

eur@PLANET Magazine

Issue
2

Finding New Ways of Envisioning Venus

Three new missions to Earth's
under-explored twin

Highlights from EPSC2021

Reports from the Europlanet
Science Congress

Fantastic Access

Europlanet's Transnational
Access programme

ALS@ IN THIS ISSUE

- Europe and the New Space Race
- Evaluation for Europlanet 2024 RI
- Designs on Pandemic and Post-Pandemic Meetings:



The official magazine of Europlanet,
the European community for planetary sciences

Since 2005, Europlanet has provided Europe's planetary science community with a platform to exchange ideas and personnel, share research tools, data and facilities, define key science goals for the future, and engage stakeholders, policy makers and European citizens with planetary science. The Europlanet Society promotes the advancement of European planetary science and related fields for the benefit of the community and is open to individual and organisational members.

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Take off

As 2021 draws to a close, there has been no let-up in the extraordinary range of activities going on in our community. The second virtual Europlanet Science Congress (EPSC2021) in September was an opportunity for us to celebrate this, and to come together to share experiences and discuss how we can support each other in these challenging times.

In this second issue of the Europlanet Magazine, we find out about some of the science presented at EPSC2021, examine ways our community is adapting to a virtual world, hear personal experiences about a career in planetary science, and look from a political perspective at Europe's role in the new Space Race.

This month's feature on Transnational Access highlights the diverse research supported by the Europlanet Research Infrastructure and, following a major review of the project, we look at some of the outcomes to date from the access and services that it provides for the community.

Throughout this issue, you will see multiple ways to get involved in Europlanet activities and opportunities to shape the community. In 2022, we encourage you to join in!

Anita Heward

Editor

Contents

In Focus	4
Celebrating Science at EPSC2021 Stavro Ivanovski and Akos Kereszturi	15
Spotlight on Diversity at EPSC2021 The Diversity Committee	17
Early career events at EPSC2021 Noah Jäggi	18
Designs on Pandemic and Post-Pandemic Meetings Amy Riches	19
Planetary Perspectives Lena Noack	21
Finding New Ways of Envisioning Venus Jörn Helbert	24
Connecting Communities Across the Industry-Academic Divide Marcell Tessenyi and Jeronimo Bernard-Salas	27
Europe and the New Space Race Niklas Nienass MEP	28



Fantastic Access

Gareth Davies introduces Europlanet's Transnational Access Programme

The Animated Universe of James O'Donoghue Federica Duras and Livia Giacomini	38
Evaluation for Europlanet 2024 RI Jennifer DeWitt and Anita Heward	40
Looking for the earliest forms of life on Earth Barbara Cavalazzi	46
The Bolivian San Agustin Remote Observatory Gabriel Andres Jaimes Illanes	48
CommKit Shorouk Elkobros	50
The Last Word - Beyond Borders Nigel Mason	51

In focus

In the second half of 2021, the Europlanet community has welcomed new faces, passed major milestones, and found numerous ways of sharing planetary science.

Europlanet Society

Welcome to New Europlanet Society Officers and Chairs



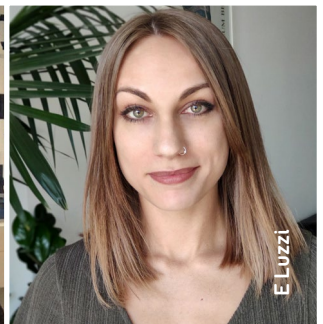
Didier Moreau



Lena Noack



Ines Belgacem



Erica Luzzi

Treasurer

Dr Didier Moreau (IASB-BIRA) has been elected as the Treasurer of the Europlanet Society's Executive Board at the General Assembly on 23 September 2021. As Coordinator/Manager of the Belgian Operations Centre from 2001-2015, Didier was responsible for the organisation of the ESA OdISSea Mission and almost 60 space experiments and missions for ESA and other space agencies. He was seconded as Programme/Project Controller in the ESA Science Directorate at the Prodex Office. Since 2017, his main duties are to monitor the national and European funding sources in line with IASB-BIRA's activities. As Treasurer of the Europlanet Society, he brings this practical knowledge of planetology and budget management skills acquired during his career.

EPSC Executive Committee Chair

Prof Lena Noack (Freie Universität Berlin) is the Incoming Chair of the Europlanet Science Congress (EPSC) Executive Committee. As well as the EPSC2022 meeting in Granada next year and the postponed meeting in Helsinki (now in 2024), Lena will lead the organisation of joint meetings with the American Astronomical Society's Division of Planetary Sciences (DPS) in 2023 in San Antonio, Texas, US, and in 2025 (European venue TBD). Lena is the joint winner of the Farinella Prize (page 12) and this month's guest in Planetary Perspectives (page 21).

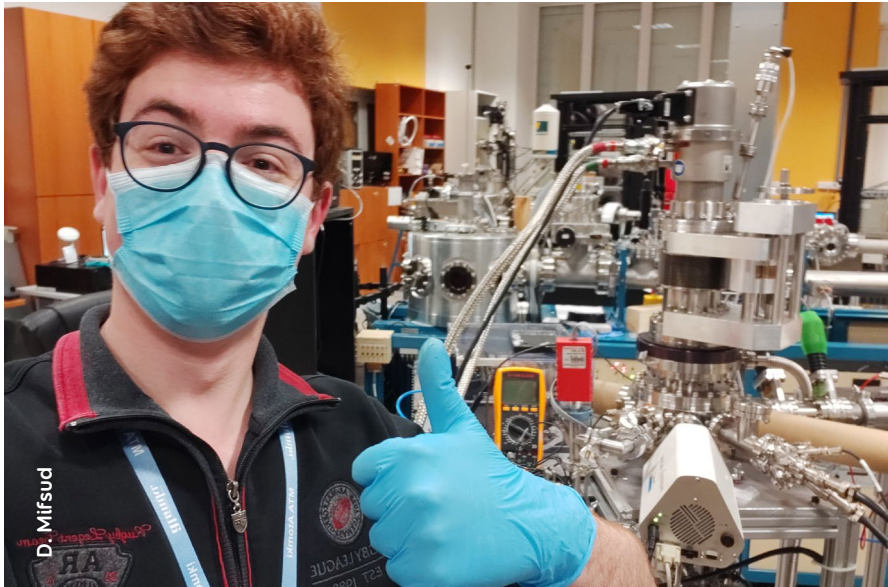
Want to help? We are looking for a Vice-Chair of the EPSC Executive Committee. Apply now: <https://bit.ly/EPSCViceChair>

EPEC Chairs

Dr Ines Belgacem and Dr Erica Luzzi are the new Co-Chairs of the Europlanet Early Career (EPEC) Network. Ines is a research fellow at the European Space Agency based in Madrid in Spain, studying the surfaces of icy moons in preparation for the JUICE mission. Erica has just completed her PhD at Jacobs University, Bremen, on geological mapping of Mars and analogue studies in the lab and field. Both Ines and Erica are active members of the Europlanet Society, Ines as the French Hub's Early Career Officer and Erica as Chair of the EPEC Annual Week Working Group. They are also both part of the EPEC Communications Working Group and launched the EPEC Twitter account in February 2021.

Euoplanet 2024 RI

Europlanet 2024 Research Infrastructure Reaches Mid-Term Milestone



Duncan Mifsud at the ice chamber and the FTIR spectrometer.

At just over a third of the way through the project, the Europlanet 2024 Research Infrastructure (RI) project has submitted its first periodic report and undergone its first interim review with the European Commission on 4 November 2021.

Despite Covid-19, most of the project's 101 deliverables are on track (page 40), although a six-month extension is being requested until 31 July 2024 to allow more time for visits

and workshops to take place. The pandemic has led to innovations in virtual visits to enable the community to access research facilities remotely (page 30), and in many cases opened up access to a wider global audience for services, workshops and training schools.

For all details on Europlanet 2024 RI, see the project website: <http://www.europlanet-2024-ri.eu>



Expert Exchange Programme Launched

An Expert Exchange Programme has been launched to mobilise the planetary community and help share expertise and best practice. In particular, the scheme, which is funded through Europlanet 2024 RI, supports discussions to open-up new facilities and services for access by the community in future projects.

All travel and accommodation expenses for a short visit, of up to one week, can be reimbursed through the programme. Due to travel restrictions from the Covid-19 pandemic, virtual visits are also now supported so that, for example, shipping of equipment or other resources can be claimed. <http://bit.ly/EuroplanetExpertExchange>



2022 GMAP Geology & Planetary Mapping Winter School

The second Geology & Planetary Mapping Winter School will be held online from 7-11 February 2022. The programme for Winter School, which is organised by Europlanet 2024 RI's Geological Mapping (GMAP) activity, will be largely hands-on and will include seminars, asynchronous interactions, and individual/project mapping work.

Registration opens on 15 December 2021 and will close on 31 January 2022. Materials (including videos, presentations, documentation and data) from the first Winter School, held in February 2021 are now accessible for prospective participants to browse. <https://www.planetarymapping.eu/>

Europlanet Africa Workshop Series Blasts Off



The first Europlanet Workshop on Satellites for Space Science and Technology in Africa took place on 15-19 November 2021 in Palapye, Botswana, and online. The workshop was attended by 72 participants and brought together space-technology specialists, scientists and students to discuss current

topics in the rapidly-developing field of space in Africa. As the first in a series to be held in different locations around Africa, under the umbrella of the Europlanet Strategic Plan for Global Collaboration, the workshop piloted a format focused on content and building links. The overall aim is to create an African

network to foster planetary science and technology development across borders in developed and developing countries and across the spectrum of academia, industry and civil society. <https://bit.ly/EuroplanetWorkshopAfrica>

Europlanet Telescope Network Science Workshop

9-11 February 2022

The first Europlanet Telescope Network Science Workshop aims to encourage community-led proposals and to highlight scientific results achieved with the Europlanet Telescope Network and other medium-size/small telescopes. Interested astronomers and amateurs are invited to participate, and to learn more about the instruments for access through the network, their capabilities and their scientific potential. Register now: <http://mao.tfai.vu.lt/europlanet2022/>

Apply For Time on the Europlanet Telescope Network

The Europlanet Telescope Network has a rolling call for proposals for observations. Decisions are made within two months of submission. For further information on the Europlanet Telescope Network and how to apply, see: <https://bit.ly/2Br5LDt>



VESPA Implementation Workshop

Europlanet 2024 RI's VESPA virtual observatory aims to make Solar System data accessible and searchable through an interoperable system, according to the principles of Open Science. An online workshop, organised by IRAP/CNRS and Jacobs University, was held from 29 November to 1 December 2021 to open up new data services to the community via the VESPA interface. Participants selected in an open call worked with the VESPA team to design and set up their projects. The new services will support solar and magnetospheric studies, asteroid characterisation and shape modelling, as well as the integration of lab and field data into VESPA from Transnational Access visits.

Eurolanet Science Congress (EPSC) 2021 Virtual Meeting



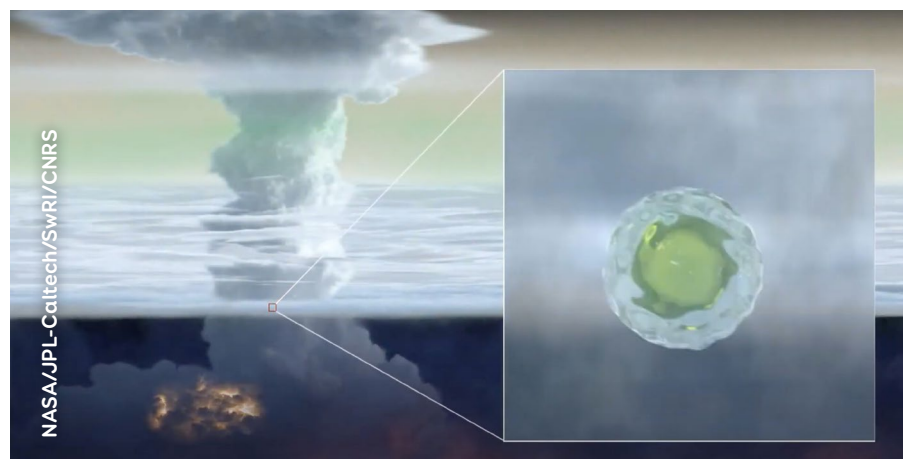
From 13-24 September, the Eurolanet Science Congress (EPSC) took place as a virtual meeting for the second time. Attended by 795 people from 47 countries worldwide, the meeting built on the format established last year of pre-submitted scientific presentations combined with live discussion sessions, keynotes, short courses and community events. In response to feedback from 2020 that requested more interactivity, innovations this year included a conference Slack, a new format for authors to 'pitch' their presentations and participate in live Q&A, and a Wonder.me social space.

News from EPSC2021

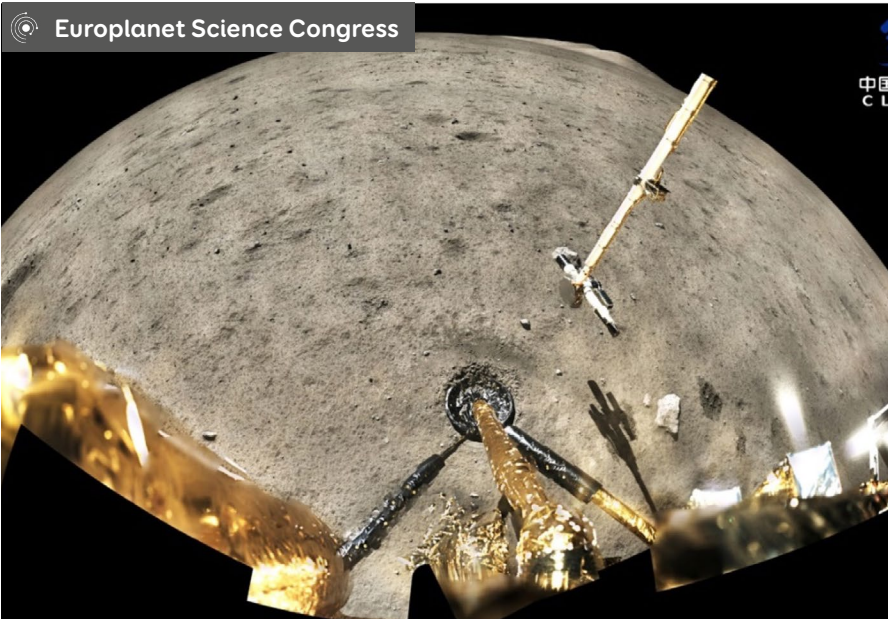
Across the 834 presentations and 42 sessions held during EPSC2021, a wide range of science was presented on many planetary topics. Here are some of the results highlighted in press releases issued during the meeting.

Mushballs Hide Ammonia at Ice Giants

Mushballs - giant, slushy hailstones made from a mixture of ammonia and water - may be responsible for an atmospheric anomaly at Neptune and Uranus that has been puzzling scientists. A study presented by Tristan Guillot (Observatoire de la Côte d'Azur/CNRS) at EPSC2021 shows that mushballs could be highly effective at carrying ammonia deep into the ice giants' atmospheres, hiding the gas from detection beneath opaque clouds.



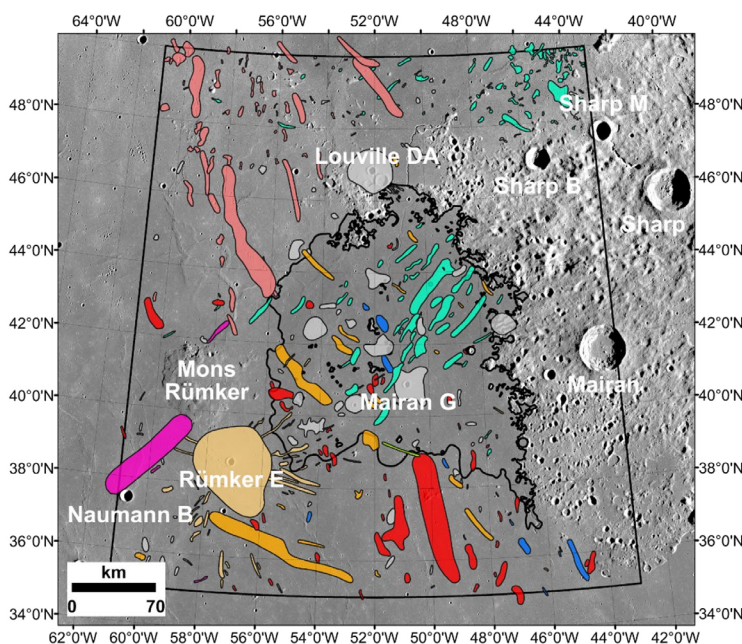
Artist's impression of a mushball descending through a giant planet's atmosphere



Exotic Mix in China's Delivery of Moon Rocks

On 16 December 2020, China's Chang'e-5 mission successfully delivered to Earth nearly two kilograms of rocky fragments and dust from the Moon. Chang'e-5 retrieved samples of the youngest lunar rocks ever brought back for analysis in laboratories on Earth. A geological mapping study presented at EPSC2021 by Yuqi Qian (China

University of Geosciences) suggests that while 90% of the materials collected by Chang'e-5 likely derive from the landing site and volcanic mare basalts from the immediate surroundings, 10% could include exotic fragments such as glassy droplets from extinct volcanic vents, and debris from impact craters up to 1,300 kilometres away.

