPSnational>.

Inductions and Honorary Members

Sigma Pi Sigma membership recognizes commitment to excellence in the study, propagation, and fellowship of physics. Most members are received as undergraduates on the basis of their chapter's standards for academic success and character. Graduate students are received by a chapter on the basis of making satisfactory progress toward an advanced degree, and professional physicists are received by a chapter on the basis

of their professional record. Physicists who have attained noteworthy distinction on the national or international level in physics or a closely allied field may be designated for the special distinction of Honorary Membership, which may only be awarded upon election by the National Council of SPS and Sigma Pi Sigma.

At the 2012 Quadrennial Physics Congress in Orlando, FL, our society welcomed

a new class of distinguished members. Four scientists were inducted as "At Large" members, and six noteworthy physicists were presented with an Honorary Membership. The presentations were made by student representatives of the SPS National Council. We are pleased to welcome our newest members into the community of Sigma Pi Sigma.

Sigma Pi Sigma Inductions



Shelly Arnold, for her great achievements in both technology development and the management of high technology companies, for her wide-ranging accomplishments in bringing valuable electronic products to market, and for her service on the Board of Directors of Habitat for Humanity for Kitsap County, WA.



David E. Mosher, for his distinguished service in the United States Government's Congressional Budget Office's National Security Division, for bringing physics knowledge to bear on crucial issues of nuclear proliferation and disarmament and for educating others to address these critical issues.



Roman Czujko, for overseeing the most thorough-going surveys and analysis of the education and employment pattern in the sciences, for his leadership in addressing issues related to the participation of all groups in the physics community, and for his commitment to aid physics departments in engaging their alumni in ever more productive ways.



Henry Reich, for seizing the opportunity to communicate physics through the medium of YouTube videos, developing the wonderful "MinutePhysics" video series. 🦊

Photos by Ken Cole.

PhysCon 2012 by the Numbers

People

- 830 attendees
- 580 students
- 189 poster presenters
- 60 exhibitors
- 48 poster judges
- 42 additional Florida scientists at "Breakfast with the Scientists"
- 9 workshop leaders
- 8 speakers
- 15 workshop wizards



NASA Tours

- 776 attendees
- 776 lunches
- 39 student reporters
- 16 tour buses
- 16 bus captains
- 16 NASA tour guides
- 6 lab tours for SPS Reporters
- 3 tour stops



Awards

- 19 chapter reporter awards
- 11 outstanding poster awards
- 8 Sigma Pi Sigma Outstanding Service Awards
- 6 Honorary Members Inducted
- 5 art awards
- 4 new at-large members of Sigma Pi Sigma
- 1 Worth Seagondollar Award



Honorary Member Inductions



Freeman J. Dyson, for his seminal insights at the birth of quantum electrodynamics, his many contributions to mathematics, his leadership in the design of the TRIGA reactor, his elucidation of the stability of solid matter, his role in making known the grave dangers of nuclear weapons, his advocacy for the environment and sustainability, the breadth of his thought from Dyson spheres to nuclear spacecraft to the relationship of science and religion, and his profound commitment to humanity. Presented by Zone 9 AZC Blaine Law.



John A. Johnson, for his leadership in the discovery and characterization of exoplanets, including the search for Earth-like planets; the clarity of his presentations of this ground-breaking work to astrophysics colleagues, the larger scientific community, and the public at large; and his inspirational mentorship of students. Presented by Zone 4 AZC Mary Clare Roche.



Daniel R. Green, for his major contributions to elementary particle physics, his mastery of the management of the large science collaborations of contemporary high-energy physics, his service as program manager and collaboration board chair for the Compact Muon Solenoid (CMS) Detector Collaboration, for his commitment to training the next generation of collider physicists, and for his excellence in communicating physics widely. Presented by Zone 15 AZC Dayton Syme.



Mercedes Richards, for her tomographic studies of binary star systems, undertaken in tandem with hydrodynamic simulations; her encouragement of physics teachers; her interdisciplinary research in tomography; her leadership in science and mathematics enrichment programs for high school students; and her serious engagement with the public. Presented by Zone 16 AZC Julianna Lautenschleger.



John M. Grunsfeld, for his studies in X-ray and gamma-ray astronomy; his leadership of the Space Telescope Science Institute; his service as a NASA mission specialist, including three Hubble Space Telescope service missions; his continuing leadership of the NASA Science Directorate; and his expansive contacts with young scientists and the public to share the joy of astronomy and space exploration. Presented by Zone 10 AZC Amanda Palchak.



David Saltzberg, for his distinguished work to advance our understanding of elementary particles, neutrino oscillations, and the possible signatures of supersymmetry; for his leadership as a physics teacher and mentor of students, including his service as an SPS chapter advisor; and for bringing a profound understanding of physicists and their science to the general public as the science consultant for *The Big Bang Theory*. Presented by Zone 7 AZC Patricia Ingraham. 🐸

Photos by Ken Cole.

Logistics

- 3,314 meals served
- 1,800 cookies and brownies
- 550+ pounds of snacks
- 184 gallons of drinks (not including at meals)
- 160 schools represented
- 39 foamboard meeting signs
- 20 pieces of art displayed
- 1 mobile app



Support & Volunteers

- 628 donors
- 42 SPS Council Members
- 11 planning committee members
- 10 sponsors (see page 37)
- 7 SPS/Sigma Pi Sigma staff members
- 3 AIP Development staff
- 1 generous subsidy from the American Institute of Physics



PhysCon 2016

- 3 reconnaissance missions to San Jose, CA
- 1 confirmation from our tours host, the SLAC National Accelerator Laboratory



... stay tuned!

Sigma Pi Sigma Outstanding Service Awards

The Sigma Pi Sigma Outstanding Service Awards recognize Sigma Pi Sigma members who exemplify an attitude of service to the discipline of physics through actions at the

local, national, or international level. These individuals have a positive impact on a Sigma Pi Sigma chapter, department or community. At the 2012 Quadrennial Physics Congress

the Sigma Pi Sigma President conferred eight Sigma Pi Sigma Distinguished Service Awards.



Douglas N. Arion, for his commitment to mentoring students in both science and business, establishing the unique ScienceWorks program in Entrepreneurship in the Natural Sciences at Carthage College, and for providing the entire world with Galileoscopes to celebrate the International Year of Astronomy.



Anna M. Quider, for her leadership in addressing significant issues in science-related public policy decision-making, for her service to the United States Congress and Department of State, and for her active engagement in science outreach efforts. Presented by Zone 17 AZC Chad Garrison.



Jocelyn Bell Burnell, for the discovery of pulsars, for her excellence as a teacher and as a mentor, for her leadership in the physics and astronomy communities, for advocating for women in science and for her service to both the 2004 and 2012 Quadrennial Physics Congresses. Presented by Zone 5 AZC Jessie Barrick.



H. Lee Sawyer, for leadership in the field of particle physics, for his excellences as a teacher, an advisor and a faculty administrator, for his mentorship of students in chapters of the Society of Physics Students and Sigma Pi Sigma, and for his service on the Society of Physics Students National Council. Presented by Zone 13 AZC David To.



Diane Alexandra Hanawalt-Jacobs, for her dedicated service to members and chapters of the Society of Physics Students and Sigma Pi Sigma, for her outstanding work as the longtime advisor of the Eastern Michigan University chapter, her leadership on the National Council, her efforts to ensure the lasting impact of the 2012 Quadrennial Physics Congress, and her Presidency of Sigma Pi Sigma, which called every member to a life of service. Presented by Zone 13 AZC David To.



James H. Stith, for his commitment to the inclusion of all persons in the physics community, his leadership of various physics associations including the American Association of Physics Teachers, the National Society of Black Physicists, and the American Institute of Physics, and for his strong support of the programs of the Society of Physics Students and Sigma Pi Sigma.



John C. Mather, for leading the COBE mission that conclusively demonstrated the blackbody nature of the Cosmic Background Radiation, for leading the way on the next generation of telescopes in the James Webb Space Telescope program, for establishing the AIP Mather Public Policy Intern Program to engage undergraduates in public policy, and for his support to the 2012 Quadrennial Physics Congress. Presented by Zone 4 AZC Mary Clare Roche.



Gary D. White, for his outstanding teaching and mentorship of students, for his work as a Society of Physics Students chapter advisor, Zone Councilor, and President, for his inspired leadership as Director of the Society of Physics Students and Sigma Pi Sigma, and for his tremendous support of outreach efforts by physics students. Presented by Zone 18 AZC Thanh Nguyen. 🐞

Photos by Ken Cole.

Feller honored with prestigious Worth Seagondollar Physics Award

by Rod Pritchard, Director of Marketing and Public Relations Instructor at Coe College, Cedar Rapids, IA

Steve Feller, the B.D. Silliman Professor of Physics at Coe College, was recently presented with the prestigious Sigma Pi Sigma Worth Seagondollar Award at the 2012 Quadrennial Physics Congress, held in Orlando, FL. Presented only once every four years, the award recognizes extraordinary levels of service and commitment to Sigma Pi Sigma – the National Honor Society in Physics – as well as the Society of Physics Students (SPS).

During the award presentation, the citation noted that Feller:

has been both an exemplary researcher in the area of glass physics and an extraordinary mentor of young scientists at Coe College, directing both his own research group as well as the college Research Experiences for Undergraduates program, and has been an inspirational leader for its Society of Physics (SPS) Chapter, recognized as the Outstanding Chapter Advisor nationally in 2000, serving two terms as SPS Zone 11 Councilor, providing leadership for SPS's program to study the effectiveness of the Undergraduate Research Experience in Physics, serving two terms as Sigma Pi Sigma President, and having led the planning for both the 2008 and 2012 Sigma Pi Sigma Congresses, to great acclaim. In every way, he has served the Physics Community, Sigma Pi Sigma, and the Society of Physics Students with distinction.

Professor Feller earned his Ph.D. at Brown University and has taught at Coe since 1979. His research in physics centers on the atomic structure and physical properties of glass. Working with Coe Physics Professor Mario Affatigato and more than 200 student colleagues, he has published nearly 140 papers in the refereed literature of the field. Also, Feller has edited a number of books on glass science. He and his students have given more than 200 presentations at well over 100 national and international conferences.

Since 1983, Feller and his colleagues have garnered more than \$7 million from a large number of foundations, including the Na-



Previous recipient Karen Williams (right), East Central University (OK), presents Steve Feller, Coe College (IA), with the Sigma Pi Sigma Worth Seagondollar Award. Photo by Ken Cole.

tional Science Foundation, to support physics research at Coe. He has been the recipient of numerous awards and honors, including being named as a Fulbright Scholar, a Distinguished Iowa Scientist by the Iowa Academy of Sciences, and the Iowa Professor of the Year by the Carnegie Foundation. He is an active member in several professional associations, including The American Ceramic Society, the American Physical Society and the Society of Glass Technology in the United Kingdom. He is a past national president of Sigma Pi Sigma.

