44th COSPAR Scientific Assembly and Associated Events
Athens, Greece
16 – 24 July 2022

Call for Papers

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Welcome Message from the COSPAR President

Len Fisk

The time has come again to issue the Call for Papers for the next COSPAR Scientific Assembly, COSPAR-2022, which will be held in Athens, Greece on 16-24 July 2022. With vaccinations becoming more widespread, much of the world is beginning to emerge from the debilitating constraints of the pandemic, and by July 2022 life for many of us will be back to normal. We will celebrate this return to normalcy with a primarily in-person Assembly in Athens. There will, of course, be an opportunity for those who are unable or unwilling to travel to participate virtually in the scientific program of the in-person Assembly. Best of all, COSPAR-2022 will be held in Athens, a remarkable city, with its mixture of antiquities and modern life, in a remarkable country known for its scenery and lifestyle, a desirable destination for all.

The COSPAR Scientific Assemblies are essential to our mission of encouraging and facilitating international cooperation in space research. We share the results of the worldwide community of scientists who conduct research from and in space. We conduct the business of COSPAR; the governing Council of COSPAR meets; there are business meetings of the Scientific Commissions and Panels. We are joined by the leaders of the space agencies from around the world that support our research.

Most important we use our Assemblies to bond our community together. To foster collaborations, build trust and understanding. Clearly, this is best done at an in-person Assembly, which we are most pleased to be able to hold again.

COSPAR 2022 will adhere to the Principles of COSPAR. The Assembly will be a forum, open to all scientists, and held without impediment from geopolitical tensions or differences. The presentations will be the result of scientific research conducted with the highest ethical standards. The Assembly will promote inclusiveness, diversity and gender equality, and no form of discrimination or harassment will be tolerated. The Assembly will encourage meaningful roles in all activities for younger scientists, who are the future of international space research. We will follow the guidance of the COSPAR Strategic Action Plan of 2019 to 2023 and hold an Assembly that is attractive to all scientists: to mid-career scientists, who will benefit from the networking activities, the opportunities for recognition of their research and for leadership in Scientific Commissions and Panels. To younger scientists, who will have opportunities to take full advantage of what a COSPAR Assembly can offer, making connections and building bonds through new opportunities for engagement and networking with scientists from around the world, and becoming a recognized member of the international community of space scientists.

So, come and join the international community of space scientists at COSPAR-2022, 16-24 July 2022, Athens, Greece. Be sure to monitor the following websites for information on the final scientific program, the deadlines for abstract submission, for registration, for social activities, for hotel information, etc:

www.cospar-assembly.org (submission of abstracts, scientific program)

www.cosparathens2022.org (registration, accommodation, social activities, etc.)

Message from the Local Organizing and Program Committee Chairs

Manolis K. Georgoulis and Stamatios M. Krimigis

The National Committee for Space Research with the sponsorship of the Hellenic Space Center and its supervising body, the Hellenic Ministry of Digital Governance, as well as the

City of Athens, are delighted to invite you to participate in the 44th COSPAR Scientific Assembly in Athens, Greece, on 16–24 July 2022. We are proud and distinctly honoured to host this iconic gathering on behalf of COSPAR and are counting on your physical participation in the first COSPAR Scientific Assembly of the post-Covid era.

COSPAR is synonymous with the dawn, establishment and unprecedented growth of the space age, born just after the launch of *Sputnik-1*. Free of political impediments, COSPAR steadily promotes and showcases its unwavering support to the peaceful scientific exploration of space, demonstrating to the world the benefits that can be realized in this new era of humanity. Via its eight Commissions and 12 Panels spanning from Earth Observation to Cosmology and from Education to Space Weather and Interstellar Exploration, it exploits the brightest global talent in space research, technology and communication in the best interests of human progress. In all respects, COSPAR has a privileged role to play in the growth of scientific knowledge and the global stability of the future.

The 44th COSPAR Scientific Assembly of Athens is the first COSPAR Assembly after the unfolding of the Covid-19 pandemic that endeavours to return to the traditional format of in-person participation. It does include a convenient virtual component to allow members of the community who are unable to travel to have access to the deliberations, but ultimately it relies on the cutting-edge science of global vaccination to promote another cutting-edge in science, that of space exploration, via personal interaction and debate.

We find it highly symbolic that this is happening in Greece, the cradle of phenomenology, hypothesis, analysis, and theory, all relying on a solid foundation of the uncompromising scientific method.

The COSPAR community has clearly embraced the undertaking by proposing more than 140 scientific sessions, pushing the use of the available time to its limits: the time scheduled for science has been subscribed by more than 99%. This has been assisted by the efforts of 21 Local Organizing Committee scientists of Greek descent from within the country and in the diaspora who have stimulated and spurred global interest in the Athens' Assembly.

We trust that Athens, a timeless cosmopolitan metropolis of 35 centuries that also hosted the Olympic Games of 2004, and the state-of-the-art main meeting venue, the Megaron Athens International Conference Center, will satisfy the most demanding meeting attendees and their accompanying guests. Perhaps most importantly, the timing of the meeting, in the heart of the mesmerizing, virtually endless Greek summer is all but guaranteed to allow some memorable quality time in the city, the surrounding Attica peninsula, and on nearby Greek islands.

We look forward to welcoming each and every one of you to this world-class scientific gathering and forum. At the same time, we hope you will take time to savour all the joys this thrilling corner of the Mediterranean can offer in summertime, while delving into the curiosity, fascination, and transformative science that COSPAR Scientific Assemblies are invariably known to offer to all their delegates.

Manolis K. Georgoulis
Local Organizing Committee Chair ChairCOSPAR 2022

Stamatios M. Krimigis
Science Program Committee Chair COSPAR 2022

Message from the Ministry of Digital Governance

HELLENIC REPUBLIC
Ministry of Digital Governance
The Minister

Kyriakos Pierrakakis
Minister of Digital Governance
11 Fragoudi & A. Pantou
Kallithea 101 63
Athens, Greece

Athens, 08-06-2021

The Hellenic Ministry of Digital Governance, as the parent organization overseeing the activities of the Hellenic Space Center (HSC), is pleased to welcome the 44th COSPAR Scientific Assembly to Athens, Greece, in July 2022. The 44th Assembly, being the first ever held in Greece since the start of the Space Age back in 1957, represents a homecoming of sorts. It was in this land of clear skies and bright sun that critical thinking about the Sun, the stars and planets began over 3,000 years ago and resulted in some of the first scientific findings about the diameter of Earth, the distance to the Moon, and even the first model of the heliocentric system.

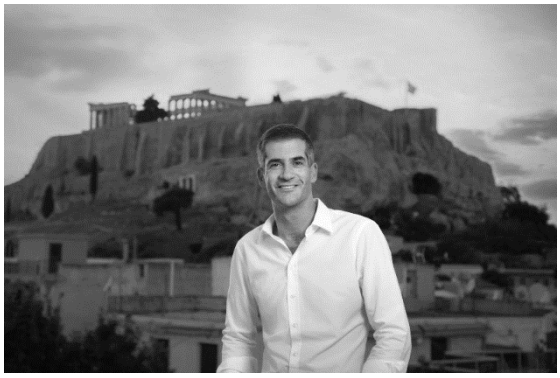
So, we say to the worldwide space science community "Welcome home", because we are anxious to hear you all give us, and the World, an update on your latest findings: About the Sun and our planetary system but also the stars and exoplanets, and the galaxies and black holes and even gravity waves and other exotic phenomena. And, circling back, to tell us about our own Earth and its atmosphere and what the future of humanity is likely to be in the midst of ongoing climate change.

We welcome the opportunity to host the 44th Assembly here in Athens, and will do all we can through the Ministry, the HSC and the LOC to make this a most memorable and rewarding event that will not only facilitate your scientific exchanges and interactions but also provide an environment that will offer you and your companions a most enjoyable social and cultural experience.

Kyriakos Pierrakakis
Minister of Digital Governance

Kiriakos Pierrakakis
Minister of Digital Governance

Welcome Message from the Mayor of Athens



Many of you already know about the great pleasures of Athens. We have an exceptional climate, world-famous monuments, and food traditions gathered from all over Greece. Recently our visitors have discovered that Athens has much more to offer. We have shown ourselves to be undeniably creative and dynamic, with diverse and vibrant neighbourhoods, the confidence to combine fine art with street food, and a commitment to sustainable tourism. We are an ancient city that looks toward the future. Some might say that transformative thinking is in our cultural DNA. That's why I am proud to invite you to Athens to share, inspire, and build the future. The City of Athens is committed to the success of COSPAR 2022, and I am confident that it will be a memorable experience for all of your delegates.

Kostas Bakoyannis

Mayor of Athens

Members of the Local Organising Committee (LOC)

- Manolis K. Georgoulis, Chair, Academy of Athens, Greece
- Nick Sergis, Vice Chair, Hellenic Space Center, Greece
- Vasilis Angelopoulos, University of California Los Angeles, USA
- Alceste Bonanos, National Observatory of Athens, Greece
- George Contopoulos, Academician, Academy of Athens, Greece
- Athena Coustenis, CNRS/LESIA, Observatory of Paris-Meudon, France
- Ioannins A. Daglis, University of Athens & Hellenic Space Center, Greece
- Manos Kitsonas, Eugenides Foundation, Greece
- Haris Kontoes, National Observatory of Athens and BEYOND Center of Excellence, Greece
- Chryssoula Kourtidou-Papadeli, University of Thessaloniki & Aeromedical Center, Greece
- Chryssa Kouveliotou, George Washington University, USA
- Stamatios M. Krimigis, Academician, Academy of Athens, Greece
- Nick Kylafis, University of Crete, Greece
- Paul Michelis, Institute of Mechanics of Materials and Geostructures S.A., Greece
- Manolis Plionis, University of Thessaloniki & National Observatory of Athens, Greece
- Emmanuel T. Sarris, Democritus University of Thrace, Greece
- Dionysis P. Simopoulos, Eugenides Foundation, Greece
- Kanaris Tsinganos, University of Athens, Greece
- Loukas Vlahos, University of Thessaloniki, Greece
- Angelos Vourlidas, The Johns Hopkins University Applied Physics Laboratory, USA
- Christos S. Zerefos, Academician, Academy of Athens, Greece

LOC/Assembly On-site Secretariat and Professional Congress Organizer:

AFEA Travel and Congress Services, 39 – 41 Likavittou Street, 106 72 Athens, Greece

Tel:+30 210 3668800, e-mail: info@afea.gr

COSPAR Athens 2022 information e-mail: info@cosparathens2022.org

Venue and Dates

The COSPAR Athens 2022 Local Organizing Committee cordially invites you to attend the

44th COSPAR Scientific Assembly and Associated Events

that will take place from 16 – 24 July, 2022

at the Megaron Athens International Conference Center (MAICC).

The Main Venue
Megaron, Athens International Conference Centre
https://www.megaron.gr/en/international-conference-centre/
Vassilissis Sofias & Kokkali, 115 21 Athens, Greece Closest Metro Station: Megaro Moussikis

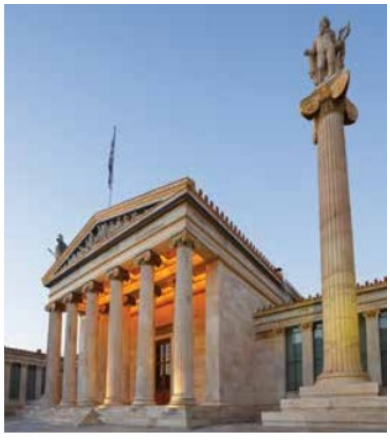
The Megaron Athens International Conference Centre is one of the finest and most technologically advanced conference venues in Europe. Situated in the city centre, yet surrounded by its own extensive landscaped gardens, Megaron offers a stunning environment, exceptional aesthetics, cutting edge technology and unrivalled client service.

Megaron Athens International Conference Centre is a landmark in Athens and is situated in the center of a vibrant, modern city that was transformed to host the 2004 Olympic Games. The Centre is on a direct metro line to the award winning Eleftherios Venizelos International Airport, making it extremely accessible for international delegates travelling to and from global destinations. Megaron is also very close to major hotels, many of which are within walking distance. And if that weren't enough, major museums, shops and fine dining are all just minutes away.

The Assembly will take place primarily at the MAICC and, secondarily, at the Divani Caravel Hotel, that will also serve as the COSPAR Athens 2022 Headquarters Hotel.

The Headquarters Hotel-Divani Caravel
https://divanicaravelhotel.com
Vassileos Alexandrou 2, Athens 161 21, Greece

Closest Metro Station: Evangelismos



info@cosparathens2022.org

AFEA Travel and Congress Services

Professional Congress Organizer

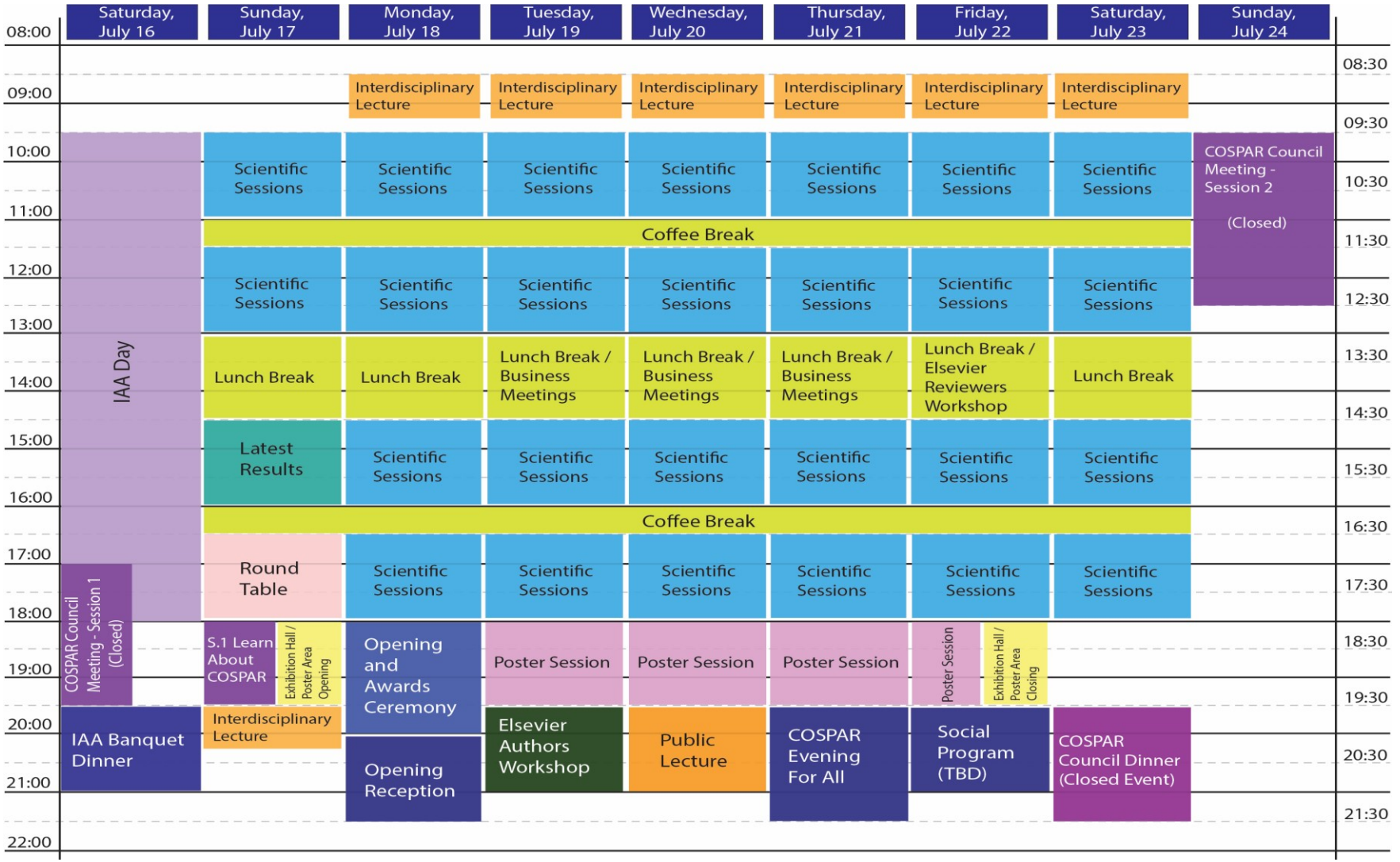
39-41 Likavittou str., 106 72, Athens, Greece, T: +30 210 3668800, F: 210 3643511, E-mail: info@cosparathens2022.org • www.afea.gr

The two meeting venues are located about 1 km (0.63 mi.) from each other, or about 11 minutes walk. This granted, there will be a shuttle service rotating between the two venues for the duration of the scientific part of the meeting (Sunday–Saturday, 17–23 July) every 20-30 minutes.

The two meeting venues are located directly on the grid of the Athens' metropolitan mass transit system (see below), connecting to the Athens' International Airport via a single metro line (blue line, or line 3). The MAICC entrance is just outside the blue line's 'Megaro Mousikis' station, at approx. 37 minutes from the Airport. The metro line 3 runs every 30 minutes from the airport and the trip to the city centre takes approximately 40 minutes. The one-way metro rate to and from the Athens International Airport is 10 €.

Riding the metro line 3 from the MAICC, one may explore the entire historic center of Athens literally within minutes. Alternatively, one may head for the Athenian Riviera in at least three different ways: (i) reach 'Syntagma' station from MAICC on line 3 and then switch to line 2 (red line) toward 'Elliniko' station (the coastline is approx. 1 km from this point), (ii) reach Syntagma and ride tram (i.e., cable car) line T5, to get directly on the coastline, or (iii) reach 'Monastiraki' station from MAICC on line 3 and then switch to line 1 (green line) on the subway to the Piraeus town and harbour.

Preliminary Assembly Schedule—Overview



The overview on the previous page is the present version of the Assembly Program-at-a-Glance. The program features the science sessions starting at 09:30 on Sunday morning, 17 July 2022, while the Latest Results and Round Table Sessions are planned for later that day, after the lunch break. The Special 'S.1 Learn about COSPAR' Session is also planned for Sunday, 17 July at 18:00. The two COSPAR Council Sessions are planned for Saturday, 16 July and Sunday, 24 July, respectively and are closed except to Council members.

The Opening and Awards Ceremony and subsequent Reception will take place on Monday, 18 July. The parallel scientific sessions are structured in quarter days (i.e., 90-minute contiguous sessions of talks and discussion), while dedicated poster and exhibition room sessions between 18:00 and 19:30 are foreseen from Sunday evening, 17 July to Friday evening, 23 July (with the exhibition room still to be confirmed for Sunday evening and a possibility to start on Monday morning, 18 July). The poster and exhibition area will be open for the duration of the meeting days during this interval.

The Assembly has planned a total of seven (7) Interdisciplinary Lectures and one Public Lecture. Interdisciplinary Lectures are 45-minute events scheduled every morning between Monday, 18 July and Saturday, 23 July, except for the first one, that takes place at 19:30 on Sunday, 17 July. The Public Lecture is planned as a 90-minute event starting at 19:30 on Wednesday, 20 July.

The Social Program includes, besides the Opening and Awards Ceremony, a gala dinner in the format of the COSPAR Evening for All on Thursday, 21 July and a social function on the evening of Friday, 22 July, whose details will be determined in due course. Other functions include the COSPAR Authors and Reviewers Workshops, planned for Tuesday, 19 July and during lunch break on Thursday, 21 July, respectively.

Lunch breaks are scheduled to last 90 minutes each and will coincide with the business meetings of COSPAR Commissions and Panels between Tuesday, 19 July and Thursday, 21 July. Two coffee breaks are foreseen for each meeting day, planned as 30-minute intervals starting at 11:00 and 16:00.

National Sponsors/Acknowledgements

The COSPAR Athens 2022 organization gratefully acknowledges national support from the following entities. The list is tentative and may be updated by the time of the Assembly:

- The Ministry of Digital Governance of the Hellenic Republic (https://mindigital.gr/)
- The Ministry of Culture and Sports of the Hellenic Republic (https://www.culture.gov.gr/en/)
- The Ministry of Tourism of the Hellenic Republic (https://mintour.gov.gr/en/archiki-english/)
- The City of Athens, via its Athens Convention and Visitors Bureau (ACVB) (https://www.thisisathens.org/)
- The Hellenic Space Center (https://hsc.gov.gr/en/)
- The Eugenides Foundation (https://www.eef.edu.gr/en)
- The Hellenic Broadcasting Corporation (ERT) (https://int.ert.gr/)
- The Academy of Athens (http://www.academyofathens.gr/en)

Further strong support toward the COSPAR Athens 2022 organization has been expressed in writing by the following national universities and institutions:

- The University of the Aegean (https://www1.aegean.gr/aegean2/)
- The University of Athens (https://en.uoa.gr/)
- The University of Crete (https://en.uoc.gr/)
- The University of Ioannina (https://www.uoi.gr/en/)
- The University of the Peloponnese (https://www.uop.gr/en/)
- The University of Thessaloniki (https://www.auth.gr/en)
- The University of Thrace

(https://duth.gr/en)
- The National Observatory of Athens (https://www.noa.gr/)
- The National Center for Scientific Research 'Demokritos' (http://www.demokritos.gr/)
- The Hellenic Foundation for Research and Innovation (https://www.elidek.gr/en/)
- The Hellenic Aerospace Industry S. A. (http://www.haicorp.com/en)
- The si-Cluster (https://www.si-cluster.gr/en/)

Projection Facilities

Each meeting room will be equipped with a projector and screen, terminal PC, monitor, loudspeakers and recording camera, as all sessions will be invariably recorded, with recordings made available to all participants within 48 hours, at most, from a session's deliberations. Microphone equipment will also be in place. The opening ceremony, inter-disciplinary lectures and the public talk will be livestreamed. Each meeting room will have a podium for speakers and a laser pointer.