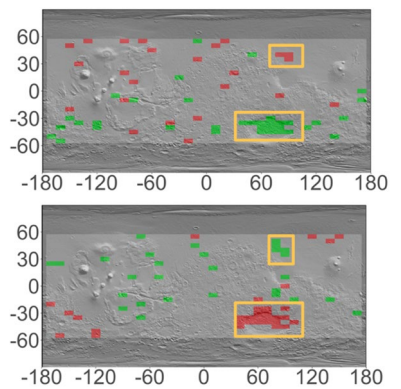


Possible sources of exotic fragments in Chang'e-5 lunar materials.

Seasonal Changes Reveal Water Deposits on Mars

Seasonal variations in levels of hydrogen detected at Hellas Planitia and Utopia Rupes, in the southern and northern hemispheres of Mars respectively, suggest that significant quantities of water ice can be found in the metre or so below the surface in these regions. Dr Germán Martínez (Lunar and Planetary Institute) said at EPSC2021: 'As the coldest ground temperatures occur at the same time as the largest-observed increase in hydrogen content, it suggests that water ice is forming in the shallow subsurface of these regions during the fall and winter seasons, and then sublimating into gas during the warm season of each hemisphere.'

These sources of water, away from the hostile polar regions, could support future human and robotic exploration in temperate regions of Mars.



Potential water deposits on Mars
Credit: G. Martínez.

Qian et al. 2021



Moon Base concept

Life Support Cooked Up From Lunar Rocks

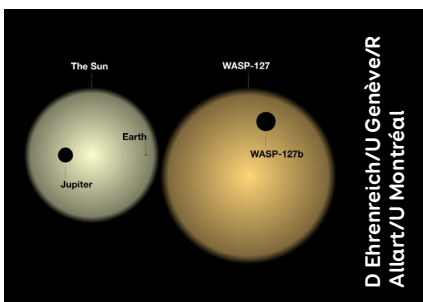
A customised laboratory demonstrator that cooks up lunar soil to extract water and oxygen has been developed by a consortium of the Politecnico Milano, the European Space Agency, the Italian Space Agency and the OHB Group. Soil simulant is vaporised in the presence of hydrogen and methane, then washed with hydrogen gas. Gases

produced and residual methane are sent to a catalytic converter and a condenser that separates out water. Oxygen can then be extracted through electrolysis. By-products of methane and hydrogen are recycled in the system.

Prof Michèle Lavagna (Politecnico Milano), presenting results at EPSC202 said: 'The capability of having

efficient water and oxygen production facilities on site is fundamental for human exploration and to run high quality science directly on the Moon. Our experiments show that the rig is scalable and can operate in an almost completely self-sustained closed loop, without the need for human intervention and without getting clogged up.'

Cloud-Spotting on a Distant Exoplanet



WASP-127b compared with Solar System planets.

Infrared observations from the ESA/NASA Hubble Space Telescope (HST) and visible light measurements from the ESPRESSO spectrograph at the European Southern Observatory's Very Large Telescope in Chile have been used to measure the altitude of clouds on the exoplanet WASP-127b. Combined data enabled researchers to narrow down the altitude of the clouds to an atmospheric layer with a pressure ranging between 0.3 and 0.5 millibars.

Located more than 525 light-years away, WASP-127b is a giant planet similar in mass to Saturn that orbits very close to its sun. Dr Romain Allart (iREx/Université de Montréal and Université de Genève) said at EPSC2021: 'There were strong water vapour signals in the infrared but none at all at visible wavelengths. This implies that water-vapour at lower levels is being screened by clouds that are opaque at visible wavelengths but transparent in the infrared.'

Dashcams Study of Slovenian Fireball

On 28 February 2020, at 10:30 CET, hundreds of people across Slovenia, Croatia, Italy, Austria and Hungary observed a bright ball of light hurtling across the morning sky. This delivery of rocks from a distant asteroid to the fields and villages of southern Slovenia was captured by cars' dashcams, security cameras, and even a cyclist's helmet. At EPSC2021, Dr Denis Vida (University of Western Ontario) described how the diverse footage was used to construct a 3D model of the fireball's trajectory and track its origins in the Solar System. Before entering the Earth's atmosphere, the initial stony mass is thought to have been four metric tons and roughly one metre across. Video footage shows the fireball breaking up into 17 smaller pieces. Three fragments amounting to 720 grams have been recovered and

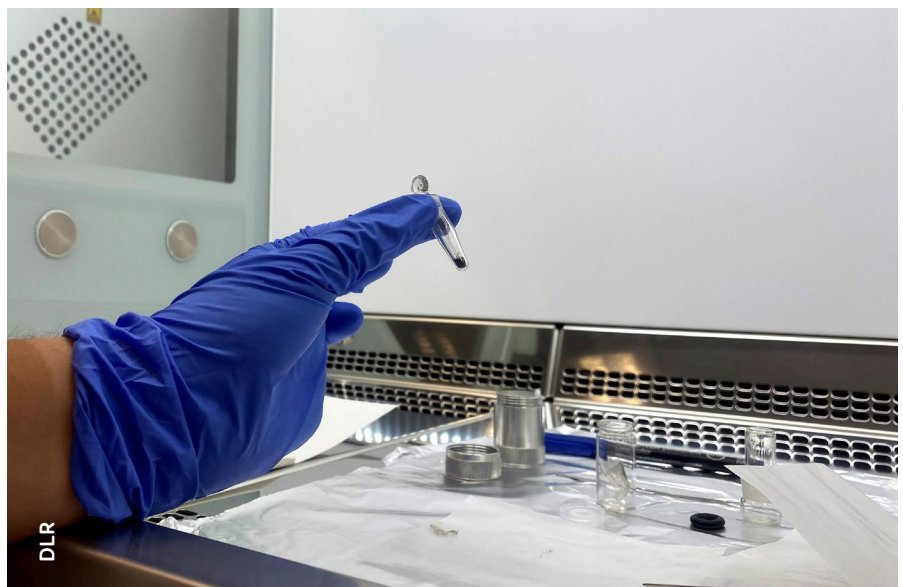


taken to laboratories for analysis. The largest fragment seen to fall, with an estimated mass of about ten kilograms, is yet to be found. It likely dropped into a muddy field and may have accidentally been ploughed in before its fall area was known.

Screenshot of the SkyFit software using the heights of houses and lampposts for dashcam calibration

Sample Analysis Lab Prepares for Planetary Mission Deliveries

The Institute of Planetary Research at DLR (German Aerospace Center) is starting construction of a new Sample Analysis Laboratory (SAL) dedicated to the study of rock and dust samples from planetary bodies such as asteroids and the Moon. The first phase will be operational by the end of 2022, on time to welcome samples collected by the Hayabusa2 mission, and fully ready by 2023. 'The SAL facility will allow us to study samples from a macroscopic level down to the nanometric scale and help us answer key questions about the formation and evolution of planetary bodies,' said Dr Enrica Bonato (DLR) in a status report at EPSC2021.



An example of extra-terrestrial material that will be analysed in SAL.

Europlanet Science Congress

EPSC Goes Live For Schools 2021

The second edition of EPSC Goes Live For Schools took place throughout November 2021, coordinated by the outreach project Lecturers Without Borders (LeWiBo). A selection of EPSC2021 presentations were highlighted to schools and teachers, with the aim of giving students an insight into contemporary planetary science.

Classes in the 12-18 age group were also invited to take part in live webinars and Q&A sessions on a range of planetary science topics, with presentations in six languages included in the programme. A Q&A session for teachers also presented Europlanet's Mars Collection of Educational Resources, which have now been translated into seven languages thanks to LeWiBo volunteers.

<https://lewibo.org/epsc2021>
<https://bit.ly/EuroplanetMarsCollection>

Europlanet Prizes

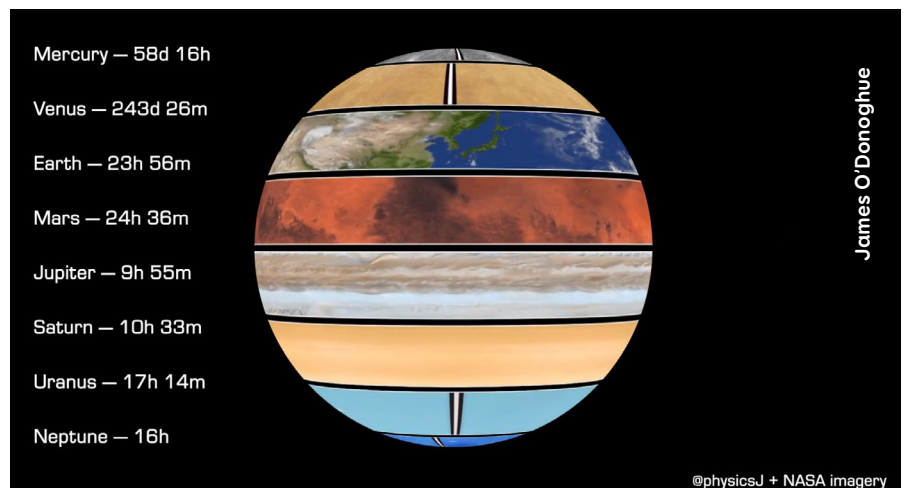
Europlanet Prize for Public Engagement 2021

The 2021 Europlanet Prize for Public Engagement has been awarded to Dr James O'Donoghue for his work in creating high-quality space science animations. James is a planetary scientist, specialising in the study of giant planet upper atmospheres, and an online content creator working



James O'Donoghue at NASA

at the Japan Aerospace Exploration Agency (JAXA). In 2018 he started creating animations and publishing them online on his YouTube channel. Now, with more than 80 animated visualisations of space topics, he has reached 200 million views on social media (page 38).



Screenshot of James's animation Planets and dwarf planets to scale in size, rotation speed & axial tilt in distance order from Sun (<https://www.youtube.com/watch?v=hf6WUmwJKZE>)

Coming (again) Soon!

EPSC 2021 goes live for schools

Special program for schools alongside the Europlanet Science Congress 2021 to be launched in October!

- Teachers' supporting material
- Live webinars with scientists
- Q&A sessions in various languages
- Interactive sessions

The program for this year will be announced soon.

See what happened last year!

We will have special sessions for teachers in Autumn 2021, to tie in with EPSC 2021

Pre-register here!

LECTURERS WITHOUT BORDERS www.lewibo.org

eur PLANET SOCIETY

Virtual Outstanding Presentation Contest (vOPC) at EPSC2021

The annual EPSC Outstanding Poster Contest (OPC) was expanded for the EPSC2021 virtual meeting to include submissions of video presentations as well as virtual posters. From 52 eligible participants, three winners were selected, who will each receive a certificate and free registration for EPSC2022 in Granada. The winners are Vinooja Thuraiethinam for his poster, 'Monte Carlo Transmission Line Modelling of Multilayer Optical Coatings for Performance Sensitivity of Exoplanet Spectroscopy', Omar Attia for his video, 'Coupling the

Atmospheric and Dynamical Evolution of Close-in Exoplanets' and Liliane Burkhard for her video, 'Investigating Inferred Strike-slip Features on Titan: Modelling Possible Shear Failure Due to Tidal Stresses and Pore Fluid Interactions'.



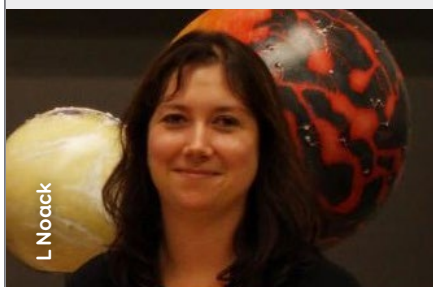
Europlanet Prizes

Farinella Prize Winners 2021



D. Valencia

Diana Valencia



L. Noack

Lena Noack

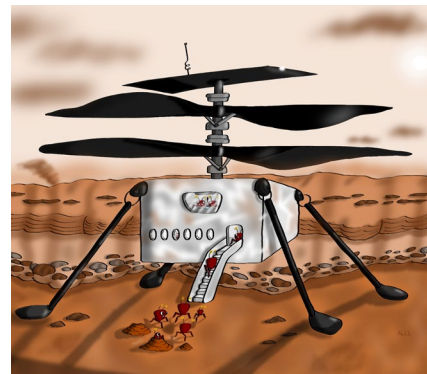
Prof Diana Valencia (University of Toronto) and Prof Lena Noack (Freie Universität Berlin) have been awarded jointly the 2021 Paolo Farinella Prize for their significant contributions to our understanding of the interior structure and dynamics of terrestrial and super-Earth exoplanets orbiting other stars. Prof Valencia's and Prof Noack's theoretical studies have led to a deeper understanding of the composition and evolution of terrestrial exoplanets and assessments of the habitability potential of exoplanets and how 'Earth-like' they might be. The annual prize was established in 2010 to honour the memory of the Italian scientist Paolo Farinella (1953-2000). The prize lectures can be viewed at: <https://bit.ly/Farinella21>.

Find out more about Prof Lena Noack in this month's Planetary Perspectives (page 21).

#InspiredByOtherWorlds 2021 Arts Contest

The theme of the second edition of the #InspiredByOtherWorlds Arts Contest was 'Ingenuity'. Entries were submitted by artists from 10 countries and of all ages. The full list of winners and runners up will be announced in a webinar on 20 December 2021.

Below: Winner of the Junior Category.
The Colorful Universe by Kajus Peceliunas is inspired by the clear skies over northern Lithuania.



Above: Winner of Adult Category. In *Boarding Jez Air-0* by Nicolas Oudart, tiny crablike creatures appropriate the Ingenuity helicopter after the end of its mission. The creatures are coming from the subsurface, where current martian rovers are searching for traces of life. The geological structures in the background remind us that the Jezero crater is an ancient lake.

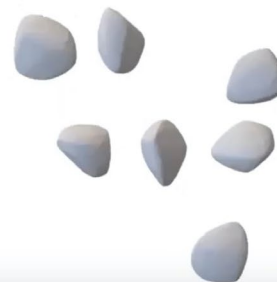
See all the entries at <https://bit.ly/Inspired2021>

EPEC-EPSC #PlanetaryScience4All 2021 Video Contest

Looking for the most ancient asteroids



Dimitrios Athanasopoulos
PhD Candidate
National and Kapodistrian University of Athens
Department of Physics
Section of Astrophysics, Astronomy and Mechanics



Dimitrios Athanasopoulos (National and Kapodistrian University of Athens) is the winner of the 2nd edition of the #PlanetaryScience4All EPEC-EPSC

Video Contest. He will receive a free registration for EPSC2022 in Granada for his winning entry, 'Looking for the Most Ancient Asteroids'.



Winners of Ariel Machine Learning Data Challenge

The Ariel Space Mission ‘Machine vs Stellar and Instrument Noise’ Data Challenge 2021, sponsored by Spaceflux Ltd, has harnessed the expertise of the artificial intelligence community to identify and remove noise in detections of exoplanet atmospheres. Over 110 teams from around the world participated with 35 teams submitting viable solutions. The competition winners, ML Analytics, an artificial intelligence company in Portugal, and a team from TU Dortmund University in Germany, were able to achieve highly-accurate solutions for even the most difficult to observe exoplanets.

Italy Hub

EduINAF Catches a Comet



Left: Image of Comet 67P/Churyumov-Gerasimenko by A Garbognai (INAF-OAS). Right: INAF’s Catch a Comet campaign.

The return of Comet 67P/Churyumov-Gerasimenko to our skies has been celebrated in a live-streamed event on 8 November 2021 as part of EduINAF’s ‘Il Cielo in Salotto’ (Sky in your Living Room) series. Researchers from the Italian National Institute for Astrophysics (INAF) shared tips on how to observe the comet with a small telescope or binoculars, and showed images of Comet 67P captured by INAF telescopes and by amateur astronomers who joined EduINAF’s ‘Catch the Comet’

observational campaign. Guests also shared recollections of highlights from the European Space Agency’s Rosetta mission, which orbited Comet 67P from 2014-2016. The comet, which had been visible with small telescopes since October, reached peak luminosity between its closest approach to the Sun on 3 November and its closest flyby of Earth on 13 November, exactly one day after the seventh anniversary of the historic landing of Rosetta’s Philae probe on 67P’s surface.

Central Europe Hub

Astronauts’ Annual Gathering Comes to Hungary

The XXXIII Conference of the Association of Space Explorers (ASE) took place in Hungary from 1-5 November 2021. During a Community Day in Budapest, students had the opportunity to meet and talk to the astronauts attending and listen to presentations. The Europlanet Central Europe Hub was represented by the Wigner Space Physics Research Group in a mini-expo of space companies and research institutes.

Members of the Europlanet Society Central Europe Hub at the ASE Community Day in Budapest.



Spain-Portugal Hub

First Scale Solar System in Spain Inaugurated



The Sun and some of the planets from the scale model of the Solar System created by AstroBriga in Salamanca, Spain.