Professor Feller also has a research-level interest in numismatics, the study of the history of money. In this area, he has published over 50 articles, parts of several books, and in 2007 he co-authored (with his daughter, Ray) "Silent Witnesses: Civilian Camp Money of World War II," now the standard in the field.

ABOUT THE AWARD

The Worth Seagondollar Award recognizes levels of service and commitment to Sigma Pi Sigma and the Society of Physics Students. Awardees are determined by unanimous vote of the Executive Committee of the SPS National Council. The award was first presented to its namesake, Worth Seagondollar, North Caro-

lina State University, at the 1996 Congress of Sigma Pi Sigma, held in Atlanta. The quadrennial congresses have served as appropriate venues to make subsequent award presentations, including George Miner, University of Dayton, in 2000; Peggy Dixon (posthumously), Montgomery College, MD., in 2004; Karen Williams, East Central University, OK., in 2008; and most recently, Steve Feller, Coe College in 2012.

Worth Seagondollar was a member of the Manhattan Project, the first scientist to measure the critical mass of plutonium, and was present at the Trinity Test. He was a very successful SPS chapter advisor at both the University of Kansas and North Carolina State University, and was a leading nuclear physicist. As Sigma Pi Sigma president, Seagondollar played a central role in the merger of the American Institute of Physics Student Sections and Sigma Pi Sigma that created the Society of Physics Students. Selected also as a Fellow of the American Physical Society, he was an active member of numerous professional organizations, and is now a professor emeritus at North Carolina State University. 🐼

This article originally appeared in the 17 December 2012 issue of The Gazette, and is reprinted with permission.

PhysCon Poster Awards

Two of the most energetic and dynamic sessions during the 2012 Quadrennial Physics Congress were the joint poster and art sessions. Over 200 student presenters engaged with peers, science faculty, and practicing physi-

cists, while discussing research, outreach, and service projects in more than two dozen categories. Concurrently, twenty pieces of art were displayed in five categories for the art contest (see the winning pieces on pages 24-25). A

small army of volunteer judges did a superb job critiquing and ranking those who participated in the poster and art competition, and several sponsors contributed cash awards and other prizes for the most outstanding presenters.

CONGRATULATIONS TO ALL THE WINNERS:

Outstanding Student Poster Awards

sponsored by The OSA Foundation



Photo by Ken Cole.

Outstanding Posters

Michael Alemayehu, Morehouse College (Andrew Peterson is pictured accepting award on his behalf (3)), *Synthetic Creation of a Chemotactic System via Utilization of Magnetically Actuated Microrobotic Walkers*

Kelsey Schafer, Ohio State University (4), *What would it take to diagnose Alzheimer's disease? A predictive study using pharmacokinetic modeling of PET imaging agents*

Adam Simpson, Abilene Christian University (1), *Using phonon imaging to determine the thermal contact between AlN and Si*

Morgan Smathers, Rhodes College (6), *Optimizing an ultrasonic backscatter technique for measuring bone density*

Christopher Trennepohl, Davidson College (7), *Time dependent upconversion in Er-Yb doped sol-gel silicate glass*

Honorable Mention

Adeyemo Adetogun, North Carolina Central University (5), *Growth of Semiconductor Nanowires using the Vapor-Liquid-Solid Approach at NCCU*

Valerie Jacobson, Colorado State University (2), *Effectively Using Electroluminescence in Photovoltaic Analysis*



To see titles and abstracts for all posters and art, visit the PhysCon website at: www.spscongress.org/physconprogram



Making a Global Connection

by Toni Sauncy

For Earl Blodgett, SPS Advisor at the University of Wisconsin - River Falls, the PhysCon 2012 "Workshop Wizard" hat is just one of many he dons. He's also Sigma Pi Sigma/SPS Historian, Professor of Physics, and Assistant Dean, College of Arts and Sciences.
Photo by Ken Cole.



One of the very real benefits of attending a gathering of SPS or Sigma Pi Sigma chapters is the opportunity to make personal connections outside your own group. This happens at SPS zone meetings around the country, even at smaller meetings where only a handful of chapters gather. These zone-level connections are important to both faculty and students. But then consider the possibilities for networking at PhysCon 2012! The opportunities were almost overwhelming. Many people at the Congress made new friends that they would never have met otherwise. There is no way to predict what those new connections might lead to over the years.

"If there is any take-home message from the poster sessions, it is that students are capable of great things." ~ students from St. Peter's College

Outstanding Student Poster Awards

sponsored by the American Astronomical Society

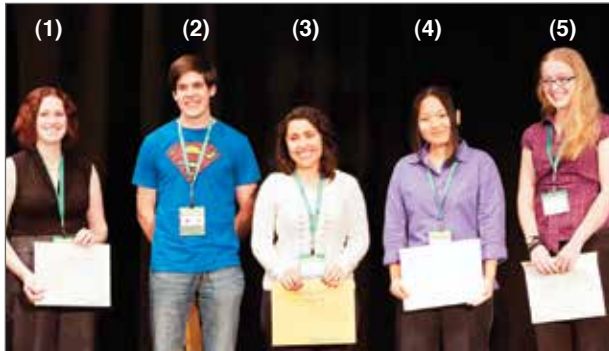


Photo by Ken Cole.

First Prize

Mary McDaniel, University of North Alabama (1), *A Spectroscopic Investigation of Delta Scorpius with its Companion*

Second Prize

Rachel Smullen, University of Wyoming (5), *Imaging the Spatial Density Within Starburst Galaxies*

Third Prize

Jennifer Kadowaki, University of California, Los Angeles (4), *Analysis of Multiband Photometry of Violently Variable Gamma-Ray Sources*

Honorable Mention

Andrew Miller, Abilene Christian University (2), *PYCBC: A toolkit for Advanced-Detector Era Gravitational-Wave Data Analysis*

Macarena Sagredo, Florida International University (3), *Angle Dependency on INTEGRAL: A Study of the Satellite through Cygnus X-1 and GRS 1915+105*

Outstanding Student Poster Awards

sponsored by
The American Physical Society Forum on Physics & Society

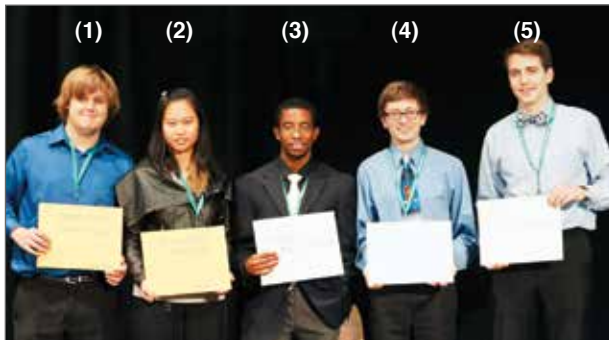


Photo by Ken Cole.

First Prize

Allen Scheie, Grove City College (5),
The Science Committee: Science Policy on Capitol Hill

Second Prize

Kofi Christie, Morehouse College (3),
Terahertz Time Domain Spectroscopy of Gold Nanorods

Matthew Goszewski, Grove City College (4),
PhysicsQuest: Bringing Super Powers to life

Honorable Mention

Jeremy Johnson, Angelo State University (1),
Peer Pressure at Angelo State University

Yulu Liu, Southeast University, China (2),
Controlled Growth of Graphene by CVD

For University of Wisconsin – River Falls professor Earl Blodgett, a connection was made during the three-day conference that recently took him around the world and back. At PhysCon, Dr. Blodgett had the opportunity to meet and get to know the students and faculty mentor from the newly formed SPS chapter at Southeast University in Nanjing, China. The international SPS students were so excited to be participating in PhysCon 2012, one could not help but share their enthusiasm. While enjoying dinner and a talk by Jocelyn Bell Burnell at the closing banquet, Blodgett was honored and surprised when asked by Zhou Zhiyong, the students' SPS chapter advisor, if he would be interested in visiting their department in Nanjing. Dr. Zhou

explained that the campus had a program to bring in guest faculty to teach a short course or even a semester-long course. The Congress ended, but that was just the beginning of Dr. Blodgett's adventure.

Dr. Blodgett travelled to Nanjing on May 20 to spend four weeks with the Southeast University physics department. While there, he taught a short course on introductory electromagnetism to a group of students eager to sample an American-style physics course. In addition to the physics, he also led discussions about undergraduate physics education, especially undergraduate advanced labs. Dr. Blodgett thoroughly enjoyed meeting the SPS members again and having the time to get to know them better. We look

forward to a full report and photos of his adventures that will appear in the next issue of *Radiations*.

Perhaps the connections made by most students and their mentors at a zone meeting or even a conference as grand as PhysCon 2012 will not lead to such a large-scale adventure as Dr. Blodgett's, and it may take years before some of the connections lead to a new opportunity. But no matter how tangible the reward may be that comes directly from participation in SPS or Sigma Pi Sigma meeting, your life will undoubtedly be enriched by the connections and friendships you make. And that may be the most important benefit of all. 🚀

PhysCon Art Contest

Sponsored by the American Association of Physics Teachers



Congress attendees were invited to submit 2- and 3-D works of art for judging or display in Sigma Pi Sigma's second Congress Art Contest. In the next issue of *Radiations*, we will feature those pieces given "Honorable Mention." To see larger images of all of the artwork, visit the Congress website at www.spscongress.org/physconprogram/artwork-contest.



BEST IN SHOW

Pirouette,

by Glenn Marsch, Grove City College

Ice Faeries seem to spin on the ground on a frigid morning at about 15-18 degrees Fahrenheit. The ice crystals grew radially from tiny sticks projecting out of frozen mud puddles. Optically darker areas of the ground appeared to promote better formation of the crystals. Unlike the more common 'frost flowers' I have seen, these ice formations were not extruded from the sticks, but were true ice crystals that look like hoarfrost, and yet there was no significant frost anywhere else that morning. A model for the development of these elegant ice crystals is that water wicked up by capillary action through these little porous wooden sticks, saturating them. A slight wind might have gently evaporated the water from these sticks and the surrounding mud puddle, and the water then formed ice crystals directly from the vapor phase onto nucleation centers on the twigs.



ARTISTS' CHOICE & PEOPLE'S CHOICE

Particle Detection in the Search for New Matter,
A collaboration by Christopher Frye and Emily Daniels, University of Central Florida

Christopher Frye has analyzed data from a particle detector inside the Large Hadron Collider to develop methods of identifying electrons in collisions. His research plays a role in physicists' search for new particles such as the Higgs boson. Upon collaborating with Christopher and learning about his research, Emily Daniels set out to capture in one piece the numerous aspects that are involved in the physics explorations at the Large Hadron Collider. Drawing from the past, she used an image of the historical bubble chamber detection of particle collisions as a background laying the foundation for modern day experimentation. Shown as a result of the collision is Cerenkov radiation, a process that is critical in the detection of particles in Christopher's research. Both collaborators aimed to show the event of a collision itself to give a general audience a visual representation of concepts overlooked by many as nothing but abstract formulas and theories.