Each meeting room terminal will be provided with the talks scheduled for the relevant session by the Speaker Ready Room, where all presentations are to be uploaded and checked for compliance. Given the virtual component of the Assembly, the Speaker Ready Room will also accept recorded full-duration presentations by remote meeting participants.

More information and instructions on how to record a presentation, if participating remotely, or interact with the speaker ready room and proceed to the meeting room for the delivery of the presentation, will appear in due course on the Assembly website at:

www.cosparathens2022.org/ and

www.cospar-assembly.org/.

Registration Fees* and Procedures

Registration type	Early-bird fee (€)	Regular fee (€)
Regular – in-person	750.00	820.00
Regular – virtual	650.00	650.00
Student – in-person	250.00	295.00
Student – virtual	200.00	200.00

**** Discounted rates to be provided for retirees or attendees not affiliated to an institution. See website indicated below for rates from August 2021.***

Notice that students must provide a copy of documentation certifying their eligibility for a student registration fee.

Information about registration cancellation procedures will be available on the COSPAR 2022 Assembly website in July 2021: www.cosparathens2022.org/

Online registration opens: early July 2021

The registration fee for in person participants (regular and student fee), includes:

For in-person participants:

- attendance at
  - ✓ the Opening Ceremony
  - ✓ the Opening Reception
  - ✓ the Interdisciplinary Lectures
  - ✓ the Public Lecture
  - ✓ all scientific and technical sessions
  - ✓ all-participant-oriented social functions
- coffee breaks
- access to the exhibition area

For virtual participants:

- access through livestreaming to:
  - ✓ the Opening Ceremony
  - ✓ the Interdisciplinary Lectures
  - ✓ the Public Lecture
- inclusion of the participant's recorded presentation(s) in the meeting program

Both in-person and virtual participants will have:

- full access to the event platform
- on-demand access to post-event recordings of the scientific parallel sessions
- the e-version of the abstract book and final program

Accommodation Information

Athens is a city with Hotel Industry Excellence. It offers a wide range of hotels of all categories with more than 680 hotel options, located in the city centre or by the sea along the Athenian Riviera.

AFEA SA, the official PCO of the 44th Scientific COSPAR Assembly, will offer assistance to delegates with the coordination of housing requirements for the Assembly. Special room rates are being negotiated at Hotels near the Congress Venue, and delegates will be able to book rooms online at the end of 2021.

Information about accommodation options and room rates will be available on the COSPAR 2022 Assembly website from December 2021 (tentatively under 'Attending / Accommodation') :

www.cosparathens2022.org/

Deadlines and cancellation procedures (registration and accommodation)

Registration and accommodations cancellations must be sent in writing to the COSPAR 2022 official e-mail address:

info@cosparathens2022.org

Cancellation deadlines and administration fees will be announced on the meeting's website (www.cosparathens2022.org/) together with the link of online reservations (tentatively under 'Attending / Accommodation').

Transfer of registration of the same registration category to another person will be possible until the end of May 2022 by sending a request to info@cosparathens2022.org

No refunds will be made for non-attendance.

In the unlikely event that COSPAR 2022 is cancelled, personal travel costs beyond registration fees and individual hotel reservations will not be refunded. A credit card and full prepayment will be required to book registration and accommodation at the room rates offered by the organization.

Detailed cancellation policies will be announced within the relevant sections of the COSPAR Athens 2022 website, www.cospar2022.org/.

Scientific/Industrial Exhibition Information

The exhibition area will be located at the main venue, the Megaron Athens International Conference Center (MAICC).

Exhibition dates *(preliminary – to be confirmed):*

Monday 18 July
Tuesday 19 July
Wednesday 20 July
Thursday 21 July
Friday 22 July

Detailed operating hours will be announced in the final version of the Assembly's scientific program.

More information will also be announced on the webpage:
www.cosparathens2022.org/sponsorship/sponsorship-exhibition-info/

General Information

Requirements for obtaining visas and procedures for handling special cases

Greece is a member of the European Union and belongs to the Schengen area. All travellers, except for those exempt from a visa requirement, should apply for the corresponding visa at their local Greek Diplomatic or Consular Offices.

We strongly advise prospective participants in need of a visa to apply in due course, allowing at least three months before their trip to Greece. Participants in possession of a valid residence permit or a valid long-term visa issued by another European Union Member State are advised to check the validity of their visa to avoid any potential inconvenience.

If an entry visa is required, please follow the procedure below:

- Submit your visa application in person, at least three months before you plan to travel to Greece to avoid any inconvenience.
- The process may take longer in certain countries, so we recommend you contact the nearest Greek Diplomatic or Consular Offices to clarify your personal case.

More information is available at the visa section of the Hellenic Ministry of Foreign Affairs (www.mfa.gr/en/visas/).

Please note that an official letter of invitation to attend COSPAR Athens 2022 will be forwarded to any requesting participant. This granted, an invitation implies no obligation for the Organization to cover registration fees, accommodation, travel expenses or any other costs pertaining to participating in COSPAR Athens 2022.

Personal letters of invitation can be requested via e-mail to: info@cosparathens2022.org.

Please note that invitation letters will be sent only upon completion of registration and the subsequent payment. Should a prospective visa be denied, a registration fee return policy will be enacted. Complete information on this policy will be announced in due time.

Please check the Greek Ministry of Tourism website https://travel.gov.gr/#/ for the latest information about Covid-19 and travel.

National associated events

We are looking into a nexus of options for satellite events complementing the main Assembly and involving both professional (e.g., K-12 teachers) and the general public. An ongoing collaboration is currently in place between the Local Organizing Committee and COSPAR's Panel on Education, while a number of institutions represented in the LOC own landmark, state-of-the-art facilities for education and public outreach (EPO). More EPO-oriented institutions have expressed a preliminary interest in participating or hosting satellite events. The LOC will be announcing a more definitive planning of associated events in Athens, and possibly beyond, in due course.

About Athens

For the last few years, Athens has been rising as Southern Europe's most exciting city-break destination. It comes as no surprise, of course, that its classical sights have drawn crowds for centuries. However, beyond the Acropolis and awe-inspiring antiquities, there are new cultural landmarks, an edgy art and design scene, and a glittering coastline where major, transformative urban regeneration projects are underway.

The city's appeal as a tourist destination is flourishing, thanks its new infrastructure and cultural attractions, an expanding transportation network, more green spaces, and the unification of the city's main archaeological sites.

You can stroll along the cobblestone, pedestrian-only path that envelops Europe's largest Archaeological Park for a close-up view of some of the world's most significant ancient treasures, the first and foremost being the Acropolis. Alternatively, you can choose to catch the tram to the coastline that stretches 120 km for a walk or a swim along the Athens Riviera and beaches.

A unique combination of the old and the new, set up against a spectacular Mediterranean landscape; a world-famous past, an exciting present, and a promising future. Ancient and

brand-new at the same time, Athens inspires and seduces its visitors, leaving its mark on their hearts and minds. Surrounded by a lining of stunning seas and mountains, this travel-friendly city is filled with gems just waiting to be discovered. Renowned archaeological sites; modern and classical art museums and galleries; opera houses; spas; elegant shops, restaurants and bars; street markets and bazaars; outdoor cinemas and 300 sun-drenched days each year are all to be found in Athens! Athens has more than 275 hotels, 137 theatres, 67 cinemas, 50 museums, two concert halls, over 180 bars and 75 clubs. It also boasts an award-winning airport (Athens International Airport) that, since its opening in 2001, has seen an annual growth of 7%, currently serving 80 international destinations.

Each year, all year round, more and more travelers are choosing Athens for their leisure and business travel. There are several reasons; Athens offers a variety of things to see and do, and most of the time, it is under favourable weather conditions. Athens is considered one of Europe's safest capitals; its transportation network is user-friendly. Athens is an ideal congress destination, combining state-of-the-art infrastructure, excellent conference facilities and easy access from all over the world with world-class cultural attractions, modern amenities, diverse entertainment and natural beauty.

Arts and Culture

The city's rich classical tradition and its geographical location—at the crossroads of cultures—have always lent it a formidable platform for artistic expression. That high regard for the arts continues today, with a mushrooming of modern innovations. Every year, the city's cultural calendar presents exhibits and festivals of international nature and scope, original productions and notable artistic happenings.

Sightseeing

Athens takes the fuss out of sightseeing. It is a user-friendly town thanks to the pleasant demeanour of the English-speaking Athenians and the easy-to-use, manageable transportation system. The visitor can see a lot even in a single day: archaeological sites and classical Greek monuments, Byzantine and Ottoman monuments, museums, art galleries, street performances, festivals.

At all times and circumstances, the Acropolis remains a "must see"... The Acropolis Museum invites you to a panoramic virtual tour of its galeries! A virtual reality 360º video at: www.theacropolismuseum.gr/en/multimedia/virtual-tour-acropolis-museum offers you the feeling that you are in the real galleries and the choice to look towards the direction you will choose. It is also possible to explore Athens via www.thisisathens.org

Getting around - Transportation

A state-of-the-art metro system, wide avenues, an efficient public transportation system and a compact city centre, all make moving around Athens easy and convenient. The Athens transportation network now includes new buses, pollution-free trolleys, trams and a revamped electric railway (subway) system that connects to two metro lines. Piraeus's port, a short distance from the Athens city center, serves national and international sea lines. The modern highways make driving to and from the city a pleasant experience.

Gastronomy

Gourmet and traditional Greek cuisine, in the past decade, has become one of the most popular in the world as it has been proven to provide a flavourful healthy and balanced diet. Culinary aficionados are encouraged to delight in the myriad of sophisticated restaurants that boast tastes and interiors inspired from all parts of the world. The local and traditional outdoor seaside taverns and cafes are plentiful and a cultural mainstay.

Shopping

Shopping in Athens—a showcase for its traditional and modern culture and lifestyle—can be a fascinating and satisfying experience. Amidst the many well-known international name brand outposts and traditional Greek art and folklore shops, are hundreds of chic boutiques and specialty stores


blossoming with great fashion finds for every taste and budget. Make sure to stop in at one of the many wonderful year-round outdoor cafés and restaurants to ideally complete your experience of shopping the Athenian way!

Sea and Sun

Athens is the only European city surrounded by pristine beaches, where you can swim for many months during the year. Visit a beach in Athens and you are likely to feel like you're on a Greek island, as you are greeted with stretches of crystal sands, fine pebbles and breathtaking, clean blue waters. Some beaches boast barren rocks and cliffs with carved caves and coves you can explore. Other beaches have floating bars, music and seaside spas, while others are secluded for romance. Most offer beach amenities, such as lounge chairs, umbrellas, lifeguards, fun playgrounds, restaurants and water sports for all ages.

In Athens, enjoying a sunset stroll or a seaside meal is a part of daily life. Walk on the many Athenian esplanades lined by tropical palm trees. Beach hopping is made possible by the new tramway. Hop-in from the centre of Athens and watch the sun set over the Saronic Gulf.

Weather

Athens is an ideal year-round destination with comfortable and favourable climate conditions for travel and sightseeing. Rainfall is minimal, and the summers (June through August) are dry and hot with temperatures ranging, on average, from 78°-94°F (20°-34°C). The Mediterranean climate makes for mild winters and even milder autumns in low-lying areas, with the coldest temperatures reported in January at a very temperate 41°-55° F (5°-13°C).

Shopping Hours

Major outlets Monday-Friday. 9:00-21:00; small shops Monday, Wednesday 9:00-15:30; Friday, 9:00-20:30; Saturday 9:00-15:30.

The Airport

The new award-winning Athens International Airport, Eleftherios Venizelos, serves 83 international destinations. Its close proximity to the city centre, 30 minutes by car and 40 minutes by train, makes the center and greater Athens area easily accessible. For more information, visit the official site of the Athens International Airport: www.aia.gr/traveler/

Transportation

Network includes new buses, pollution-free trolleys, tram and a revamped electric railway system that connects to the metro lines. Taxis are readily accessible with or without reservation and are inexpensive by European

standards. For more information, please consult: http//www.stasy.gr

Official Airline Information

We take pride in announcing that Aegean (https://en.about.aegeanair.com/), the premier airline of Greece, a ten-times Best Regional Airline in Europe (last time in 2019) and a 4-star Covid-19 safety rated airline from Skytrax, will be the Official Carrier of COSPAR Athens 2022.

Aegean will provide discounted fares to all conference attendees who choose the airline to reach Athens for the 44th COSPAR Scientific Assembly. The procedure to be followed will be announced in the Assembly's website in due course.

Website

www.cosparathens2022.org

Social Media – Spread the News


Twitter: https://twitter.com/cospar_2022


Facebook:
www.facebook.com/events/406455310469812


LinkedIn:
https://www.linkedin.com/events/cospar2022-44thscientificassemb6785182469445488640/

Financial Support

A limited amount of money will be available to facilitate participation in the 44th COSPAR Scientific Assembly. Please read the instructions below and, if appropriate, complete the application form available by clicking the 'Financial Support' link at www.cospar-assembly.org.

Participants in COSPAR Scientific Assemblies are reminded that they should rely on their own national sources to finance travel/living expenses. In exceptional cases, partial support, up to a maximum of €1,200, may be available to those who are unable to obtain sufficient funding. In many cases, only some seed money will be provided. In cases where participation is virtual, support will be the equivalent of the appropriate registration fee. Priority will be given to:

1. Scientists under 35 years of age on 1 January 2022 (50% of available funds will be reserved for this category),
2. Scientists from developing countries,
3. Scientists from COSPAR member countries in good standing.

To qualify for financial support, the applicant:

a. Must be scheduled to make a presentation (poster or oral), of which he/she is the principal author, in one or more of the Assembly events and have submitted, **by the deadline for financial support applications**, the abstract over the web in accordance with the abstract submission instructions;
b. Must secure most of the required financial support from national sources;
c. Must submit a completed financial support application form to the Main Scientific Organizer of the relevant event (with a copy to the COSPAR Secretariat, cosparcom@cosparhq.cnes.fr) by 11 February 2022 (by that date, abstracts must be available on the web and should not be attached to the application form; early submission of financial support application forms is strongly encouraged);
d. Must submit proof of age if applying as a scientist under 35 and provide proof of student status if planning to register at the student rate.

Successful applicants for financial support from COSPAR are strongly encouraged to submit a manuscript resulting from their Assembly presentation to *Advances in Space Research* or *Life Sciences in Space Research*.

Applications will be judged by the Main Scientific Organizer (MSO) with regard to the importance of the applicant's contribution to the

relevant event, with special consideration being given to applicants under 35 years of age. The importance of the contribution will be determined in relation to the complete set of abstracts received and the consequent structuring of the event by the MSO.

Final decisions will be made by the COSPAR Bureau according to the funding available and the priorities outlined above.

All applicants will be informed by the COSPAR Secretariat of the outcome of this process in April 2022. Successful applicants will receive their support upon arrival at the Scientific Assembly or at the time of registration if participation is virtual. No support will be allocated during the Assembly.

Submission of the financial support application form constitutes authorization to COSPAR and its contractors to share any or all information submitted with the local organizing committee (LOC) of the relevant Assembly and/or the professional congress organizer hired by the LOC.

Abstract Submission

The abstract submission website is located at: www.cospar-assembly.org. ZARM (the Centre of Applied Space Technology and Microgravity, University of Bremen, Germany) assists in the organization of COSPAR's Scientific Assemblies, partic-ularly with respect to management of the abstract handling arrangements.

Abstract Submission Procedure

Participants who wish to give a presentation (oral or poster) must submit an abstract following the instructions below. Abstracts should be short (one page maximum), clear, concise and written in English with correct spelling and good sentence structure. Mathematical symbols and equations must be typed in, and metric symbols should be used. Figures and tables should not be included. It is important that the abstract should be checked thoroughly, particularly with regard to the list of authors, before it is submitted. By submitting an abstract, the author is undertaking to make a presentation during the Assembly.

Abstracts must be submitted on-line. Authors are encouraged to prepare their abstracts using a text editor of their own choice prior to entering the submission website.

Follow the instructions below to submit your abstract:

1. Use the Call for Papers or the Assembly website to identify the event most appropriate for your presentation.

2. Go to the web page of the scientific program: www.cospar-assembly.org.

3. Click on 'Abstract Submission and Log-in' in the left-hand menu column.

4. Log-in.

(a) If not already a user of the system with a username and password, click 'OBTAIN LOGIN for Abstract Submission' in the left-hand menu column and enter the requested information. Choose your personal username and set your own password.

(b) If registered for a previous Assembly or a co-author on a paper presented at an Assembly from 2008 (Montréal) or later, enter your Username and Password or click "Forgot your password." If you have forgotten your Username, first click "Forgot your username" to receive this information by e-mail and then reset your password afterward.

5. Click "Add Abstract" near the centre of the screen and fill in the "Add Abstract" form according to the instructions indicated.

Abstracts submitted by e-mail, fax or hard copy will not be processed.

6. Compose and edit your abstract online at www.cospar-assembly.org. You will be asked to provide: (1) Title; (2) Author(s); (3) Affiliation(s) of Author(s); and (4) Text of the abstract (see the full instructions on-line for the proper formatting of this material).

7. Acknowledgement: Authors whose abstracts have been received and successfully processed will receive an acknowledgement regarding the receipt and status of their contribution as well as its ID-No. for future updating/correction or withdrawal.

Please Note: This call for papers is the sole printed announcement for the 44th COSPAR Scientific Assembly. Updates will be posted on the web at: www.cospar-assembly.org.

See also the website of the Local Organizing Committee for registration, accommodation, local logistics, etc. at:

https://www.cosparathens2022.org.

Important

Submissions are limited to not more than two solicited abstracts and two contributed abstracts on which the submitter is the presenter.

To cover COSPAR's cost for processing abstracts, an administrative fee of €25 will be charged for each abstract submitted. The abstract submission fee is non-refundable and is not based on approval of your abstract submission or attendance at the Scientific Assembly. Refunds will not be issued for abstracts that are withdrawn.

Any amendments within your abstract can be done free of charge using the online submission system.

The only method of payment accepted for the abstract submission fee is by credit card (Visa, MasterCard, or American Express) through the abstract submission system.

The abstract submission fee does not register you for the Scientific Assembly for which a separate registration fee, paid to the Local Organizing Committee, applies. All presenters must register in order to attend the Scientific Assembly.

Abstract Publication

Abstracts of contributions accepted for presentation by the event organizers and by the Program Committee will be published online as 'Accepted Abstracts' of the respective session/event.

Scientific Assembly at a Glance

The following information on scheduling is subject to modification (please see the Assembly webpage in May, June, and July 2022 for updates). Note that scientific sessions will begin on Sunday morning, 17 July 2022 and run through Saturday afternoon, 23 July 2022.

Inaugural Events

The Assembly opening ceremony and reception will take place Monday afternoon, 18 July 2022. Scheduled for Sunday afternoon, 17 July, are a session on latest results, a space agency roundtable discussion, and an introduction-to-COSPAR event.

Open Scientific Commission and Panel Business Meetings

The majority of business meetings of the COSPAR Scientific Commissions and Panels will be held from Tuesday to Thursday, 19–21 July 2022, during the lunch break.

All Assembly participants are encouraged to attend the business meetings of the Scientific Commissions and Panels which cover topics of interest to them. At these meetings Associates (i.e. Assembly participants) will have the opportunity to influence COSPAR policy by electing scientific officers, joining in the discussions concerning scientific matters, and helping to determine the program for the next Scientific Assembly.

COSPAR Council and Bureau Meetings (Closed except to members as noted below)

The first session of the Council meeting (closed except to official representatives of National Institution and Scientific Union members, Scientific Commission Chairs, and the Finance Committee Chair) will be held on Saturday afternoon, 16 July 2022.

The final Council session (closed as noted above) will be held on Sunday morning, 24 July 2022.

The agenda for the Council meeting is expected to cover, among other items:

- Election of officers
- Presentation of bids for the 2026 Assembly

(first session) and selection of the site for the 2026 Assembly (second session),
- Review of actions taken by the Bureau between 2021 and 2022 COSPAR Assemblies,
- Business to be dealt with and decisions to be taken during the Assembly.

A meeting of the COSPAR Bureau (closed) will be held on Saturday morning, 23 July.

Members of the Council and Bureau are reminded of the importance of attending these meetings, particularly since decisions on financial and other matters are scheduled. The meetings will also provide an opportunity to exchange information on items of interest to the space research community.