Spain's first permanent, three-dimensional scale model of the Solar System has been installed in the western province of Salamanca, created by the AstroBriga association. The Sun and the terrestrial planets generate a walking tour around the eastern walls of the historic city of Ciudad Rodrigo, and the scale model extends for almost 25 km to the border with Portugal. At the scale chosen (1:290,000,000), the speed of light corresponds to average walking pace, so visitors can stroll from the Sun to the Earth in a little over eight minutes.

The Sun is made of interlocking brass hands contributed by crowdfunders, and the spheres of the planets and moons float within glass segments of steel monoliths. Interpretation panels and educational programmes integrate the scale model with local towns, UNESCO archaeological sites, and dark skies of the surrounding landscape, with the aim of bringing new 'astrotourists' to the region. The completed model was inaugurated in a festival of astronomical events from 3-5 September 2021. <https://astrobriga.es>

NoRCEL Launches Event Series

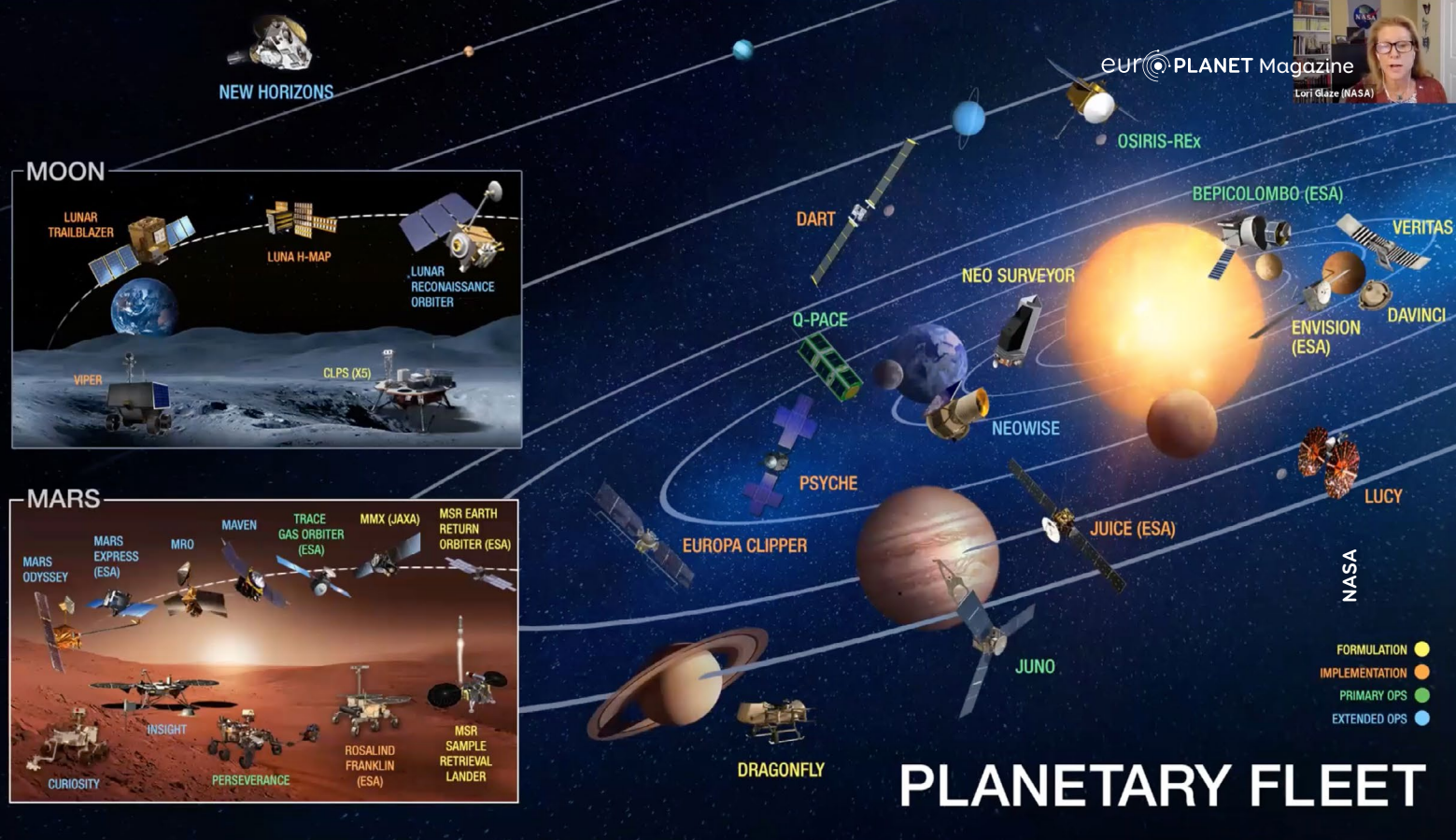
The Network of Researchers on the Chemical Evolution of Life (NoRCEL) was founded in 2013 to put scientists in touch with one another, form networks and discuss ideas in a relaxed environment. NoRCEL has seen its membership rise steadily, despite Covid-19 and it has now launched two new flagship projects. The Blue Earth Project (BEP) inaugural day of lectures will take place on 8 January 2022 and address the topic: 'Is humanity settling its own fate on ecological survival?' The hybrid event will take place physically in Leeds, UK, and be streamed online. The first Astroscience Exploration Network (ASEN) conference on 'A Way Forward for Science in Africa's New Hub' will take place in Bulawayo, Zimbabwe, on 12-13 April 2022. www.norcel.net

Community News

Europlanet Public Engagement Funding Scheme 2021

The Europlanet Public Engagement Funding Scheme aims to encourage new ways of sharing planetary science with different kinds of audiences across Europe (and beyond) to create socially impactful initiatives that combine research, learning, innovation and social development. In 2021, two projects have been funded through the scheme. The San Agustin Remote

Observatory in Cochabamba will provide remote-access to support astronomy outreach in Bolivia (page 48). The second project is a walk through the Botanical Gardens of Cluj-Napoca, Romania which will connect the surroundings to astrobiology and convey the message: 'We are all special, there is no Planet B!' <https://bit.ly/EuroplanetOutreachFunding>



Dr Lori Glaze, Director of NASA's Science Mission Directorate's Planetary Science Division, participates in the 'Dialogue with Agencies' session at EPSC2021.

Celebrating Science at EPSC2021

Stavro Ivanovski (INAF) and Akos Kereszturi (Konkoly Thege Miklos Astronomical Institute), Co-chairs of the Scientific Organising Committee (SOC), review the second virtual Europlanet Science Congress.

Reflecting on the feedback from the second virtual edition of the Europlanet Science Congress (EPSC) gives us an opportunity to highlight what has been achieved through another successful meeting and what we are working to improve for future EPSCs.

Established in 2006, EPSC is a scientific forum and platform for sharing planetary science, gathering both early career and experienced researchers together to share their

ideas, to learn from each other, and to shape the future of planetary science.

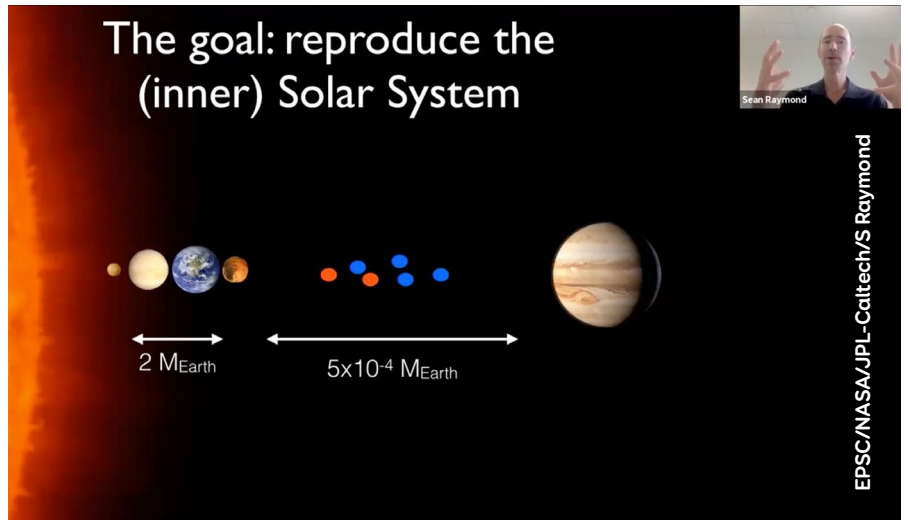
For the 2021 virtual meeting, the conveners and the Scientific Organising Committee (SOC) compiled a comprehensive programme with the best of new planetary science discoveries, recent advances in various scientific topics, updates on space missions and the-state-of-the-art in planetary research. The scientific content

of the meeting was delivered over 42 scientific sessions, 13 keynote talks, and 12 splinter meetings and workshops, which resulted in about 600 oral, 203 poster and 440 early career contributions.

The programme was as scientifically broad as possible and covered fields from terrestrial planets and space exploration missions, through small bodies, exoplanets and other planetary systems, to the contributions made by amateurs.

The keynote talks, linked to the six scientific programme groups, showcased current outstanding planetary science. Even though the virtual format lacks the interactivity that in-person meetings offer, the Virtual Organising Committee (VOC) of EPSC2021 worked hard and used feedback from last year to improve interaction among the participants, and the meeting benefited from the connection of researchers from all over the world. Feedback suggests that people particularly enjoyed that everyone had the opportunity to engage in fields outside their specific scientific area and could learn and be inspired by other colleagues' research at their own pace and in their own time zone.

The success of EPSC relies on the voluntary efforts of hundreds of people in the organising committees and the teams of conveners, as well as the engagement of the participants. We would like especially to acknowledge the input of the conveners, as the format this year entailed significant work, not only in checking pre-recorded oral talks but also in running the live-pitch sessions and moderating the Slack channels, where proactive conveners were key to generating discussion.



Sean Raymond delivers his presentation on 'Building terrestrial planets: dynamical models and how to test them'.

Despite the increase in fees this year, which were essential to put the virtual meeting on a secure financial footing, bursaries funded through the Europlanet 2024 Research Infrastructure enabled worldwide applicants with limited resources to attend the meeting.

We are looking forward to meeting everyone in person next year at EPSC2022 in Granada. As well as offering some level of virtual access (a clear request from the feedback), we are investigating new features to include, such as

meetings with editors of top-rated scientific journals, and discussions between teams working on the same scientific problems but with competing approaches.

EPSC 2022 will take place at the Palacio de Exposiciones y Congresos de Granada, Spain from 18-23 September 2022. <https://www.europlanet-society.org/epsc/>



Left: EPSC2021 SOC Co-Chairs, Stavro Ivanovski and Akos Kereszturi join the Daily Briefing with Niamh Shaw. Right: Francesca McDonald of ESA prepares for her keynote lecture on 'Scientific Exploration of the Moon'.

Spotlight on Diversity at EPSC2021

The Europlanet Diversity Committee describes events at EPSC2021 to highlight equity, diversity and inclusion.

The Europlanet Diversity committee delivered a number of events at EPSC2021, to bring the community together and to share stories and experiences around equality, diversity and inclusion activities.

In a keynote lecture following the conference opening ceremony, Eugenia Coverton described her role and the amazing work of Lecturers Without Borders (LeWiBo), who try to connect international scientists to schools and universities when travelling. Marina Molla then described the integration of LeWiBo in the ‘EPSC goes live for schools’ initiative and the impact this had on school students in 2020.

For the first time we organised a short course, delivered by Dr Moses Milazzo, on how to be an effective bystander when dealing with situations or comments that we know are not right. This included learning when an intervention can help to interrupt inappropriate behaviour and how to do that. The course included excellent examples and tips, and also a lively discussion with the participants. Even those that had attended similar events previously commented that they took away lots of useful guidance with them and they hoped for more bystander-intervention training at future EPSC meetings.

For a second year in a row Arianna Piccialli organised the

Planetary Science Wiki edit-a-thon. This started with an introduction given by Camelia Boban (WikiDonne), Ester Bonet (WikiMujeres) and Geert Van Pamel (Wikimedia Belgium), and was followed by almost daily edit-a-thon sessions where participants met to continue to create and translate Wikipedia profiles to highlight diversity within the planetary science community.


For the third consecutive EPSC, a dedicated session on diversity in planetary science was also part of the conference programme. This session showcased a wide range of topics aiming to foster debate within the planetary sciences community.

Several presentations analysed the demographics and the statistics of under-representation (gender, cultural, ethnic origin and nationality biases) with a focus on the impact of Covid-19. We also discussed best practices to promote a more diverse and inclusive environment both within the scientific community and in schools.

Another event organised this year was a screening of the documentary, “Can we talk?”, by Dr Kendall Moore. The film focuses on the issue of social belonging in the context of STEM (Science, Technology, Engineering, and Maths) and the effect it has on the lives of under-represented people of colour. After watching the film, we discussed these issues with Dr Tana Joseph and Dr Leonardo

dos Santos, who shared their perspectives on the barriers that scientists from minority backgrounds still encounter when becoming part of our community and strategies to overcome these challenges. These are difficult conversations that must, nevertheless, be had if our field is to become as welcoming and diverse as it can be.

Finally, we organised a round table event to discuss key and current issues facing the community. This open discussion gave community members the opportunity to feed their ideas and concerns into the Diversity Committee and Europlanet Society. We talked through some of the issues around different ways in which the community could come together (e.g. face-to-face versus online, versus hybrid events) and then challenges and advantages of each of those options for different parts of the community.

The community input from this will be used to focus the Committee’s attention for the coming months. Anyone wishing to provide input, who was unable to attend EPSC and the event, can send an email to diversity@europlanet-society.org. 

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Early Career Events at EPSC2021

Noah Jäggi, Chair of the EPEC@EPSC Working Group, reports on a packed programme at EPSC2021 organised by the Europlanet Early Career (EPEC) network.

The EPEC@EPSC Working Group's efforts to help, guide, educate, and involve early career participants joining the Europlanet Science Congress (EPSC2021) did not disappoint!

To make sure no early career felt lost during EPSC, the mentoring@EPSC programme matched mentees with mentors ahead of the start of the meeting. EPSC2021 kicked-off for early careers with an icebreaker event, which allowed participants to make acquaintances and find out about all the events organised by EPEC@EPSC. As well as a social event, where all kinds of creative games were played online to connect the early careers, the annual Science Flash contest was, for the first time, combined with a quiz where early careers could demonstrate their knowledge in all things space-science.

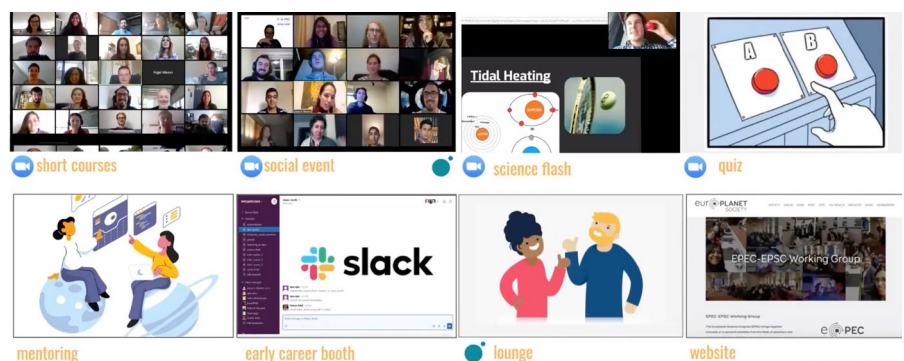
The principal activities organised for early careers were three short courses, evenly distributed over the 1.5 weeks of the live programme, which targeted different soft skills and topics of high value for future career paths. The first short course was given by João Retrê (University of Lisboa, Portugal) on communication during the age of virtual meetings. This had a large focus on the importance of body language, not only from the standpoint of the presenter, but also the listener. In the second short course, Dan Bower (University of Bern, Switzerland) gave a rundown on how

to write a successful proposal - i.e. one that gets accepted. The closing short course about mental health was given by Alan Percy (University of Oxford, UK), who was back for the third time in a row by popular demand. The focus this year was on coping with different degrees of stress as well as self-imposed perfectionism, how to discover such behaviour within oneself, and how to find a healthy balance. As is the case in all short courses, a lot of discussion ensued and the feedback was overwhelmingly positive.

The Europlanet Early Career (EPEC) General Assembly, organised by the EPEC Co-chairs, Erica Luzzi and Ines Belgacem, provided an introduction to the wider activities carried out by the EPEC community. The respective chairs of the EPEC Working Groups presented past activities, the ongoing projects and proposals, as well as fresh ideas for the future. At the end

of the presentations a significant amount of time was spent in a fruitful discussion, where all the participants could ask questions, comment on the working groups, and propose new ideas. Reaching out to new people is always a primary goal for the EPEC community, and the General Assembly has been the perfect occasion to find new members and strengthen our inclusive network.

More than 90 early careers enjoyed activities during EPSC 2021, organised through the hard work of a small group of EPEC members. If you are an early career wishing to see what's going on behind the scenes and would like to help build a new set of early career activities for the next virtual or in-person EPSC conference, please do get in touch or subscribe to our mailing list. <https://bit.ly/epec-epsc> @



Summary of activities organised by EPEC@EPSC for EPSC2021, presented during the EPEC General Assembly.