FIRST PRIZE:
SPACE & GENERAL SCIENCE

Water Droplet on a Blade of Grass
(colored pencil drawing),

by Lauren Dallachiesa, Grove City College

A water droplet is hanging from a blade of grass. The sphere-like droplet clings to the tip of the piece of grass. More grass (unseen because of the out of focus background) is reflected in the water. Light passes through the droplet, but refraction causes the light to be bent and the reflected image of the other blades of grass to be bent.

FIRST PRIZE:
PHYSICS FOR EVERYONE

Daylight,

by Natalia Guerrero, Massachusetts Institute of Technology

It is sometimes the simplest effect, well-understood for centuries, that creates the most wonder. Rediscovered again and again, the results are each time fascinating not only because they are surprising and beautiful, but also because the individual has found them herself. A mirror, coincidentally angled, projected an image of the outside world onto my dorm room wall, and sparked my curiosity in how light works. I decided to make my room into a camera obscura, literally a "darkened chamber," covering up my window with posterboard and cutting from it a small aperture. Even though it was the middle of the night, I could see dim lights from the buildings outside my window. I dragged my friends into my room to see the fast-moving lights of cars as they flitted across my walls like shooting stars. As my weekend project evolved in its presentability, I showed them again one afternoon the living pictures projected onto a piece of cardboard and then, a few days later, illuminating a hanging paper screen. I have never been one to hide my enthusiasm for my interests and, with this project, I could share with others my passion and curiosity for this beautiful natural phenomenon.

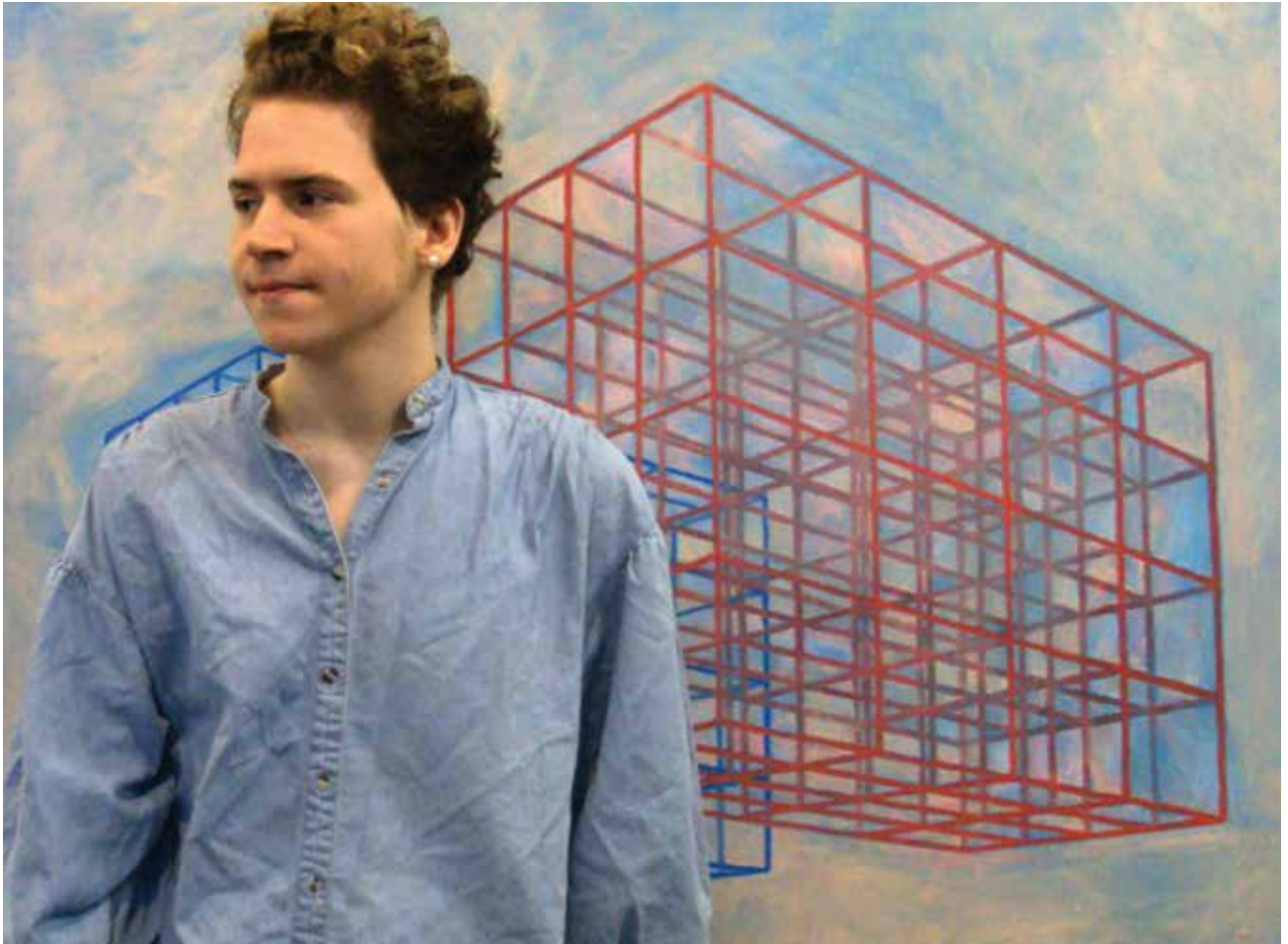


FIRST PRIZE:
CONNECTING WORLDS

Nothing Going on Here, or So It Seems,
by Jordan Guzman, University of Central Florida

In this piece, I am responding symbolically to the way we interact with the environment, the space and time that surrounds us. Space is often thought of as being far away from us; some think only of outer space. However, current research informs us that is not so. Although we do not fully understand what space is, we are more familiar with it than we realize. In a lonely room, the apparent nothingness imposes itself onto every crevice. Matter and space constantly interact with each other. From moments of stillness to moments of fierce energetic movement, there is more push and pull than we can ever fathom.





Art student Paul Finch, whose contributions to the STEAM Project at UCF have produced several controversial STEM inspired artifacts, points out that historically, many scientists were artists, and the two fields often overlapped. Michelangelo, for example, was a sculptor, painter and poet in addition to being an architect and engineer, American inventors Robert Fulton and Samuel F.B. Morse were portrait painters before they invented the steamship and the telegraph, respectively. "Most of us [artists] know more about science than people expect," Finch said. Photo by Ivan Riascos.

HUMANITIES, SCIENCES MUST BE UNITED FOR OUR COLLECTIVE SUCCESS

BY CARLA POINDEXTER, UNIVERSITY OF CENTRAL FLORIDA

When Pablo Picasso presented his first cubist paintings to the world, even most educated people thought them hideous and irrational, yet his peers saw them to be ingenious. Likewise, Albert Einstein's theory of relativity was equally baffling to the uninitiated.

But to those who were knowledgeable about both art and physics, parallels would have been recognized between Einstein's new visions of reality and Picasso's paintings that could be viewed from multiple points of view in simultaneous space and time. They might also have speculated that Einstein's visionary physics may have directly inspired Picasso's revolutionary paintings—or was it the other way around? How is it that the sciences and the arts have lost their interconnectivity in our contemporary educational cultures?

At the highest levels of in-

novative thought, art and physics share a common goal: the investigation of reality. Both begin with observation. Art tends to communicate through metaphor and poetics. Science communicates through logic and mathematics. Both disciplines seek to foster and produce creative and innovative problem solvers.

As an upper level fine arts educator, I have come to realize that the most immediate issue facing our future is not the ongoing budget deficiencies in state and national support, but the lack of awareness or interest in our discipline outside the College of Arts and Humanities. The insulated art world is probably equally responsible for this dilemma in our contemporary society. However, at the university level, a way to bridge the gap is through collaborative academic activities.

Two almost overlapping events in Orlando, FL—a NSF sponsored student art exhibition and a national physics con-



ABOVE

Art student Alea de Bengson's painting, "Florida In Bloom" was directly inspired by UCF biologist, Linda Walters, whose research investigates coral reef decay in Florida's coastal waters. Her futurist image depicts UCF's football stadium - after people. "I created my paintings based on the assumption that Florida will eventually end up underwater," she said. "...Algae blooms degrade aquatic ecosystems and water resources for human consumption. Eventually, there are no fish, no coral - and no people." Photo by Ivan Riascos.

BELOW

Art student Adrienne Romine's "Untitled" (acrylic painting on canvas) was done while she was considering a long distance move. "I meditated on the effects space and time hold over my personal relationships, here shown from the perspective of my pet," she said. "In a world where we are aware and can perceive somehow the multitude of the universes, what is the meaning of any action? For example, if my pet can see me sitting in one universe and gone in another universe, what does the act of leaving really mean?" Photo by Ivan Riascos.



RIGHT

Art Student Slawek Kozub's painting "Coma" (acrylic on canvas) was created in response to a presentation about "Popular Beliefs in Pseudoscience" by Physicist Costas Efthimiou. Says Slawek, "People generally think that the natural world is separate from them and that they don't belong in it. Some have exaggerated preconceived ideas about it, often fueled by the media's incorrect portrayal of science. This painting represents some of those fears, those which are based on ignorance and surfaces when a phobia dominates or inhibits our approach to science. I hope this piece will turn fear into curiosity and inspire people to experience nature for themselves."

Photo by Ivan Riascos.



ference—serve as examples where both disciplines were enhanced by the other.

One event was the STEAM Exhibition: "Searching for Ultimate Truth in Science and Art," an exhibition of STEM inspired artifacts by

University of Central Florida's (UCF) fine art students. The curriculum acronym STEM stands for Science, Technology, Engineering and Mathematics, but the arts more and more are becoming wedged into the mix to create

STEAM (Science, Technology, Engineering, Arts and Mathematics).

The foci of the exhibition were artworks created by fine art painting and sculpture students who challenged STEM and non-STEM view-

ers to interpret the science inspired artworks through visual metaphor. The work presented offered commentaries on the potentials for both good and harm to humanity and the earth.

The overlapping confer-



CHRISTOPHER FRYE ON THE STEAM PROJECT

Sigma Pi Sigma member Christopher Frye's collaborative work with UCF art student Emily Daniels ("Particle Detection in the Search for New Matter," pictured on page 24) was recognized with the "Peoples Choice – Best of Show" award at PhysCon 2012. Pictured here is the diptych "You Picked Me," (Hi Frye) which was inspired by his collaboration with UCF art student Mary Joy Torrecampo. This acrylic and charcoal on canvas shows the observer effect in quantum mechanics and the possibility of which path electrons take before they are observed.