COSPAR Program Committee

The COSPAR Program Committee is chaired by Professor Tom Krimigis, Academy of Athens, (tom.krimigis@jhuapl.edu). The Vice-Chair is Professor Ioannis Daglis, Hellenic Space Center (ioannis.daglis@hsc.gov.gr). Each COSPAR Scientific Commission (SC), Panel and independent Task Group chair is a member of the Committee. See the inside back cover of *Space Research Today* for the full titles of COSPAR's Scientific Commissions and Panels.

SC A	Dr. Ralph Kahn (USA) ralph.kahn@nasa.gov
SC B	Dr. Maria Teresa Capria (Italy) mariateresa.Capria@inaf.it
SC C	Prof. Andrew Yau (Canada) yau@phys.ucalgary.ca
SC D	Dr. Nicole Vilmer (France) nicole.vilmer@obspm.fr
SC E	Prof. Tomaso Belloni (Italy) tomaso.belloni@inaf.it
SC F	Prof. Tom Hei (USA) tkh1@cumc.columbia.edu
SC G	Dr. Marc Avila (Germany) directorate@zarm.uni-bremen.de
SC H	Prof. Claus Laemmerzahl (Germany) claus.laemmerzahl@zarm.uni-bremen.de
PCB	Dr. Juan Carlos Gabriel (Spain) juan.carlos.gabriel@gmail.com
PE	Prof. Michel Boër (France) michel.boer@oca.eu
PEX	Dr. Frances Westall (France) frances.westall@cnrs-orleans.fr
PEDAS	Dr. Carolin Frueh (USA) cfrueh@purdue.edu
PIR	Dr. Ralph McNutt (USA) ralph.mcnutt@jhuapl.edu
PoIS	Dr. Eric H. Smith (USA) eric.h.smith@lmco.com
PPP	Dr. Athena Coustenis (France) athena.coustenis@obspm.fr
PRBEM	Dr. Yoshizumi Miyoshi (Japan) miyoshi@isee.nagoya-u.ac.jp
PSB	Dr. Tetsuya Yoshida (Japan) yoshida.tetsuya@jaxa.jp
PSD	Ms. Heike Peter (Germany) heike.peter@positim.com
PSSH	Dr. Isabelle Sourbès-Verger (France) isabelle.sourbes@cnrs.fr
PSW	Dr. Maria Kuznetsova (USA) maria.m.kuznetsova@nasa.gov
TGCSS	Dr. Dan Baker (USA) daniel.baker@lasp.colorado.edu

info@cosparathens2022.org

Matrix of Events of <u>Particular</u> Interdisciplinary Interest

For previous Assemblies, the Program Committee used joint event numbering to identify events which were of interest to more than one discipline. To avoid the confusion and repetition of joint numbering, the matrix on the following pages shows at a glance sessions of particular interdisciplinary interest. Participants are advised to scan all event titles for other sessions of interest.

For reference, topics covered by COSPAR Scientific Commissions and Panels are listed below:

SC A Earth's Surface, Meteorology and Climate
SC B Earth-Moon System, Planets, and Small Bodies of the Solar System
SC C Upper Atmospheres of the Earth and Planets including Reference Atmospheres
SC D Space Plasmas in the Solar System, including Planetary Magnetospheres
SC E Research in Astrophysics from Space
SC F Life Sciences as Related to Space
SC G Materials Sciences in Space
SC H Fundamental Physics in Space
PCB Capacity Building
PE Education
PEDAS Potentially Environmentally Detrimental Activities in Space
PEX Exploration
PIR Interstellar Research
PoIS Innovative Solutions
PPP Planetary Protection
PRBEM Radiation Belt Environment Modelling
PSB Technical Problems Related to Scientific Ballooning
PSD Satellite Dynamics
PSSH Social Sciences and Humanities
PSW Space Weather
S Special Event
TGCSS Task Group on the Establishment of a Constellation of Small Satellites

	SCIENTIFIC COMMISSION / PANEL																				
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Scientific Program—Overview

Key to event numbering: The first letter (A-H) of the event indicates the COSPAR Scientific Commission. Numbers, except 0, immediately following the letter indicate Sub-commissions. The second number designates events organized within the remit of a specific Commission or Sub-commission. COSPAR Panel and independent Task Group events are identified by the organizing body's acronym.

MSO = Main Scientific Organizer

Scientific Commission A: Space Studies of the Earth's Surface, Meteorology and Climate

A0.1 Land-Ocean-Atmosphere Interaction
MSO: Severine Fournier (NASA Jet Propulsion Lab.-JPL-Caltech, USA)

A0.2 The Group on Earth Observations (GEO)
MSO: Yasuko Kasai (National Institute of Info-rmation and Communication Technology, Japan)

A0.3 Big Earth Observation Data for Resil-iance and Sustainability of Social and Economic Sectors
MSO: Charalampos Kontoes (National Observatory of Athens-NOA, Greece)

A0.4 The Bond Between Spacecraft In-strument Technologies and the Science They Enable
MSO: Ralph Kahn (NASA GSFC, USA)

A1.1 Space-based and Sub-orbital Observations of Atmospheric Physics and Chemistry: Vital Information on the Health of Our Planet
MSO: Yasuko Kasai (NICT, Japan)

A2.1 Science and Applications enabled by Satellite Missions forGlobal Ocean, Inland Seas and Cryosphere
MSO: Stefano Vignudelli (Consiglio Nazionale delle Ricerche, Italy)

A3.1 Update on Copernicus Land Products Validation Activities
MSO: Ernesto Lopez-Baeza (University of Valencia, Spain)

A3.2 New Developments and Applications of Land Surface Phenology (LSP)
MSO: Jadu Dash (University of Southampton, UK)

A3.3 Earth Observation for Monitoring Photosynthetic Variables in Mangrove Forests
MSO: Mukunda Dev Behera (IIT Kharagpur, India)

Scientific Commission B: Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System

B0.1 Comparative Planetology
MSO: Olga Sykioti (IAASARS, NOA, Greece)

B0.2 Space Resources
MSO: Ian Crawford (Birkbeck College, University of London, UK)

B1.1 Small Body Exploration Sciences:From the Solar System to Inter-stellar Objects
MSO: Ernesto Palomba (INAF-IAPS Rome, Italy)

B1.2 Kuiper Belt and Trans-Neptunian Objects
MSO: Carly Howett (Southwest Research Institute-SwRI, USA)

B1.3 Astrochemistry and Composition as Ariadne's Threads for Planet Formation
MSO: Diego Turrini (INAF - Astronomical Observatory of Torino, Italy)

B2.1 Space Geodetic Reference Systems and Frames: Current State and Future Challenges for Geody-namical Investigations
MSO: Christopher Kotsakis (Aristotle University of Thessaloniki, Greece)

B3.1 Lunar Science and Exploration
MSO: Carle Pieters (Brown University, USA)

B3.2 Human and Robotic Exploration of the Moon and Synergy with Mars and Asteroids
MSO: Bernard H. Foing (ESA/ESTEC, Netherlands)

B4.1 Venus Science and Exploration
MSO: Colin Wilson (University of Oxford, UK)

B4.2 Mars Science Results
MSO: Timothy Haltigin (Canadian Space Agency, Canada)

B4.3 Forward Planning for the Exploration of Mars
MSO: Brandi Carrier (JPL-Caltech, USA)

B4.4 Mars Sample Return
MSO: David Beaty (JPL-Caltech, USA)

B4.5 Mercury
MSO: Johannes Benkhoff (ESA/ESTEC, Netherlands)

B5.1 Ocean Worlds
MSO: Anezina Solomonidou (JPL-Caltech, USA)

B5.2 Giant Planets and their Systems
MSO: Adam Masters (Imperial College London, UK)

B6.1_E4.1 Exoplanet Detection and Characterisation: Current Research, Future Opportunities and the Search for Life Outside the Solar System
MSO: L.B.F.M. Waters (SRON Netherlands Institute for Space Research, Netherlands)

Scientific Commission C: Space Studies of the Upper Atmospheres of the Earth and Planets including Reference Atmospheres

C0.1 International Standards for Space Environment
MSO: Yukihito Kitazawa (JAXA,Japan)

C0.2 Advances in Remote Sensing of the Middle and Upper Atmosphere and Ionosphere from the Ground and from Space, including Sounding Rockets and Multi-instrument Studies
MSO: David Rees (The Paradigm Factor, UK)

C0.3 Variabilities of Radio Wave Propagation Characteristics in Lower Ionosphere
MSO: Sudipta Sasmal (Indian Centre for Space Physics, India)

C1.1 Recent Advances in Equatorial, Low- and Mid-latitude Mesosphere, Thermosphere and Ionosphere Studies
MSO: Paulo Roberto Fagundes (Universidade do Vale do Paraiba, Brazil)

C1.2 Conditions of Enhanced Risk for the Ionospheric Weather
MSO: Anna Belehaki (NOA, Greece)

C1.3 Magnetosphere-Ionosphere- Atmosphere Coupling Dynamics at Different Temporal and Spatial Scales
MSO: Mirko Piersanti (INAF-IAPS Rome, Italy)

C1.4 Probing the Lower-Thermosphere-Ionosphere with In-situ Measurements
MSO: Guram Kervalishvili (German Research Centre for Geosciences-GFZ, Germany)

C1.5 Space Weather and Earth's Atmosphere-Ionosphere
MSO: Nicholas Pedatella (High Altitude Observatory, NCAR, USA)

C1.6 Development and Use of Upper Atmosphere Models and Whole Atmosphere Models for Space Weather Application
MSO: Tim Fuller-Rowell (University of Colorado, USA)

C1.7 Information Theory and Machine Learning for Geospace Research
MSO: Georgios Balasis (NOA, Greece)

C2.1 Wave Coupling Processes and Consequences in the Whole Atmosphere and Ionosphere
MSO: Erdal Yiğit (George Mason University, Space Weather Lab, USA)

C2.2 Advances in External Forcing Studies for the Middle Atmosphere and Lower Ionosphere
MSO: Yvan Orsolini (Norwegian Institute for Air Research,Norway)

C3.1 Planetary Atmospheres
MSO: Hilary L. Justh (NASA Marshall Space Flight Center, USA)

C3.2 Planetary Upper Atmospheres,Ionospheres and Magnetospheres
MSO: Syed A. Haider (Physical Research Laboratory-PRL, India)

C4.1 Real-time and Retrospective Ionosphere Modelling with In-situ and GNSS Satellite Data
MSO: Dieter Bilitza (George Mason University, Virginia and NASA GSFC, USA)

C4.2 Development of Models Related to the COSPAR International Reference Atmosphere and to ISO Standards for the Atmosphere
MSO: David Rees (The Paradigm Factor, UK)

C5.1_D4.1 Active Space Experiment
MSO: Björn Gustavsson (University of Tromsø, Norway)

C5.2_D4.2 Dust Observations in Space and Laboratory Experiments
MSO: Jiri Pavlu (Charles University, Czech Republic)

Scientific Commission D: Space Plasmas in the Solar System, including Planetary Magnetospheres

D0.1 Overview Session Commission D
MSO: Nicole Vilmer (Observatoire de Paris, LESIA, France)

D1.1 Neutron Monitor Science: Current and Future Prospects
MSO: Du Toit Strauss (North-West University, South Africa)

D1.2 Magneto-plasma Structures, Streams and Flows in the Heliosphere
MSO: Olga Khabarova (IZMIRAN, Russia)

D1.3 Understanding and Predicting Solar Energetic Particle Events across the Heliosphere
MSO: Athanasios Papaioannou (NOA, Greece)

D1.4 Revealing the Heliosphere and Interstellar Medium with IBEX and IMAP
MSO: Eric J. Zirnstein (Princeton University, USA)

D1.5 Theory and Applications of Kappa Distributions in Space Science
MSO: George Livadiotis (SwRI, USA)

D1.6 Acceleration and Transport of Energetic Particles in the Heliosphere and Beyond
MSO: Agnieszka Gil Swiderska (Siedlce University, Poland)

D1.7 Large-Scale Heliospheric Structure: Theory, Modelling, and Data
MSO: Jens Kleimann (Ruhr Universität Bochum, Germany)

D2.1_E3.1 Exploring the Cradle of the Solar Wind with PSP/SolO/Proba-3: What Do We Really Know about the Inner Solar Corona?
MSO: Kanaris Tsinganos (National and Kapodistrian University of Athens, Greece)

D2.2_E3.2 Connecting Solar and Stellar Coronal Mass Ejections: Lessons Learned, Challenges and Perspectives
MSO: Spiros Patsourakos (University of Ioannina, Greece)

D2.3_E3.3 Parker Solar Probe: Ushering a New Frontier in Space Exploration
MSO: Nour E. Raouafi (JHU APL, USA)

D2.4_E3.4 Magnetic Reconnection in the Turbulent Plasmas from the Sun through the Heliosphere to Galaxies
MSO: Jörg Büchner (Max Planck Institut für Sonnensystem-forschung, Germany)

D2.5_E3.5 Probing the Sources of Solar Wind and Energetic Particles and Tracking their Journey into the Heliosphere
MSO: Louise K. Harra (PMOD/WRC, Switzerland)

D2.6_E3.6 Space Climate: From Past to Present and into the Future
MSO: Kalevi Mursula (University of Oulu, Finland)

D3.1 Highlights of Magnetospheric Plasma Physics
MSO: Michael A. Balikhin (University of Sheffield, UK)

D3.2 Cross-scale Coupling and Multi-point Observations in the Magnetosphere
MSO: Katariina Nykyri (Embry-Riddle Aeronautical University, USA)

D3.3 Origin of Non-thermal Distributions in Space Plasma and their Role in Wave Generation and Heating/Acceleration of Particles
MSO: Gurbax Singh Lakhina (Indian Institute of Geomagnetism, India)

D3.4 Particle Acceleration and Loss in the Earth and Planetary Magnetospheres
MSO: Yuri Shprits (GFZ, Germany)

D3.5 Magnetotail Dynamics and Sub-storms during Storm and Non-storm Times
MSO: Elena Grigorenko (Space Research Institute (IKI), RAS, Russia)

D3.6 Imaging of the Magnetosphere
MSO: Steve Milan (University of Leicester, UK)

D3.7 Dialogues Between Space Science and Art
MSO: Fiori-Anastasia Metallinou (NOA, Greece)

C5.1_D4.1 Active Space Experiment

C5.2_D4.2 Dust Observations in Space and Laboratory Experiments

Scientific Commission E: Research in Astrophysics from Space

E1.1 The Last Few Miles: Accreting Black Holes Between the Disk,Corona and Jet
MSO: Andrzej Zdziarski (Copernicus Center, Poland)

E1.2 Black Hole Astrophysics: Observational Evidence and Theoretical Models
MSO: Sandip Kumar Chakrabarti (Indian Centre for Space Physics, India)

E1.3 Origins of Cosmic Rays
MSO: Igor Moskalenko (Stanford University, USA)

E1.4 Signatures of Cosmic Black Holes
MSO: Sudip Bhattacharyya (Tata Institute of Fundamental Research, India)

E1.5 Science with AstroSat: from Ultraviolet to Gamma Rays
MSO: Dipankar Bhattacharya (Inter University Centre for Astronomy and Astrophysics, India)

E1.6 Spectral/Timing/Polarimetry Properties of AGN: Theory and Observations of the Inner Workings in these Objects
MSO: Iosif Papadakis (University of Crete, Greece)

E1.7 Properties and Evolution of Active Galactic Nuclei in Galaxy Clusters
MSO: Elias Koulouridis (NOA, Greece)

E1.8 Timing the Spectra of Accreting Black Holes and Neutron Stars. Advanced Analysis and Modelling
MSO: Mariano Mendez (University of Groningen, Netherlands)

E1.9 Cherenkov Telescope Array: The Ground-based Eyes to Observe the Gamma Ray Universe
MSO: Tulun Ergin (TUBITAK Space Technologies Research Institute, Turkey)

E1.10 Star Formation with Spaceborne Infrared Facilities: the Era of JWST
MSO: Odysseas Dionatos (University of Vienna, Austria)

E1.11 Supermassive Black Holes at High Redshift
MSO: Andrea Comastri (INAF- Osservatorio di Bologna, Italy)

E1.12 Observations and Prospects for X-ray Polarimetry
MSO: Herman Marshall (Massachusetts Institute of Technology,USA)

E1.13 Detecting Gravitational Waves from Space
MSO: Nikolaos Karnesis (Aristotle University of Thessaloniki, Greece)

E1.14 Astronomy from Space and the Ground: Synergies and Challenges
MSO: Alvaro Giménez (Consejo Superior de Investigaciones Cientificas-CSIC, Spain)

E1.15 Broad-band and Multi-messenger View of High-energy Transient Phenomena
MSO: Shuang-Nan Zhang (Institute of High Energy Physics, CAS, China)

E1.16 X- and Gamma-ray Counterparts of New Transients in the Multi- messenger Era
MSO: Lorenzo Natalucci (INAF, Italy)

E1.17 Small Satellites and Constellations for Astrophysics and Planetary Exploration
MSO: Alessandra Di Cecco (ASI, Italy)

E1.18 Twenty Years of AGN Discoveries with Space Observations: Main Results and Perspectives on AGN in the High-energy Sky
MSO: Gabriele Bruni (INAF-IAPS, Italy)

E2.1 Solar and Stellar Magnetic Flux Ropes
MSO: Alexander Nindos (University of Ioannina, Greece)

E2.2 Catalyzing Progress in our Understanding of the Physics of Solar and Stellar Eruptions via Data Driven Simulations
MSO: Georgios Chintzoglou (Lockheed Martin Solar and Astrophysics Laboratory, USA)

E2.3 Seismology of the Sun, Stars and their Atmosphere
MSO: Tom Van Doorsselaere (KU Leuven, Belgium)

E2.4 The Dynamic Sun at Small Scales
MSO: Kostas Tziotziou (NOA, Greece)

E2.5 Abundance Variations and Fundamental Questions in Solar and Stellar Physics
MSO: Deborah Baker (UCL, Mullard Space Science Laboratory, UK)

D2.1_E3.1 Exploring the Cradle of the Solar Wind with PSP/SolO/Proba- 3: What Do We Really Know about the Inner Solar Corona?

D2.2_E3.2 Connecting Solar and Stellar Coronal Mass Ejections: Lessons Learned, Challenges and Perspectives

D2.3_E3.3 Parker Solar Probe: Ushering a New Frontier in Space Exploration

D2.4_E3.4 Magnetic Reconnection in theTurbulent Plasmas from the Sun through the Heliosphere to Galaxies

D2.5_E3.5 Probing the Sources of Solar Wind and Energetic Particles and Tracking their Journey into the Heliosphere

D2.6_E3.6 Space Climate: From Past to Present and into the Future

B6.1_E4.1 Exoplanet Detection and Characterisation: Current Research, Future Opportunities and the Search for Life Outside the Solar System

Scientific Commission F: Life Sciences as Related to Space

F0.1 Scientific Commission F Overview Talks
MSO: Tom Hei (Columbia University Medical Center, USA)

F1.1 Gravity Perception and Response in Plants and Fungi: Ground and Space Studies
MSO: Chris Wolverton (OhioWesleyan University, USA)

F2.1 Biological Effects of Space Radiation and Co-stressors: from Basic Research to Practical Recommendations
MSO: Christine Hellweg (DLR - Inst. of Aerospace Medicine, Germany)

F2.2 Space Radiation Risk, Quality of Radiation and Counter-Measures: Physical and Biological Mechanisms, Modelling and Simulations
MSO: Francis Cucinotta (University of Nevada Las Vegas, USA)

F2.3 Space Radiations: Dosimetric Measurements and Related Models, Detector Developments and Ground-Based Characterization
MSO: Thomas Berger (DLR, Germany)

F2.4 Genetic Epigenetic and MetabolicChanges in Spaceflight and Simulated Spaceflight
MSO: Yeqing Sun (Dalian Maritime University, CAS, China)

F3.1 Chemical Complexity of Molecular Universe

MSO: Ankan Das (Indian Centre for Space Physics, India)

F3.2 Astrobiology
MSO: Petra Rettberg (DLR - Inst. of Aerospace Medicine, Germany)

F3.3 Habitability of Mars
MSO: Javier Martin-Torres (University of Aberdeen, UK)

F3.4 Biosignatures and Biomarkers - Searching for Traces of Prebiotic Organic Compounds
MSO: Michel Viso (CNES, France)

F3.5 Simple and Complex Molecules in Star-forming Regions
MSO: Robin Garrod (University of Virginia, USA)

F3.6 Quest to Detect Extraterrestrial Life: Scientific Approaches and Cultural Impact of Discovery
MSO: Nectaria Gizani (Hellenic Open University, Greece)

F4.1 Advanced Life Support Technologies and Test Bed Facilities
MSO: Christophe Lasseur (ESA, Netherlands)

F4.2 Influence of Spaceflight Environments on Biological Systems
MSO: Galina S. Nechitailo (Inst.of Biochemical Physics, RAS, Russia)

F4.3 Space Food and Nutrition
MSO: Naomi Katayama (Nagoya Women's University, Japan)

F5.1 Molecular, Cellular and Physiological Changes in Response to Spaceflight and Ground-based Analogues
MSO: Elizabeth Blaber (Rensselaer Polytechnic Institute, USA)

F5.2 Exploring the Space Exposome and Approaches for Cumulative Risk **Assessment of Space**-flight-Associated Human Health Risks
MSO: Zarana Patel (NASA JSC, USA)