Designs on Pandemic and Post-Pandemic Meetings: Learning with the EPSC 2021 Team

Amy Riches (University of Edinburgh, UK, and SETI Institute, USA) describes her experiences as a planetary geochemist diving into the EPSC2021 Media Internship Programme.

Crucial to science is sharing with others and, as with all we do, it is important to work together. The 'hat' I usually wear is that of a petrologist and geochemist, deciphering the history of our Solar System embedded in slices of rocks. Via microscopes and various mass spectrometry approaches, I tease out rocky stories over a span of around 4.6 billion years. Included amongst my chemical tools of choice are the 'highly siderophile element' group (ruthenium, rhodium, palladium, rhenium, osmium, iridium, platinum, and gold) and related isotopic tracers.^{1,2}

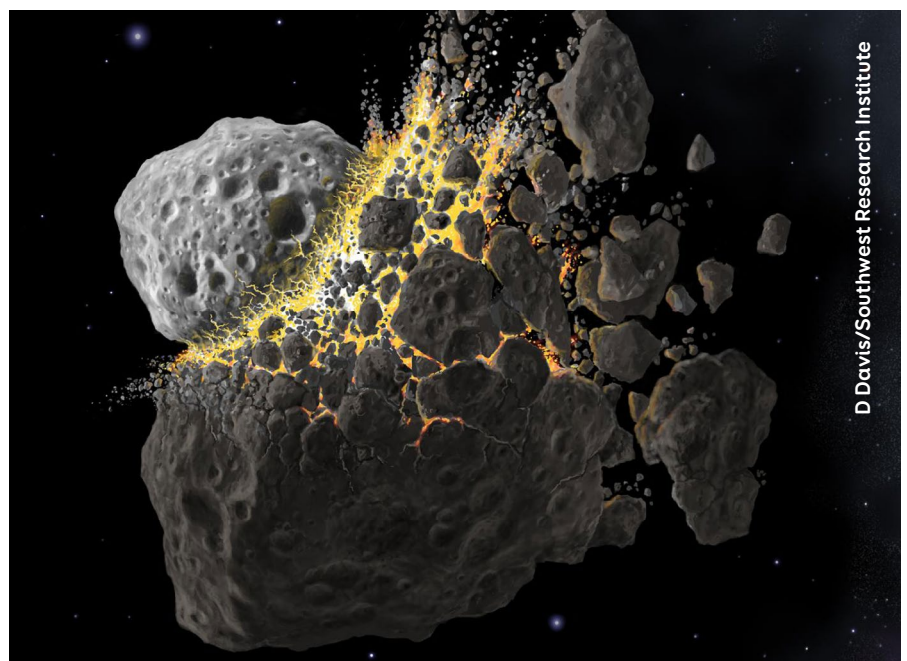
There is much to learn in life, and diving into science-writing for public audiences has proved a thrilling challenge. It was a great privilege to be part of the Media Team for the virtual Europlanet Science Congress (EPSC) 2021. I had a lot of fun with a group of talented people as we reported on new results and eagerly immersed ourselves in as much of the meeting as possible (we still have catch-up access to recordings until September 2022 - what a treat!)³

My role involved liaising with scientists and writing press releases

concerning a meteorite-dropping fireball over Slovenia and 'exotic' fragments of the Moon recovered by China's Chang'e-5 sample return mission (pages 8-10). As well as helping to propel exciting science into international news, I pitched in to support the Social Media Team with a bit of tweeting under the #EPSC2021 tag. It was a great experience that I learnt a lot from, while making new professional friends and balancing other commitments. I can certainly recommend giving this type of activity and training a try.

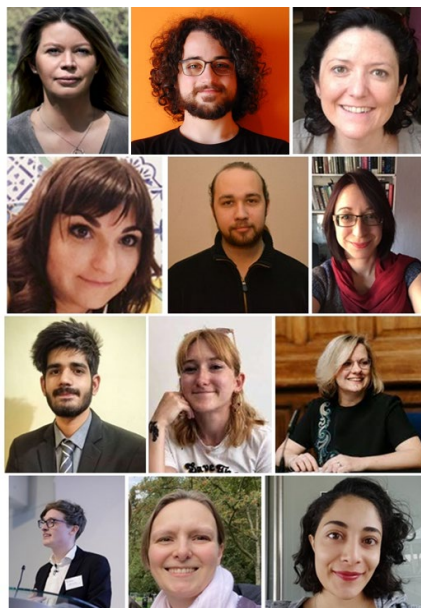
Together in a Changed World

The Covid-19 pandemic has been a difficult time with sad losses of life across the world. This has changed the ways in which we work and prompted deep reflection concerning how societies operate, support and include one another, and how we can adapt and progress with the times.^{4,5,6} Emerging evidence (e.g. among scientific publishers) shows that the Covid-19 crisis has exacerbated long-standing inequities among scientific communities.⁷ This emphasises the



D Davis/Southwest Research Institute

Impacting asteroids can result in fragments that fall to Earth as meteorites.



The EPSC2021 Communications Team.
Top row: Anita Heward, Luca Nardi, Livia Giacomini. Second row: Adriana Postiglione, Thibuat Roger, Amy Riches. Third row: Siddhant Sharma, Grace Richards, Kateryna Frantseva. Bottom: James McKeivitt, Vix Southgate, Shorouk Elkobros.

urgency required in deconstructing cultural and systemic barriers faced by scientists of under-represented groups. As Co-Chair of the European Association of Geochemistry’s Diversity, Equity, and Inclusion Committee, the understanding I have gained from interacting with the Europlanet Society’s Early Career Network (EPEC) and Diversity Committee during EPSC (pages 17-18) will feed into our own activities and assist reciprocal exchanges in future.⁸ International conferences such as EPSC have long brought scientists together and been prominent in our calendars. Given the excitement that communities feel as work is prepared for these events, the shift to fully virtual meetings has sparked a range of responses, necessitated flexibility among organising teams, and prompted changes not only in how and from where talks are given, but in the ways that we network.

Stream and Beam at Home

In remotely attending this year’s EPSC, not only did I learn a great deal from all the speakers, but so too did my cat and - all be it briefly - the occasional mail delivery person. It was a thrill to instantly ‘find the room’ and have time to attend every keynote lecture! Of course, fully virtual meetings cannot solve persisting needs for childcare provisions and other support of people’s needs during conferences, nor do they offer in-person networking that many of us have long been familiar with. But at EPSC, I found the chat function during live presentations, the virtual community events and the Slack channels to be effective forums for exchange, and potentially a little less intimidating for some people. In particular, members of scientific communities who have caring responsibilities or mental health/neurological differences that pose barriers to attending in-person meetings have reported benefits in accessing and enjoying virtual conferences, and these factors aid the tackling of ableism.^{9,10,11}

Opportunities Benefitting all our Futures

As we emerge into a changing world, mindful of our duty of care for the safety and welfare of others, scientific conferences will never be the same. It has been valuable to learn through the various virtual practices and experiences of the recent EPSC2021, the 52nd Lunar and Planetary Science Conference, and the Goldschmidt 2021 Virtual Conference. If travel and recovery from jet-lag had been

required, I would certainly not have had time, or have been choosing responsibly in attending/presenting work at all three of these 2021 international events, supplemented by presentations at smaller gatherings too. These experiences have been especially informative in the run-up to the inaugural Forming and Exploring Habitable Worlds meeting, taking place in hybrid format in Edinburgh from 7-13 November 2022, which I will Chair with support from its Scientific Steering Committee and sponsors.¹² This event in Edinburgh, which offers bursaries, will facilitate a range of useful discussions while providing for opportunities beneficial across career stages, including planned publishing projects.

With conference formats reformed, it remains as important as ever for cooperative communities to unite in exchanging new findings, testable ideas, and sharing best practices that will accelerate scientific progress. As the opportunities of the recent EPSC taught me a great deal, I am eager to engage with the science of the Europlanet community and others again soon, and as part of the approaching meeting in Edinburgh!

Follow @PlanetaryAmy on Twitter.

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Planetary Perspectives

Prof Lena Noack is a planetary scientist in the Department of Earth Sciences at the Freie Universität Berlin. Her research focuses on geodynamics and mineral physics of planetary processes. She is Incoming Chair of the Europlanet Science Congress (EPSC) Executive Committee, Vice-Chair of the Europlanet Diversity Committee, a founding Member of the Europlanet Early Career (EPEC) Network and joint winner of the 2021 Farinella Prize.

How have you reached your current job position?

I started my scientific career in Berlin, my home town, as a doctoral student at the German Aerospace Center. When I learned a few years ago, during my postdoctoral phase at the Royal Observatory of Belgium, that there was a position available for a junior professor at the Freie

Universität Berlin to study planetary processes, it seemed like a perfect match. It was a tough competition, and I am still very happy that the committee decided to hire me.

Just a few months ago I was promoted to a regular university professor, and I am looking forward to continuing to work in a city that combines so many different aspects of planetary sciences. It is an

exciting place to work! Recently a colleague of mine hinted that one of the reasons that they made me an offer four years ago was because of my interest in committee and administrative work.

At that time I was already engaged in two Astrobiology networks (EANA and AbGradE) as well as Europlanet (EPEC and diversity activities), so being involved

in these networks was an important stepping stone for my career!

Who or what are your inspirations?

What drives and motivates me and my research is my scientific curiosity. If there is something that I do not understand, or that is not well-known, I want to learn more, even if I have to work for years to find out about the topic. When I finished university, I thought that the time of learning would be over, but instead I realised that there are so many more exciting things to discover and to learn, especially if you work with different disciplines, or if you work in a rather young field, as is the case for exoplanets. The first confirmed exoplanet detection around a sun-like star happened only about 25 years ago, and the first rocky planets were discovered just when I started my PhD. So there is still lots to do, and I know that my scientific curiosity will probably never be saturated. There is so much more to do and discover!

What have we learned about the interiors of terrestrial planets in our Solar System by studying exoplanets?

One of the most important facts that we have learned about the terrestrial planets in our Solar System is, in my opinion, that they are the exception rather than the rule. Our classical view of how a planetary system should look (rocky planets close to the star, gaseous or icy bodies further out) was shaken-up quite a bit in the last two decades. But what is perhaps more important for me is that we have gained a much deeper understanding of how the interior processes inside a rocky planet influence its surface conditions. We have learned that the habitability of Earth may depend on the fact that

our planet is not a more massive 'super-Earth'. We are also lucky that our star is not much more massive (in which case it would be short-lived) or less massive (in which case it would destroy our atmosphere with solar flares). We seem to be at a sweet spot here, for both planet and star, and it should not be expected that every rocky planet that experiences moderate surface temperatures will evolve into a habitable planet. Of course, for now, many of these predictions come solely from computer models. But the better-able we are to study atmospheres of exoplanets (and the launch of the James Webb Space Telescope will be a big step in this direction), the better we can confirm or adapt our current understanding of planetary interiors.

You've been involved in almost every aspect of the Europlanet Society's activities. How did you first become involved?

In the beginning, I only knew about EPSC, and did not know for some time that Europlanet was behind this great conference. It was at the Europlanet General Assemblies during EPSC that I learned about the research infrastructure and the added value of connecting different institutes across national borders. And since I was living in Brussels, I was soon asked by Europlanet if I would be interested in assisting at meetings that Europlanet organised at the European Commission and the European Parliament. This was a very exciting experience for me, to get in direct contact with such important stakeholders, and to learn about their point of view. And then one thing followed the next, being asked to set up the Early Career Network (which then became EPEC), getting involved in the Diversity Committee, and becoming a member

of the Scientific, Local and Virtual Organising Committees and now the Executive Committee for EPSC.

What main actions would you like to see implemented to increase diversity and widen participation in the planetary community?

In my experience, one of the best approaches to widen participation with respect to any aspect of diversity (gender, age, cultural background, nationality, LGTBQ+, etc) is to create role models. At conferences, this means adding diversity to the committees, convenership, and, as a result, to the solicited speakers. Another avenue, which Europlanet has already followed for a long time, is to offer bursaries to groups that may otherwise not have appropriate funding. This is one of the most important actions to make sure that no participant is excluded due to financial means. What I would very much like to see is hosting a future EPSC in one of the countries represented in the Europlanet Central Hub, where travel budgets are typically more limited than in Western Europe, and which might then result in a more even spread of participants from all parts of Europe. We are actually starting now to look for a potential host for EPSC 2025 - the call will be out soon!

What has most surprised you about how EPEC has developed over the last five years?

I am immensely impressed with how strong EPEC has grown and how continuously it brings together the early career community in planetary sciences in Europe - even during the pandemic. In the beginning, we started with some loose ideas of how EPEC could work, and were completely overrun by the

enthusiasm of so many early career professionals. It took a while to set EPEC up, starting from some first brainstorming ideas with different Europlanet Board members, and acting as a head-hunter to find several representatives of different institutes and networks to become involved. When the first official EPEC activities started in 2017 in Riga, I was actually already hired as professor and was therefore no longer an early-career scientist myself, so it seemed wrong to keep chairing the EPEC activities. We were extremely lucky to immediately find active members for EPEC, and of course Indhu Varatharajan as an excellent Chair of EPEC, who really invested a lot of her time to keep EPEC growing from 2017-2021. Without dedicated people leading EPEC, and specifically the different working groups, the story of this network may have ended shortly after its launch. Instead, it is

becoming larger every year, and with the two new Co-chairs, Erica Luzzi and Ines Belgacem, it will have a bright future for many years to come.

What are you most looking forward to in your new role as Chair of EPSC?

Helping to organise EPSC in the past at different levels has been a rewarding challenge, and it is exciting to change now my role to Incoming Chair of EPSC. Apart from finding a great venue for EPSC 2025, I look forward to strengthening the collaboration with DPS in the joint meeting in 2023, and I am really excited that we will finally have the chance to visit both Grenada and Helsinki in 2022 and 2024 respectively and that we did not miss hosting an EPSC at these great locations due to the pandemic. EPSC has been constantly growing over the past years, but I specifically look

forward to contributing to making it as inclusive and diverse as possible, to truly represent the planetary sciences community within the whole of Europe. At the same time, I think it is important to keep the ‘family feeling’ of the Europlanet Society and EPEC at EPSC, so that participants have a rewarding experience when attending our annual conference. With approximately 1000 participants each year, we are now at a comfortable size for EPSC, where we can all experience the newest scientific discoveries and breakthroughs, but still have the chance to meet and exchange with our colleagues without feeling lost, something we definitely want to keep for the future, especially after the cut-backs during the pandemic! 🌍



Lena Noack presents at a Dinner Debate organised by Europlanet in the European Parliament, Brussels, in 2018.



The Planetary Spectroscopy Laboratory at DLR.

Finding New Ways of Envisioning Venus

Jörn Helbert (DLR) looks forward to three new missions to investigate Earth's mysterious twin.

Venus is our next-door planet. It's almost identical in size to Earth and yet we know so little about it. It has been visited by the European Space Agency (ESA) Venus Express mission from 2006-2014 and the Japanese mission, Akatsuki, is still in orbit there. But otherwise, it has been really neglected in terms of missions.

This has always been puzzling to me, because I have a long list of things

that we don't know about Venus.

We have been fighting to get missions to Venus for a really long time – I've been involved with the VERITAS mission concept for 12-13 years and in iterations of EnVision for a similar length of time. It's really exciting to have three missions now selected. The new interest in Venus has partly come through discussions with the exoplanet community about why their models always lean towards

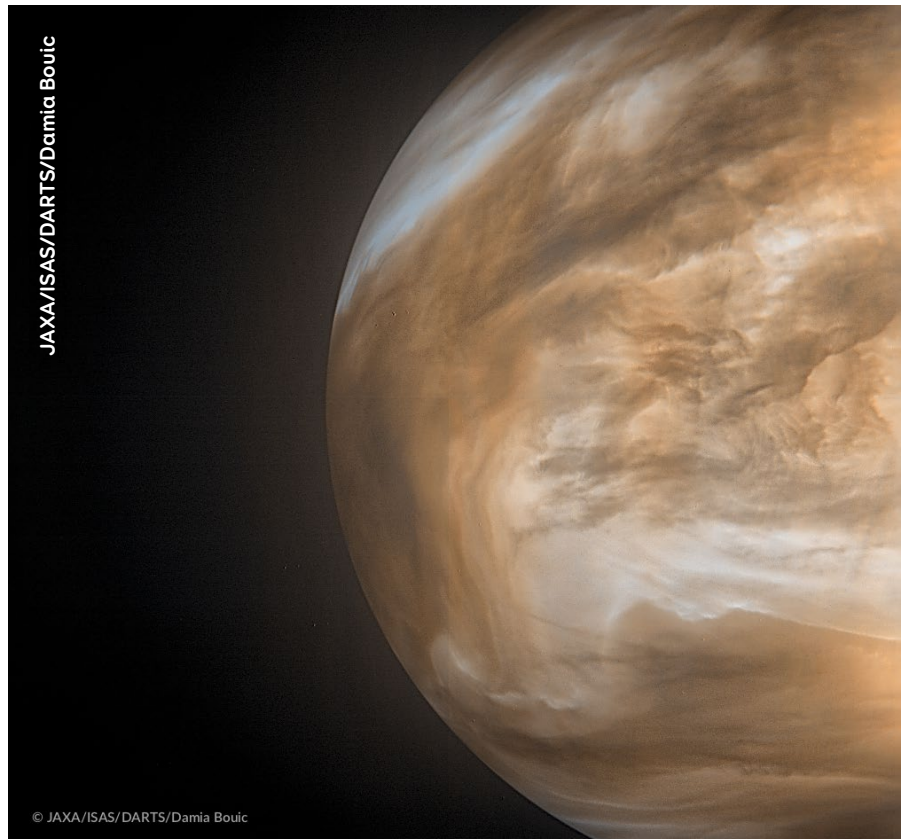
Earth-like planets. They've asked for fundamental parameters for Venus to improve their models, like the composition, or what's on the surface of Venus, and we just don't have the answers. So people have finally realised that we need to find out more about this planet that has evolved in such a different way from the Earth.