Frye first met with a UCF painting class more than two years ago when he gave presentations on relativity and quantum mechanics. He followed that up with discussions about the philosophical implications of the theories of modern physics.

Before joining the STEAM project, Frye said he seldom left the environment of the Math and Physics building at UCF. During discussions with the artists, however, he learned to explain concepts in a way entirely different from the way he talks with fellow science students. "So not only did I teach new physical concepts to the

students in the art class, but I also discovered new ways to explain scientific ideas to non-science students," he said. "This is a skill I can use later in my career when teaching is part of my job."

In response to his collaborative work, Frye said he has a new appreciation for art. "Since I've been involved with this STEAM project, I've seen more art than I've ever looked at before. I respond to paintings like I never did," Frye said. "I had only been around math and physics and that style of training. Now I've seen what bending the universe looks like." 🍷

Photo by Jay Flynn.

ence was the 2012 Sigma Pi Sigma Quadrennial Physics Congress, also known as PhysCon. This year's theme was "Connecting Worlds through Science and Service." As the PhysCon brochure announced: "From global warming to Facebook to the International Space Station, we're realizing now, more than ever, how connected we all are – as physicists, as scientists, as members of society, as humans, and as part of a vast universe."

At the Congress, it was often acknowledged that as scientific research and knowledge become increasingly more specialized and complex, outreach and education becomes more important.

Two popular sessions at the Congress highlighted professionals who cross both disciplines to communicate complex ideas through art and emerging media. The first was Henry Reich, the creator and animator of the popular YouTube video series called "MinutePhysics." In his series, Reich illustrates, "cool topics in physics" through a series of expressive drawings and conversational dialog. The other session featured David Saltzberg, the science consultant to the popular sitcom, "The Big Bang Theory." His contribution to the show is to work with artists – the scriptwriters, art directors, prop designers and actors – to make sure the science behind the show is correct.

The 2012 Congress also included its second fine art contest of paintings, drawings, photography, and digital mixed media artworks. Jordan Guzman, Bachelor of Fine Arts painting major at UCF, was awarded first-place in the category of "Connect-

GAINING STEAM

BY CARLA POINDEXTER



"The STEAM Exhibition: Searching for Ultimate Truth in Science in Art" took place at UCF's Center for Emerging Media in Downtown Orlando in the Fall of 2012. Photo by Ivan Riascos.

The UCF STEAM project is the result of work by many STEM and Arts faculty members and students. Theo Lotz, a project Co-PI and Fine Art Instructor of Undergraduate and Graduate Studies at UCF, initiated the STEAM project. Lotz envisioned seminars in which STEM researchers and Fine Art undergraduate faculty and students interacted and collaborated to explore and understand each other's discipline. "I have always felt that the Sciences and the Arts were not that different in their processes. Both are creative endeavors that benefit from experimentation, exploration, and trusting one's intuition. I wanted the UCF art students to see that their studio process is very similar to the laboratory process of the science students," said Lotz.

Although one initial goal of the STEAM project was to expose fine arts students to complex STEM research, faculty and project facilitators quickly realized that the potential for creative thinking and learning was far greater for student participants from both disciplines. During the projects, as formal discourse evolved into more casual sharing of information and ideas, collaborations began to naturally occur. Initial visual articulation of STEM theories and applications evolved from illustration to creative visual reactions to the research presented.

Eventually, competition for the best ideas and most compelling images between art students and collaborative pairs evolved. This led the fine art students to experience a less-understood process of inquiry and discovery that is familiar to mature artists. The process closely relates to what is employed in basic scientific inquiry.

For a student involved in basic artistic research, creative discovery involves the formulation of questions based on intuition and knowledge of the subject, followed by testing and retesting until a suitable, personally relevant, solution – their finished artwork – is found. This mostly private undertaking is followed by public scrutiny in the form of a group critique of the work by instructors and peers, which when effective, leads to essential skills of self-criticality and eventually, a creative visual outcome.

While the scientific method investigates phenomena in an effort to find empirical truth, it could be argued that an artist investigates phenomena in the effort to experience the myriad possibilities between truth and untruth. In art, the answer to the inquiry or hypothesis is never intended to confirm reality, only to lead to more inquiry – so that art is always a series of questions to be contemplated, not solved. 🐞

ing Worlds.” At UCF, she responded enthusiastically to the opportunity to work with STEM inspired subject matter, especially physics.

Describing her painting, “Nothing Going On Here, Or So It Seems” (pictured on page 25), inspired by a presentation on the Multiverse by Mathematics and Physics Professor Costas Efthimiou, Guzman states,

“I am responding symbolically to the way we interact with the environment, the space and time that surrounds us. Space is often thought of as being far away from us, some think only of outer space. However, current research informs us that is not so. Although we do not fully understand what space is, we are more familiar with it than we realize. In a lonely room, the apparent nothingness imposes itself onto every crevice. Matter and space constantly interact with each other. From moments of stillness to moments of fierce energetic movement, there is more push and pull than we can ever fathom.”

At the University of Central Florida, four major STEAM Exhibitions of science-themed artworks have been held since Spring 2011 in the University’s galleries. The most recent exhibition in April 2013 drew 500 visitors on opening night. For many of the hundreds of visitors who attend the opening night receptions, the artworks provide a visual doorway to the science behind the images, sparking enthusiasm and conversation throughout the crowds in the gallery spaces. The shows have consistently illustrated how images that emerge from collaborations between science and art students can provide provocative points of view to contemplate and discuss outside the traditional science classroom. In January 2013, UCF student produced STEAM artifacts were exhibited for the first time outside of an academic art gallery setting during the popular Otronicon event at the Orlando Science Center where 7,000 visitors attended a four day showcase of new interactive media and virtual systems.

As Florida and other states wrestle with current pressing issues of how best to fund and facilitate effective educational preparedness for future students, perhaps legislators could take a larger view of the long-term issues facing our young people.

A solid education offers opportunities for students to become innovative problem solvers by encouraging them to seek out unanticipated interdisciplinary connectedness and by exposing students to more – not less – diversity. 🌀

This article originally appeared in the November 14, 2012 UCF Forum, and was adapted for use in Radiations.



Carla Poindexter is an associate professor of fine art at the University of Central Florida, a Co-PI of UCF’s ICubed Initiative, and a columnist for the UCF Forum, an opinion series by a panel of faculty, staff and students. She can be reached at Carla.Poindexter@ucf.edu.

The University of Central Florida welcomes opportunities to share information about its STEAM Initiative and encourages opportunities for collaborative exhibitions and forums with other academic institutions. For more STEAM information and artwork, see: <http://licubed.ucf.edu/steam.php>.



UNIVERSITY OF CENTRAL FLORIDA

Principals, Co-PIs & Faculty Participants

UCF’s STEAM (Science, Technology, Engineering, ARTS and Mathematics) is an initiative supported through a five-year NSF grant for ICubed (Innovation Through Institutional Integration), titled The UCF Community Embraces the Knowledge-Based Economy. Provost Tony Waldrop is the Principal Investigator. Michael Georgiopoulos, Interim Dean, College of Engineering and Computer Science is Project Director of the UCF ICubed grant. The STEAM initiative of the UCF ICubed project is the brain child of Debbie Reinhart (Professor of Environmental Engineering at UCF and Assistant Vice President of Research at UCF, now on leave at NSF), and Theo Lotz (School of Visual Arts and Design) two of the original contributors of the UCF ICubed proposal to NSF.

This year’s STEAM initiative (2012-2013) is coordinated by two members of the UCF ICubed project committee, Costas Efthimiou (Physics), who is also the Society of Physics Students and Sigma Pi Sigma Chapter Advisor, and Carla Poindexter (School of Visual Arts and Design).

About the STEAM project, Efthimiou says, “Due to my cultural background, my aesthetics had always been influenced by classical antiquities. Hence I tended to have an animosity towards abstract modern art, which I had always considered random and ugly. Perhaps, my biggest benefit from my involvement in the STEAM project is looking at some abstract works deeper and more carefully. This has led to a re-evaluation of my beliefs and aesthetics criteria. For example, I appreciate Pollack more now and it takes a much longer time before I dismiss something.”

“Working with Costas Efthimiou to coordinate the STEAM initiative this year has led me to a larger appreciation of contemporary physics. I have always been interested in science and over the years, scientific discoveries have inspired my work in drawing, painting and photography. From the beginning, the STEAM project’s goals to bring STEM and Art faculty and student participants together in creative collaborative activities seemed to be a natural fit. I am not at all surprised by our students’ success,” says Poindexter.

Three years into the five-year ICubed Initiative, Georgiopoulos says the project “is creating synergies that weren’t there before. It has encouraged faculty collaborations between researchers from different disciplines and it is allowing STEM and non-STEM students unique opportunities to communicate and engage in creative processes about STEM research at UCF”. 🌀

Spotlight on Hidden Physicists

Share your story at www.sigmapi.org

Charles L. Chipley, Nokomis, FL Medical Physicist, 21st Century Oncology, Inc.



I worked as an emergency medical technician in high school, and loved it, but had always wanted to be a US naval officer, which required a college degree.

Since my military college had no maritime-oriented degree programs, I chose math simply because it was a subject in which I excelled in high school. After four years of college, I got my wish and started working as a naval officer. A couple of years later, while jogging in the surf at Virginia Beach, I stepped into a hole and fell. Unable to stand afterward, I was sent to the Portsmouth Naval Hospital's nuclear medicine department, where I was injected with a radioactive compound and scanned with a scintillation camera. I was informed that my ankle was broken—the phosphorus was taken up preferentially at the injury site.

From that point on, I read everything I could about nuclear medicine, as I saw it as a perfect career fit for me, combining math (at which I was good) with medicine (which I enjoyed). After my commitment to the Navy was over, I transferred to the Reserves and enrolled back in school. I earned a master's degree in health physics with a medical physics track from Georgia Tech. I then began my physics career working in radiation oncology departments of hospitals and freestanding cancer centers in Alabama, Maryland, Florida, and even the US Virgin Islands. I have done some diagnostic physics in radiology and nuclear medicine, and taught radiological physics to x-ray and radiation therapy students at community colleges.

I have been doing a job for twenty years now that I enjoy, and at which I'm good, and I am well-compensated to boot. I consider myself fortunate. Ironically, my lowest undergraduate grades

were in physics—I got a C both semesters, the only ones I ever got in college. If you had told me then that someday I would be a physicist, I would have laughed in your face! Life can be funny.

Casey M. Dedeugd, Orlando, FL Medical Student, University of Central Florida



I received my bachelor's degree in physics from North Carolina State University in 2006. As an undergraduate, I was very involved in undergraduate research and worked primarily in the field of nanoscience, synthesizing and characterizing monolayer films and measuring electric dipoles using dielectric spectroscopy. This experience led me to pursue a master's degree in biomedical engineering from the University of Florida.