Scientific Commission G: Materials Sciences in Space

G0.1 Gravitational Effects on Physico-Chemical Processes
MSO: Jeff Porter (Universidad Politécnica de Madrid, Spain)

G0.2 Drop Tower Days
MSO: Marc Avila (ZARM, University of Bremen, Germany)

G0.3 Influence of Free Space Environment on the Behavior of Materials
MSO: Alexey Kondyurin (Ewingar Scientific, Australia)

G0.4 Advanced Materials and their Technologies for Space Exploration
MSO: John Vlachopoulos (McMaster University, Canada)

Scientific Commission H: Fundamental Physics in Space

H0.1 Commission H Highlight Talks
MSO: Claus Laemmerzahl (ZARM, University of Bremen, Germany)

H0.2 Gravitation, Dark Energy and Dark Matter
MSO: Orfeu Bertolami (Universidade do Porto, Portugal)

H0.3 Space Missions for Fundamental Physics
MSO: Paul McNamara (ESA-ESTEC, Netherlands)

H0.4 Gravitational Wave Astrophysics
MSO: Michele Vallisneri (JPL, USA)

H0.5 Advanced Methods for Geodesy, Metrology, Navigation and Fundamental Physics
MSO: Roberto Peron (INAF-IAPS, Italy)

H0.6 Enabling Technologies for Fundamental Physics Experiments andMissions
MSO: Ernst Maria Rasel (Leibniz Universität Hannover, Germany)

LR.1 **Latest Results**
MSO: Jean-Claude Worms (COSPAR)

Panel on Capacity Building (PCB)

PCB.1 Capacity Building
MSO: Carlos Gabriel (COSPAR, Spain)

PCB.2 Small Satellites for Capacity Building
MSO: Carlos Gabriel (COSPAR, Spain)

Panel on Potentially Environmentally Detrimental Activities in Space (PEDAS)

PEDAS.1 The Science of Human-Made Objects in Orbit: Space Debris and Sustainable Use of Space
MSO: Carolin Frueh (Purdue University, USA)

Panel on Exploration (PEX)

PEX.1 Establishing a Framework for Scientifically-based Stewardship of Celestial Bodies
MSO: Frances Westall (CNRS, France)

PEX.2 A Shared Vision for Global Exploration of Moon, Mars, near Earth Asteroids and beyond
MSO: Bernard H. Foing (ESA/ESTEC, Netherlands)

Panel on Education (PE)

PE.1 Space Explorers in Schools—Empowering the Next Generation of Researchers

MSO: Rosa Doran (NUCLIO - Núcleo Interactivo de Astronomia, Portugal)

PE.2 Current Trends, Initiatives and Research in Education and Outreach for Space Sciences
MSO: Michel Boer (CNRS, France

Panel on Interstellar Research (PIR)

PIR.1 Near-term Exploration of the Interstellar Medium
MSO: Ralph McNutt (JHU APL, USA)

Panel on Innovative Solutions (PoIS)

PoIS.1 Monitoring and Forecasting of Space Weather Conditions
MSO: Irina Kitiashvili (NASA Ames Research Center, USA)

PoIS.2 Mars Atmospheric Modelling Using Sparse and Disparate Data
MSO: George A. Danos (Cyprus Space Exploration Organisation, Cyprus)

PoIS.3 Infrastructure and Tools for Leveraging Exponentially Increasing Data, and Engaging the World's Next Generation of Scientists
MSO: Jonny Dyer (Private Individual)

Panel on Planetary Protection (PPP)

PPP.1 Planetary Protection
MSO: Athena Coustenis (Paris Observatory, France)

PPP.2 Planetary Protection Mission Implementation and Status
MSO: Masaki Fujimoto (Institute of Space and Astronautical Science, Japan)

PPP.3 Planetary Protection Research and Development
MSO: Petra Rettberg (DLR - Inst. of Aerospace Medicine, Germany)

Panel on Radiation Belt Environment Modelling (PRBEM)

PRBEM.1 Empirical and Numerical Models of the near-Earth Radiation Environment
MSO: Yihua Zheng (NASA GSFC, USA)

PRBEM.2 Radiation Belt Missions, Data Sets, Data Processing, and Inter-calibration
MSO: Ingmar Sandberg (SPARC- Space Applications and Research Consultancy, Greece)

PRBEM.3 Extending the Prediction Horizon of Earth's Radiation Belts:from Science to End-users Space Weather Services
MSO: Ioannis A. Daglis (National and Kapodistrian University of Athens, Greece)

Panel on Technical Problems Related to Scientific Ballooning (PSB)

PSB.1 Scientific Ballooning: Recent Developments in Technology and Instrumentation
MSO: Mattias Abrahamsson (Swedish Space Corporation, Sweden)

Panel on Satellite Dynamics (PSD)

PSD.1 Satellite Dynamics: New Developments and Challenges for Earthand Solar System Sciences
MSO: Heike Peter (PosiTim UG (haftungs beschraenkt), Germany)

Panel on Social Sciences and Humanities (PSSH)

PSSH.1 Engaging Space in Society
MSO: Isabelle Sourbès-Verger

Panel on Space Weather (PSW)

PSW.1 Space Weather Nowcasting and Forecasting Capabilities for Improved Space Weather Services: The Role of Validation and Performance Assessment in Enabling R20 and O2R
MSO: Alexi Glover (ESA, Germany)

PSW.2 Space Weather at Planetary Bodies in the Solar System
MSO: Reka Winslow (University of New Hampshire, USA)

PSW.3 Ionospheric Indices and Scales for Applications
MSO: Norbert Jakowski (DLR, Germany)

PSW.4 Space Weather Information Architecture and Innovative Solutions
MSO: Arnaud Masson (Telespazio UK for ESA, ESAC, Spain)

PSW.5 COSPAR International Space Weather Action Teams (ISWAT): Progress and Plans
MSO: Maria Kuznetsova (NASA-GSFC/Heliophysics Science Division, USA)

PSW.6 COSPAR Space Weather Roadmap as a Community-driven Effort
MSO: Mario M. Bisi (Rutherford Appleton Laboratory, UK)

PSW.7 Panel Discussion: Global Coordination in Space Weather and Interfacing with User Groups
MSO: Ian Mann (University of Alberta, Canada)

PSW.8 The Use of Ground-Based Instrument Arrays in Support of Space Missions
MSO: Hermann Opgenoorth (Umå University, Sweden)

PSW.9 International Space Weather Missions and Coordination: Current and Planned Missions
MSO: Juha-Pekka Luntama (ESA, Germany)

Special

S.1 Come and Learn about COSPAR and this Assembly
MSO: Michel Viso (CNES, France)

Task Group on the Establishment of a Constellation of Small Satellites (TGCSS)

TGCSS.1 Small Spacecraft - Big Science
MSO: Daniel N. Baker (LASP, University of Colorado, USA)

Scientific Program—Details

The complete Scientific Assembly timetable indicating event dates and durations will be posted on the web in April 2022, but in the meantime please see the Assembly home page for updates and additional information, including institutional affiliation and contact details of scientific event organizers, completed Scientific Committee membership lists, etc.

MSO = Main Scientific Organizer
DO = Deputy Organizer

A0.1 Land-Ocean-Atmosphere Interaction

MSO/DO: Severine Fournier (NASA JPL / Caltech, USA), Jérôme Benveniste (ESA, Italy)

Organizing Committee: TBA

Event Information: The Earth system involves interactions of atmosphere, ocean, and land. These interactions affect energy, water, and carbon cycles, and thus the biosphere. Understanding the underlying processes of the interactions and quantifying the fluxes across different elements of the Earth's system are of fundamental importance to human society. Satellite measurements allow us to observe different elements of the integrated Earthsystem, greatly increasing the capabilities to conduct interdisciplinary research. Sustaining and enhancing space-based integrated observing system for the Earth system is essential for the development of Earth System model, analysis, and prediction systems, which has important implications for the ability to project future climate change. This session encourages contributions that emphasize the linkages of the atmosphere, ocean, and/or land based on satellite observations or in conjunction with models. The objectives are to foster interdisciplinary collaborations and to advocate for the need to sustain and enhance remote sensing capabilities to observethe integrated Earth system.

A0.2 The Group on Earth Observations (GEO)

MSO/DO: Yasuko Kasai (National Institute of Information and Communication Technology, Japan)

Organizing Committee: TBA

Event Information: The Group on Earth Observations (GEO) is building a Global Earth Observation System of Systems (GEOSS) to support three overarching themes: United Nations (UN) Sustainable Development Goals; UN Framework Convention on Climate Change Paris Agreement; and, UN Sendai Framework for Disaster Risk Reduction. The Symposium will highlight the science enabled by satellite observations of several major GEO program elements. GEO science leaders will describe current developments and future activities, and promote opportunities for COSPAR Associates to participate in GEO projects. All papers will be solicited with oral presentations.

A0.3 Big Earth Observation Data for Resiliance and Sustainability of Social and Economic Sectors

MSO/DO: Charalampos Kontoes (National Observatory of Athens-NOA, Greece), Thierry Ranchin (Private Individual)

Organizing Committee: Thierry Ranchin (MINES ParisTech—PSL/ARMINES, France), Stelios Kazadzis (Physikalisch-Meteorologisches Observatorium Davos, World Radiation Center—PMOD/WRC, Switzerland), Nicola Pirrone (Italian National Research Council–CNR, Italy), Marie-Francoise Voidrot (Open Geospatial Consortium–OGC, France), Ivan Petiteville (ESA, France)

Event Information: This event showcases major scientific advances in the synergistic handling, management and exploitation of big earth observation data, for building cross sector services to address common priorities and user needs in a

range of key domains, such as natural disasters, epidemics, renewable energy and agriculture. Building upon the employment of High Performance Cloud Computing resources, Datacubes/ Array Data Bases and Machine Learning / Artificial Intelligence, it emphasizes on novel methods to efficiently process big volumes of data provided from Copernicus Sentinels and third party satellite missions, but also in-situ, and crowd data from low cost sensor networks and media, providing high spatial and temporal resolution. This event presents state-of-the-art services and solutions in support of informed decision making towards the UN SDGs and the implementation of relevant EU and Global Directives for Societal Benefit including the Sendai Framework for Disaster Risk Reduction and the Paris Agreement to combat climate change.

A0.4 The Bond Between Spacecraft Instrument Technologies and the Science They Enable

MSO/DO: Ralph Kahn (NASA Goddard Space Flight Center-GSFC, USA), Jérôme Benveniste (ESA, Italy)

Organizing Committee: Ralph Kahn (NASA GSFC, USA), Jérôme Benveniste (ESA, Italy)

Event Information: One unique aspect of COSPAR, distinct from other large international geosciences meetings, is the emphasis on science and technology performed in space. For example, COSPAR affords opportunities for interdisciplinary sessions that link a geosciences focus with key, space-instrument-related engineering considerations. This event highlights current and/or future spacecraft technologies relevant to a range of instruments and applications, that would include (but not limited to) new geostationary and 'small' satellites. We seek interdisciplinary presentations, simultaneously carrying both the sensibilities of engineering expertise and those relating to the science application. As such, we encourage abstracts with co-authors having both engineering and science expertise. The presentations should cover both the technology and the application of the resulting data, with the aim of advancing Earth system science. Critical to the success of this session is that the presentations not merely provide a typical disciplinary science discussion on one hand and a disjointed engineering-oriented discourse on the other hand. Rather, they should offer a fresh look at the relationship between the engineering and the science of space-based geoscience observation.

A1.1 Space-based and Sub-orbital Observations of Atmospheric Physics and Chemistry: Vital Information on the Health of Our Planet

MSO/DO: Yasuko Kasai (National Institute of Information and Communication Technology, Japan), Kaley Walker (University of Toronto, Canada)

Organizing Committee: John Burrows (Institute of Environmental Physics, University of Bremen, Germany), James Drummond (Dalhousie University, Canada), Ralph Kahn (NASA GSFC, USA), Jean-Christopher Lambert (Belgian Institute of Space Aeronomy, Belgium), Jean-Pierre Pommereau (LATMOS, France), Christian Von Savigny (Ernst-Moritz-Arndt-Universitaet Greifswald, Germany)

Event Information: Space-based remote sensing observations of the Earth's atmosphere have become an indispensable tool for monitoring the state of the atmosphere as well as improving the scientific understanding of physical-chemical processes in the Earth system. Many satellite data products have reached a state of maturity that qualifies them to be used as essential climate variable (ECV) data sets. One of the main aims of COSPAR session A1.1 is to provide a forum for interaction between space-based and sub-orbital remote sensing communities working in related science areas of atmospheric chemistry and physics, in order to facilitate interaction across the sub-discipline boundaries. Contributions to the following areas are welcome: New missions and techniques, validation, technical and spacecraft

engineering issues, greenhouse gases, tropospheric pollution, tropospheric and stratospheric aerosols, UT/LS interaction,ozone, dynamics and chemistry of the UT/LS, stratosphere and mesosphere. Contributions on small satellites and geostationary satellites are particularly encouraged.

A2.1 Science and Applications Enabled by Satellite Missions for Global Ocean, In-land Seas and Cryosphere

MSO/DO: Stefano Vignudelli (CNR, Italy), Severine Fournier (NASA JPL-Caltech, USA)

Organizing Committee: Andrey Kostianoy (P.P. Shirshov Institute of Oceanology, RAS, Russia), Naoto Ebuchi (Institute of Low Temperature Science Hokkaido University, Japan), C. K. Shum (Ohio State University, USA)

Event Information: The aim of this session is to promote the values of satellite missions for the global ocean, inland seas and cryosphere, as well as to foster the related international collaborations and coordination. The scope includes scientific and operational exploitation of the aforementioned satellite measurements from past, current and future missions, retrieval improvements, including calibrations and validations. Satellite measure-ments are interpreted in terms of sea surface temperature, sea surface salinity, marine gravity, bathymetry, relative sea-level, tides, ocean-surface wind, waves, currents, ocean color, ocean mass, etc. as well as sea-ice related parameters (freeboard, extent, concentration, thickness, age). These data are used in studies of oceanographic processes including mesoscale and sub-mesoscale dynamics as well as eddies and advection of oil pollution. Of particular interest are studies in coastal oceans, estuaries, and polar oceans, where special retrieval algorithms are required to improve accuracy. The contributions of the above holistic satellite measurements to study climate change are also solicited. Also encouraged is the use of satellite measurements in synergy, as well as their use within models and combined with in situ data in situ data. Finally, contributions to advance the science of future mission concepts, sensor technologies, and instrument data processing algorithms, are welcome.

A3.1 Update on Copernicus Land Products Validation Activities

MSO/DO: Ernesto Lopez-Baeza (University of Valencia, Spain)

Organizing Committee: TBA

Event Information: Copernicus is the European flagship programme on Earth Observation that looks at our planet and its environment offering information services based on satellite Earth observation data and in situ (non-space) data.The Copernicus Global Land Service (CGLS) systematically produces a series of qualified bio-geophysical products on the status and evolution of the land surface, at global scale and at mid to low spatial resolution, complemented by the constitution of long-term time series. The products are used to monitor the vegetation, the water cycle, the energy budget and the terrestrial cryosphere. Validation is the processof assessing by independent means the quality of the data products derived from a system outcome. As applied to Earth Observation, validation is, therefore, the activity that gives sense to remote sensing geophysicalretrieved products, to confirm that they meet the service requirements and the needs of users. Validation of Copernicus land prod- ucts is therefore of paramount significance and this session deals with updating on the different activities carried out both from satellite-sensed observations carried out from the different Sentinels and ground-based measurements, validation sites/super-sites and methodologies. Scientific communications—oral or poster—are kindly requested giving account of validation activities, methodologies and results on the common Copernicus Global Land Service products: Vegetation; Fraction of Photo-synthetically Active Radiation Absorbed by the Vegetation; Fraction of Green Vegetation Cover; Leaf Area Index; Normalized Difference Vegetation Index; Vegetation Condition Index;

Vegetation Productivity Index; Dry Matter Productivity; Burnt Area; Soil Water Index; Surface Soil Moisture-Energy; Land Surface Temperature; Top of Canopy Reflectance; Surface Albedo-Water; Water Bodies; Lake Surface Water Temperature; Lake Water Quality-Terrestrial Cryosphere; Lake Ice Extent; Snow Cover Extent; Snow Water Equivalent.

A3.2 New Developments and Applications of Land Surface Phenology (LSP)

MSO/DO: Jadu Dash (University of Southampton, UK)

Organizing Committee: Victor F. Rodriguez Galiano (University of Seville, Spain)

Event Information: Land surface phenology (LSP) is the study of seasonal patterns inplant phenophases based on time series derived from satellite data and has played an essential role in monitoring the response of terrestrial ecosystems to environmental changes from local to global scales. We welcome contributions concerning recent developments and applications in modelling and/or monitoring of Land surface phenology, including (but not limited to): human-induced disturbances on Land surface phenology in urban environments; impacts of climate change on Land surface phenology; interactions between Land surface phenology and carbon and water cycles; new methods to derive Land surface phenology from time series of satellite data; characterizing Land surface phenology of different land-covers/ eco-systems intercomparison/validation with: in situ phenological observations, flux towers, phenocams using phenometrics for the mapping of forest and croplands narrowband spectral indices to derive vegetation dynamics long-wave sensors (active and passive) to derive Land surface phenology; Land surface phenology from solar induced fluorescence

A3.3 Earth Observation for Monitoring Photosynthetic Variables in Mangrove Forests

MSO/DO: Mukunda Dev Behera (IIT Kharagpur, India), Rajeev Kumar Jaiswal (ISRO, India)

Organizing Committee: TBA

Event Information: Mangrove forests are one of the most carbon-rich ecosystems in the tropics as they can accumulate almost four times carbon per unit area compared to other forests. Although mangroves cover only 0.7% of the world's tropical forests, their carbon-storing capacity alleviates climate change. Quantitative appraisal of photosynthetic parameters using Earth observation data is imperative since they provide assessment, monitoring and prediction of mangrove forest health and sustainability.

This event show cases retrieval of photosynthetic variables such as tree/ canopy height, tree basal area and diameter at breast height, crown height and structure, phenology, leaf/ foliar chlorophyll and nitrogen, fAPAR, LAI, SiF and biomass; using different methods such as parametric regression (including vegetation indices, shape indices, and spectral transformations), nonparametric regression (including linear and nonlinear machine learning regression algorithms), physically based methods (including inversion of Radiative Transfer Models (RTMs) using numerical optimization and LUT approaches), and hybrid regression methods (that combine RTM simulations with machine learning regression methods). This event solicits presentations on the evaluation of different techniques for the retrieval of photosynthetic variables using Earth Observation data such as SAR, and optical multi-/ hyper spectral and LiDAR from various platforms exploiting data synergy and optimization, to better understand/ characterize mangrove forests.

B0.1 Comparative Planetology

MSO/DO: Olga Sykioti (IAASARS, National Observatory of Athens, Greece), Anezina Solomonidou (Caltech/JPL, USA)

Organizing Committee: Elias Chatzitheodoridis (National Technical University of Athens, Greece), Athanasios Rontogiannis (Institute for

Astronomy, Astrophysics, Space Applications and Remote Sensing, NOA, Greece), Athanasios Papaioannnou (Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing, NOA, Greece)

Event Information: Comparative planetology, as a multidisciplinary branch of space and planetary science, examines dif- ferent natural processes and systems by their effects and phenomena on and between both Earth-like and Jovian bodies in our solar system. An integrated, comparative planetology approach may combine space missions and instruments, autonomous surface exploration, sample return laboratories and after-mission data exploitation in order to study physical/geophysical properties (e.g. surface gravity, albedo, temperature), geological properties (e.g. geomorphology, chemical composition, mineralogy, stratigraphy) and advanced data processing techniques (e.g. pattern recognition, imaging spectroscopy, image and signal processing, data denoising). Comparative studies between planetary bodies such as surface mineralogy and chemical composition, interiors of planets, crustal evolution, magnetic fields, planetary atmospheres and aspects of habitability are welcomed.

B0.2 Space Resources

MSO/DO: Ian Crawford (Birkbeck College, University of London, UK), John Rummel (Friday Harbor Partners LLC, USA)

Organizing Committee: Mahesh Anand (Open University, UK), Ben Bussey (APL, USA), Andrew Dempster (UNSW, Australia) Martin Elvis (Harvard Smithsonian Center for Astrophysics), Amara Graps (PSI/University of Latvia/Baltics in Space, USA/Latvia), Wenzhe Fa (Peking University, China), Jessica Flahaut (CNRS, France), Junichi Haruyama (JAXA, Japan), Clive Neal (University of Notre Dame, USA), Beth Lomax (ESA).

Event Information: There is growing interest in the use of the resource base of the Solar System to facilitate space exploration and enable the development of a space economy. Such activities might also supplement theeconomic resources of our own planet. This event will address the extent to which lunar,asteroid, and martian resources may con- tribute to these objectives. Papers are invited on all aspects of the science and engineering of space resource utilisation, including the development of synergies among techniques developed to access resources on different Solar System objects, and the scientific investigations that support them.