Venus Express was mainly an atmospheric mission. When our team

at DLR first proposed that we could use a really small wavelength range around one micron to see the surface, I had the impression that no one really believed much would come out of it. In the end we were very successful and made some real advances for surface science at Venus, to a degree that people were not expecting. Through Venus Express, we demonstrated that we could measure the surface composition of Venus from orbit in a way that does not require landers, and I think this helped us with the selections earlier this year by NASA of the VERITAS mission and by ESA of EnVision (due for launch in 2028 and 2031 respectively).

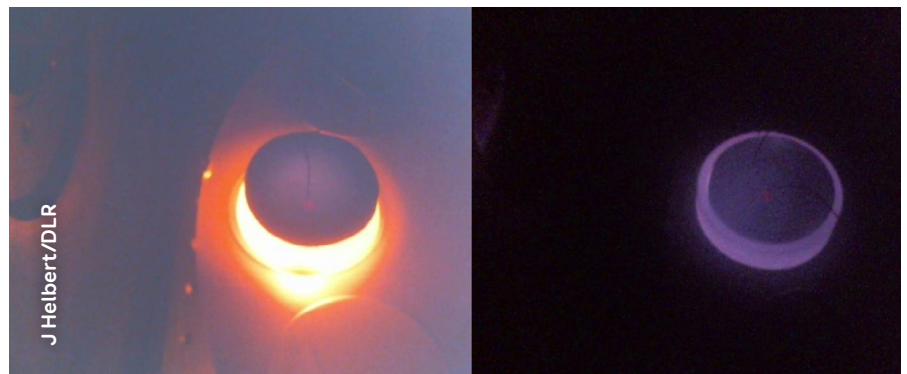
However, the instruments on Venus Express were never really designed for the surface observations that we made, so we had many limitations. We could show there were variations on the surface - this region looks different from that region - and that there has been volcanism in the recent geological past of Venus. But we couldn't actually be sure what we were looking at. The problem was that we were looking on the night side of the planet from orbit to see the infrared glow from the surface through the clouds. Even though the surface is really hot - 450 degrees - it's a very tiny signal to detect. And because it was a strange, new technique, there were no laboratory measurements to help us interpret the data.

So, triggered by Venus Express, we set up a laboratory in Berlin that allowed us to do measurements in the exact range of one micron. Combining these experimental results with Venus Express data, we were able to show that it's possible to learn a lot about the surface of Venus from orbit. That allowed us to say that now is the time to go back there with this new technology, and to propose instruments that are now both on EnVision and VERITAS.



JAXA/ISAS/DARTS/Damia Bouic

© JAXA/ISAS/DARTS/Damia Bouic



J Helbert/DLR

Top: The night side of Venus in thermal infrared. Bottom: Inside the PSL Venus chamber at temperatures of 480°C, innovative ceramic enclosures (right) are needed block out background radiation that would otherwise drown out the spectral signals from samples at high temperatures (left).

The Planetary Spectroscopy Laboratory (PSL) at DLR in Berlin can be accessed through the Europlanet 2024 Research Infrastructure (RI) Transnational Access Programme. PSL provides reflection, transmission and emission spectroscopy of samples from ultraviolet to far infrared. Simulation chambers are available for emissivity measurements: from 0.7 to 200µm under vacuum for in a temperature range from 320-900 Kelvin, or under dry air from 290-420 Kelvin.

The development of the PSL Venus Chamber received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654208 (Europlanet 2020 RI)



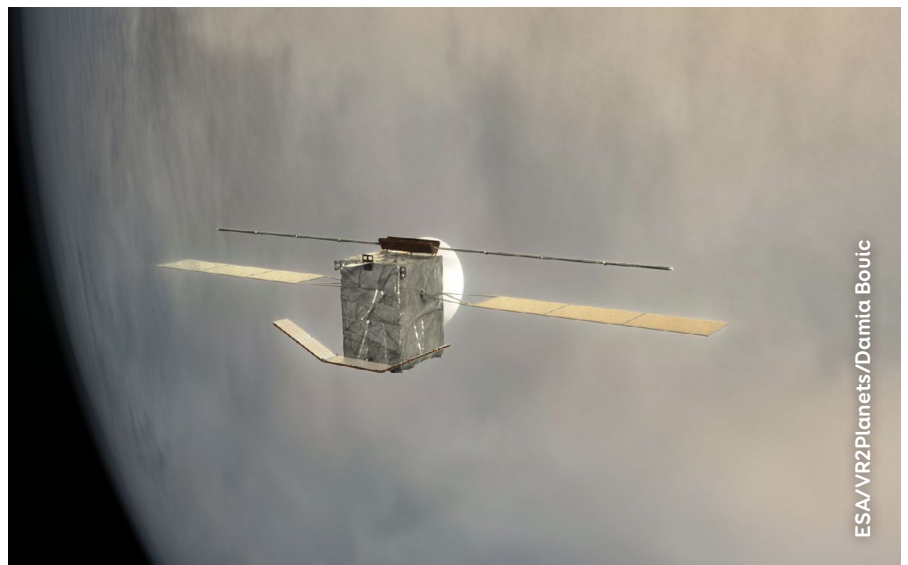
J Helbert/DLR

Above: Samples for testing in the PSL Venus chamber.

Right: Artist impression of ESA's EnVision mission at Venus.

We have already built a prototype of the instrument that we want to fly, to show that it works in principle. We are now in the detailed planning phase to get from this prototype to something that will fly to Venus on the spacecraft, with all the testing and steps that are involved to do that.

It's particularly interesting, because we are doing this for two missions at the same time. We have the experience of working with teams from NASA and from ESA, which both have slightly different approaches. Because EnVision, VERITAS and the DaVinci+ Venus decent probe (due for launch in 2029) have all now been selected, our teams are not in competition anymore. So we can come together and think how we can collaborate to help each other:



ESA/VR2Planets/Damita Bouic

VERITAS will go first, and VERITAS data will help make EnVision better.

On the other hand, it's been challenging to get through the study phase of a mission with the Covid-19 situation. Everyone has been working from home and could not travel. It's a strange situation working with people I've only seen on screen, and never actually met in person. Hopefully, this

will change and we can soon meet face-to-face

EnVision: <https://bit.ly/EnVisionMission>

VERITAS: <https://go.nasa.gov/3lPhy2J>

Connecting Communities Across the Industry-Academic Divide

Marcell Tessenyi (Blue Skies Space Ltd) and Jeronimo Bernard-Salas (ACRI-ST) report on a survey and new database to support industry-academia collaborations.

Synergistic relationships between academic and industrial communities can have enormous benefits, from enhancing the impact of projects by broadening the scope of innovation to opening up new opportunities in funding and career development. However, for many academics, knowing where to start when approaching industry engagement can be challenging.

The Europlanet Industry and Policy Teams sent out a survey in August 2021 to find out about the experiences and priorities of the planetary community in working with companies outside academia. Early results show an interest from the respondents in becoming involved in collaborations, but a perceived lack of opportunities for engagement and limited awareness on industry capabilities relevant to research.

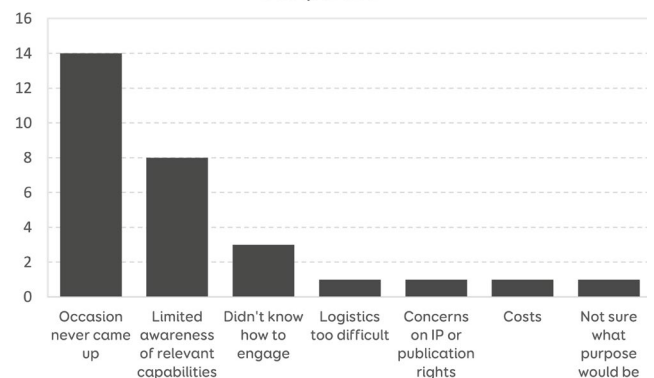
The Industry Team, supported by Industry Officers across the 10 Europlanet Regional Hubs, is tasked with helping the Europlanet Society to foster industry-academic interactions through a set of networking events and online support tools, which include a large, pan-European industry database. With the help of the planetary community across Europe, a first version of the database is currently being completed.

The online database is designed to help planetary scientists find companies that could be relevant to their research areas, with filters allowing the selection of companies across ESA's Technology Domains and per country. A preliminary version will be rolled out to a group of beta-testers in early 2022, with the release of the full database to the whole Europlanet community planned for the summer of 2022.

The database will also be of value to companies that are seeking visibility among the planetary science



Reasons behind lack of experience in working with companies



Example of early results from the Europlanet Industry Survey

community of academics, either for specialised areas of expertise (partnerships, consultancies) or for potential recruitment opportunities.

The Europlanet Society would like to invite academics, researchers and companies to help expand the database. Please contact industry@europlanet-society.org for additional information or to provide details of companies that might be relevant for inclusion. <https://bit.ly/EuroplanetIndustry>



European Union

Europe and the New Space Race

Following the Industry-Policy Session at EPSC2021, Livia Giacomini (INAF) spoke to Niklas Nienass, a Member of the European Parliament (MEP) for Germany in the Group of the Greens/European Free Alliance, about his vision for space science in Europe.



What is your personal vision of the European space industry, now and in the future?

Doing the economy the European way — for me that means an economy that is sustainable, fair and innovative. Furthermore, our strength is competitive smaller players, who are world leaders in very specialised segments. The space industry is one of the sectors where we have several big players and more and more smaller players. It is important to enable new

players to enter the market and to lower entry barriers. A more diversified set of players, particularly smaller ones, is the key for the future of the European space industry.

What can politics do to regulate space? Both on a local basis for the 27 nations but also at the European scale?

We need to push for a democratic international space law that is able to guarantee that the Article One and Two of the Outer Space

Treaty will be a reality for future generations. We need a space that is open for all humankind — and free of weapons. However, the first step to achieving a global space law is unity on a European level. We can only have global influence if we speak together. And the idea of a unified law will be much more credible if already proven in Europe.

So instead of 27 different national laws, we need one common European space law. We must and can prove that space knows no

borders — but nevertheless is not a legal vacuum!

Can space be one of the sectors to invest in to overcome the pandemic crisis?

I think public investments in infrastructure and technology are definitely the way to go. And the space sector offers various possibilities, where public investments can generate major gains for citizens. With Horizon Europe, we have almost 100 billion Euros to spend on research in the next seven years. The question is: how do we make politicians understand the potential of space research and space industries? We have to show politicians how important space can be and to see a shift of perspective, so that people understand the space race that we are in and the potential that lies in space, especially New Space, in the future.

What can the scientific and academic community do to help the development of this sector?

Our society is dependent on space and a functioning satellite network. We use these technologies every day without thinking about it. I think that if awareness grows, a lot will be gained. Where does the GPS signal,

the weather data, etc. come from? We should talk about it much more. We have to make people understand that this research is something that is ground-breaking, for humanity and for the way our society lives and functions.

How would you invest in education?

Unfortunately, way too often, educational success is based upon the wealth of the parents. We need to eliminate this throughout Europe and ensure that every child has the possibility to be interested and excited about research. We need all smart minds, and not just rich smart minds!

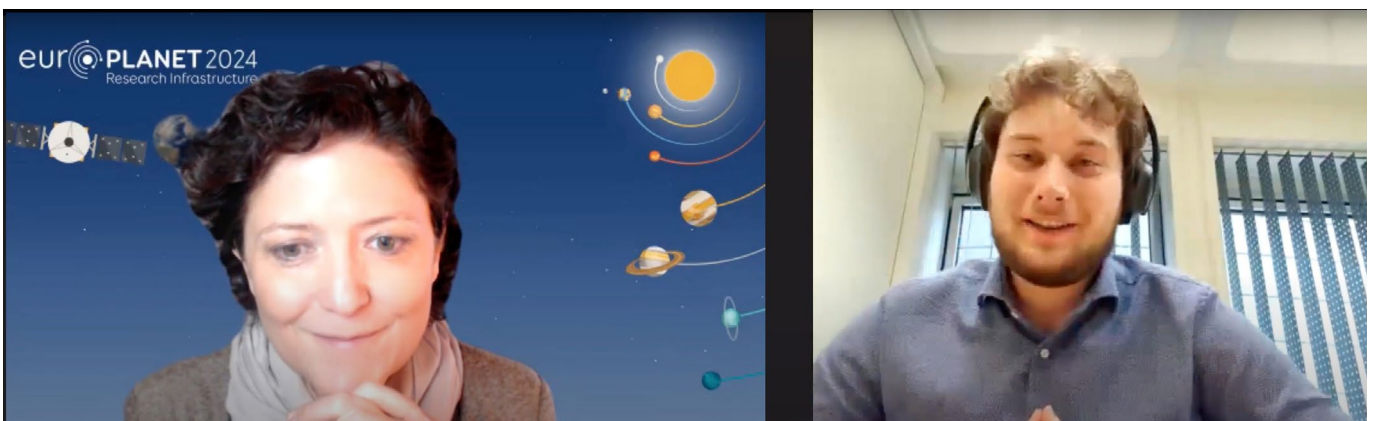
For space research, and especially planetary science, I envision a European university for space. What the International Space University in Strasbourg does is great. However, I envision a flagship project that combines all fields concerned with space and that really shows people this is the heart of European space sciences. I think, we can really combine questions and bring people together who think about space and space exploration in different terms and exchange ideas with each other and prosper. It could be the place, not just in Europe but in the world to accelerate the sciences behind

space and space exploration. I think that would be a wise investment into education. This could bring young people close to the ideas of space to show them it is not a question of science fiction but really is science, something to work with and worth the investment of time and money.

How is Europe fostering curiosity driven science?

Curiosity is only possible if the outcome is uncertain. However, curiosity is not in the politicians' mindsets, because they always want to see timely results delivered. The resulting bureaucracy is not compatible with all the realities of how science works. We need an awareness that scientists deal with uncertainties — that is their daily bread. Basic research is often long-winded. Practical benefits often only emerge late and, if so, then perhaps only by chance. Curiosity needs freedom. Curiosity needs time. Curiosity is only possible with planning security and adequate funding. Our universities should be the place for such a curiosity.🌐

Watch the full interview online: <https://bit.ly/NienassInterview>



Livia Giacomini, on behalf of Europlanet, interviews Niklas Nienass MEP.

FANTASTIC ACCESS

As we emerge from nearly two years of restricted travel, Gareth Davies (Vrije Universiteit Amsterdam) gives an update on Europlanet's Transnational Access programme, which provides free access to facilities and field sites around the world.

Rio Tinto is one of the suite of planetary field analogue sites offered by Europlanet 2024 Research Infrastructure. It is one of the best characterised extreme habitats on Earth due to decades spent in characterising the local geology, hydrology and biology.

Transnational Access (TA) is a cornerstone of all research infrastructure projects funded by the European Commission. By enabling researchers from one country to visit facilities in another, with all travel and service costs covered, the Commission aims to maximise the efficiency and quality of science produced, simultaneously bridging the gap between highly developed and lesser-developed regions, as well as supporting international collaboration and the training of the next generation of researchers.

Europlanet’s TA programme dates back to 2009, initially offering free access to five planetary analogue field sites – places on Earth that resemble environments found on other planetary bodies – and eleven state-of-the-art laboratories. The programme has evolved and expanded over the past 13 years to include seven field sites and over 40 laboratories spread across four continents, providing a rich resource for planetary scientists and engineers to draw on, and supporting research on topics as diverse as the interior of Venus and the atmospheres of icy moons.

New Solutions for a Changing World

The Covid-19 pandemic has had a negative impact on scientific research in many ways over the past two years, and Europlanet’s TA programme has been no exception. Europlanet’s most ambitious project to date, the Europlanet 2024 Research Infrastructure (RI), received €10 million funding from the European Commission with the aim of supporting over 200 TA visits between 2020 and 2024. Almost 120 TA visits have been approved since the project launched in February last year but, to date (late 2021), only about 20 TA visits have been fully

completed. The good news is that many of the 40-plus facilities have set up mechanisms to conduct virtual visits, and more than 10 TA visits are now planned per month. However, it is likely that almost another year will be needed to catch up on the backlog. This is because most of the facilities involved in the TA programme have many commitments in addition to TA visits and these will, in some cases, need to take priority. The next full TA call for applications has, therefore, been postponed and is currently scheduled for late 2022. Nonetheless, Europlanet 2024 RI’s TA management team recognises that research can move quickly and many members of our community work to fixed deadlines. In particular, younger scientists may require a research visit to complete their project and so could suffer if their contracts come to an end before the next opportunity to apply for a TA call. This has been the driving force for us to introduce a ‘Fast Track TA’ programme over the next year, until the normal TA calls are able to resume.