My graduate research was focused on optical imaging of tumor microvessels in vivo using a unique hyperspectral imaging system that was able to determine the oxygen saturation of newly formed vessels within a tumor. This research aimed to understand the dynamics of tumor oxygenation in order to optimize the current antiangiogenic agents that are an emerging treatment modality.

After receiving my master's degree, I pursued a research opportunity at Duke University in the lab of my "grand-advisor" (my graduate research advisor's previous advisor). During this time, I worked on developing radiation-sensitive nanoparticles and learned many other imaging techniques including confocal microscopy and TEM. Simultaneously, I applied and was accepted into medical school at the University of Central Florida to achieve my dreams of becoming a physician-scientist. Surprisingly, I found there is a lot of physics in medicine, and I have been able to brush up on some of

my undergraduate studies. I am currently in my third year of medical school, and I thrive on every possible research opportunity that comes my way and am working on several retrospective research studies. I will graduate in May 2014, and I hope to pursue a career in orthopedic surgery.

Timothy Chambers, West Hartford, CT Adjunct Professor of Philosophy

I graduated from the University of Connecticut in 1993 with degrees in physics and math (B.Sc.) and philosophy (B.A.). From there, I went on to focus on philosophy and symbolic logic in my graduate studies at Tufts and Brown. Still, my enchantment with physical law—and the intriguing philosophical questions of (what Eugene Wigner called) "the unreasonable effectiveness of mathematics in the natural sciences" has never waned. For the record, I suppose my own view on the matter could be called vaguely Kantian; though the older I get, the more good sense I find in Wittgenstein.

My study of physics prepared me well for my years in academic philosophy. Most notably, I've assisted with and taught summer-courses in "Science, Perception and Reality" at Brown (1999-2003, 2005). My familiarity with the mathematical models behind relativity and quantum mechanics often saved me from "going mystical" when leading discussions of philosophical aspects of modern physics—an ever-present occupational hazard in academic philosophy!

More recently, I was fortunate to help oversee a student's honors thesis on Galileo's "Starry Messenger" at the University of Hartford; again, my training in physics saved me from being seduced by Feyerabend's "anti-method" portrait of Galileo's achievements.

I will always be grateful to have been a full-time student of physics as a young man. There is, as Victor Weisskopf once said, a deep "privilege of being a physicist." I can never forget the sensation of my first exposure to Maxwell's Equations (integral form) on the chalkboard: "entranced" is possibly the right word. So I am grateful to Sigma Pi Sigma for recognizing me as a young student; I look forward to continuing to read *Radiations* for years to come. 🐉

Thank You



for your continued dedication to AIP's student programs. Your contributions go directly to fostering the talents and careers of America's next generation of physicists, scientists, researchers, and professionals in the physical sciences. Sigma Pi Sigma and the Society of Physics Students connect students to a world outside of their classrooms and colleges and broadens their perspectives on what they can achieve. By supporting our programs you are investing in the future of our society. Thank you for your support in 2012! Donate now at donate.aip.org.

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- Svok, George, '71
- Wetzel, Paul E., '79

Eastern Illinois University

- Anderson-Horn, Merri L., '80
- ◆ Mednick, Kenneth, '70

Eastern Michigan University

- ★ Hanawalt-Jacobs, Diane A., '76
- Jones, Andrew J., '01
- Moverman, Mark I., '90
- Mutart, Douglas L., '92
- Voss, Rachel A., '97

Elizabethtown College

Dotter, Ray E., '74

Elmhurst College

- O'Kelly, Roy J., '89
- Ramsay, Alice J., '97

Emory University

- Dyer, George R., '61
- Funke, John, '78
- Rowe, John E., '63

Emporia State University

Burkey, Richard W., '66

Evansville, University of

- Batteiger, Byron B., '61
- Law, Robert J., '50
- Megli, Darrell, '63

Fairfield University

Scannapieco, Frances T., '06

Florida Inst of Technology

- Chambers, Susan A., '75
- Pearlman, Melvin, '69

Florida State University

- Kromhout-Schiro, Sharon E., '78
- Lane, Jean Willits, '58
- Magee, Norman H., '63
- Ofsowitz, Keith R., '88

Florida, University of

- Boettcher, Evelyn J., '95
- Nguyen, Peter, '11

Fort Hays State University

- Duell, Arthur L., '42
- Weigel, Edna M., '64

Francis Marion College

Maxwell, Erin S., '04

Franklin & Marshall College

- Balent, James S., '90
- Dommel, John G., '62
- Kozak, Mark, '79

George Mason University

- Bjorklund, Christine L., '73
- Taylor, Douglas J., '77

George Washington University

- Frey, Mary A., '69
- ⌘ Hughes, Mark V., '69
- Kelsall, Thomas, '56
- Prather, John L., '56
- ⌘ Schmid, Paul E., '54
- Wiest, Quentin W., '39

Georgia Inst of Technology

- Albritton, Daniel L., '61
- Ethridge, Noel H., '49
- Fortenberry, Robert S., '80
- Kirch, Steven J., '78
- Patronis, Eugene T., '52
- Thackston, Michael G., '74

Georgia State University

Blackburn, Thomas E., '71

Georgia, University of

- Ivey, Henry F., '41
- Maddox, Marvin R., '62

Gettysburg College

- Keiser, Richard L., '49
- Kumler, Ruth S., '49
- O'Brien, Robert E., '50

Guilford College

- Blau, S., '05
- Field, Christopher T., '10
- James, Bruce F., '95
- Remmes, Nicholas B., '97

Gustavus Adolphus College

Meierbachtol, Collin S., '07

Hanover College

Wakefield, Joseph S., '74

Hofstra University

- Hickey, Mary J., '52
- Klatt, Robert W., '64
- Murnick, Daniel E., '60
- Richford, Daniel P., '08
- Stahl, Frieda A., '55
- ◆ Terrone, William M., '68

Holy Cross, College of the

- Cronauer, Edward A., '74
- Sullivan, Kelley D., '99
- Tangherlini, Frank R., '70

Hope College

Koeppel, Peter V., '82

Houston, University of

De, Charles S., '63

Hunter College of the CUNY

Santhanam, Padmanabhan, '78

Idaho State University

- Morford, Larry J., '76

Idaho, University of

Bennett, Gary L., '61

Illinois Benedictine College

- Cavallo, William C., '65
- Laho, Ralph R., '63
- Schlick, Fred J., '74
- Stella, Dominick J., '91

Illinois Inst of Technology

- Bragg, Robert H., '49
- Juhala, Roland E., '57
- Voss, James R., '49

Illinois-Chicago, Univ of

Ares, Julian Y., '89
 ● Goldberg, Howard S., '88

Indiana State University

Bertermann, Jonathan M., '70
 Grow, Susan J., '72

Indiana Univ of Pennsylvania

Couch, Russell H., '89
 Stobie, James A., '72

Indiana University-Bloomington

◆ Goodwin, William E., '65
 Small, Timothy M., '62
 Volkman, Sylvia M., '63

Iowa State University

Keever, Mark R., '76
 Swenson, Clayton A., '76
 ● Vary, James P., '64

James Madison University

* Serway, Raymond A., '58
 Zimmerman, Bryan A., '88

John Carroll University

Ivons, Alan, '75
 ◆ Melich, Branden T., '92
 Newell, Catherine, '10
 ◆ Petti, Ernest J., '96
 Szente, Joseph J., '84
 Ursic, Joseph J., '76

Juniata College

Donley, Barbara J., '01
 Norris, Wilfred G., '75

Kansas, University of

◆ Agin, Gary P., '62
 Barrett, Bruce R., '60
 Brice, David K., '55
 Dike, Larry L., '59
 Francis, Charles L., '70
 ● Halderson, Dean W., '67
 ● Leamon, Richard G., '65
 ● Smith, Luther W., '54
 Spahn, Robert G., '66
 Thomas, Brian C., '01
 ● Trump, Peter A., '64
 Woelk, Darrell W., '69

Kent State University

● Chapman, Gilbert B., '75
 ● Christensen, Stanley H., '72
 ◆ Cunningham, Beth A., '81
 Latta, Gregory P., '82
 Stanford, Jack D., '76

Kentucky, University of

● Arvin, Alan D., '82
 ● Brown, William J., '87
 Demunbrun-Harmon,
 Donne O., '47
 ◆ Kemper, Raymond A., '49

Lamar University

Durling, George E., '79

Lewis & Clark College

Clarkson, Kathleen M., '99
 Olsen, Thomas F., '88

Lewis University

Pomykala, Joseph, '94
 Ressler, Michael, '84

Linfield College

Cram, Robert S., '66

Louisiana St Univ-Baton Rouge

Ball, Byrd M., '60
 Browne, Dana A., '95
 Giammerse Jr., Jack, '75
 Rauch, Richard T., '76
 Stoessell, Alfred L., '61
 Thomason, Richard S., '62

Louisiana Tech University

Evans, William K., '74

Louisiana Univ at Lafayette

● Howard, Jerry W., '58
 Miller, James E., '60

Louisiana-Monroe, Univ of

Moore, Kathy, '71
 ● White, Gary D., '81

Louisville, University of

Anolick, Eugene S., '67
 Cocks, James A., '82
 Erhart, Herbert G., '61
 Jones, Demoville P., '55
 Krebs, Ramon B., '60
 ● Nedelkoff, Bogdan, '60
 Shah, Nareshchandra P., '56
 ● Verser, Dan W., '63

Loyola University, New Orleans

● Barrera, Carlos M., '78
 ● Villere, Monty P., '65

Loyola-New Orleans University

Faust, Donald C., '08

Lycoming College

Howes, Michael L., '73
 ● Stover, David R., '73

Maine, University of

Atkinson, Leland G., '77
 ● Brigham, Ernest B., '51
 Dickey, Dana H., '50
 ● Hennings, John H., '57
 Knight, Richard A., '50
 ● Larson, Reginald E., '53
 ● Moore, Duncan T., '67
 Mortenson, Victor A., '68
 Soini, Frank R., '72
 Williams, John R., '49

Manchester College

Ebbinghouse, Joe C., '48

Manhattan College

Marczyk, Richard F., '57
 Rant, Stephen J., '64

Marquette University

Budlong, Albert H., '49
 ● Kelley, Clifford W., '64
 Kolata, James J., '63
 ◆ Maruszewski, David P., '91
 Mattson, Edward J., '63

Marquette University (cont.)