B1.1 Small Body Exploration Sciences: From the Solar System to Inter-stellar Objects

MSO/DO: Ernesto Palomba (INAF-IAPS Rome, Italy), Stefanie Milam (NASA GSFC, USA)

Organizing Committee: TBA

Event Information: *Hayabusa 2* and OSIRIS-Rex, two carbonaceous asteroid sample return missions have just completed their observations and samplings. The initial results from the *Hayabusa 2* samples collected from Ryugu are ongoing and results as well as additional samples will be available to the scientific community soon. The upcoming James Webb Space Telescope will conduct observations of various objects across the Solar System and continue the exceptional science of remote sensing that the Hubble Space Telescope has and will continue to provide for the community. Other missions, including Herschel and Spitzer (archival), NEOWISE, and Gaia continue producing observational results to advance our understanding of the Solar System formation and evolution. Additionally, a fleet of new missions such as Psyche, Lucy, MMX, Destiny+, DART and Hera are under development to explore multiple small bodies (M-type asteroid, Jupiter Trojans, Martian satellites, an active asteroid, and a binary NEO, respectively) and will also significantly contribute to this fundamental question and provide ground-truths for remote sensing and population studies. This session will host multidisciplinary topics on smallbody science and will include presentations from telescopic observations, meteoritic and meteors analyses,

laboratory experiments, computational and theoretical studies. The intent of this session is to be the gathering place of recent results and future prospects of small body exploration from the scientific and the technologic point of view. The Organizing Committee welcomes contributions with a Scientific, Technical or Instrumental focus encompassing all the topics above to advance new and future small body missions.

B1.2 Kuiper Belt and Trans-Neptunian Objects

MSO/DO: Carly Howett (Southwest Research Institut-SwRI, USA), Kelsi Singer (SwRI, USA)

Organizing Committee: TBA

Event Information: The Kuiper Belt and Trans-Neptunian Objects session solicits contributions relating to the study of Trans-Neptunian (TNO) and Kuiper Belt (KBO) Objects. The session will discuss all aspects of these bodies, including but not limited to comparisons between objects, and object's shapes, orbits, composition, geology, geophysics, and atmospheres. Investigations using both ground-based and space-based observations will be discussed. The intent of this session is to allow intercomparisons to be made about these intriguing outer solar system bodies.

B1.3 Astrochemistry and Composition as Ariadne's Threads for Planet Formation

MSO/DO: Diego Turrini (INAF—Observatory of Torino, Italy), Maria Drozdovskaya (University of Bern, Switzerland)

Organizing Committee: TBA

Event Information: Understanding how planetary systems form is becoming an increasingly interdisciplinary field of study that is approaching the limits of insight being gained from individual disciplines. The composition of planetary bodies and the astrochemical processes that shape it represent the common thread helping us to navigate the multifaceted problem of planetary formation. Future studies will become even more interdependent and will require combining the information supplied by meteorites and polluted white dwarfs, the interstellar medium and protoplanetary disks, comets and asteroids, planetary surfaces and exoplanetary atmospheres, and more. This event aims to offer an interdisciplinary venue to bring together researchers studying the Solar System, exoplanets, star formation, protoplanetary disks, main sequence and evolved stars to combine the insights provided by their theoretical and experimental perspectives, as well as by observations from ground-based and space-borne facilities.

B2.1 Space Geodetic Reference Systems and Frames: Current State and Future Challenges for Geodynamical Investigations

MSO/DO: Christopher Kotsakis (Aristotle University of Thessaloniki, Greece)

Organizing Committee: TBA

Event Information: Space geodetic tech-niques offer a powerful means of studying the geometrical and physical characteristics of the deformable Earth. Their scientific applications cover a wide range of topics such as plate tectonics, post glacial rebound, mean sea level rise, seismic deformation, Earth rotation and gravity field variations, non-tidal loading effects and geocenter motion. All of these important applications fundamentally depend on a truly global reference system and its realizations (the so-called terrestrial reference frames—TRFs) that only space geodetictechniques can deliver with sufficient accuracyto potential users. The goal of this sessionis to provide a forum to discuss the present state of space geodetic reference systems and frames, and their implementation for current and future Earth monitoring applications. The aim is to look beyond current practices by addressing open problems, data Modelling issues and method-ological advancements that are crucial for augmenting both the long-term stability and the short-term predictability.

B3.1 Lunar Science and Exploration

MSO/DO: Carle Pieters (Brown University, USA), Bernard Foing (ESA/ESTEC & ILEWG

EuroMoonMars & Leiden/VU Amsterdam, Netherlands)

Organising Committee: TBA

Event Information: Since the start of our Millennium, lunar science and exploration experienced a broad renaissance with more than 12 orbiters and 5 landers sent to the Moon from multiple space-faring nations. Building on this growing experience, the next "International Lunar Decade" envisions a diverse range of small to large missions that include CubeSats, landers, orbiters, sample return, and eventually human-robotic partnership in lunar exploration on the surface. This involves multiple countries and commercial endeavors, resulting in a robotic network and then functional human 'village' of lunar activities. COSPAR-22-B3.1 "Lunar Science and Exploration" will include invited, contributed, and poster papers, with sub-sessions: 1) Results from Recent Lunar Missions and integrated analyses: progress in lunar science from recent missions, latest science results, new insight into our understanding of the Moon, modelling and synthesis of different scientific data, and new science questions (of, from and on the Moon). 2) Concepts, studies, technology and support research towards future lunar exploration and science: new lunar mission concepts, instrumentation for the future missions, use of the next lunar decade of landers, and preparations for human lunar exploration are welcome in this session. COSPAR-22-B3.1 will also be ICEUM17A, part of 17th International Conference on Exploration and Utilisation of the Moon from the ILEWG ICEUM series started in 1994.

B3.2 Human and Robotic Exploration of the Moon and Synergy with Mars and Asteroids

MSO/DO: Bernard Foing (ESA/ESTEC & ILEWG EuroMoonMars & Leiden/VU Amsterdam, Netherlands), Christiane Heinicke (ZARM, Germany)

Organizing Committee: TBA

Event Information: The COSPAR-22-B3.2 session/ICEUM17B "Human and Robotic Exploration of the Moon and Synergy with Mars and Asteroids" will include solicited and contributed talks and poster/interactive presentations. Papers are also welcome from affiliates of other relevant COSPAR Scientific Commissions, for example SC-E (Astrophysics), SC-F (Life Sciences), SC-H (Fundamental Physics) and COSPAR Panels. COSPAR-22-B3.2 session will also be ICEUM17B, part of 17th International Conference on Exploration and Utilisation of the Moon from the ILEWG ICEUM series started in 1994. It will address various themes and COSPAR communities.

We expect the following sub-sessions:

1) Sciences (of, on, from) the Moon enabled by humans; Research from cislunar and libration points; From robotic villages to international lunar bases; Research from Mars & NEOs outposts; Humans to Phobos/Deimos, Mars and NEOs;

2) Challenges and preparatory technologies, field research operations; Human and robotic partnerships and precursor missions; Resource utilisation, life support and sustainable exploration;

3) Stakeholders for human exploration. One half-day session will be dedicated to a workshop format and meetings/reports of task groups: Science, Technology, Agencies, Robotic village, Human bases, Moon & Mars Villages, Society & Commerce, Outreach, Young Explorers. COSPAR has provided through Commissions, Panels and Working Groups (such as ILEWG, IMEWG). We shall discuss Synergy with the exploration of Mars and Asteroids.

4) A human-robotic outpost on the Moon would offer significant scientific opportunities by providing a scientific infrastructure on the lunar surface. An analogy is provided by human outposts in Antarctica, which facilitate research activities across multiple scientific disciplines in a hostile environment. This event will explore the multiple scientific areas expected to benefit from a lunar outpost, including planetary science, astronomy, astrobiology, life sciences, and fundamental physics. In addition, a lunar

outpost will help develop the use of lunar resources, which may yield additional longer-term scientific benefits. Papers are invited which address any of these aspects of science enabled by a lunar outpost.

B4.1 Venus Science and Exploration

MSO/DO: Colin Wilson (University of Oxford, UK), James Cutts (JPL-Caltech, USA)

Organizing Committee: TBA

Event Information: This session welcomes presentations on all aspects of the Venus system including interior, surface, atmosphere and ionosphere. We welcome presentations based on current and past observations, including those from the Akatsuki and Venus Express orbiter, as well as from ground-based observations. Modelling and theoretical work, and supporting ground-based studies are also welcomed, as are presentations related to fu- ture instruments and investigations. COSPAR offers a particular opportunity for the discussion of international collaboration in space exploration; accordingly, the session seeks to include future exploration plans from all international agencies considering Venus missions, including NASA, ESA, Roscosmos, ISRO, CNSA, and JAXA.

B4.2 Mars Science Results

MSO/DO: Timothy Haltigin (Canadian Space Agency, Canada), Michael Meyer (NASA Headquarters, USA)

Organizing Committee: TBA

Event Information: Mars has been ex-tensively studied using spacecraft data, theoretical Modelling, laboratory studies, and comparative planetology over the last several decades. As of the conference, there are expected to be eight operating orbiters (ODY, MEx, MRO, MAVEN, MOM, TGO, Hope, and the Tianwen-1 orbiter), and three operating rovers (Curiosity, Perseverance, and the Tianwen-1 rover). These spacecraft are exploring Mars'; atmosphere, surface, and subsurface to understand the planet's history and habitability. This session will address new science resulting from these missions and other recent missions, as well as studies reliant on theory, Modelling, laboratory studies, and comparative planetology. This session will include a combination of solicited and contributed presentations, with a focus on international diversity.

B4.3 Forward Planning for the Exploration of Mars

MSO/DO: Brandi Carrier (JPL-Caltech, USA), Jorge Vago (ESA, Netherlands)

Organizing Committee: TBA

Event Information: Mars continues to be a compelling planetary exploration target inspite of, or perhaps even because of, the large number of prior and ongoing missions. The findings of each mission are typically met with an equal or greater number of questions raised to be answered by future missions. This session focuses on forward planning for the exploration of Mars including 1) future hypothesis-driven or discovery-driven science instruments or missions and 2) The precursors that may help us prepare for future human missions. Topics of interest include the primary scientific drivers that require future missions to Mars, recent developments in our engineering and technological capabilities related to missions to Mars, an updated understanding of current mission concepts, and candidate instrumentation for future missions. The session will consist of a mixture of solicited and contributed presentations. The program will be developed with a special regard to achieving international representation.

B4.4 Mars Sample Return

MSO/DO: David Beaty (JPL-Caltech, USA), Gerhard Kminek (ESA, Netherlands)

Organizing Committee: TBA

Event Information: NASA and ESA have embarked on a highly collaborative endeavour to return samples from Mars. A fundamental premise of this partnership is that scientists working around the world would share access to the samples such that the scientific benefits and discoveries are maximized. Progress in this international endeavor will be presented, including the progress Perseverance has made collecting samples in

Jezero Crater, the planned mission architecture for returning thesamples from Mars, and planning for analysis of the samples when they are returned to Earth. In addition, there will be presentations of recent of Mars Sample Return Science Planning Group reports, which have been aimed at formulating mechanisms through which the international scientific community can achieve our shared scientific objectives with the returned samples. The challenges of ensuring the best international science is accomplished, while adhering to planetary protection requirements will be discussed. Contributions to this session are sought to reflect international interest in sample return and its potential scientific benefits.

B4.5 Mercury

MSO/DO: Johannes Benkhoff (ESA/ESTEC, Netherlands)

Organizing Committee: TBA

Event Information: Understanding theformation, evolution, composition, the interior structure and the environment of Mercury is a primary goal of the ESA/JAXA BepiColombo mission and of many theoretical, observational, and experimental studies. NASA's MESSENGER spacecraft provided many new insights and surprising results regarding these goals. However, the mission also raised many new questions that will be addressed by ESA/JAXA BepiColombo that has been successfully launched in October 2018. This session welcomes contributions addressing the planet's geology, surface composition, geodesy, interior structure, laboratory measurements, ground-based observations, exosphere, mag-netosphere, gravity and magnetic fields and all those work related to the investigation of this terrestrial planet.

B5.1 Ocean Worlds

MSO/DO: Anezina Solomonidou (JPL-Caltech, USA), Morgan Cable (JPL-Caltech, USA)

Organizing Committee: Rosaly Lopes (JPL, USA), Olivier Witasse (ESTEC, Netherlands), Michael Malaska (JPL, USA), Cynthia Phillips (JPL, USA), Olga Sykioti (Athens Observatory, Greece), Ioannis Iliopoulos (University of Patras, Greece), Ioannis Daglis (University of Athens, Greece), Giuseppe Mitri (University of Nantes, France), Gabriel Tobie (University of Nantes, France), Ioannis Baziotis (AUA, Greece)

Event Information: The exploration of the Ocean Worlds of the outer solar system has been one of the largest sources of clues in the quest to discover signs of life beyond Earth in the past decade and will continue to be in the ones to come. We invite contributions that cover a wide range of topics focusing on confirmed or potential subsurface (including surficial in the case of Titan's lakes) ocean worlds of our solar system. The topics can include studies on the geomorphology and composition of ocean worlds, geophysics and ocean properties, as well as laboratory investigations. Furthermore, studies that examine interactions between planetary interiors, surfaces, atmospheres, and astrobiology/habitability are welcomed.

B5.2 Giant Planets and their Systems

MSO/DO: Adam Masters (Imperial College London, UK), Sandrine Guerlet (Laboratoire de Météorologie Dynamique, France)

Organizing Committee: TBA

Event Information: The Solar System's giant planets are of great scientific interest, and each has its own extensive system of rings and moons. For each system there is a long list of open questions that spans all the diverse disciplines of planetary science, providing compelling cases for in situ exploration by spacecraft. This is responsible for the recent Cassini-Huygens mission to Saturn and Titan and the ongoing Juno mission to Jupiter, as well as the upcoming JUICE and Europa Clipper missions to Jupiter and plans to go back to Uranus and Neptune. We invite abstracts on new scientific results concerning all fourof these giant planets across all the relevant disciplines: Planet and system origin and evolution, planetary interior, planetary atmo-sphere, rings, moons, and magnetosphere. Results of theory, laboratory experiments, ground-based observations, spacecraft data analysis, and numerical modelling work are all welcome.

B6.1_E4.1 Exoplanet Detection and Characterisation: Current

Research, Future Opportunities and the Search for Life Outside the Solar System

MSO/DO: L.B.F.M. Waters (SRON Netherlands Institute for Space Research, Netherlands), Francesca Altieri (INAF-IAPS Rome, Italy)

Organizing Committee: TBA

Event Information: Exoplanet searches using ground- and space-based facilities have revealed a remarkable variety in observed properties of exoplanets and the planetary systems they are part of. It is clear by now that planetary systems are commonly found in low- and intermediate mass stars. In order to understand the observed diversity in planetary systems we begin to link their architecture to the properties of planet forming disks around young stars, and to trace the present-day properties of exoplanets (mass, radius, chemical composition, atmosphere) to their formation history and evolution to mature planetary systems. Such studies are important to understand which planets in which planetary systems have properties that would support the emergence of life as we know it. The increasing accuracy of mass and radii determinations provides improvedconstraints on the composition and interior structure of rocky exoplanets. Spectra of increasing quality and resolution enable us to investigate exoplanet rotation, atmospheric chemical composition, the presence of clouds and day to night side differences of large samples of exoplanets, and to study important biomarkers. These more detailed observations require more sophisticated modelling efforts, including understanding potential abiotic origins of bio-markers and evolutionary models of processes such as atmospheric escape. These developments allow an increasingly more quantitative comparison to the properties and formation history of the solar system planets. This COSPAR event aims to bring together the planetary and exoplanetary community to discuss exoplanets in context, and address results of ongoing space missions and future opportunities.

C0.1 International Standards for Space Environment

MSO/DO: Yukihito Kitazawa (JAXA, Japan), W. Kent Tobiska (Space Environment Technologies, USA)

Organizing Committee: Vladimir Kalegaev (Moscow State University, Russia), Yugo Kimoto (JAXA, Japan), Jean- Francois Roussel (ONERA, France), Dieter Bilitza (GMU College of Science, USA), Tamara Gulyaeva (IZMIRAN, Russia), David Rees (The Paradigm Factor Ltd., UK)

Event Information: Standardization based on important scientific knowledge is one of the effective means to make the results of natural science useful to society. For example, ISO (International Organization for Standardization) develops international standards related to space environment and impactson space and ground-support systems caused by space environment. Over 20 ISO space environment standards have been developed since 1992.Scope of this session is to supply an important opportunity to foster the contacts between engineering community, main users of the standards, and scientific community developing the standards. The examples ofmain topics also include definition of testconditions, procedure of risk analysis for spacecraft, satellite operational guidelines based on the space environment information, forum/national standards and recommendations related above topics. Contributions and potentials on developments of international standards, the user requirements and the on-going research activities that can be transferred to user-oriented engineering tools are welcomed.

C0.2 Advances in Remote Sensing of the Middle and Upper Atmosphere and Ionosphere from the Ground and from Space, including Sounding Rockets and Multi-instrument Studies

MSO/DO: David Rees (The Paradigm Factor, UK), Mamoru Yamamoto (Research Institute for Sustainable Humanosphere, Kyoto University, Japan)

Organizing Committee: TBA

Event Information: Advances in Remote Sensing of the Middle and Upper Atmosphere

and Ionosphere from the Ground and from Space, including Sounding Rockets and Multi-Instrument Studies. This event will provide a forum for the presentation and discussion of novel instruments for exploring the middle andupper atmospheres and ionospheres of the Earth and planets by remote sensing techniques deployed from space platforms. The meeting will include a special session on two space missions of the European Space Agency. Aeolus, now measuring global winds by means of a Lidar System, was launched in August 2019. EarthCARE—which will make very detailed studies of clouds and aerosols relating to climate—is expected to be launched in 2021. The meeting will consist of Solicited and Contributed papers and a Poster session related to the topics of the Meeting.

C0.3 Variabilities of Radio Wave Propagation Characteristics in Lower Ionosphere

MSO/DO: Sudipta Sasmal (Indian Centre for Space Physics, India), Stelios M. Potirakis (University of West Attica, Greece)

Organizing Committee: Masashi Hawakawa (University of Electro Communication, Japan), Maxim Golubkov (Russian Academy of Sciences, Russia), Katsumi Hattori (Chiba University, Japan), Sandip K. Chakrabarti (Indian Centre for Space Physics, India), Pier Francesco Biagi (University of Bari, Italy), Giovanni Nico (Italian National Research Council, Italy), Aleksandra Nina (Institute of Physics Belgrade, Serbia), Konstantinos Katzis (European University Cyprus, Cyprus), Konstantinos Eftaxias (National and Kapodistrian University of Athens, Greece), Michael E. Contadakis (Aristotle University of Thessaloniki, Greece), Ramesh Singh (Chapman University, USA), Dibyendu Chakrabarty (Physical Research Laboratory-PRL, India), Abhay K. Singh (Benaras Hindu University, India)

Event Information: Ionospheric disturbances from terrestrial and extra-terrestrial sources leave impressions on the natural and manmade sources of radio signals during their propagation through earth-ionosphere waveguide. The signals get modulated due to the variabilities of the ionospheric characteristics. This session focuses on the methods of both ground and space-based studies of such ionospheric variabilities from observation and theoretical viewpoint. In this session, we invite participants who have specialized inthe following aspects: (a) Disturbances dueto solar flaresand solar winds. (b) Disturbancesdue to X-rays and Gamma-ray events in space (Terrestrial Gamma-Ray Flashes, Gamma-Ray Bursts, Soft Gamma-Ray Repeaters, etc.) and their interpretations. (c) Disturbances due to solar eclipse (current, historical). (d) Disturbances due to earthquake preparation. (e) Numerical Modelling of ionospheric response due to various sources. (f) Magnetospheric and Ionospheric coupling processes. (g) Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) mechanism using thermal, acoustic, and electromagnetic channel (observations and simulations). (h) Polar ionospheric characteristics and their interpretations. (i) Chemistry of lower ionosphere (D-layer). (j) Low ionosphere as quantum resonance medium for radio-signal propagation. (k) Comparison of ground and space-based responses of ionospheric perturbations. (l) Instrumentations, campaigns, networking, etc. Lead representatives from various countries are most welcome.

C1.1 Recent Advances in Equatorial, Low- and Mid-latitude Mesosphere, Thermosphere and Ionosphere Studies

MSO/DO: Paulo Roberto Fagundes (Universidade do Vale do Paraiba, Brazil), Libo Liu (Institute of Geology and Geophysics, CAS, China)

Organizing Committee: Venkatesh Kavutarapu (NARL, India)

Event Information: Papers are invited for a session on the recent advances in the field of equatorial, low- and mid-latitude mesosphere, thermosphere and ionosphere from observational (ground-based and space-borne), theoretical and simulation studies. Contributions related to all aspects in these areas are welcome. Topics include: MLT region; response of the thermosphere-ionosphere system to forcing from above and below; coupling between high-, mid-

and low latitude regions; magnetosphere-ionosphere coupling; Ionospheric response to SSW; ionosphere F-layer stratification; data-assimilation and tomography; space weather events; latitudinal and/or longitudinal variability; ionospheric irregularities and scintillations. The session will include both solicited and contributed (oral and poster) papers.