The Fast Track TA application procedure remains similar to past TA calls and the peer-review process, managed by the European Science

Foundation, will continue to find external reviewers with the required expertise to assess anonymous proposals. Not all facilities are included in the Fast Track TA calls due to high demand and the existing backlogs but, encouragingly, most field sites are open for applications. These include new planetary analogues in the high Andes that offer dry cold environments in the Puna region, and the much wetter regions in Patagonia and Tierra del Fuego. All Fast Track TA applications will have strict requirements for a detailed implementation plan, to be drawn up in collaboration with the proposed facility host, to facilitate the completion of TA visits in 2022.

The other main innovation since the onset of the pandemic has been the development of virtual TA visits. While there are clear disadvantages to virtual visits, in that training opportunities, personal relationships, collaborations and synergies cannot be as fully developed, in many cases virtual visits are proving highly successful. The benefits include reducing the amount of travel and carbon footprints, as well as opening up access to members of our community that cannot travel for



The Carbon-14 Dating AMS Laboratory at Isotoptech Zrt, Hungary, can be accessed through the Europlanet 2024 RI programme.



Lonneke Roelofs prepares her experiment in the Mars Chamber

physical reasons or who have caring responsibilities. The first Fast Track TA call closed on 3 November 2021, and the 27 eligible applications submitted are currently under review. The next Fast Track call is scheduled to open in late February 2022.

Despite all the challenges over the past two years, the diverse science that is supported by Europlanet's TA programme has continued to result in high-impact publications and conference presentations, and to spark new collaborations (page 40).

Here, we find out about the experiences of some of the researchers that have taken part in recent physical or virtual visits to laboratories and field sites through the Europlanet 2024 RI TA programme.

Going with the Flow in Mars Conditions

Lonneke Roelofs (Utrecht University, Netherlands) visited the Mars

Chamber at the Open University, UK, from 29 September - 6 October 2021.

Like similar systems on Earth, martian gullies are found on steep slopes, with branched 'alcoves' at the top funneling into narrow channels that lead to fan-shaped deltas at the base. Suggestions for the formation of these features include the action of liquid water and brines, the effects of sublimating carbon dioxide ice, or a combination of these processes.

Recent activity on Mars, and detections of new flow deposits, have shifted the leading hypothesis from water-based flows to carbon dioxide-driven flows, as it is hard to reconcile present activity with the low availability of atmospheric water under today's martian conditions. However, direct observations of flows driven by sublimating carbon dioxide on the surface of Mars are nonexistent, and our knowledge of carbon dioxide-driven flows under martian conditions remains limited.

With our TA research visit to the Mars Chamber at the Open University in the UK, we aimed to start deciphering how sublimating carbon dioxide could affect mass-flow dynamics and deposits in martian gully systems. We wanted to specify to what degree and in what quantities the sublimation of carbon dioxide ice could induce fluid mass flows in present-day martian gullies.

During the first two days of our visit, we connected and inserted a flume set-up, built at Utrecht University, into the Mars Chamber. After a few days of fixing some electrical and mechanical problems, we did something no one else has ever done before: we created the first carbon dioxide-driven granular flow under martian atmospheric conditions.

During the rest of our visit, we performed 126 experiments, with varying ratios of carbon dioxide to sediment, at varying slope angles and with different types of sediment. With the results of all these

variations, we will be able to better understand carbon dioxide-driven flows, constrain the environments and locations where they can occur on Mars and, ultimately, better understand the processes that shape the surface of Mars today.

20-EPN2-023 - FLUME-ET: Fluidisation of mass flows by metastable volatiles on extra-terrestrial bodies. Scientific summary: <https://bit.ly/20-EPN2-023>

In the Land of the Dust Devils

Daniel Toledo and Victor Apestigue (Instituto Nacional de Técnica Aeroespacial (INTA), Spain), visited the Makgadikgadi Salt Pans in Botswana from 29 September - 6 October 2021 to study how dust is lifted into the air.



Team photo during the field campaign at the Makgadikgadi Salt Pans, Botswana.

For our investigation, we used the spare units of the Radiation and Dust Sensor (RDS) from the NASA Mars 2020 mission and the Sun Irradiance Sensor (SIS) from the ExoMars 2022 mission, which are designed to study dust carried in the atmosphere of Mars by measuring how sunlight is scattered by the dust particles.

As well as giving information about the properties of airborne dust, these instruments are also sensitive to the presence of dust devils - swirling columns of sand and dust that are a common feature of desert areas on Mars and on Earth. RDS and SIS can detect the changes over time in the sky-brightness produced by a dust devil, and this offers a unique opportunity for monitoring and studying such events during the Mars 2020 and ExoMars 2022 missions. However, to be able to characterise and interpret dust devil observations on Mars, we first need to understand how dust devils affect SIS and RDS signals by thoroughly testing and evaluating the instruments in Mars-like conditions on Earth.

To achieve this goal, we conducted a TA field campaign in the southern part of the Makgadikgadi Salt Pans, in the Pan near Mopipi town. This location is characterised by frequent dust devils and conditions

that promote the lifting of high levels of aerosols (dust and particles) into the atmosphere. Each day of the campaign, we set up RDS and SIS at two different locations from sunrise to sunset, separated by about 25m, along with two cameras to record panoramic videos during the campaign period, and a weather station to perform measurements of pressure, wind direction and intensity, temperature and relative humidity. We also set up a radiometer to measure how much light was absorbed by the dust at different wavelengths.

The objective of having the two main instruments at two different locations was to observe the dust lifting events from different perspectives. During the campaign, we observed multiple dust devils and at least ten dust lifting events produced by wind gusts. For each dust lifting event we recorded the dust devil distance, size, duration and direction by marking out concentric circles with radii of 25, 50, 75, 100, 125 and 150m on the ground. This information, along with the videos from the cameras, helped us to establish the amount of dust lifted by the dust devil, as well as the distances from the instruments. The data collected for each event was key to establish the RDS and



The mixture of sediment and carbon dioxide ice flows down the slope under martian conditions in the chamber.

SIS capabilities for dust lifting characterisation on Mars.

The first two days of the campaign were characterised by high dust-loading conditions and frequent formations of dust lifting events produced by dust devils or wind gusts.

During these two days, each dust lifting event registered by the cameras was also detected by RDS and SIS, with signals showing a sharp peak at the time when the event passed within the sensors' field of view. Preliminary analysis suggests that we can infer from RDS and SIS signals the difference between dust lifting events produced by dust devils and those produced by wind gusts - an important result for the observations on Mars.

The third day of the campaign had to be cancelled due to rain. This resulted in lower dust-loading conditions in the following days, and thus the amount of dust lifted by vortices or wind gusts was smaller compared to the first two days.

On our return to BIUST in Palapye on 6 October, we held a seminar for staff and students to share our experiences.

Overall, the campaign was a complete success. Our observations have demonstrated the capability of the RDS and SIS sensors to detect and characterise dust devils on Mars, and the rainy episode offered us the chance to study dust lifting events in different aerosol loading conditions. The analysis of the signals, along

with the information acquired by the other instruments, will allow us to quantitatively establish the sensors' limits of detection, and support interpretation of the data received from Mars.

20-EPN2-065 - Characterising dust lifting events using the ground-based Mars 2020 RDS and ExoMars 2022 SIS radiometers. Scientific summary: <https://bit.ly/20-EPN2-065>

From Greenland to Ganymede

Costanza Rossi (INAF - Astronomical Observatory of Padova, Italy) and Paola Cianfarra (Università degli Studi di Genova) visited the Kangerlussuaq site in Greenland.

From 19-29 July, together with two other research groups, we took part in a field research trip



F Franchi

Characterising dust lifting events at the Makgadikgadi Salt Pans.



C Rossi

Paola Cianfarra (left) and Costanza Rossi (right) at the glaciers of Kangerlussuaq in Greenland.

in the Kangerlussuaq area of the Greenland Ice Sheet. Our group of two geologists was looking for glacial deformation structures (such as fractures, faults and crevasses) that we could relate to deformation structures observed on icy moons of giant planets, such as Ganymede, Europa or Enceladus.

Most of these icy moons show widespread tectonic deformation, which is revealed through kilometric-scale linear or curving fractures and faults that shape the moons' surfaces. These structures provide insights into crustal evolution and underlying oceans, which help us to unravel the tectonic activity of these icy bodies.

Fractures also represent a way of transporting material between the surface and the liquid layer beneath, and are preferential pathways for fluids to escape, as we observe in the 'Tiger Stripe' plumes at Enceladus's south pole. Detection of fractures and faults is, therefore, important for advancing our knowledge of icy satellite geology. However, analysis

of observations from remote-sensing planetary missions, like Cassini or JUICE, can be supported by making field studies of analogue sites on Earth that share many of the properties of icy moons.

The Greenland Ice Sheet, which we visited for our project, UPSIDES, is one of the most interesting terrestrial analogues for icy moons. Glaciers represent active bodies that are driven by gravity flows and deform due to their own weight. They present specific and predictable deformation patterns, depending on the area of the glacier, because of the stress that is exerted on them.

UPSIDES focused on the identification, detection and measurement of the deformation structures in the Isunguata Sermia and Russell Glaciers in the western margin of the Greenland Ice Sheet. Our aim was to relate our studies of local-scale structures and outcrops with regional-scale and remote analysis using data from satellites. We carried out a campaign to

measure in-situ the structures and their attributes, such as their horizontal and vertical displacement, orientation, height, spacing, distribution and crosscutting relationships. We then compared the collected outcrop data with images from remote-sensing satellites to understand the consistency of measurements made at the two different scales of investigation.

The fieldwork is important for constraining the interpretation of the tectonics of remote and unreachable surfaces such as those of the icy moons. The comparison of local-scale and regional-scale data on outcrops at the Isunguata Sermia and Russell analogues will allow us to better understand the tectonics and give us insights into deformation structures on icy moons observed by past and future missions.

20-EPN-089: UPSIDES - Unravelling icy Planetary Surfaces: Insights on their tectonic DEformation from field Survey. Scientific summary: <https://bit.ly/20-EPN-089>




Denice Borsten and Jochem Sikkes (top) carry out remote SIMS measurements supervised by Keewook Yi (bottom).

Virtual Access from Europe to Asia

Denice Borsten and Jochem Sikkes are part of a group of Master's students from the Vrije Universiteit Amsterdam (VUA) who study the changing geological and environmental conditions across the Great Oxidation Event that occurred on Earth ~2.4

Billion years ago. From late September to November 2021, they carried out remote Secondary Ionisation Mass Spectrometry (SIMS) measurements under the guidance of Keewook Yi at the Korea Basic Science Institute (KIST) for projects supervised by Fulvio Franchi from BIUST Botswana & Gareth Davies (VUA).

The Great Oxidation Event saw a major rise in levels of oxygen in the early Earth's atmosphere and was a pivotal event that ultimately led to the planet becoming habitable. Our specific project is to evaluate the tectono-magmatic evolution of the regional geology in Botswana during the Archaean to mid-Paleoproterozoic eons (~3.2-2.0 billion years ago). Using uranium-lead radiometric dating and lutetium-hafnium isotope analysis we aim to create better constraints of the geological timeframe and provide insights into the formation of the Kanye sedimentary basin in eastern Botswana, which contains some of the best-preserved rocks from this key period in the Earth's history. In autumn 2021, we had the

opportunity to remotely-access the Sensitive High Resolution Ion Microprobe (SHRIMP IIe/MC) mass spectrometer in South Korea on several occasions, to date uranium-lead ratios in zircons retrieved from Botswana. It was very exciting for us, as Master's students, to use these cutting-edge techniques to analyse our samples and to collaborate with the team of Dr Keewook Yi of the Korean Basic Science Institute (KBSI). It has been a wonderful learning experience and we are particularly looking forward to the prospect of preparing a joint publication. 

Find out more

Information on all the Europlanet TA facilities, case studies, and resources to help plan applications and visits can be found at on the Europlanet website: <https://bit.ly/europlanet2024ri-ta>.



A moulin (vertical shaft caused by meltwater) on the Russell Glacier, measured during the UPSIDES field campaign at Kangerlussuaq, Greenland



J O'Donoghue

James O'Donoghue in Hawaii

The Animated Universe of James O'Donoghue

Federica Duras and Livia Giacomini (INAF) talk to the winner of the Europlanet Prize 2021 about his motivations for creating animations to communicate challenging scientific concepts and his advice on a career in planetary science.

Dr James O'Donoghue, winner of this year's Europlanet Prize for Public Engagement, is proof that it's possible to communicate science in a simple and intriguing way.

An astronomer at JAXA, Japan, James uses ground-based infrared telescopes to study Jupiter, Saturn and Uranus. His goal is simple: to paint an accurate picture of the Solar System in people's minds and, at the same time, highlight its features in an

intuitive way. His trademark is short and content-rich animations on his social media networks, which now have more than 200 million views.

His work is used around the world by teachers, in outreach events, for press releases, and in space mission descriptions. James spoke to us about his motivations and career:

Blending science with design

I'm lucky because the Universe is a cool topic. My area of expertise is in

observing the uppermost parts of the atmospheres of Jupiter and Saturn.

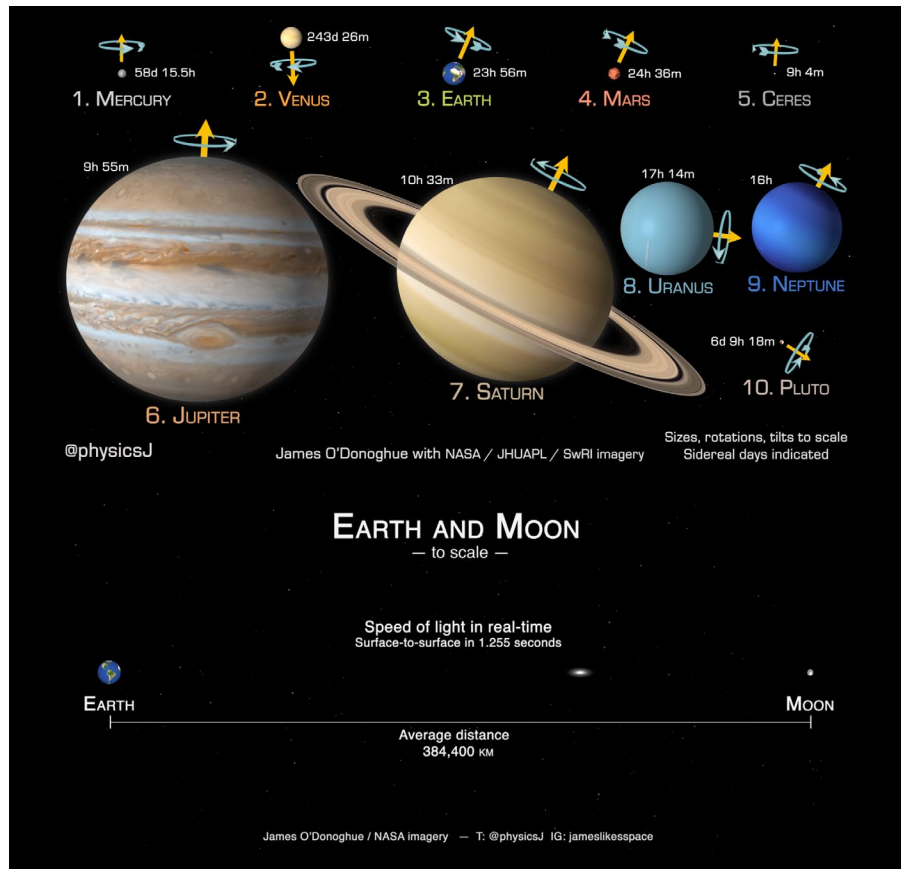
After Earth, I'd have to say my favourite planet is either one of the ice giants, Uranus or Neptune. It used to be Saturn, but I changed my mind recently, as these freezing cold giants have so many unknowns. That's mostly because they've only ever had one fly-by of a spacecraft, in the 1980s. You could say that I'm somewhat obsessed by their mysteriousness! Cassini is my

favourite mission: it was a real tank of a spacecraft that orbited Saturn for 13 years and made countless discoveries.

My communication is mainly through the medium of animations or images. I think it's the fastest way to get the information across and the most fun! I also enjoy making animations. I feel that it's finally a way for me to have a creative outlet, especially as I was never good at more traditional forms of art. Making these animations allows me to blend science with design and share my personal view of space with people directly. In other words, I often have an idea about how some space phenomenon works in my head, and while I could explain it with words, I much prefer to show people a picture. When some of my first videos went viral, it was a bit of a shock to my system. As an introvert, as it felt like millions of people were getting a direct line into my thoughts through the animation. After getting over that, however, I started to really enjoy that connection with people. I've made almost 100 new videos since then. My motivations began, and continue, with the feedback received from the public and educators who have continued to be fascinated and surprised by how the universe works. Without them I might have stopped or slowed down early on.