Miller, Paul G., '62
 Vandrevalla, Cyrus M., '09

Maryland-Baltimore Cty, Univ of

Edwards, Jerrah, '97
 Mishchenko, Lidiya A., '07
 Rubin, Morton H., '80

Maryland-College Park, Univ of

Futch, Archer H., '53
 Graham, Richard S., '69
 ● Lupton, William H., '56
 ● Messina, Carla G., '58
 ● Peter, Susan, '64
 Young, Frank C., '59

Massachusetts Inst of Tech

Huber, Martin E., '82
 Kushner, David M., '82
 Stevenson, Kim, '89

Massachusetts-Boston, Univ of

O'Brien, James J., '70

Massachusetts-Lowell, Univ of

Hanfling, Edward B., '78
 Largy, Timothy P., '94

McMurry University

◆ Tabb, Steve A., '71

Miami University

Bullis, W. Murray, '50
 Harris, Richard J., '65
 Johnson, Ramsey D., '58
 Leonard, Scott R., '79
 ◆ McCord, James K., '82

Michigan State University

Brazee, Ross D., '53
 Walsh, Kathleen A., '10

Michigan-Ann Arbor, Univ of

◆ Dodds, John A., '94
 Hutchins, Charles F., '91
 ● Rose, Hugh, '00

Minnesota, University of

Christensen, Thomas M., '79
 Pepin, Robert O., '80

Missouri-Rolla, University of

● Hardebeck, Harry E., '56
 McDaniels, John L., '59
 McKee, William D., '52
 Ollinger, Frank L., '66

Monmouth University

Bleier, Steven A., '74

Montana State University

● Kirkpatrick, Larry D., '78

Morehouse College

● Oz, Orhan K., '82

Morningside College

Rasmus, Russell W., '49
 Strandburg, Donald, '50
 Yoder, Jerry L., '58

Murray State University

Baughner, Eric M., '91
 Beatty, Steven A., '76
 Robertson, Charles S., '64
 Rose, Gerald T., '63

Muskingum College

Guthrie, Joseph A., '69
 ● MacMillan, Richard D., '66

Nebraska Wesleyan University

Bures, Marvin G., '52

Nevada-Reno, University of

Burge, Dennis K., '61
 Gehrke, Robert J., '63
 Rosenbaum, Robert P., '62

New Mexico State University

Duncan, Richard H., '50
 Gillespie, Patti L., '73
 Gillespie, James B., '40
 Nunn, Elwin C., '63

New Orleans, University of

Geisler, Heike, '98
 ◆ Lawrence, Thomas N., '67
 Morris, Dane Joseph, '79
 Tashmukhambetov, Arslan M., '06

New York Inst of Technology

Boehm, Raymond E., '73
 Frankel, Kenneth L., '10
 ● Nothdurft, Robert H., '71

New York University

● Bruhns, Betty A., '03
 ● Hodara, Morris, '48
 ● Kainer, Selig, '58
 Markatos, Louis G., '64
 Mendell, Rosalind B., '61
 Richman, Monroe F., '49
 Sherman, Harold, '53
 Spruch, Grace M., '51

North Carolina State Univ

Cantrell, Jeff, '87
 Christian, Wolfgang, '69
 ● Doggett, Wesley, '60
 Duncan, Donald P., '67
 ● Herman, Martin, '64
 ● Jackson, Robert H., '73
 Knight, Paul D., '94
 Penny, Jack M., '73
 ● Waters, Dean A., '60
 Wilburn, Wesley S., '86

North Carolina Greensboro, Univ

● Garner, Larry W., '77
 Soliday, Stephen W., '91

North Georgia Coll & St Univ

● Pendleton, Winston K., '93

North Texas, University of

● Campbell, Roger D., '82
 Gardner, Robert A., '82

Northern Arizona University

Eagan, Ann M., '79
 Rettig-Lochbiler, Susan, '84

Northern Illinois University

- Brown, Harold I., '74
- Janusek, Fred C., '74
- Overmyer, Steven A., '78
- Sill, Larry R., '73

Northern Iowa, University of

- Heller, Paul R., '84

Occidental College

- Hutcheon, Ian D., '67
- Newnam, Brian E., '62
- Worcester, John L., '51
- Wuerker, Ralph F., '50
- Zinn, Kenneth M., '95

Ohio State University

- Baker, William L., '64
- Collier, J. R., '57
- ◆ Donlan, Vincent L., '68
- Hecht, Lewis C., '64
- Kaleps, Ints, '68
- Kean, Joseph A., '66
- Kidder, Ray E., '46
- Kinzel, Evelyn S., '68
- Lea, Suzanne M., '65
- Lubich, Jeffrey N., '04
- McCaa, David J., '62
- Needels, Theodore S., '42
- Niple, Edward R., '73
- Patty, Richard R., '58
- Robinette, William H., '67
- Roll, Ronald E., '58
- Roop, Raymond M., '64
- Sayre, Joseph G., '44
- Simonson, Simon C., '66
- Steiner, William S., '63
- Vivien, David, '63
- Whitt, Sylvia J., '03

Ohio State University - Research Foundation

- Alexander, Carl A., '08
- Bingley, John D., '62

Oklahoma City University

- Davison, David, '67

Oklahoma State University

- Freeman, John A., '65
- Weigert, Ludwig J., '50

Oklahoma, University of

- Evatt, Bruce L., '59
- Rhyn, James J., '57

Old Dominion University

- Glaser, Ronald C., '71
- Welch, Charles R., '72

Oregon State University

- Gibbs, Bruce, '79
- Goldsmith, Todd A., '85
- Henning, Stephen M., '62
- Jones, Eric D., '56
- Lambert, Michael A., '87
- Stekel, Shirley, '58
- Wood, Clyde R., '69

Oregon, University of

- Balsiger, Mel, '50
- Wood, Floyd W., '48

Pennsylvania State Univ

- Brunner, James S., '58
- Burton, Marion B., '51
- Caplan, Sandor, '59
- Cox, Elizabeth E., '60
- Davies, Emlyn B., '49
- ★ Herritt, John A., '67
- Kost, Lawrence M., '65
- Lowitz, David A., '51
- McGrew, David L., '60
- Mebus, Edward A., '63
- Owens, Barbara R., '10
- Pryor, Richard J., '64
- Shaffer, Fredrick B., '59

Pittsburgh, University of

- Hausman, Hershel J., '51
- ◆ Zlochower, Yosef E., '96

Polytechnic University

- Dalsass, Louis J., '59
- Guidone, Raffael J., '67
- LaFemina, John A., '69
- Sank, Victor J., '65
- Yarr, Edward G., '65

Pratt Institute

- Spokony, David, '70

Principia College

- Barton, Stephen C., '91

Purdue Univ-West Lafayette

- Alexander, David H., '67
- Beitsch, Donald, '55
- Bennett, C. L., '67
- Bicknell, Bruce A., '68
- Brill, Wilfred G., '51
- Brown, Ronald A., '60
- Carter, Robert E., '43
- Cole, Teresa L., '72
- Collins, Robert J., '51
- Cone, David, '65
- Cunningham, Gary R., '72
- Daniell, Robert E., '69
- Goodwin, Robert M., '62
- Gorwals, John K., '63
- Harke, Douglas J., '68
- Hoffman, Gerald M., '44
- Kay, John H., '73
- Lawnicki, Victor F., '76
- Mansfield, Maynard J., '55
- Mazanek, Edward S., '67
- Mennel, John J., '66
- Miller, Robert J., '64
- Morningstar, Donald E., '65
- Nelson, Donald L., '65
- Oyer, Clarence E., '70
- Reed, Frederick T., '86
- Richards, Gerald T., '63
- Rinker, Jack N., '50
- Seiler, John P., '68
- ◆ Skelley, Elder D., '55
- Steed, Phillip W., '74
- Stendahl, Steven J., '76
- Stretchberry, D. M., '61
- Thieme, Gary A., '71
- Voorheis, Howard T., '74
- Weber, Mark M., '82

Randolph-Macon College

- Sandford, Stephen P., '85

Redlands, University of

- O'Neill, Brendan P., '95

Rensselaer Polytechnic Inst

- Berman, Paul R., '63
- Good, David E., '72
- Gunning, William J., '72
- Kalnin, Andrew, '77
- Leonardi, John C., '67
- Rapids, Richard F., '66
- Reynders V, John, '86
- Van, Randy C., '73
- Vitko, John, '66

Rhode Island, University of

- Ashton, Robert A., '70

Rhodes College

- Kendrick, Stephen E., '69
- Smith, L. Montgomery, '77
- ⌘ Smith, Jenna K., '08

Rice University

- Fienberg, Richard M., '78

Richmond, University of

- Ammerman, Don J., '59
- Berman, Herbert S., '70
- Kusheba, Michael C., '63
- Rothschild, Barbara G., '46
- Ryan, William S., '62
- Wingfield, Harvey N., '61

Ripon College

- Polanski, Xavier M., '73
- ◆ Polley, Walter W., '10

Roanoke College

- Johnson, Robert S., '73

Rochester Inst of Technology

- Elston, Stuart B., '69
- Manginell, Ronald P., '89
- Schwaneffugl, Franklyn K., '69

Rochester, University of

- Heinecke, Michael J., '98

Rose-Hulman Institute of Tech

- Sorrell, Lee R., '85

Rutgers University-Camden

- Coates, Joann M., '83
- Manieri, Matthew F., '78
- Masucci, Christopher M., '97

Saint Joseph's University

- Dibiase, James A., '59
- Morris, Robert A., '60
- Steckler, Kenneth D., '67
- Sunderland, Robert J., '72

Saint Olaf College

- Bongard, Michael W., '04

Sam Houston State University

- Jacobsen, Kelly S., '79
- ★ Steele, Robert S., '78

San Diego State University

- Cahill, Gerald D., '64
- Greenberg, William M., '69
- Lindman, Nils G., '69
- Mannix, Richard C., '71
- Maurer, Edward H., '58
- Muhl, William O., '58
- Zarnowitz, Richard M., '47

Santa Clara University

- Brown, David S., '81

Scranton, University of

- Corey, Christopher J., '04
- Spigarelli, Robert P., '70

Seattle University

- Creemers, David A., '71
- Wetzel, Jason D., '90

Seton Hall University

- Kreidler-Moss, Jennifer L., '94
- Natale, Stephen V., '71
- Stamer, Peter E., '69

Shippensburg University

- Imler, James H., '73

Siena College

- ◆ Knight, Charles T., '83
- Smith, Paul J., '80

South Carolina, University of

- Propst, Wyatt E., '57
- Rosenfeld, Carl, '86

South Dakota Sch Mines & Tech

- Dorland, Louis J., '78
- Graham, Keith D., '51
- Kopp, Fred J., '70

South Dakota State University

- Crossman, Leon D., '60
- Leinbach, Harold, '49
- Lundquist, Charles, '47

South Dakota, University of

- Betinis, Emanuel J., '50
- Cleland, Marshall R., '47
- Predoehl, Martin C., '54
- Twigg, Laurence W., '72