C1.2 Conditions of Enhanced Risk for the Ionospheric Weather

MSO/DO: Anna Belehaki (NOA, Greece), Tamara Gulyaeva (IZMIRAN, Russia)

Organizing Committee: Feza Arikan (Hacettepe University, Turkey), Elvira Astafieva (Institute de Physique du Globe de Paris, France), Manuel Hernández- Pajares (UPC, Spain), Iwona Stanislawska (Space Research Center, Poland) Sergey Pulinets (IKI, RAS, Russia), Shunrong Zhang (MIT Haystack Observatory, USA)

Event Information: Ionosphere and plasma-sphere present very complicated, time and space varying, inhomogeneous, temporally and spatially dispersive environment. The ionosphere varies under the influence of solar, interplanetary, geomagnetic, gravitational, atmospheric and seismic activities. Since the beginning of 20th century, scientists have tried to infer information about this ever changing and challenging structure. With the development of earth and space based sophisticated measurement devices such as sounders and satellites, scientists and engineers have started to observe the complicated nature of the surrounding system. The risks due to space weather may originate from solar and interplanetary environment in the form the geomagnetic and ionospheric storms, or they may originate due to variability in Earth's crust in the form of earthquakes, volcanoes or tsunamis. The goal of the proposed session is to bring geophysicists, geodesists, electrical and electronics engineers, ionospheric and atmospheric physicists, meteorologists, environmental engineers, seismologists, and space weather observers under one special roof so that a platform might be generated to share information and observation to determine conditions of enhanced risk for the ionospheric weather.

C1.3 Magnetosphere-Ionosphere-Atmosphere Coupling Dynamics at Different Temporal and Spatial Scales

MSO/DO: Mirko Piersanti (INAF-IAPS, Italy), Piero Diego (IAPS-INAF, Italy)

Organizing Committee: Zeren Zhima (National Insitute of Natural Hazard MEMC, China) Ubertini Pietro (INAF-IAPS, Italy), Vincenzo Carbone (Universit`a della Calabria, Italy)

Event Information: LEO satellites provide global view of near-Earth plasma, electro- magnetic field, and particlesenvironment. Their measurements are complementary to ground-based observations providing great spatial coverage. The AMPERE project and the contribution of the Swarm data into Space Weather program are examples of this approach. Ionospheric measurements availability has been recently increased by the CSES mission. Even if conceived for the monitoring of lithosphere-ionospherecoupling, CSES provides a complete set of instruments for Space Weather studies. On the other hand, the Sun-Earth interactions have to be carefully evaluated for analysis of anomalies induced into the near-Earth space by earthquakes. A multi-instrumental approach, using both ground-based and LEO satellites measurements, can help in clarifying the lithosphere -ionosphere coupling mechanism sassociated to earthquakes. This session aims to collect contributions to the analysis of satellites/ground-based data and to the improvement of magnetosphere-ionosphere-atmosphere coupling model related to both space weather and natural hazard.

C1.4 Probing the Lower- Thermo-sphere-Ionosphere with In-situ Measurements

MSO/DO: Guram Kervalishvili (GFZ, Germany), Christian Siemes (Delft University of Technology, Netherlands)

Organizing Committee: Anita Aikio (University of Oulu, Finland), Claudia Stolle (GFZ German Research Centre for Geosciences, Germany),

David Knudsen (University of Calgary, Canada), Iannis Dandouras (Research Institute in Astrophysics and Planetology, France), Maxime Grandin (University of Helsinki, Finland) Roderick Heelis (University of Texas at Dallas, USA), Stephan Buchert (Swedish Institute of Space Physics, Sweden)

Event Information: The Lower-Thermo-sphere-Ionosphere (LTI) is a complex dynamical system responsive to forcing from above and below. It is the gateway between the Earth's atmosphere and space, and is a crucial region for understanding key processes that determine the energetics, dynamics and chemistry of the whole atmosphere. Key processes involving the inter-actions of neutralsand plasmas often require knowledge of all relevant geophysical observables with a sufficient temporal and spatial scale, where some of them can only be obtained in-situ. This session aims at introducing and discussing scientific activities towards the exploration of the LTI with in-situ measurements. In particular, we invite presentations on in-situ observations of plasma density and temperature, ion drift, neutral density and wind, ion and neutral composition, electric and magnetic fields, and energetic particles to study the electrodynamics and neutral dynamics of the LTI and its response to atmospheric waves, solar and geomagnetic activity. We welcome presentations on results from existing satellite missions and future mission concepts, CubeSats, re-entry analyses, sounding rocket campaigns, as well as potential synergies between in-situ and ground- or satellite-based remote-sensing observations, and on techno-logical concepts, data processing, modelling,and data-assimilation.

C1.5 Space Weather and Earth's Atmosphere-Ionosphere

MSO/DO: Nicholas Pedatella (High Altitude Observatory, NCAR, USA), Loren Chang (National Central University, China: Academy of Sciences Located in Taipei)

Organizing Committee: Duggirala Pallamraju (PRL, India)

Event Information: The space weather of the Earth's middle and upper atmospheres is characterized by variability across a range of spatial and temporal scales. The variability encompasses spatial scales from meters to global scale variations, and minute to decadal time scales. Such a range of scales makes predicting the variability of the middle and upper atmosphere challenging. This session solicits presentations focused on the applica-tion of numerical models and observations to characterize and understand middle and upper atmosphere variability, with the ultimate goal of improving the predictability of this region. Topics of particular interest include the response of the ionosphere-thermosphere to forcing from above and below, the effect of atmospheric waves and composition changes on the middle-upper atmosphere, improved specif-ications of solar and magnetospheric forcing of the middle-upper atmosphere, and the chemical and dynamical response of the middle atmosphere to solar and magneto-spheric forcing.

C1.6 Development and Use of Upper Atmosphere Models and Whole Atmosphere Models for Space Weather Application

MSO/DO: Tim Fuller-Rowell (University of Colorado, USA), Sean Bruinsma (CNES, France)

Organizing Committee: TBA

Event Information: The accuracy required of operational thermosphere-ionosphere models is presently not reached for a number of reasons. This session aims at presenting the recent advances in ionosphere, thermosphere, coupled upper atmosphere and Whole Atmosphere Modelling, and recommendations for future research and developments, as well as observational requirements. The topics include Modelling and forecasting of the ionosphere, MLT and/or thermosphere, model validation and assessment, data requirements and data assimilation techniques, response of the mesosphere-thermosphere-ionosphere to forcing from the lower atmosphere, analysis of specific events (e.g., geomagnetic storms, SSW). Papers on the use of physics-based atmosphere-ionosphere models for predictions on neutral density, plasma density, and plasma

irregularities for space weather applications are particularly welcome.

C1.7 Information Theory and Machine Learning for Geospace Research

MSO/DO: Georgios Balasis (NOA, Greece), Simon Wing (JHU, USA)

Organizing Committee: Enrico Camporeale (NOAA, USA) Jay Johnson (Andrews University, USA) Giovanni Lapenta (KU Leuven, Belgium)

Event Information: Recent works point to a considerable importance of informationtheory and machine leaning in Space Physics and Space Weather. Information-theoretic measures have been used to shed light on the storm-substorm interaction and the solar wind drivers of the outer radiation belt through the general perspective of quantifying information transfer, including linear and nonlinear mechanisms. Machine learning techniques have beenapplied to the forecasting of geomagnetic indices, relativistic electrons at geosynchronous orbits, solar flares occurrence, coronal massejection propagation time, solar wind speed. We invite contributions of information theory for uncovering relevant yet complex processes interlinking different geospace subsystems, variables and spatio-temporal scales. We solicit contributions of machine learning for space weather forecasting and on open challenges for the community related to the combination of physics-based and machine learning approaches, known as gray box. Studies combining information theory and machine learning in geospace would be of particular interest.

C2.1 Wave Coupling Processes and Consequences in the Whole Atmosphere and Ionosphere

MSO/DO: Erdal Yiğit (George Mason University, Space Weather Lab, USA), Christopher Heale (Embry-Riddle Aeronautical University, USA)

Organizing Committee: Ruth Lieberman (NASA GSFC, USA), William Ward (University of New Brunswick, Canada)

Event Information: This symposium focuses on the multi-scale wave coupling from the troposphere to the thermosphere- ionosphere system. New measurements, computational Modelling, theoretical results, and analysis techniques are encouraged, including electrodynamical and chemical studies. In particular, studies in the following areas are most welcome: 1. Global structure, variability, sources, and propagation of atmospheric gravity waves, planetary waves, tides, and Kelvin waves, 2. Ion-neutral coupling, 3. Ionosphere-thermosphere-mesosphere response to lower and middle atmospheric variability, 4. Wave generation and propagation effects in the neutral and ionized atmosphere. 5. Retrieval of atmospheric waves and variability from space-borne missions (e.g., ICON, GOLD, TIMED.)

C2.2 Advances in External Forcing Studies for the Middle Atmosphere and Lower Ionosphere

MSO/DO: Yvan Orsolini (Norwegian Institute for Air Research (NILU), Norway), Yoshihiro Tomikawa (National Institute of Polar Research, Japan)

Organizing Committee: Shigeo Yoden (Kyoto University, Japan)

Event Information: The event has a focus on new results concerning the middle atmo- sphere and lower ionosphere response to a variety of external forcings such as (but not restricted to) energetic particle precipitation (EPP) and solar UV variability during the solar cycle. Results comparing the solar forcing importance relative to other external forcings arising from natural variability (such as volcanic forcing) or to anthropogenic forcing are also welcome. Contributions related to the inter-comparison of coupled climate model responses to solar forcings are also invited. This event is particularly relevant for the international SPARC initiative SOLARIS-HEPPA investigating the solar influence on the middle atmosphere and climate (http://solarisheppa.geomar.de) and for SCOSTEP's new scientific program "Predictability of the Solar-Terrestrial Coupling" (PRESTO). Of special interests are

the long and deep minima of the solar cycle, the treatment of EPP in chemistry-climate models, and the climate system response tosolar forcing. Analyses of ground-based or satellite observations and of model simulations are welcome.

C3.1 Planetary Atmospheres

MSO/DOs: Hilary L. Justh (NASA MSFC, USA), Larry Esposito (LASP, University of Colorado, USA), Aymeric Spiga (LMD/Sorbonne University, France)

Organizing Committee: TBA

Event Information: This session is focused on the planetary atmospheres of the inner and outer planets and their moons. Presentations of results from recent and ongoing planetary missions, ground-based observations, Modelling, and theoretical studies are welcomed. Solicited talks, contributed presentations, and posters will be included in this session which encompasses all solar system bodies except the Earth.

C3.2 Planetary Upper Atmospheres, Ionospheres and Magnetospheres

MSO/DO: Syed A. Haider (PRL, India), Nicholas Schneider (LASP, University of Colorado, USA)

Organizing Committee: Andy Nagy (University of Michigan, USA), Stephen Bougher (University of Michigan, USA), Gina A. DiBraccio (NASA GSFC, USA), Anil Bhardwaj (PRL, India)

Event Information: Within recent decades, special emphasis is given on the observations, Modelling, data assimilation and theoretical interpretations of planetary atmospheres. This session covers the studies of the upper atmospheres, ionospheres, magnetospheres and exospheres of Mercury, Venus, Mars (Messenger, ExoMars-TGO, MAVEN, Mangalyaan, Venus Express, Akatsuki, Mars Odyssey and MRO etc.), Jupiter, Saturn, Uranus, Neptune (Cassini and Juno, New Horizon) and their satellites. Papers on latest atmospheric missions like Emirates Mars Mission (EMM), Tianwen-1 and BepiColombo are welcome. The comparative studies of the upper atmospheres, ionospheres and magnetospheres of inner and outer planets are also encouraged. Both solicited talks and contributed presentations are welcome in this event, which encompasses all solar system bodies except the Earth.

C4.1 Real-time and Retrospective Ionosphere Modelling with In-situ and GNSS Satellite Data

MSO/DO: Dieter Bilitza (George Mason University, Fairfax, Virginia and NASA, GSFC, USA), Andrzej Krankowski (University of Warmia and Mazury in Olsztyn, Poland, Poland)

Organizing Committee: Vladimir Truhlik (Institute for Atmospheric Physics, Czech Republic), Andrzej Krankowski (University of Warmia and Mazury, Poland), Ivan Galkin (University of Massachusetts Lowell, USA), Bodo Reinisch (Lowell Digisonde International Inc., USA), Shigeto Watanabe (Hokkaido University, Japan), David Themens (University of New Brunswick, Canada), Haris Haralambous (Frederick University, Cyprus)

Event Information: Ionospheric models have performed well when descriptions of average ionospheric conditions are required. The International Reference Ionosphere (IRI) is an excellent example as documented by many validation studies and for this reason has been elected by the International Standardization Organization (ISO) as the ISO standard for the ionosphere. With this session we want to explore the use of in-situ and GNSS satellite data to further improve the prediction quality of ionosheric models, like IRI, both in retrospective and in real-time mode. We welcome contributions to this topic as well as more general papers dealing with validation, comparisons, improvements and applications of the IRI model.

C4.2 Development of Models Related to the COSPAR International Reference Atmosphere and to ISO Standards for the Atmosphere

MSO/DO: David Rees (The Paradigm Factor, UK), W. Kent Tobiska (Space Environment Technologies, USA)

Organizing Committee: TBA

Event Information: This event will consider the further development of atmospheric models related to the COSPAR International Reference Atmosphere (CIRA). Issues of systematic changes in the thermosphere starting with the "Space Era" are solicited, including physical changes to the thermosphere during geomagnetic storm periods from joule heating and particle precipitation, short-term cooling by nitric oxide, long-term cooling by carbon dioxide, hemispheric variability, exospheric oxygen-helium transition during solar activity,and changes in densities due to solar photo-absorption will be discussed. The exploitation of well-known and highly-developed atmospheric models as well as the appearance of newmachine learning and other Modelling techniques will also be presented and discussed. Contributions towards the harmonizing of international standards of the atmospherefrom the troposphere to the exosphere are welcomed. The meeting will consist of a set of solicited papers, supported by poster presentations.

C5.1_D4.1 Active Space Experiment

MSO/DO: Björn Gustavsson (University of Tromsø, Norway), Haiyang Fu (Fudan University, CAS, China)

Organizing Committee: Paul A. Bernhardt (Naval Research Lab.-NRL, USA), Savely Grach (Lobachevsky State University of Nizhni Novgorod, Russia), Wayne A. Scales (Virginia Tech, USA), James P. Sheerin (Eastern Michigan University, USA)

Event Information: Geospace can be considered as a complex plasma lab. Active space experiments play an important role in exploring natural space phenomena and new effects induced by artificial sources. Active probing of natural geospace phenomena in ionosphere and magnenetsphere may include the injection of particle and electromagnetic beams into geospace from ground and spaceas well as disturbances by rockets. Contributions are solicited focusing on recent progresses of ground- and satellite-based active experiments, observations, theoretical,and numerical Modelling techniques. Topics covered in these sessions may include but are not limited to: (1) Space modification by HF heating facilities and associated processes; (2) Space modification by rocket exhausts and as- sociate processes; (3) New active space design using injections of particle and wave beams from spacecraft and others; (4) Laboratory progresses for active experiments pertaining to space plasmas.

C5.2_D4.2 Dust Observations in Space and Laboratory Experiments

MSO/DO: Jiri Pavlu (Charles University, Czech Republic), Shengyi Ye (Southern University of Science and Technology, CAS, China)

Organizing Committee: Sergey I. Popel (Space Research Institute-IKI, of the Russian Academy of Sciences-RAS, and HSE University, Russia), Timothy J. Stubbs (NASA GSFC, USA), Hubertus M. Thomas (DLR, Germany)

Event Information: The session covers dust-plasma interactions and dust detection in space, including the investigation of naturally occurring phenomena in the Solar System (and beyond) and relevant laboratory investigations. This session is interdisciplinary by nature and its goal is to provide an overviewof recent advances in the understanding of dust-involved processes in the interstellar medium, planetary environments, near the surfaces of airless bodies, or in the upper atmospheres of bodies with atmospheres. Dust can be studied also experimentally in simulated space-like environments, e.g., under microgravity conditions, in laboratory facilities that are capable of simulating relevant processes (as strong coupling, dust charging, or dust impacts). The session is open to presentations concerning ongoingand future space missions on related topics. Sharing findings and ideas across various "dusty" fields will lead to further development of dusty plasma research as a whole. We especially encourage young researchers to take part in the session. We expect to address (not only) the following topics: (A) "Dust in the atmosphere" (addressing NLC, PMSE, PMWE, and related issues, non-terrestrial

atmospheres) (B) “Dust in space, rings, comets, asteroids” (latest results of space missions) (C) “(Micro) gravity dusty and complex plasma (experiments)” (addressing complex plasma experiments regardless of the magnitude of gravity) (D) “Space Instruments and laboratory experiments” (i.e., dust detectors, antenna observations, dust accelerator studies, charging of dust, light scattering on dust, destruction and growth of dust...)

D0.1 Overview Session Commission D

MSO/DO: Nicole Vilmer (Observatoire de Paris, LESIA, France)

Organizing Committee: Agnieszka Gil-Swiderska (Space Research Center, Poland), Konstantin Herbs (University of Kiel, Germany), Olga Khabarova (IZMIRAN, Russia), Yuri Shprits (GFZ Helmholtz Centre Potsdam, Germany), Jie Zhang (George Mason University, USA)

Event Information: In this session the recent developments and highlights in the study of solar, heliospheric and magnetospheric plasmas are presented and summarized. The session consists of invited talks exclusively, one for each of the subcommissions (the heliosphere, transition from the Sun to the heliosphere, and magnetospheres), followed by a survey of the entire commission. The session will be scheduled on a single half-day with no other commission D sessions in parallel. Please submit an abstract to this session only when invited by the MSO or one member of the SOC.

D1.1 Neutron Monitor Science: Current and Future Prospects

MSO/DO: Du Toit Strauss (North-West University, South Africa), Stepan Poluianov (University of Oulu, Finland)

Organizing Committee: Helen Mavromichalaki (National and Kapodistrian University of Athens, Greece); David Ruffolo (Mahidol University, Thailand); Maria Abunina (IZMIRAN, Russia); Sunyeon Oh (Chonnam National University, South Korea)

Event Information: Cosmic ray measurements have been made, on ground level, for several decades with neutron monitors. More recently, these measurements have received renewed interest in many diverse fields from near real-time space weather monitoring to soil moisture measurements. In addition to new science, neutron monitor detectors are now capable of detecting individual particles with sub millisecond temporal resolution, leading to many new science possibilities. For this symposium we are soliciting talks related to neutron monitor hardware developments and detector simulations, new and novel studies with neutron monitors, applications of the data, and related science.

D1.2 Magneto-plasma Structures, Streams and Flows in the Heliosphere

MSO/DO: Olga Khabarova (IZMIRAN, Russia), Olga Malandraki (IAASARS, NOA, Greece)

Organizing Committee: Lan Jian (NASA GSFC, USA), Jörg Büchner (Berlin Institute of Technology, Germany), Luca Franci (Queen Mary University of London, UK), George Livadiotis (SwRI, USA), Georgios Nicolaou (SwRI, USA)

Event Information: The heliosphere contains various structures both originated from the Sun and formed directly in the solar wind. The common feature of the magneto-plasma objects is their contribution to the nonlinear energy cascade and the ability to produce other structures, leading to the development of dynamical processes that make the solar wind an inhomogeneous medium in which turbulence and intermittency coexist with structuring and regularity. Streams, flows, shocks, current sheets and magnetic islands are important sources of particle acceleration and sites of magnetic reconnection. These structures can also be geoeffective and cause hazardous space weather effects. We invite space physicists to share their recent results in studying: interplanetary coronal mass ejections (ICMEs); corotating/stream interaction regions (CIRs/SIRs); current sheets of various origins, including the heliospheric current sheet (HCS); flux rope/plasmoids/blobs/magnetic islands; inter-

planetary and bow shocks, and related processes. Contributions discussing theoretical aspects, Modelling and observations are welcome.

D1.3 Understanding and Predicting Solar Energetic Particle Events across the Heliosphere

MSO/DO: Athanasios Papaioannou (NOA, Greece), Anastasios Anastasiadis (IAASARS, NOA, Greece)

Organizing Committee: Angels Aran (Universitat de Barcelona, Spain), Athanasios Kouloumvakos (IRAP, Université Toulouse III—Paul Sabatier, France), Monica Laurenza (INAF-IAPS, Italy), Angelos Vourlidas (JHU APL, USA)

Event Information: The study of Solar Energetic Particles (SEP) and their impacts on Earth and other planets has made significant progress in the last decade due to: (a) an armada of spacecraft delivering observations from different vantage points within the heliosphere; (b) high performance numerical simulations and (c) extensive analysis efforts. These advances enable the detailed study of SEPs from their birth and acceleration in solar eruptive events to their acceleration, injection and transport in the interplanetary space. They can also be used for the prediction of SEPs. In this session, we invite contributions on models and observations of SEPs, covering their initiation by solar eruptive events, acceleration, injection, transport and prediction of their occurrence and corresponding characteristics at Earth and other planets. The session particularly focuses on-going developments to address SEP forecasting at different time scales.