Communicating Challenging Concepts

My favourite animation is on light speed, as it is something I have wanted to get across for a long time. Since I was a teenager I've realised the vast distances in space take a long time to cross, even at light-speed, and it fills me with horror to think about how distant we are from even the nearest planets. It would take at least several thousand years to get to the nearest star with our fastest spacecraft, and that's just



Stills from animations by James O'Donoghue on the relative rotations of planets in our Solar System (top) and the speed of light in real time (bottom).

over 4 light-years away! The entire galaxy is 100,000 light-years across and the nearest large galaxy is 2.5 million light-years away. These distances are unthinkable vast, even travelling at light speed, and it's been my pleasure to share this nightmare with tens-of-millions of people. I would like to explain general and special relativity, but I need time to investigate how best to teach it visually.

A Career in Space Science

The main thing I would say is that space science will keep you busy by growing dozens of different skills simultaneously. It's not just about observing with a telescope or receiving data from a distant spacecraft, the job entails a large amount of computer programming and writing. You will not get bored and will never run out of things to do.

You can certainly find the things you are best at and become the world's expert in it quite quickly, since there are usually very few people working in each area. There are only about ten thousand astronomers and space scientists out there and we have an entire universe to cover. To speak frankly and honestly, it is a tough job in terms of career security because most of the time you will be operating on a 3-year contract approximately until getting a permanent job.

My dream job is one which combines research and outreach, with a bit of teaching. Right now, my outreach efforts are mostly done in my free time and, as my free time is getting less every year, I would like to do it as part of my job in a more serious way.🙏

<https://bit.ly/ODonoghueYouTube>



Laura Sánchez-García of the Centro de Astrobiología (INTA-CSIC) starts ice drilling at the Kangerlussuaq Planetary Analogue Field Site in Greenland during a Transnational Access visit in July 2021.

Evaluating the Impact of Europlanet 2024 RI

Project Evaluator, Jennifer DeWitt, and Communications Manager, Anita Heward, report on outcomes of the first review of Europlanet's flagship research infrastructure.


 In the cusp of the pandemic, over two days in February 2020, 69 members of the planetary community met in the historic town of Windsor, UK, for the kick-off of the Europlanet 2024 Research Infrastructure (RI) project. Largely unaware of the global disruption and challenges that were to come, we discussed our plans for the project and the outcomes that we hoped we would achieve.

An important part of the conversation was how we could measure success. Europlanet 2024 RI is the third in a series of projects to provide access to research facilities and field sites, virtual services, tools and networking, in support of the planetary community. To sustain these programmes beyond July 2024, when the current €10 million grant from the European Commission's Horizon 2020 programme finishes, we will need to be able to show the impact that we have achieved to date, demonstrate that we have a wide-reaching user-base, and make a solid case for future funding.

Building on the consultations in Windsor, we put in place an evaluation framework through which we could examine the extent to which the project's various activities reach their intended goals, and understand what causes barriers to their success. Our framework is aligned with the Organisation for Economic Co-operation and Development (OECD) strategic objectives for assessing research infrastructures, which include a range of core indicators for scientific, education, training and societal impacts.¹ The framework also incorporates categories of information requested by the European Commission's reporting portal.²

The project management and activity coordination teams identified metrics and indicators of impact, such as publications and conference



Raman spectroscopy training course by Dr Frédéric Foucher (CNRS, Orléans) funded through a Europlanet 2024 RI expert exchange visit to the University of Bologna.

presentations, new collaborations, numbers of users or participants in workshops and training sessions, and media coverage. We also defined the user groups that we wanted to engage, such as researchers, industry, policy makers, early careers and under-represented communities.

Through the Europlanet website and online tools, we set up a series of forms and databases to track this information on a regular basis, and designed feedback surveys for users and visitors to facilities to provide input on their experiences. To help understand the experience of TA visits in more depth, we included questions in the feedback forms that ask respondents if they would be willing to be contacted for a short interview to assist with evaluation.

On 4 November 2021, the European Commission held its first interim review of the Europlanet 2024 RI project and we presented the progress made to date. Many of the activities planned in Windsor have been delayed or implemented in a radically different way. However, despite all the challenges and restrictions brought by the pandemic on a personal, professional and societal level, the

project evaluation shows some early signs of significant impact.

Out of 171 Transnational Access (TA) applications received to visit laboratories and field sites, 117 have been approved for funding and 18 teams of researchers have visited facilities and submitted their reports. All seven of the field trips and four of the lab visits involved people travelling to the sites, with the remainder taking place as virtual visits (including one hybrid of in-person and virtual participation). While the virtual trips have been innovations in response to travel restrictions from the pandemic (page 30), feedback from both in-person and online participants has reflected very positive experiences.

Evaluation from the visitors highlights that the trips are extremely productive scientifically. Three quarters of visitors are considering new scientific activities that they would not have envisaged without Europlanet support. Many are planning future collaborations with the host facility, and are also planning outreach activities connected with their visit. While delays due to the pandemic mean that TA visits have only started

relatively recently, nearly 30 publications are expected from the visits that have taken place to date. One conference paper has been presented so far, with nearly 40 anticipated in the coming years.

Several of the TA facilities will be upgraded or extended through Europlanet 2024 RI funding, and all works will be complete by the end of 2022, in time for the next full call for TA applications. The new Ice Chamber for Astrophysics-Astrochemistry (ICA) at the ATOMKI Institute for Nuclear Research in Debrecen, Hungary, has already hosted four TA visits, and has been featured in a review paper on sulfur ice astrochemistry.³ Collaborations that originated in TA visits have also led to research beyond planetary science, e.g. art conservators have used facilities at the Vrije Universiteit Amsterdam to identify the geological origins of pigments in Vermeer’s Girl with a Pearl Earring.⁴ Wider society has been engaged with the TAs through social media and press coverage of visits and emerging results, and through a set of teaching resources linking the planetary field sites to core topics in schools’ curricula.⁵

Overall, the visits are enabling impacts, particularly on a scientific basis, that would simply not be possible without access to the Europlanet 2024 RI’s facilities and expertise. Going forward, the inclusion of additional facilities in China and Korea in the TA programme promises impact (scientific and otherwise) at an even broader global scale.

Examples of impact are also emerging from Europlanet 2024 RI’s suite of four Virtual Access (VA) services.⁶ The VESPA virtual observatory for planetary data has been in development since 2015.

At the start of the Europlanet 2024 RI project, 52 planetary and heliophysical data services were

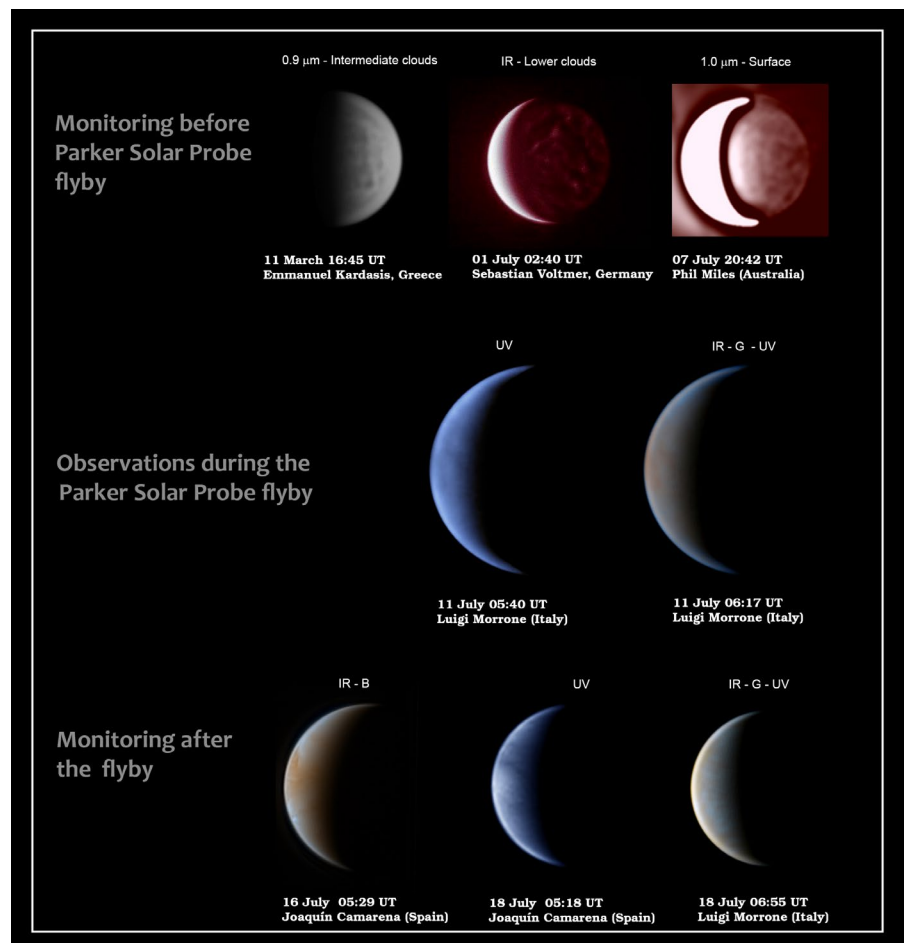
installed in VESPA from 18 different institutes worldwide. The European Space Agency (ESA) has implemented EPN-TAP, a protocol to describe and access data, on the Planetary Science Archive (PSA), which now includes over 20 million files from 30 years of space missions in Europe.

Since February 2020, VESPA has built closer links with space agencies, through representation in the International Planetary Data Alliance (IPDA), participation in the NASA Planetary Data Ecosystem independent review board, and through additional projects with ESA and NASA. The VESPA management team has also been closely involved in international consortia such as the International Virtual Observatory Alliance (IVOA) in astronomy, the Research Data Alliance, and bodies

related to the European Open Science Cloud (EOSC).

Although planned workshops to bring new data services into VESPA are only now taking place in late 2021 (see news on page 6), many of the existing services have been updated and upgraded.⁷

Also building on heritage from the previous Europlanet 2020 RI project, SPIDER provides novel services to model planetary environments and solar wind interactions through a dedicated run-on-request infrastructure and associated databases. Since February 2020, services have been prototyped and launched to support studies of Mercury’s exosphere, as well as plasma instrument background counts at Venus and Mars. SPIDER services have already led to



Selection of amateur observations of Venus before, during and after the Parker Solar Probe flyby.



The Europlanet 2024 RI kick-off meeting in Windsor in February 2020 was attended by 69 representatives of participating organisations.

publications relating to simulations of Mercury’s magnetosphere, and were used by the community for the ESA/JAXA Bepicolombo mission’s flybys of Venus and Mercury.⁸ Opportunities identified through SPIDER for synergistic observations by BepiColombo during its cruise phase with the Solar Orbiter and Solar Parker Probe missions have been implemented by ESA and JAXA.

Two new virtual access services have been introduced for Europlanet 2024 RI. GMAP is building infrastructure for Europe in geological mapping of planetary bodies, a critical requirement to support future robotic and human exploration. A virtual Planetary Mapping Winter School in February 2021 was highly successful, attracting 200 participants from around the world, and was a major first step in starting to build a user-community of planetary geological mappers. A follow-up school is planned in February 2022 (page 5).

Europlanet 2024 RI also aims to foster wider use of Machine Learning

(ML) technologies in planetary research, and to develop open-source ML tools for seven science cases. A portal has been developed to provide access to services, and codes and scripts are now available through a GitHub.⁹ To start building the user community, two completed ML pipelines were presented at EPSC2021, and 100 participants attended a workshop on how ML can support fireball observations. A further workshop is planned in early 2022.

Restrictions on travel and face-to-face contact have meant that Europlanet 2024 RI’s networking activities have mainly taken place virtually. Lessons learned from the 2020-2021 experiences show that online meetings can bring in additional speakers and participants from industry, as well as people with caring responsibilities, or from under-represented groups that have limitations on travel, time or financial support.

However, in-depth and one-on-one conversations are less likely to take place in a purely virtual

environment, and this has, to some extent, limited the impact of networking and opportunities for building new collaborations.

Nonetheless, virtual training sessions focused on supporting early careers and new users in under-represented states have been over-subscribed and generated positive feedback.

A hybrid workshop on supporting the development of a planetary community in Africa has taken place successfully, implementing the first step in Europlanet’s Global Collaboration and Development Strategy, published in December 2020.¹⁰ Europe’s main annual gathering of planetary scientists, the Europlanet Science Congress (EPSC), held virtually in 2020 and 2021, has developed a successful and robust model for holding online conferences using a combination of asynchronous scientific presentations and discussion supported by a programme of live events (page 15). Multiple presentations and splinter sessions relating to Europlanet

2024 RI were held at the EPSC virtual meetings, and high-level sessions were attended by Members of the European Parliament, representatives of space agencies and the European Commission, and (importantly) industry.

Fostering links between industry and academia is a priority for Europlanet 2024 RI and has proved particularly challenging without opportunities for face-to-face networking. However, the Europlanet Society’s ten Regional Hubs have supported development of a database of industry with an interest in planetary science (page 27), and this has laid solid foundations for industry engagement as restrictions begin to ease.

The wider societal pressures of the pandemic, from financial restrictions to mental health, mean that early career researchers are currently in particular need of support. The bursaries, training schools, internships (page 19) and mentoring services provided by Europlanet 2024 RI are more important than ever in alerting early careers to opportunities, and helping them develop skills and build their network of contacts. A mentorship programme, launched in August 2020, now involves 28 mentor-mentee pairs and has already resulted in a paper and two mentees finding new positions.

Europlanet 2024 RI’s other main innovation, a network of 16 small-scale telescopes in Europe and beyond, was established in June 2020. Through an open call, amateur and professional astronomers can apply

Europlanet 2024 RI has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 871149.



R Schneider

Peat sampling during a Transnational Access visit to the Kangerlussuaq field site in Greenland by researchers from Uppsala University and Stockholm University.

for time to carry out observational campaigns, either by visiting the telescope or (for 14 facilities) through remote access. Eight projects have taken place to date, with two thirds led by women from under-represented countries.

All data collected using the Europlanet Telescope Network will be open access and two scientific articles resulting from the network have already been published. An observational alert system has also been implemented for planetary targets requiring a rapid response, enabling amateur astronomers to contribute scientifically valuable data. The alerts, which are followed by over 200 active observers, have resulted in publications, including on storm activity in Saturn’s north polar region and in Jupiter’s south temperate belt. More widely, collaborations stimulated through Europlanet 2024 RI, and involving its beneficiaries,

have led to a number of successful proposals for new projects funded through the European Commission and national agencies. From the development of ML tools to mobilising researchers in Africa, these external projects act as multipliers for the impact of Europlanet 2024 RI in many different communities.

Overall, Europlanet 2024 RI is largely on track to meet its expected impacts. The world has changed since we met in Windsor; the pandemic has led to innovations that support widening participation and reduced carbon footprints, but has also highlighted areas where face-to-face contact remains important. As we approach the halfway point of the project, with more time elapsing for case studies to emerge, we look forward to developing a more robust understanding of these impacts, and using lessons learned to build a sustainable research infrastructure for planetary science. ©

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Join us

The Europlanet Society promotes planetary sciences in Europe for the benefit of its community.

The Society is open to both individuals and organisations. Launched in 2018, it builds on 15 years of successful Europlanet projects funded by the European Commission. It is the parent organisation of the European Planetary Science Congress (EPSC) the largest annual meeting for planetary sciences in Europe.

Find out more at:

www.europlanet-society.org/join/

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Organisational Memberships

For research organisations, institutions and industrial partners involved in planetary science and related fields.