South, University of the

- Cordell, Francis M., '85

Southern California, Univ of

- Dickson, Richard L., '74
- Shigemitsu, Thomas M., '72

Southern Mississippi, Univ of

- Rayborn, Grayson H., '71
- Stevens, Harold W., '71

Southern Nazarene University

- Neuenschwander, Dwight E., '75

Southwestern Oklahoma St Univ

- Funkhouser, Gary P., '81

St. Bonaventure University

- Kovar, Frederick R., '60

St. Lawrence University

Clark, Doris L., '41
 ● Miller, Jeffrey R., '00
 Reklis, Robert P., '69
 Watkins, Sylvia A., '46
 Wells, Lois S., '53

St. Olaf College

Aggerbeck, Lawrence P., '66
 Arenson, John D., '69
 ● Gimmestad, Gary G., '66
 Halsted, Elizabeth L., '78
 Hopps, Kevin J., '79
 Kullberg, Craig, '69
 ● Logghe, Sean B., '75
 ● Mollidrem, Bernhard P., '66
 Schlichting, William H., '64

St. Peter's College

Lopez, Jose L., '07

SUNY at Albany

Bono, Paul C., '77
 Coppola, Richard A., '66
 Landi, Peter C., '88
 ● Sullivan, Joseph M., '67

SUNY at Binghamton

Calistri-Yeh, Millie, '89
 Vabnick, Ian B., '91
 Veselka, John J., '74
 Zadrozny, Stanley A., '86

SUNY at Fredonia

● Bicknell, Paul A., '75

SUNY at Plattsburgh

● Kauder, Lonny R., '03

SUNY at Stony Brook

Naylor, Christopher E., '96

SUNY College Brockport

Gentile, John P., '01

Syracuse Univ

Barroll, Sara D., '46
 Eisaman, L. C., '45
 Lehmann, William L., '47
 ● Richman, Gilbert C., '48
 ● Wright, Robert A., '50

Tennessee Technological Univ

Kozub, Raymond L., '78

Tennessee-Chattanooga, Univ of

● Fincher, Arvel L., '55
 French, Mary J., '78
 ● Mathis, Joe T., '61

Tennessee-Knoxville, Univ of

Breeding, J. E., '61
 Cooper, David A., '68
 ● Crume, E. C., '68
 Dishman, Rose M., '10
 ● Fleming, Edward R., '67
 Hinsdale, Sandra J., '65
 ● Hubisz, John L., '64
 Jarratt, James S., '67
 ● King, Philip W., '68
 Lewis, Rex D., '61
 Riedinger, Leo L., '10
 Reeves, Charles A., '68

Tennessee-Space Institute

● Shelnut, Riley C., '70

Texas A&M Univ-College Station

⌘ Burrow-Ludlow, Janet, '76
 Gruben, James H., '72
 ● Stewart, Robert D., '71

Texas A&M Univ-Kingsville

Wheeler, Bob L., '77

Texas Christian University

Campbell, Russell C., '79
 Hilley, Larry L., '63
 ★ Kent, Graham G., '65

Texas Tech University

Berry, Richard E., '63
 ● Herlin, Bruce G., '65
 Kelly, William F., '59
 ● Mariglyn, Stephen, '65
 Pleil, Matthias W., '88
 ● Sauncy, Toni D., '93
 Smith, David L., '70
 Thacker, George H., '63

Texas-Arlington, University of

◆ Guthrie, Don W., '68

Texas-Austin, University of

● Brown, Keith C., '53
 ● Herbst, Walter E., '51
 ● Kodosky, Jeffrey L., '72
 Monahan, Edward C., '60
 ● Otto, William M., '55
 Tropp, Richard J., '67
 Wylie, Dennis C., '00

Texas-El Paso, University of

Gibson, Randal E., '73

Thiel College

Chesonis, Dawn C., '76

Thomas More College

● Barker, Thomas E., '98
 Eismann, Michael T., '84

Toledo, University of

● Bagley, Brian G., '92
 Federman, Steven R., '90
 Schweikert, James D., '06

Towson University

Ludwig, John J., '80

Trinity College

Knutson, Donald S., '53
 ● Mason, William C., '71
 Miller, John H., '50
 ● Twardy, Stanley A., '46
 ◆ Washington, Allyn J., '50

Trinity University

◆ Luckett, Larry W., '69
 Moore, Charles D., '74

Tufts University

Altschuler, Edward E., '54
 Bruns, C., '50
 ● Halladay, Maurice E., '51
 ◆ James, William J., '49
 Striker, William W., '50

Tulane University

Daniel, Charles D., '60
 Daubert, Henry C., '50
 De, Willie P., '54
 ● Deutsch, John L., '59
 Scott, Norvell O., '58
 Yeager, William M., '67

Tulsa, University of

● Davis, Linda R., '77
 ● Wetzell, Michael G., '67

Union College

Dockery, Stephen E., '85
 ● Johnston, John B., '82

United States Military Academy

● Williams, David C., '10

United States Naval Academy

Fordham, Earl W., '78
 Jourdan, David W., '74
 Klee, Carl R., '73
 McCumber, Leonard D., '68
 ⌘ Reese, Cassidi A., '03
 Roe, Eric A., '05
 ● Studt, Kurt F., '90
 Waddell, James B., '69

Univ of California San Bernardino

Lowande, Karen, '08

Uppsala College

Corwin, Vera-Anne V., '10
 Hirvonen, Alice P., '63

Ursinus College

Giammarco, Joseph M., '82

Utah State University

Hatch, Eastman N., '52
 Mattson, Reed B., '71

Utah, University of

Blackburn, Alan D., '71
 ● Bowman, Carlos M., '56
 Feingold, Arnold M., '59
 ● Gledhill, Jessica T., '61
 Hills, Richard G., '59
 Kingsbury, Paul I., '62
 Marquis, Marilyn A., '49
 Tatro, L. D., '51

Utica College of Syracuse Univ

Capparelli, Michael J., '62

Vanderbilt University

Jenkins, John K., '82

Virginia Military Institute

Bottoms, Mitcheal L., '79
 McCrary, James K., '01
 ● Serenbetz, Stuart W., '76
 ● Tucker, John H., '78

Virginia State University

◆ Stith, James H., '64

Virginia Tech

● Long, Jerome R., '10
 Nimick, Daniel S., '78
 Robins, C. H., '65

Virginia, University of

● Modlin, Raymond E., '68
 O'Brien, George T., '69

Wabash College

Livengood, C. D., '62
 Monroe, Bruce M., '60

Wayne State University

Gubbins, Harry L., '49
 ● Katz, Fern S., '49
 Morin, Dornis C., '48

West Florida, University of

Barlow, Paul Michael, '75

West Virginia University

● Allen, Anna M., '92
 Shanholtzer, Wesley, '61
 Smith, Fred R., '70

Western Illinois University

Boparai, Jack S., '84
 Conner, Allan L., '59
 Dickison, Alexander K., '65
 Meservey, Richard H., '61

Western Kentucky University

● Bennett, Maury T., '80
 Glasgow, Glenn P., '64
 Harris, Donald T., '63
 Hoffman, Eugene J., '83

Western Washington University

Cline, John R., '76

Westminster College

Cetrone, Raymond G., '73
 ● Church, Charles C., '73
 Mansell, Edward R., '89
 Metzler, Roger A., '69

Wheaton College - IL

Abraham, Douglas S., '86
 Mc, James G., '43
 McDowell, H. C., '58
 Richert, Norman J., '71

Whittier College

deWilde, Nichole A., '08

Wichita State University

◆ Ladd, Nelson S., '62
 Pistotnik, Frank S., '72

Widener University

Miller, Kenneth D., '91

William & Mary, College of

Harrell, Lee E., '91
 Hoppe, John C., '63
 ● Judy, Richard, '65
 Muench, Jean A., '67
 Roach, J. F., '59
 Slauson, William E., '64
 ◆ Stevens, Robert B., '72
 Tropf, William J., '66

William Jewell College

Dixon, John W., '58
McElwee, Carl D., '63
Philpot, John L., '55

Wisconsin-Eau Claire, Univ of

Daniels, Keith, '53
● Schneider, Robert S., '80

Wisconsin-Oshkosh, Univ of

Robinson, Joseph H., '54

Wisconsin-River Falls, Univ of

Blodgett, Earl Daniel, '53
● Deml, Ann M., '06

Wisconsin-Superior, Univ of

● Diesslin, Blaine R., '71
Sjostrom, Keith J., '84

Wisconsin-Whitewater, Univ of

De, Michael J., '77
Zagorski, William G., '71

Wooster, The College of

Coffey, William N., '42
Trautman, Miriam, '37

Worcester Polytechnic Inst

Bernacki, Stephen E., '70
● Colby, Paul Campbell, '73
Lawry, Stephen R., '79
Tsakraklides, George, '92

Wright State University

● Dierking, Matthew P., '84
Hehmeyer, John L., '87
● Rice, Donald W., '69
Wiefeling, Kimberly M., '83

Wyoming, University of

● Bunch, Wilbur L., '49
● Meyer, Edmond G., '64

Xavier University

Grothaus, Jeffery T., '77
◆ Martino, Anthony J., '79
Starr, Brian, '09

Youngstown State University

Adams, Louis W., '72

Friends of Sigma Pi Sigma

Anderson, R. Joseph
● Bartosz, Elizabeth E.
● Bartran, David
Blickinstaff, Jacob
◆ Blue, Charles
Braun, Terri
Cabell, Brenda
● Caron, James
Caron, Elizabeth
Cole, Ken
Conners, Sara
Daniel, Sandra
● Delboca, Robert

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Dennis, Viv
Dollison, Julius
● Dombroski, Angela
Dombroski, Linda
Duda, Leonard
● Eckert, Alan C.
● Edwards, Jean
Egan, Jim
● Fuller, Roger
◆ Gardner, Marilyn
● Glass, George
Glazier, James A.
Guinnessy, Paul
Hennig, Lee A.
Hicks, Patch
Hilborn, Bob
Huen, Albert
● Ivie, Rachel
● Jones, Donna
Kent, Geoffrey S.
● Kirby, Kate P.
● Konno, Rikio
◆ Krivanek, Jenny
Lang, Liang
Lee, Jenny
Littlejohn, Del
Lucibella, Michael
● Macrander, Albert T.
McGrew, Ralph V.
● Mower, Robin M.
● Mulvey, Judith

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● Mulvey, Patrick
● Parraway, Gayle
Pirnet, Jen
Poirier, John A.
● Redmond, Kendra
Reft, Chester S.
Ronan, Gregory J.
Schwab, Tracy
Slattery, Penny
● Smith, Richee
Stein, Benjamin P.
◆ Stonecipher, Jerry
Swartz, Gigi
Taylor, Yvonne
Tittman, Jay
◆ Watson, Pearl
Webb, Sara
West, Priscilla
● White, Nancy
● White, Adrienne
White, Susan
● Wiley, Margaret

Chapter not known*

Cline, Alan B., '10
Dalby, Richard J., '10
Hakel, Peter, '10
Meadors, John G., '10
● Sheriff, Jack W., '10
Tranchina, John P. '10

*The national office seeks information on these members. Please go to www.sigmapi.org/radiations/mailling_status.htm to update your information.