D1.4 Revealing the Heliosphere and Interstellar Medium with IBEX and IMAP

MSO/DO: Eric J. Zirnstein (Princeton University, USA), Aleida Higginson (Private Individual)

Organizing Committee: Ian Cohen (JHU APL, USA), Réka Winslow (University of New Hampshire, USA)

Event Information: The Interstellar Boundary Explorer (IBEX) has been observing energetic neutral atom (ENA) emissions from the outer heliosphere and neutrals from the interstellar medium for more than a full solar cycle, providing invaluable measurements of the interstellar medium, heliospheric plasma distributions, and the large-scale structure of the heliosphere. IBEX will continue making observations through theupcoming launch of the Interstellar Mapping and Acceleration Probe (IMAP) in 2025, providing simultaneous measurements of interstellar neutrals and heliospheric ENAs over a wide range of energies. IMAP will also make in situ observations of ions, electrons, magnetic fields, dust, and hydrogen resonant backscatter glow. We await new discoveries from IMAP, and fresh opportunities born from simultaneous IBEX and IMAP measurements. We welcome submissions that provide new insights into past and current IBEX measurements of the heliosphere, theoretical and observational studies of the structure and evolution of the heliosphere, as well as predictions of IMAP measurements.

D1.5 Theory and Applications of Kappa Distributions in Space Science

MSO/DO: George Livadiotis (SwRI, USA), Peter Yoon (University of Maryland, USA)

Organizing Committee: Manfred Leubner (University of Innsbruck, Austria); Konstantinos Dialynas (Academy of Athens, Greece)

Event Information: Kappa distributions have become increasingly widespread in Space Physics as the power-law nature of various suprathermal tails is merged with the classical Maxwellian cores. Remarkably, Astrophysics Data System identifies an exponential growth of the number of published papers that use these distributions in space and plasma physics. Recent theoretical developments explain the origin of kappa distributions through statistical mechanics and thermodynamics, revealing the robust physical meaning of temperature, thermal pressure, kappa and polytropic indices, entropy, and other thermodynamic parameters that characterize space plasma properties and processes. The kappa distributions, or combinations thereof, are used to describe particle plasma populations in the

heliosphere, from solar wind and planetary magnetospheres, to the heliosheath and beyond, the interstellar and intergalactic plasmas. We welcome abstracts that involve theoretical aspects or applications of kappa distributions in space plasmas; e.g., numerical applications in space plasmas, linear/nonlinear plasma waves and instabilities; particle acceleration or circulation; pickup ions; polytropes; turbulence, mechanisms generating kappa distributions; aspects ofnonextensive statistical mechanics.

D1.6 Acceleration and Transport of Energetic Particles in the Heliosphere and Beyond

MSO/DO: Agnieszka Gil Swiderska (Siedlce University, Poland), Nicholas Eugene Engelbrecht (North-West University, South Africa)

Organizing Committee: Valeria Di Felice (INFN Sezione di Roma Tor Vergata, Italy), David Ruffolo (Mahidol University, Thailand), Ilya Usoskin (University of Oulu, Finland), Anna Wawrzaszek (Space Research Centre, Polish Academy of Sciences, Poland)

Event Information: The heliosphere and surrounding local interstellar medium is filled with several populations of energetic particles such as Galactic cosmic rays, anomalous cosmic rays, accelerated pickup ions and suprathermal solar wind particles. They interact with plasma and magnetic fields with embedded turbulence, leading to particle drift, diffusion, and acceleration. These processes are fundamental to energetic particle production and intensity modulation by solar activities. In some cases, energetic particles can play an important dynamic role in the formation of heliospheric structure. Various space-borne or ground-based obser-vations of particle intensity, spectrum and anisotropy contain valuable information about the mechanisms of particle acceleration and transport through the heliosphere. This session is designed to bring together observers and theoreticians studying acceleration, transport, and emission from energetic particles in order to discuss the progress and challenges in understanding the underlying physics of particle acceleration and transport in the heliosphere and local interstellar medium.

D1.7 Large-Scale Heliospheric Structure: Theory, Modelling, and Data

MSO/DO: Jens Kleimann (Ruhr-Universität Bochum, Germany), John Richardson (MIT, USA)

Organizing Committee: TBA

Event Information: The heliosphere is the circumsolar structure which is formed by the non-linear interaction of the solar wind and the interstellar medium (ISM) through which the Sun moves. Its properties are modulated by magnetic field influences, particle-based interactions, and hydromagnetic instabilities of the interface, to name but a few. Recently, data from new observational channels, notably remote satellite instruments such as IBEX (measuring energetic neutral atoms) and Earth-based detectors such as IceCube and the Tibet air shower array, have shifted the focus of modelling efforts from the upwind direction – for which the two Voyager spacecraft continue to provide valuable in-situ data– to include also the extended tail region. This session will focus on observational data from various sources that may serve to constrain the physical properties of the heliosphere as a whole (or large parts thereof), and numerical and analytical modelling efforts aiming at the physical interpretation of such data, or otherwise suitable to render our present concepts of the heliosphere's large-scale structure and dynamics more consistent and complete. This includes, in both cases, the study of so-called astrospheres, heliosphere-like structures around nearby stars, which have recently been observationally confirmed and are being theoretically investi-gated. Furthermore, contributions addressing the heliosphere's embedding into the ISM, and especially the recent heliopause crossing of the *Voyager 2* spacecraft, are particularly encouraged.

D2.1_E3.1 Exploring the Cradle of the Solar Wind withPSP/SolO/Proba-3: What Do We Really Know about the Inner Solar Corona?

MSO/DO: Kanaris Tsinganos (National and Kapodistrian University of Athens, Greece), Andrei Zhukov (Royal Observatory of Belgium, Belgium)

Organizing Committee: Angelos Vourlidas (JHU APL, USA), Ester Antonucci (INAF - Osservatorio Astronomico di Torino, Italy), Yannis Zouganelis (ESA/ ESAC, Spain), Manolis K. Georgoulis (Academy of Athens, Greece), J.-C. Vial (CNRS-Université Paris-Sud, France), Marco Romoli (Universita degli Studi di Firenze, Italy), Marco Velli (UCLA, USA), Raffaella D'Amicis (INAF-IAPS, Italy), Manuela TEMMER (University of Graz, Austria), Petr Heinzel (Astronomical Institute, Academy of Sciences, Czech Republic), L.D. Xia (Shandong University, China), Volker Bothmer (University of Göttingen, Germany)

Event Information: The inner solar corona is occupied by closed magnetic field structures, trapping plasma to form relatively dense regions associated with the slow solar wind (SW). They are surrounded by coronal holes with open magnetic fields, wherein the fast SW accelerates. Slow SW formation in the inner corona is generally attributed to processes like interchange reconnection, or plasmoid release at the streamer cusps. Direct imaging of these processes is currently difficult. Parker Solar Probe's latest available batch of science data cover the mission's 5th solar encounter, including a perihelion approach at 19 million km. The Solar Orbiter is off to an excellent start, already providing the closest ever taken solar pictures from a distance of 77 million kilometers. The inner SW is among the science goals of the formation flying coronagraph PROBA-3/ASPIICS. The session aims to understand how such synergistic observations and theoretical developments may answer the question of the title.

D2.2_E3.2 Connecting Solar and Stellar Coronal Mass Ejections: Lessons Learned, Challenges and Perspectives

MSO/DO: Spiros Patsourakos (University of Ioannina, Greece), Manolis K. Georgoulis (Academy of Athens, Greece)

Organizing Committee: TBA

Event Information: Despite the routine recording of solar Coronal Mass Ejections (CMEs) for decades, direct observations of their stellar counterpart remains a formidable challenge, and therefore, mainly rely on inferences of stellar CMEs by frequently taking stock of our current understanding of solar CMEs. Given the importance of CMEs in both solar and stellar contexts (e.g., space weather, exoplanet habitability) and recent advances in the observational and Modellingfronts we propose a synergistic session which will: review the state-of-the art on theory, Modelling and observations of solar CMEs with particular emphasis given to a systems recapitulation of the causes, dynamics and energetics of solar CMEs; review the state-of-the art on theory, Modelling and observationsof stellar CMEs; scrutinize potential parallels that could be drawn between solar and stellar CMEs, their properties and consequences in terms of shocks and energetic particles; investigate new observables for stellar CMEs inspired by solar paradigms.

D2.3_E3.3 Parker Solar Probe: Ushering a New Frontier in Space Exploration

MSO/DO: Nour E. Raouafi (JHU APL, USA), Arik Posner (NASA HQ, USA)

Organizing Committee: Adam Szabo (NASA GSFC, USA), Marco Velli (UCLA, USA), Trevor Bowen (UCB, USA), Kristopher G. Klein (University of Arizona, USA), Colin J. Joyce (Princeton University, USA), Phillip Hess (NRL, USA), Volker Bothmer (University of Goettingen, Germany), Olga Malandraki (NOA, Greece), Manuela Temmer (University of Graz, Austria), Emilia K. J. Kilpua (University of Helsinki, Finland), Jie Zhang (George Mason University, USA), Richard Harrison (STFC, UK), Miho Janvier (IAS Orsay, France), Alexis Rouillard (IRAP, France), Mihir Desai (SwRI, USA)

Event Information: NASA's Parker SolarProbe (PSP), launched on 18 August 2018, is venturing closer to the Sun than any other spacecraft, exploring the solar wind's birthplace. In Dec. 2020, PSP completed six of the scheduled 24 orbits. By July 2022, PSP will have completed twelve orbits getting as close as 13.3 solar radii

from the Sun center. The new phenomena revealed by the science data are changing our view of the solar corona and the solar wind forever. Getting closer to the Sun and synergies with Solar Orbiter and other space missions and ground-based observatories will lead to revolutionary discoveries. This session invites contributions on data analysis and model comparisons to advance our understanding of the solar atmosphere's multi-scale dynamics from the base of the corona into the inner heliosphere, the origins of the solar wind and its evolution from the Sun, and the dynamic evolution of solar wind structures.

D2.4_E3.4 Magnetic Reconnection in the Turbulent Plasmas from the Sun through the Heliosphere to Galaxies

MSO/DO: Jörg Büchner (Max Planck Inst. -MPI for Solar System Research, Germany), Masahiro Hoshino (University of Tokyo, Japan)

Organizing Committee: Vassilis Angelopoulos (University of California, USA), Xiaohua Deng (Nanchang University, China), Michael Hesse (NASA ARC, USA), Hantao Ji (Princeton University, USA), Wieslaw Macek (Warsaw Space Research Center, Poland), Lev Zelenyi (IKI, RAS, Russia)

Event Information: Magnetic reconnection is a major phenomenon of energy release in the Universe. It can be observed, more or less directly in the Sun and in the heliosphere, in situ in planetary magnetospheres as well as in the laboratory. A number of space mission is devoted to its exploration, MMS in the Earth magnetosphere, the Parker Solar Probe, Solar Orbiter to name a few. Also, new laboratory Experiments are carried out to understand the Physics of reconnection better. In particular the close but not yet well understood relation between reconnection and turbulence is in the focus of the ongoing research. The session aims at the presentation of new data as well as at their illustration by appropriate numerical simulation results, verification of reconnection models by laboratory experiments and extrapolations of the reconnection concept to the stellar, interstellar, galactic and intergalacticplasmas.

D2.5_E3.5 Probing the Sources of Solar Wind and Energetic Particles and Tracking their Journey into the Heliosphere

MSO/DO: Louise K. Harra (PMOD/WRC, Switzerland), Daniel Müller (ESA/ESTEC, Netherlands)

Organizing Committee: Stuart Bale (University of Berkeley, USA), Peng-Fei Chen (NJU, China), Ludwig Klein (Obspm, France), Lucia Kleint (Uni Geneve, Switzerland), Cristina Mandrini (IAFE, Argentina), Shin Imada (Nagoya University, Japan). Nour Raouafi (JHU APL, USA) Kathy Reeves (CFA, USA)

Event Information: In 2020 Solar Orbiter was launched, following the launch of Parker Solar Probe in 2018. Both missions get close to the Sun, with Solar Orbiter providing both remote sensing and in situ measurements from a slightly different perspective. At the end of 2021 Solar Orbiter will begin its full scientific operations with all the remote sensing instruments in action. This session will address how to link sources of events on or near the Sun with the in-situ measurements close up. Recent Parker Solar Probe and Solar Orbiter in-situ measurements have highlighted the extremely dynamical structures and particle level that exist close to the Sun - and the aim is to understand their sources from the very small scales in coronal holes to large-scale coronal mass ejections.

D2.6_E3.6 Space Climate: From Past to Present and into the Future

MSO/DO: Kalevi Mursula (University of Oulu, Finland), Dibyendu Nandi (Center of Excellence in Space Sciences India, IISER Kolkata, India)

Organizing Committee: Sarah Gibson, (HAO/NCAR, USA), Natalie Krivova (Max-Planck Inst. for Solar System Research, Germany), Alexei Pevtsov (National Solar Observatory, USA) Ilya Usoskin (Sodankylä Geophysical Observatory, Finland)

Event Information: Solar activity increased to a historic maximum only half a century ago but reduced to a much lower level during cycle 24.

What changes did this dramatic variation imply in the Sun, in the solar wind, on the Earth? How did the solar-terrestrial system evolve in history, how will it evolve in the future? This Event joins experts from different scientific communities, including solar, heliospheric, cosmic ray, magnetospheric, space weather, ionospheric, atmospheric and climate researchers to study the versatile topics of Space Climate, the long-term evolution of the solar-terrestrial environment. This Event is jointly organized with Commission D and Panel on Space Weather's International Space Weather Action Team (ISWAT), in particular ISWAT Cluster S1 on "Long-term Solar Variability", which seeks to coordinate and facilitate international research endeavourson long-term solar variability, extreme solar events and long-term observations pertinent to Space Climate.

D3.1 Highlights of Magnetospheric Plasma Physics

MSO/DO: Michael A. Balikhin (University of Sheffield, UK), Lev Zelenyi (Space Research Institute of RAS, Russia)

Organizing Committee: TBA

Event Information: Our capabilities to study the magnetosphere and various magnetospheric processes in all their complexity are experiencing gigantic growth. Numerous spacecraft and multi satellite missions provide unprecedented volume of high quality data. Advances in the development of numerical codes and available computer resources allow comprehensive simulations of the global evolution of the magnetosphere that involves a enormous number of dynamical processes operating at various spatial and temporal scales. In addition to the traditional triad of theory, observations and simulations, machine learning is now widely applied to the various problems of magnetospheric physics enhancing our ability to extract important information from vast amounts of available data. We are anticipating both novel constellation missions and imaging missions such as SMILE that will enable remote observations of global magnetospheric dynamics by simultaneous observations of the solar wind and the response of Earth's magnetosphere. This symposium is aimed to assess key recent developments in the physics of the magnetosphere, to review unsolved problems that impede the progress and expectations from future missions.

D3.2 Cross-scale Coupling and Multi-point Observations in the Magneto-sphere

MSO/DO: Katariina Nykyri (Embry-Riddle Aeronautical University, USA), Marina Stepanova (Universidad de Santiago de Chile (USACH), Chile)

Organizing Committee: Iannis Daglis (University of Athens, Greece), Rumi Nakamura (Space Research Institute of the Austrian Academy of Sciences, Austria), Benoit Lavraud (IRAP, France), Vassilis Angelopoulos (University of California, Los Angeles, USA), Eftyhia Zesta (NASA GSFC, USA)

Event Information: One of the most compelling problems in near collisionless space plasmas is to understand how energy is being transferred between different spatial and temporal scales and how particles are being accelerated in the geospace system. Great progress has been made during recent years in understanding the physical mechanisms that allow the solar wind energy and plasma transport, and circulation through the magnetosphere-ionosphere system. One of the main mechanisms, allowing plasma and energy transport across the magnetopause and energy release in the magnetotail during substorms, is magnetic reconnection. While the micro-physics of reconnection is actualized in the ion and electron diffusion regions, the resulting field configuration has global effects on the magnetosphere. Also, other processes can affect the external boundary conditions that drive reconnection. These include various plasma instabilities, high-speed jets, or other processes that can create a thin current sheet. This session invites studies of cross-scale cou- pling processes and multi-point system studies of the magnetosphere. We also invite papers on multi-spacecraft mission concepts targeted for

understanding the remaining science questions in the bow shock-magnetosheath- magneto-sphere-ionosphere system.

D3.3 Origin of Non-thermal Distrib-utions in Space Plasmas and their Role in Wave Generation and Heating / Acceleration of Particles

MSO/DO: Gurbax Singh Lakhina (Indian Institute of Geomagnetism, India), Ioannis Kourakis (Khalifa University of Science and Technology, UAE)

Organizing Committee: Viviane Pierrard (Royal Belgian Institute for Space Aeronomy, Space Physics and STCE, Belgium). Two more scientists to be decided

Event Information: Nonthermal distributions occur commonly in Space plasmas, e.g., in solar and stellar coronas, in the solar wind and in planetary magnetospheres. The origin of nonthermal distributions in Space plasmas is still under debate. Nonthermal distributions are described by Cairns, Kappa, Lorentzian and Tsallis q-extensive distributions. Since such distributions are characterized by an excess of energetic particles in the suprather- mal region, the extra free energy can give rise to various kinds of plasma waves and instabilities and to nonlinear coherent electro-static solitary waves, such as bipolar solitarystructures, double layers and supersolitons. We solicit papers on the origin of nonthermal distributions in space plasmas, and their role in exciting plasma wave modes and solitary structures and their effects on plasma heating and acceleration in the planetary magnetosphere, in solar/stellar coronas, in thesolar wind and in other astrophysical plasma contexts. All papers based on observations, Modelling, theory and computer simulations are welcome.

D3.4 Particle Acceleration and Loss in the Earth and Planetary Magnetospheres

MSO/DO: Yuri Shprits (German Research Centre for Geosciences, Germany), Maria Usanova (University of Colorado, USA)

Organizing Committee: TBA

Event Information: Since the discovery of the Van Allen radiation belts, understanding of the acceleration and loss processes in the Earth's magnetosphere and magnetospheres of the outer planets has been a central topic of research in the space physics community. Observations from the Van Allen Probes, ARASE, MMS, Cluster, Double Star, THEMIS, NOAA POES and GOES, Lomonosov, and a number of CubeSat missions provided a vast amount of data. New planetary missions such as Juno and JUICE will provide additional information about the radiation environments of the outer planets, which will lay the foundation for quantitative comparative studies. In this session, we invite Modelling and observational contributions that focus on the physics of acceleration and loss of particles in the Earth and planetary magnetospheres.

D3.5 Magnetotail Dynamics and Substorms during Storm and Non-storm Times

MSO/DO: Elena Grigorenko (IKI, RAS, Russia), Ian Mann (University of Alberta, Canada)

Organizing Committee: TBA

Event Information: Substorms are key manifestations of energy conversion and transport in the Earth's magnetosphere, which encompass various plasma processes, evolving at different spatial and temporal scales, and in different magnetospheric regions including the magnetotail plasma sheet, its boundary layer, and the auroral ionosphere. During recent years, the multipoint spacecraft observations performed in the magnetotail by MMS, Cluster, THEMIS/ARTEMIS, Geotail and other missions, along with the observations in the inner magnetosphere and on the ground, have generated a unique opportunity for multiscale studies of tail dynamics and substorm-related plasma phenomena. In combination with advanced modelling and theoretical studies, these observations have improved our understanding of this highly coupled system and begun to provide a system-wide perspective. However, manyfundamental problems are still unsolved. This session seeks contributions on recent

advances in the studies of substorm-related phenomena (e.g. night-side reconnection, tail flows, the dynamics of the near-Earth transition region and auroral ionosphere) and their interplay enabled by modern multi-point spacecraft observations in the magnetotail, geosynchronous orbit, on the ground and/or related modelling. New insights into the microphysics of energy conversion processes enabled by MMS during various substorm- related magnetotail phenomena are especially encouraged. Contributions addressing the comparative impact of tail processes duringstorm and non-storm times are also welcome.

D3.6 Imaging of the Magnetosphere

MSO/DO: Steve Milan (University of Leicester, UK), Michael Collier (NASA GSFC, USA),

Organizing Committee: TBA

Event Information: Past studies provide evidence for a host of fundamental processes, including reconnection and particle acceleration, that govern the solar wind-magnetosphere interaction. These processes sculpt the global plasma structures that define the Earth's magnetosphere. Consequently, global observations of the locations, motion, and densities of the bow shock, magnetopause, cusps, auroral oval, plasmapause, ring current, plasma sheet, outer exosphere, and other regions provide crucial information that can be used to diagnose proposed interaction modes. Recent technological advances make it possible to globally image the Earth's neutral atmosphere and the plasma structures that comprise the Earth's magnetosphere in Lyman-alpha, soft X-rays, far ultraviolet, extreme ultraviolet, energetic neutral atoms, and Thomson-scattered sunlight, and other signatures. These technological advances go hand-in-hand with the development of increasingly sophisticated global numerical simulations that encapsulate the fundamental physical processes and predict their diagnostic signatures. Presentations describing results from past/current/future simulations, imaging concepts, and imaging observations are welcome.