Benefits:

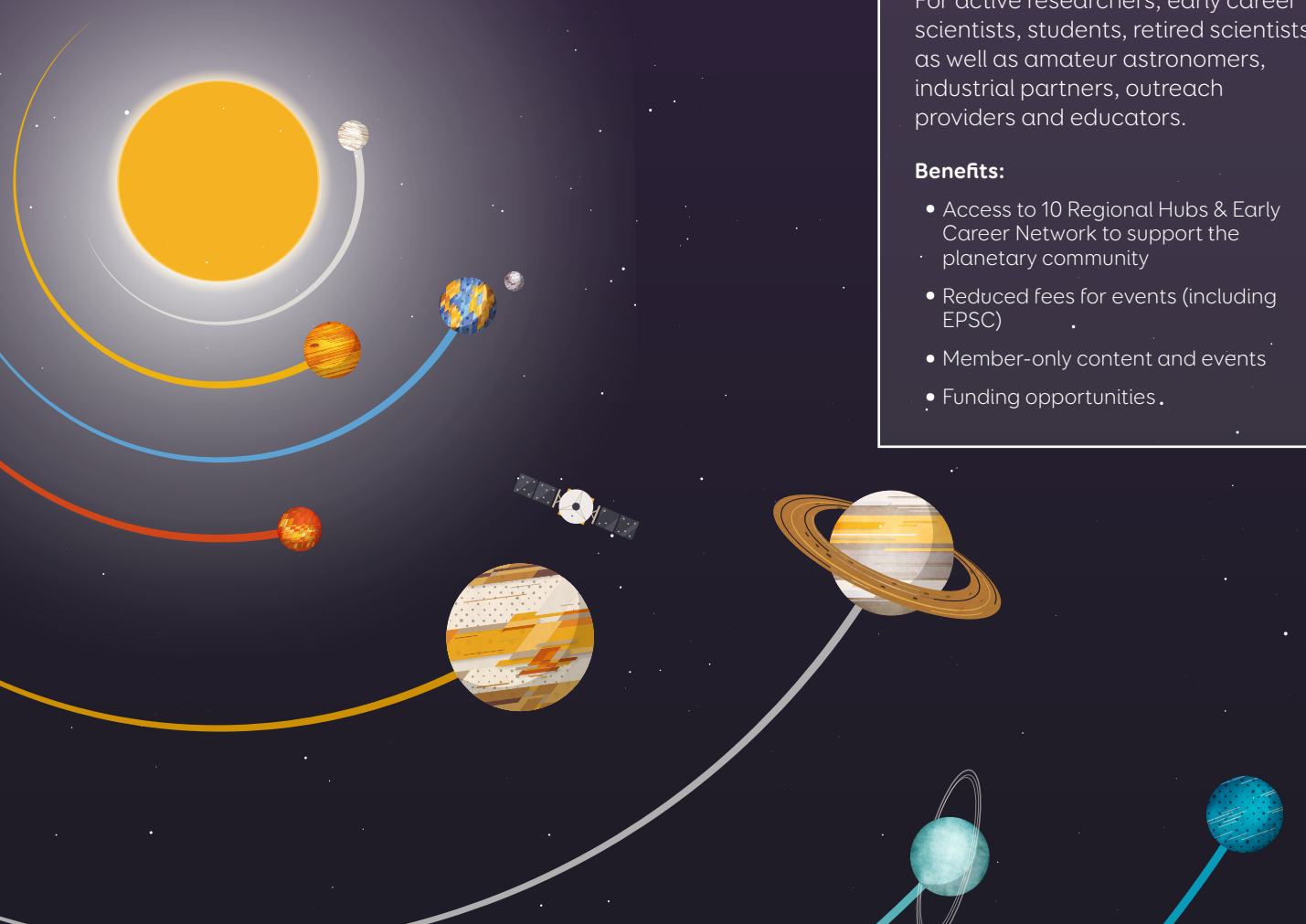
- Representation at the General Assembly
- Reduced fees for events (including EPSC)
- Member-only content and events
- Can include up to 10 individual memberships

Individual Memberships

For active researchers, early career scientists, students, retired scientists as well as amateur astronomers, industrial partners, outreach providers and educators.

Benefits:

- Access to 10 Regional Hubs & Early Career Network to support the planetary community
- Reduced fees for events (including EPSC)
- Member-only content and events
- Funding opportunities



Looking for the earliest forms of life on Earth



A Hofmann

The study area in the Barberton Greenstone Belt in South Africa.

Barbara Cavalazzi (University of Bologna) describes how an international effort has identified some of the earliest examples of life on Earth.

While Earth may have been habitable within the first billion years after the planet formed, the exact nature of the earliest forms of life (including the cellular constituents, metabolic pathways, and the habitats occupied on a local and global scale), remain largely unknown.

On Earth today, sub-surface habitats, heated by volcanic activity, are populated by microbes. These mostly include single-celled organisms called Archaea prokaryotes, which can live in the absence of oxygen and use methane for their metabolism. These environments are likely to have hosted some of Earth's earliest

microbial ecosystems. The interaction of cooler seawater with warmer subsurface hydrothermal fluids would have created a rich chemical soup, and variations in conditions could have led to multiple potential micro-habitats. However, although we know that Archaea prokaryotes can be fossilised, we have found extremely limited direct examples to date.

The Onverwacht Group in the Barberton Greenstone Belt in South Africa, near the border with Eswatini and Mozambique, contains some of the oldest and best-preserved sedimentary rocks found on our planet. In July 2021, we published a paper in *Science Advances* with the results of a study of chert (fine-

grained, microcrystalline quartz) deposits collected near the base of the Kromberg Formation of the Onverwacht Group, which formed 3.42 billion years ago. The samples contained evidence of ancient hydrothermal veins that would have been located below the floor of a shallow ocean. Over time, the hydrothermal veins have been filled in with carbonate and chert.

Within these samples, we found exceptionally well-preserved evidence of fossilised Archaea prokaryotes that appear to have flourished along the walls of cavities created by warm water from hydrothermal systems a few meters below the seafloor. The thread-like

structures of the microfossils were embedded in two thin layers (around a thousandth to ten-thousandth of a centimetre in depth) of the chert infill. Our study is the result of 15 years of work to better understand the geology and geological environment, which ended in the finding of the right sample. This was followed by an international effort by the team using state-of-the-art facilities around the world to gather converging and mutually supportive evidence that the structures we found were of biological origin.

In 2017, I visited the NanoSIMS facility at the Open University, funded through Europlanet’s Transnational Access programme, to investigate the ratios of carbon, silicon and oxygen in the structures, which could provide evidence that they were indeed microfossils. Although these results were promising, the samples analysed did not contain sufficient carbonaceous material to obtain a significant carbon-isotope ratio that would give us a definitive answer.

The final published study combined results from facilities for optical and electron microscopy in the US to observe the structures, as well as Time-of-Flight Secondary Ion Mass Spectrometry (ToF SIMS) in the US and Italy, Raman microspectroscopy imaging in South Africa, Dual-Beam Focused Ion Beam Scanning Electron Microscopes in the US and Italy, and micro and nano-X-ray imaging in France, which together enabled us to analyse the chemical composition, map the location of the structures, and search for biological signatures.

We found that the microfossils had a carbon-rich outer sheath and a chemically and structurally distinct core, consistent with a cell wall or membrane around intracellular or cytoplasmic matter. Filaments appear to have been clustered at the tips of

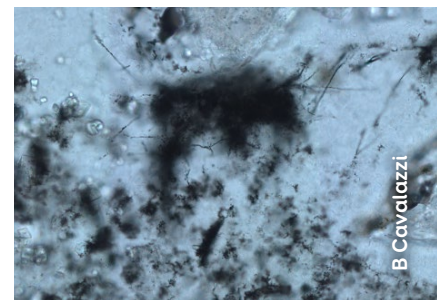


Cavalazzi et al

Top: The outcrop from which the rock sample was taken.

Right: Optical microscope image of the microfossil filaments.

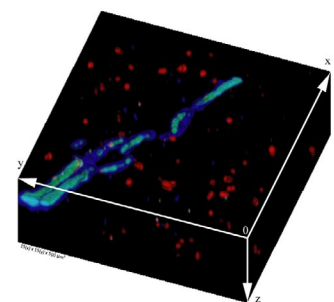
Bottom right: Raman spectra image of microfossil filaments in the microscope image above.



B Cavalazzi

pointed hollows in the walls of the hydrothermal cavity, and scattered individually across the cavity floor. Chemical analysis shows that the filaments include most of the major elements needed for life. The concentrations of nickel in organic compounds provide further evidence of primordial metabolisms and are consistent with nickel-content found in modern Archaea prokaryotes.

These microfossils are the oldest evidence for this type of life and expand the frontiers of potentially habitable environments on the early Earth, as well as other planets such as Mars. Our findings extend the record of Archaea fossils for the first time into the era when life first emerged on Earth.🌐



Cavalazzi et al

‘Cellular remains in a ~3.42 billion-year-old subsurface hydrothermal environment’, B. Cavalazzi, L. Lemelle, A. Simionovici, S.L. Cady, M.J. Russell, E. Bailo, R. Canteri, E. Enrico, A. Manceau, A. Maris, M. Salomé, E. Thomassot, N. Bouden, R. Tucoulou, A. Hofmann, *Science Advances*, 2021, DOI: [10.1126/sciadv.abf3963](https://doi.org/10.1126/sciadv.abf3963)
 The research was carried out with the support of Europlanet 2020 RI, which received funding from the European Union’s Horizon 2020 programme (Grant No 654208)



GA Jaimes Illanes/FESA

Astronomy activities with students at the San Agustín Astronomy Club, Cochabamba, Bolivia

The Bolivian San Agustín Remote Observatory



Gabriel Andres Jaimes Illanes, the IAU National Education Coordinator for Bolivia and member of the San Agustín Educational Foundation (FESA), reports on plans to develop a remote observatory to support astronomy outreach in Bolivia.

Astronomy is an intrinsic part of humanity's world and cultural heritage. Talking about topics related to the Andean constellations, observation with instruments, outreach activities, cultural astronomy and

archaeoastronomy is common in amateur clubs and schools throughout Bolivia. Astronomy is not an official subject within the national curriculum or our education system. However, topics relating to the Solar System, the Universe

and stellar evolution can be found even in elementary school, and the capacity of astronomy to inspire is widely recognised. The Bolivian San Agustín Remote Observatory is an initiative managed by San Agustín Educational Foundation (FESA)



The San Agustín Astronomy Club, Cochabamba, Bolivia

and supported by the 2021 round of the Europlanet Public Engagement Funding Scheme. It seeks to develop sustainable collaboration, inclusive participation, high-quality educational experiences, and innovation in research activities. Located in the city of Cochabamba, the project will put in place the instrumentation and the physical and management structures to create an efficient observatory that results in significant impact.

The evolution of astronomical instrumentation over the last fifteen years has allowed students, teachers, amateur astronomers, and interested people to make tangible contributions to the field of astronomy so that, as well as sharing their passion, they can carry out real research. Observations that make use of computerised mounts, corrective optics, narrow band filters, solar telescopes and generic accessories can generate a great variety of astronomical data and knowledge.

However, like everywhere around the world, the current pandemic situation has had a direct impact on educational systems in Bolivia, and made public access to scientific

facilities and observations more challenging. Outreach to rural populations in remote regions, where telecommunications access is also often limited, has been particularly affected.

The San Agustín School, managed by FESA, has a long track-record of success for students and tutors participating in scientific olympiads. We have been the best performing school in Bolivia in four editions of the Olimpiada Científica Estudiantil Plurinacional Boliviana (OCEPB) competition, receiving awards from our state's Vice President, as well as participating at the national, South American, Latin American and International levels. The Bolivian San Agustín Remote Observatory will be supported by this infrastructure and environment, in which we have already developed many different academic activities for students interested in astronomy.

The FESA foundation believes that astronomy and space sciences present a great opportunity for us to contribute significantly to our community through the generation of educational, scientific and outreach resources. Beyond the

very constructive experiences in our school astronomy club, where we have carried out virtual sessions during the pandemic, we currently hold the National Astronomy Education Coordinator (NAEC) role for the International Astronomical Union (IAU) in Bolivia. Diverse experiences and approaches will be needed to support the growth of astronomy in Bolivia, and projects such as the Bolivian San Agustín Remote Observatory have great potential for scalability and impact in this field.

Despite our region's strong academic performance, STEAM-trained workforce, and community of amateur astronomers, students and teachers with an interest in astronomy, the city of Cochabamba currently does not have any interactive museums for science, or observatories or planetaria.

The grant from the Europlanet Society's Public Engagement Funding Scheme will not only provide instruments that will enable us to implement the project, but also help us with institutional support and is an endorsement for the growth and sustainability of the project. There are many different academic, social, and sustainable challenges for developing scientific projects in Bolivia. However, we firmly believe that the key to success is through building collaborations, like in our case with Europlanet and the global planetary science community.

Our next steps are to develop resources to train students in the use of the equipment and remote observatories. Through a programme of teacher-training, outreach activities, and positive case studies around participation in this first remote observatory in Bolivia, we hope to be able to see the eventual inclusion of astronomy in the school curriculum.🌐

CommKit

Shorouk Elkobros (Europlanet Society/ESF) is Europlanet Magazine’s columnist on science communication topics and tools.

Summer 2021 was busy for my team at the Europlanet Society and our colleagues from the Copernicus team getting ready for the largest planetary science meeting in Europe, the Europlanet Science Congress (EPSC). The annual event that typically sees more than 1000 participants from around the world was again held online. The ethos for EPSC2021 was to create a simple, flexible, and inclusive virtual meeting that provides multiple opportunities for interaction, scientific discussion and networking.

For the first time at EPSC, we decided to use Slack to complement Zoom sessions. Being the platform’s main administrator, it is fair to say that I spent more time on Slack this summer than on any other app. Is your scientific conference

suddenly going virtual? Fret not. In this issue’s column, I share with you our successful case study to help you plan an engaging Slack workspace.

Slack management is not exactly a piece of cake; we had to streamline every process to ensure nothing got out of line. Four months before the event, we created a timeline of pre, during and post conference checklists. We designed Slack channels to match the needs of a busy attendee: an announcement channel for news, a helpdesk for support and a coffee break channel for networking. I loved using the Slack Block Kit Builder, a clean and consistent user-interface framework for Slack apps. It helped me to customise organised and visually appealing posts. Scheduling posts and integrating apps were great tricks to save time. For example, an app such as the Direct Memo can send messages to all Slack members with one button. During EPSC2021, we helped participants navigate the large mix of talks, workshops and poster sessions by providing a daily schedule and reminders for each activity. Our conveners played an excellent role in this by managing their sessions’ channels. They directly engaged with attendees and answered their questions. Finally, we offered a unique space for networking activities. My favourites by far were the EPSC2021 early-career events (page 18).

During EPSC2021, we welcomed 795 participants from 47 countries,




If you have science communication tips and tricks to share, please reach out to our Communications team at media@europlanet-society.org

734 of which joined Slack. Despite hurdles around sending participants invitations, checking working links, and facilitating communications, the feedback shows we held an engaging digital EPSC2021. Using an online platform for a global meeting was challenging, but we did it! And you can too.


Planetarily yours,
Shorouk

Slack: slack.com

 **EPSC2021** 12:15 PM
Social Event time! 🌟

Bring your packed lunch and join the EPSC2021 Social Event from 12:45-14:15 in the EPSC wonder.me room, for an opportunity to catch up with past acquaintances, make new friends and join informal activities.

We will be organising a Spaceguessr activity at 13:00, where you will be asked to guess locations in the solar system based on images and magnetic fields!



 The Last Word

Beyond Borders

The Europlanet Society's President and Europlanet 2024 RI Coordinator, Nigel Mason, looks back at international collaborations in 2021.

The work discussed in this issue of the Europlanet Magazine has been performed amidst one of the gravest health crises of recent times. I find the ingenuity and the dedication shown by the planetary community in response to these challenging circumstances very inspiring.

Planetary science is a growing field across the world, with increasing numbers of countries developing their own space programmes. As we hear from Niklas Nienass MEP (page 28), these individual programmes need to be supported by cooperation and coordination at all levels, from grass-roots efforts to involve the wider community, to policy-makers building a robust legal framework. Through our Strategy for Global Collaboration and Integration, launched last December, Europlanet aims to support the creation of a more integrated and interconnected global planetary science community, and foster conditions for new scientific partnerships between EU and non-EU countries.

In 2021, we have strengthened our partnerships with Argentina, China and South Korea, opening up facilities in those countries for access by the European research community, and vice versa through reciprocal arrangements (page 30). The recent workshop in Botswana (page 6) is the first in a series to build collaborations with African colleagues, to exchange knowledge and to train local experts with the skills and technical capability

to meet African goals for the development of space science. The past year has also been a showcase for the global nature of planetary exploration, with missions from China and the United Arab Emirates joining Indian, European and US spacecraft at Mars back in February, and the selection of complementary European and US missions to Venus in June.

Planetary science projects are amongst the longest-duration science endeavours currently undertaken by humanity, spreading over decades from conception, to design, launch and operation (as highlighted in the article on page 24). The doctoral candidates and postdocs of today, working on the first stages of a space mission, may be the operational scientists when the mission arrives at its destination. Europlanet therefore must ensure that we both attract and retain the best early career researchers. The vibrant Europlanet Early Career Network (EPEC) continues to grow and, through its activities (page 18), is supporting an increasingly diverse new generation of planetary scientists. I urge you to support EPEC by encouraging early career colleagues to join, or volunteering to become a mentor yourself. I am particularly delighted to see founding members of EPEC now taking on senior leadership roles in the Europlanet Society (Planetary Perspectives, page 21).

The benefits of collaboration and community support are clear from the impacts now emerging

from the Europlanet 2024 Research Infrastructure (RI) and its predecessors (page 40). We are gathering evidence that the research infrastructure stimulates new areas of scientific activity that would not have come about without this sharing of facilities and expertise.

As we enter 2022, the European Commission's Horizon Europe programme will bring many new opportunities for our community. The Europlanet Society will support you in forming consortia and writing proposals, and we ask that you help us in the Society's growth and development by taking on roles within its organisation.

I wish you all a happy (and safe) festive season and hope to see you at a face-to-face Europlanet Science Congress in Granada in 2022.

<https://www.europlanet-society.org>



Transnational access fosters cross-border collaboration

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