Thank You to our 2012 Quadrennial Physics Congress Sponsors



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The American Physical Society Forum on Physics and Society, organized in 1971 to address issues related to the interface of physics and society as a whole. www.aps.org/units/fps



The OSA Foundation, the charitable organization working on behalf of The Optical Society (OSA). www.osa-foundation.org

Vernier, which puts easy-to-use data loggers, sensors, experiments and graphing/analysis software into the hands of students. www.vernier.com



The Optical Society (OSA), where science and technology innovations in optics and photonics come together. www.osa.org

The American Astronomical Society, the major organization of professional astronomers in North America. <http://aas.org>



The American Association of Physics Teachers, the premier organization representing and supporting physics and physical science teachers and teaching in the United States. www.aapt.org

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The Puzzle Corner

This edition's crossword puzzle celebrates "Connecting Worlds," the theme of the 2012 Quadrennial Physics Congress (PhysCon). SPS communications specialist Elizabeth Hook constructed this delightful brainteaser.

Fall Contest Winner

Congratulations to Dr. Diedrich Schmidt, of North Carolina A&T State University, for being the first respondent to correctly solve last fall's moon-earth orbit puzzle.

Prizes

For each physics puzzle, the submitter of the first correct answer, and a second chosen at random from all correct answers will be awarded a \$25 gift card for a book vendor of the winner's choice, and the winners' names will appear in the next issue of *Radiations*.

Call for Puzzles

We welcome any interesting puzzles you may have to share with your fellow alumni. As a token of our appreciation, we will send a \$25 gift card to the submitter of each original puzzle we accept. Please submit your puzzles to Sigma Pi Sigma Puzzle Corner, One Physics Ellipse, College Park, MD 20740, or by email to sps@aip.org.

Across

2. Science advisor for 6-across & plenary speaker at 38-down.
6. A popular American sitcom, also the prevailing model for the development of the early universe.
8. Variety; a range of different things; a good thing to have in any group.
11. Plenary speaker at 38-down, discoverer of pulsars.
12. To publicly display; there were 60 at 38-down.
14. The first plenary speaker at 38-down and an astronaut known as the Hubble repairman (also for eating peanut butter and raspberry sandwiches in space).
15. The second administrator of 27-across.
16. Investigation; study; expedition.
18. Plenary speaker at 38-down, specializes in the detection and characterization of exoplanets.
20. Dr. Lee Sawyer led a workshop at 38-down on connecting science and this.
22. (pl) The study of the behavior of light.
23. Scientist who specializes in tomography, she spoke at 38-down
24. The community associated with the pursuit of research & education.
27. Federal agency responsible for the civilian space program and aeronautics and aerospace research.

Please submit your answers to the physics puzzles by surface mail to ΣΠΣ Puzzle Corner, One Physics Ellipse, College Park, MD 20740, or by email to sps@aip.org.

Deadline

15 September 2013

Answers

Answers will appear at www.sigmapi-sigma.org/radiations/puzzlecorner/ in late September.

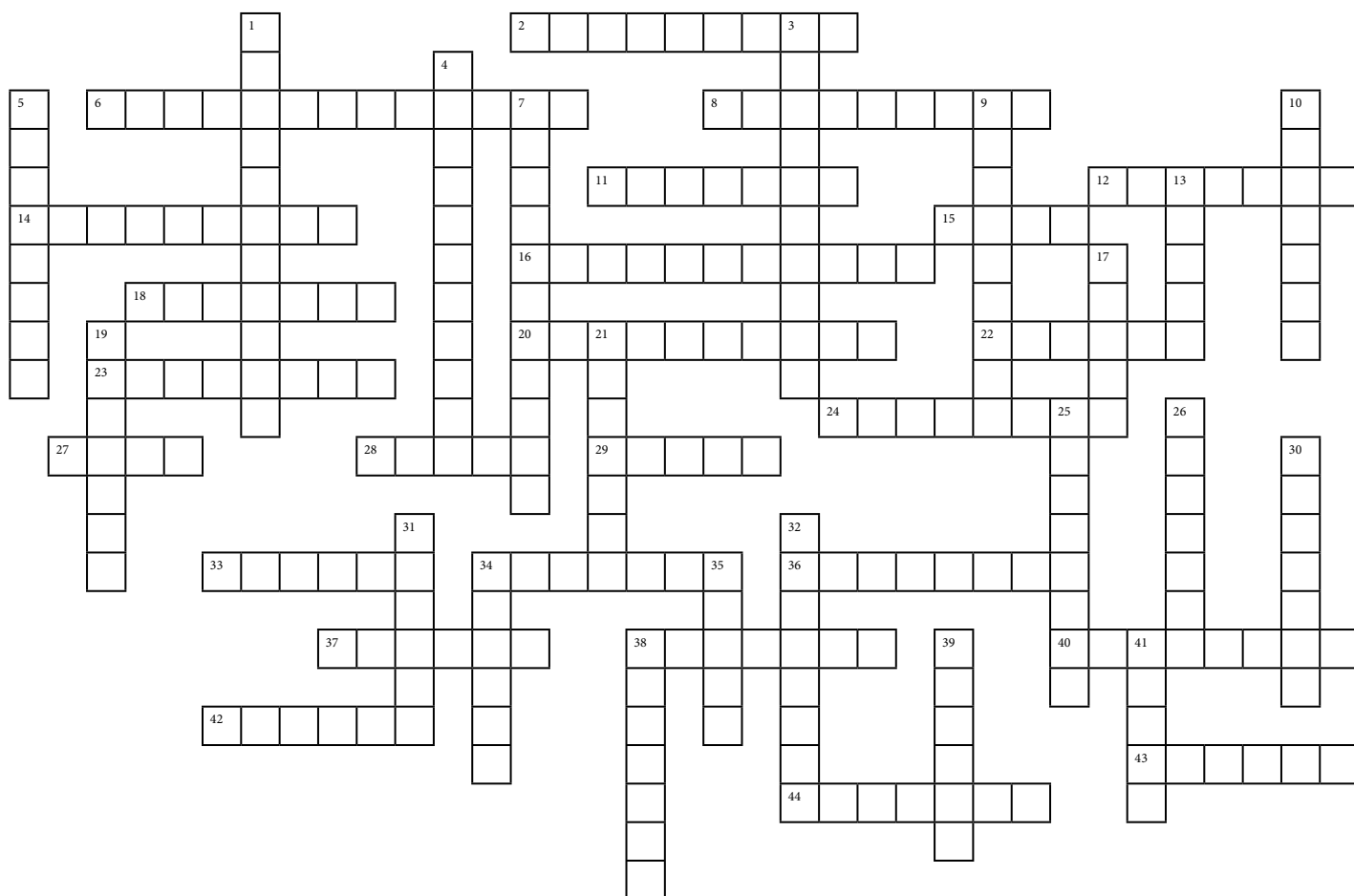
Scan with a QR code reader on your smart phone or tablet to see the puzzles and answers online.



28. Plenary speaker at 38-across; former CERN CMS program manager and chair of the CMS collaboration.
29. The third planet from the sun in our solar system.
33. The phenomena of the physical world collectively; also a scientific journal.
34. The scientific discipline that studies how the universe behaves.
36. This shuttle had just arrived in Florida when 38-down took place.
37. Astronomer; the space 9-down launched in 1990 was named for him.
38. (pl) In 2006 the IAU redefined the definition for these celestial bodies and excluded Pluto.
40. Systematic investigation; many students presented information on theirs at 38-down.
42. Plenary speaker at 38-down; astrophysicist who received the Nobel Prize in Physics in 2006.
43. A vehicle that obtains thrust from the combustion of its contents.
44. 35th President of the United States; the 27-across space center in Florida is named after him.

Connecting Worlds

by Elizabeth Hook, SPS Communications Specialist

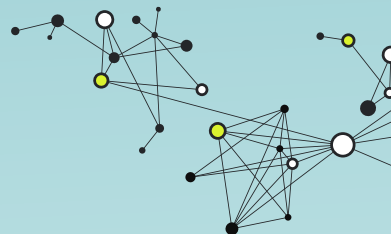


Down

1. Once every four years.
3. A dramatic and wide reaching change. At 38-down, Dyson gave a lecture on four of these.
4. A point of view.
5. A meeting (or series of meetings) for discussion; a national legislative body.
7. (pl) The throwing back by a body or surface of light, heat, or sound without absorption; serious thoughts and considerations.
9. 37-across and 15-across are both one of these (in space).
10. @SPS_physicsnews & @SPSwebster are on this social network.
13. The newest subatomic particle, named for this physicist that postulated its existence.
17. The chapter that traveled the farthest to 38-down was from this country.
19. 38-down was held in this city.

21. (pl) Occupations.
25. Manufacturing, production.
26. The action of helping or doing work for someone.
30. The systematic study of the structure and behavior of the natural and physical world through observation and experiment
31. An individual that belongs to a group (like Sigma Pi Sigma).
32. A social networking site, where SPS and Sigma Pi Sigma can interact with its members and keep them updated on goings-on in science & the National Office.
34. A course of action adopted or proposed by a government.
35. The near vacuum between planets and stars, containing small amounts of gas and dust.
38. Abbreviation for the most recent Sigma Pi Sigma Congress.
39. Students gave these types of presentations at 38-down.
41. (pl) The luminous objects in the night sky.

Stay Connected: 2012 Quadrennial Physics Congress



The 2012 Quadrennial Physics Congress (PhysCon) may be in the past, but the excitement, inspiration, and new connections that were formed will have a lasting impact on Sigma Pi Sigma and its members for years to come. It's impossible to capture the spirit and highlights of the meeting in just these few pages—so look for more coming in the next few issues of *Radiations* and on the PhysCon website. And whether you attended the Congress in person or are experiencing it through these pages for the first time, here are some ways that you can continue "Connecting Worlds through Science and Service":

Be inspired by the words of Freeman Dyson, John Mather, Jocelyn Bell Burnell, and the other plenary speakers by listening to or viewing their talks.

www.spscongress.org/physconprogram/speakers

Explore the workshop topics in more detail using the resources on the PhysCon Media List.

www.spscongress.org/resources/reading-list

Check out the coverage of PhysCon in the press and blogosphere.

www.spscongress.org/about/press

Browse meeting photos and upload your own.

www.spscongress.org/about/#photo