D3.7 Dialogues Between Space Science and Art

MSO/DO: Fiori-Anastasia Metallinou (NOA, Greece), Konstantina Moutsouroufi (Private Individual)

Organizing Committee: George Balasis (IAASARS, NOA, Greece). Afroditi Nasi (National and Kapodistrian University of Athens, Greece)

Event Information: A large variety of plasma waves have been observed in near-Earth space; many of these waves have frequencies in the range 20 Hz to 20 kHz, which puts them in the audio-frequency range. Although these electromagnetic waves cannot be heard directly, they can be converted into audio files and played back as sound. This process reveals a series of weird and wonderfulnoises, known as "sounds of space". The proposed will address collaborations between space scientists, artists and audio engineers, leading to activities that fuse art and science. This dialogue between art and science can be very effective for the communication of space sciences to the general public.

C5.1_D4.1 Active Space Experiment

C5.2_D4.2 Dust Observations in Space and Laboratory Experiments

E1.1 The Last Few Miles: Accreting Black Holes Between the Disk, Corona and Jet

MSO/DO: Andrzej Zdziarski (Copernicus Center, Poland), Nikolaos Kylafis (University of Crete, Greece)

Organizing Committee: Tomaso Belloni (INAF -Osservatorio Astronomico di Brera, Italy), Barbara De Marco (Universitat Politècnica de Catalunya, Spain), Alexandra Veledina (University of Turku, Finland)

Event Information: The event is aimed at discussing two hotly debated topics in astrophysics of accreting black-hole binaries. One is the accretion geometry in the hard spectral state. A number of spectral results show thin accretion discs are truncated at tens of gravitational radii from the innermost stable circular orbit (ISCO) in the bright hard state;

however, indications of the broad iron lines suggest the discs extend close to the ISCO already at relatively low luminosities. Most of the current timing results support the former picture. The second topic is the nature and role of the jet, present in the hardstate. The jets are seen from the radio to the IR, but the radio and X-ray fluxes are often correlated, which motivated models with the bulk of the X-rays emitted by the jet. In this picture, Comptonization occurs within the jet rather than in the corona.

E1.2 Black Hole Astrophysics: Observational Evidence andTheoretical Models

MSO/DO: Sandip Kumar Chakrabarti (Indian Centre for Space Physics, India), Kanaris Tsinganos (National and Kapodistrian University of Athens, Greece)

Organizing Committee: TBA

Event Information: The history of black hole astrophysics, including stellar mass and supermassive black holes, has often been the study of different phenomena on a case by case basis. Disk or jets were being studied separately, hydrodynamics of one component ignored the other, spectral properties ignored timing properties or viceversa. With the advent of very good satellite observations, it is possible to look at the problems holistically. Such an approach will lead to ways for new and specific measurements. Most recently, LIGO/VIRGO detections of binary mergers and simultaneous observations in electro-magnetic radiation has opened up a completely new window in this subject. Furthermore, the Event Horizon telescopes (EHT) view of the photonsphere of a black hole paved the way for science in the strong gravity limit. We wish to gather experts to discuss various outcomes of theoretical models which are either observed or observables. Similarly, observers will describe measurements for testing our theoretical understanding. Results of numerical simulations (both hydrodynamic or magneto-hydrodynamic) are most welcome. Another important aspect is to estimate intrinsic parameters, such as, mass, distance, spin, inclination angle, etc. of the black hole systems using methods which rely on theoretical models. We also have to look into observed emission line properties. We expect to have sufficient time for discussions after every talk. We will cover the following topics: Theoretical models of stellar, extragalactic, intermediate mass black hole accretion flows; Spectral and timing properties of these black holes across the nine decades of mass range; Multi-wavelength spectra ranging from radio to very high energy gamma- rays; Numerical simulations (hydro, MHD, Monte-Carlo) of disk-jet connection, spectral and timing properties; Observational evidences of black holes in the Universe (Stellar, Intermediate, Massive, Super-massive) Jets / Outflows; Discussion on disk-jet connections in various observed spectral states; Estimation of intrinsic parameters (mass, spin, distance, inclination, etc.) black hole; Line emission profiles and study of their spectral broadening; polarization properties, predicted and observed, if any; Time or phase lags; Theoretical understanding of positive or negative time lags; General observational peculiarities to be addressed by theorists; LIGO/VIRGO detections of binary mergers and impli- cations on accretion flows; Multi-messenger Astronomy; Imaging of black holes by Event Horizon telescopes and the interpretations, Anticipations and Expectations from New Space Missions, if any. NOTE: WE ARE NOT dealing with THEORIES WHICH MAY OR MAY NOT PREDICT BLACK HOLES, PER SE. NEITHER ARE WE DEALING WITH QUANTUM BLACK HOLES, ALTERNATE THEORIES OF GRAVITY ETC. So please do not send any abstracts in these topics.

E1.3 Origins of Cosmic Rays

MSO/DO: Igor Moskalenko (Stanford University, USA), Eun-Suk Seo (University of Maryland, USA)

Organizing Committee: TBA

Event Information: Cosmic rays (CRs) and tiny dust grains are the only pieces of matter available to us that come from Galactic and extragalactic distances. The spectra of CR species, composition, and direction at the highest energies provide invaluable infor-

mation about their origin and propagation history. The bulk of Galactic CRs is associated with the most energetic events such as supernova explosions, but some fraction may also come from pulsars and interstellar shocks, and perhaps from more exotic and less studied processes. The origin of extragalactic CRsis still a mystery with speculations ranging from nuclei of active galaxies to gamma-ray bursts and primordial shocks. Last decade was generous on discoveries in astrophysics of CRs, thanks to new experimental techniques and technological breakthroughs integrated into the instruments launched to the top of the atmosphere and into space. Among them PAMELA, Fermi-LAT, AMS-02, CALET, DAMPE, NUCLEON, and ISS-CREAM. Ground-based gamma-ray telescopes, such as H.E.S.S., MAGIC, and VERITAS, and water Cherenkov detector HAWC, proved to be able to probe CR fluxes in distant locations. Besides, we witnessed the birth of gravitational wave astronomy (LIGO and Virgo) and the first astrophysical neutrinos detected by IceCube. Meanwhile, instruments designed and built using the technology of 1970s, *Voyager 1*, *2* spacecraft, are also continuing to surprise us by beaming unique information from interstellar space. Spectacular recent discoveries in multi-messenger astrophysics and new measurements of spectra of CR species and their isotopic composition will be discussed during this event. Direct measurements of gamma-ray emission froma number of particle accelerators and from interstellar space, new CR results at very-high and ultra-high energies, as well as new contro-versies and alternative theoretical models will also be highlighted. This session encourages presentations of new experimental approachesand theoretical analyses directed towards answering questions related to the origins of cosmic messengers. Prospective invited talks will include highlights and presentations from all major collaborations. COSPAR Scientific Assembly and its proceedings *Advances in Space Research* are open to all bona fide scientists.

E1.4 Signatures of Cosmic Black Holes

MSO/DO: Sudip Bhattacharyya (Tata Institute of Fundamental Research, India), Marat Gilfanov (MPI for Astrophysics, Germany)

Organizing Committee: TBA

Event Information: Cosmic black holes span a broad range of masses and can be of different origin—supermassive, stellar-mass and prim-ordial black holes being a few examples. Astrophysical studies of cosmic black holes is a broad and rapidly evolving field—the existence of supermassive and stellar-mass black holes has been generally accepted, observational indications of intermediate-mass black holes have been reported and plausible ways to detect primordial black holes are being discussed. The goal of this meeting is to provide a comprehensive review of astro-physical sig-natures of black holes, the current status of observing black hole signatures, and future prospects of these studies. The proposed event will cover both theoretical and observational viewpoints, and will bring together a wide spectrum of astronomers and physicists.

E1.5 Science with AstroSat: from Ultraviolet to Gamma Rays

MSO/DO: Dipankar Bhattacharya (Inter University Centre for Astronomy and Astro-physics, India), Tomaso Belloni (INAF, Italy)

Organizing Committee: Luciana Bianchi (JHU, USA), David Buckley (SAAO, South Africa), Phil Charles (University of Southampton, UK), Gulab Dewangan (IUCAA, India), Tadayasu Dotani (ISAS, Japan), Denis Leahy (University of Calgary, Canada), Sara Motta (INAF-OAB, Italy), Iossif Papadakis (University of Crete, Greece), Tiziana di Salvo (University of Palermo, Italy), S. Seetha (RRI, India), Annapurni Subramaniam (IIA, India), Wenfei Yu (Shanghai Astronomcal Observatory, China)

Event Information: The Indian Space Astronomy mission AstroSat has completed over five years of science operation. With its high quality UV imaging and the capability of simultaneous broadband spectroscopy and timing, AstroSat has accumulated a wealth of valuable observations, shedding new light on star formation and ionising radiation in galaxies,

diversity of stellar populations in star clusters, distribution of hot diffuse gas around sources of excitation, temporal and spectral variability of compact star binaries and active galaxies, hard X-Ray polarisation of multiple sources including gamma ray bursts, among others. The mission remains open for observing proposals and most of the data are available for public access. This event will showcase the science results from AstroSat and discuss the prospects of key science projects through a combination of further observations, coordination with other observatories as well as the use of archival data.

E1.6 Spectral/Timing/Polarimetry Properties of AGN: Theory and Observations of the Inner Workings in these Objects

MSO/DO: Iosif Papadakis (University of Crete, Greece), Michal Dovciak (Astronomical Institute, Academy of Sciences of the Czech Republic, Czech Republic)

Organizing Committee: E. Cackett (Wayne State University, USA), B. Czerny (Center for Theoretical Physics PAS, Poland), I. M. McHardy (Southampton University, UK), A. Ingram (University of Oxford, UK), E. Kara (MIT, USA), G. Matt (Roma Tre University, Italy), P. O. Petrucci (Grenoble University, France)

Event Information: AGN are the most luminous, persistent sources in the Universe. They are also among the most variable at all wavebands. Flux and spectral variations are observed on short time scales and hold significant information regarding the physical processes that operate in the immediate vicinity of their central supper-massive black holes. Significant progress has been made the last few years, both with observations from the current X-ray observatories (like XMM-Newton, NuSTAR, NICER, Swift) and in theoretical advancements of the study of the corona properties and the inner accretion flow. With the soon to be launched world's first satellite polarimetric mission, IXPE, the very first polarimetric observations of AGN will be performed in early 2022. The main aim of this event is to bring together both theorists and observers, and to review the latest advances in this field, including: i) X-ray spectral/timing properties of AGN, ii) X-ray polarimetric observations of AGN, iii) X-ray corona properties and modelling, iv) the disc/corona interplay and the recent Swift plus ground based multi-wavelength campaigns, v) X-ray reflection and disc thermal reverberation, vi) the nature of the 'soft excess', and vii) the nature of the inner accretion flow in AGN.

E1.7 Properties and Evolution of Active Galactic Nuclei in Galaxy Clusters

MSO/DO: Elias Koulouridis (NOA, Greece), PaolaMarziani (INAF, Italy)

Organizing Committee: Paul Martini (Ohio State University, USA), Mirjana Povic (Ethiopian Space Science and Technology Institute, Ethiopia), Deborah Dultzin (Universidad Autonoma de Mexico, Mexico), Cristian Vignali (Bologna University, Italy), Antonis Georgakakis (NOA, Greece)

Event Information: Since the discovery that all massive galaxies in the local Universe host a central super massive black hole (SMBH) with a mass proportional to that of the galaxy spheroid, the study of SMBHs and Active galactic Nuclei (AGNs) remains a lively topic in modern astrophysics. There is compelling evidence that the presence of AGNs is closely linked to the small- and large-scale environments. Galaxy clusters, being the most massive self-gravitating entities in the Universe, are ideal laboratories to investigate the impact of the environment on AGN demographics. The AGN fraction inclusters was found to depend on the distance from the cluster centre, the mass of the cluster and the redshift. During this event we will focus on recent developments in the field, emerging from space observatories and ground-based facilities.

E1.8 Timing the Spectra of Accreting Black Holes and Neutron Stars. Advanced Analysis and Modelling

MSO/DO: Mariano Mendez (University of Groningen, Netherlands), Diego Altamirano (University of Southampton, UK)

Organizing Committee: TBA

Event Information: Studies of the energy and power spectra of accreting black holes andneutron stars, averaged over relatively long time intervals, of order of minutes to hours, ignore a significant part of the information that is encoded in the energy-dependent X-ray light curves of these systems over very short time scales. In the past decade, a wealth of spectral-timing models have been developed to extract this information, in some cases resolving the energy-dependent variability downto time scales of a few milliseconds. Models of reverberation from reflection of coronaphotons off the accretion disc, propagation of mass accretion rate fluctuations in the accretion disc, and time-dependent Comptonisationin a corona coupled to the accretion disc, allow us, for the first time, to unravel the dynamical and radiative properties of the accretion flow in regions of the space-time very close to neutron stars, stellar-mass and supermassive black holes.We propose to hold a 2-full-day session on spectral-timing techniques applied to all classes of objects, encompassing recent developments both on the data analysis and the modelling. State-of the art analysis methods and modelling are crucial to maximise the outcome of current missions like NICER, Insight-HXMT, Astrosat and NuSTAR, and to prepare ourselves to the wealth of exquisite data that will become available in the coming decade from eXTP and Athena.

E1.9 Cherenkov Telescope Array:The Ground-based Eyes to Observe the Gamma Ray Universe

MSO/DO: Tulun Ergin (TUBITAK Space Technologies Research Institute, Turkey), Pol Bordas (Private Individual)

Organizing Committee: TBA

Event Information: Thousands of astrophysical sources have been discovered in gamma-ray astronomy by space-borne instruments, such as Fermi and AGILE, and ground-based observatories, such as H.E.S.S., VERITAS, MAGIC, ARGO, and HAWC. More advanced observatories, such as the Cherenkov Telescope Array (CTA), are currently being built to detect gamma rays between tens of GeV and up to about a hundred TeV. CTA will have an improved angular resolution and flux sensitivity witha larger field of view and a higher detection rate of transient gamma-ray sources. We welcome presentations about status anddevelopments within the CTA project, as well as presentations from experiments, such as H.E.S.S., VERITAS, MAGIC, HAWC, ARGO, LHAASO, Pierre Auger, Fermi, LOFAR, SKA, and IceCube. Contributions focused on multi-wavelength observations, analysis, and theoretical modelling of galactic and extragalactic gamma-ray sources are also very welcome.

E1.10 Star Formation with Space-borne Infrared Facilities: the Era of JWST

MSO/DO: Odysseas Dionatos (University of Vienna, Austria), Marc Audard (University of Geneva, Switzerland)

Organizing Committee: Agnes Kospal (Konkoly Observatory, Hungary), Francois Ménard (University of Grenoble, France), Joel Green (StScI, USA), Inga Kamp (University of Groningen, Netherlands)

Event Information: Almost 40 years since the Infrared Astronomical Satellite (IRAS) completed the first, full-sky survey, a succession of infrared space-born facili- ties (ISO, Spitzer and Herschel) have each pushed the frontiers, helping us to uncover the complex processes which govern the formation of stars and planets. The unique capabilities of the upcoming James Webb Space Telescope (JWST) will soon allow us to study the, otherwise inaccessible, energetic processes governing the formation of stars and planets, to an unprecedented detail. The session comes in prompt time to discuss the first-light data from JWST in the context of the star-formation scheme established from previous space-infrared facilities, but also in comparison with the recent discoveries from ground-based interferometers. Our maingoal is to bring together experts with

diverse observational and theoretical/Modelling backgrounds to discuss the in-flight capabilities of JWST and establish, early on in the mission lifetime, the key science drivers for follow-up studies.

E1.11 Supermassive Black Holes at High Redshift

MSO/DO: Andrea Comastri (INAF - Osservatorio di Astrofisica e Scienza dello Spazio di Bologna, Italy), Ioannis Georgantopoulos (NOA, Greece)

Organizing Committee: James Aird (University of Edinburgh, UK), Eduardo Banados (MPIA, Germany), Rychard Bouwens (Leiden University, Netherlands), Tiziana Di Matteo (Carnegie Mellon University, USA), Simona Gallerani (SNS, Italy), Roberto Gilli (INAF-OAS, Italy), Yoshiki Matsuoka (Ehime University, Japan), Priyamvada Natarajan (Yale University, USA), Ran Wang (KIAA Peking University, China)

Event Information: Optical and near-IR surveys, because of their large area, are exploring very efficiently supermassive black holes (SMBH) at high redshifts, $z>5$, and follow-up mm-observations, e.g. with ALMA, are offering an unprecedented view of the physical properties of their host galaxies. Optically selected AGN, however, may only form the tip of the iceberg as they are prone to obscuration. Many theoretical studies predict that the vast majority of these high redshift AGN are in fact heavily obscured. X-ray surveys represent the perfect tool to peer through obscuration and discover these hidden SMBH, but, owing to their limited area, have probed only a couple of tens AGN above redshifts of $z=5$. The situation is rapidly changing with the serendipitous XMM and Chandra catalogues and certainly with the eROSITA all-sky survey. In this meeting we will bring together the results coming from current optical and X-ray surveys, and from observations with state-of-the art mm and radio interferometers, trying to define solid paths for the future JWST, ATHENA, Lynx and AXIS surveys.

E1.12 Observations and Prospects for X-ray Polarimetry

MSO/DO: Herman Marshall (MIT, USA), Wayne Baumgartner (NASA MSFC, USA)

Organizing Committee: TBA

Event information: With observations of a few targets by INTEGRAL, PoGO+, and X-Calibur at high energies, the upcoming launch of IXPE, and the planned mission eXTP, X-ray polarimetry can provide insights to various physical phenomena that are not currently possible. The main topics of the event would be current and upcoming instrumentation, observational results from existing missions, scientific principles and theoretical considerations relating to X-ray polarization, and models of possible observations. Observations in other bandpasses are often relevant for Modelling and are encouraged.

E1.13 Detecting Gravitational Waves from Space

MSO/DO: Nikolaos Karnesis (Aristotle University of Thessaloniki, Greece), Nikolaos Stergioulas (Private Individual, Greece)

Organizing Committee: TBA

Event Information: In recent years, with the improved in the sensitivity of ground-based detectors, a catalogue of transient signals emitted by binary Black Holes and Neutron Star mergers has been compiled. At the same time, the community is also focusing on space-based Gravitational Wave observatories that will allow us to measure signals in the low-frequency range of the gravitational-wave spectrum. Space-based detectors will operate in a vastly different environment than the ground-based ones, which means that there will be different technological and data analysis challengesto address. In this session, we will highlight recent developments in instrumentation and data analysis for space-based gravitational wave observatories. We will focus on new technologies of flight hardware and software, as well as on data analysis strategies aiming to extract the full scientific potential of such space missions.

E1.14 Astronomy from Space and the Ground: Synergies and Challenges

MSO/DO: Alvaro Giménez (Consejo Superior de Investigaciones Cientificas (CSIC), Spain), Pietro Ubertini (INAF-IAPS Rome, Italy)

Organizing Committee: Matt Mountain (AURA, USA), Fabio Favata (ESA, Netherlands), Saku Tsuneta (NAOJ, Japan)

Event Information: Astronomy develops with data provided by space platforms and ground-based observatories across the electromagnetic spectrum as well as high-energy particles and gravitational waves. The development of large observatories and complex space missions, requires considering the scientific benefits of their complementarity and the joint exploitation of both types of infrastructures. The purpose of this event is to review the synergies and the need for cooperation, from the perspective of the scientific community, leading to e.g. multi-messenger astronomy. In addition, the identification of challenges to advance further,and how to mitigate potential difficulties, will be discussed. Examples of these challengesinclude, exchange of information, coordinationof mutual support, open data access, response to alerts, time allocation, or the evaluation of proposals. The meeting will put together the view of the scientific community and the agencies developing the different facilities, both ground and space-based.

E1.15 Broad-band and Multi-messenger View of High-energy Transient Phenomena

MSO/DO: Shuang-Nan Zhang (Institute of High Energy Physics, CAS, China), Tomaso Belloni (INAF, Italy)

Organizing Committee: Enrico Bozzo (University of Geneva, Switzerland), Marat Gilfanov (MPA Garching, Germany and IKI, Moscow,Russia), Chryssa Kouveliotou (George Washington University, USA), Xiang Dong Li (Nanjing University, China), Di Li (NAOC, Beijing China), Sera Markoff (University of Amsterdam, Netherlands), James Miller-Jones (Curtin University, Australia), Elena Pian (INAF-OAS, Italy), Katja Pottschmidt (University of Maryland, USA), Dave Russell (New York University Abu Dhabi, UAE), KP Singh (IISER Mohali, India), Shu Zhang (IHEP, Beijing, China).

Event Information: Transients, including outbursts of XRB and violent bursts of GRB/FRB etc., are of great interest to the astronomical communities due to their emissions of a large number of photons and thus the delivering of timely information for probing their nature and as well revealing new phenomena. Three aspects are essential to the investigation of transients: triggers from Swift/BAT, MAXI, the newly in service GECAM and future missions of CATCH and EP; broadband views from INTEGRAL, AstroSat, Insight-HXMT and future missions like SVOM and eXTP; multi-messenger observations from FAST, GRID, POLAR (POLAR2) and from future missions: eXTP, XIPE and others. This event is aimed at collecting/sharing the state-to-art discoveries on transients in view of broadband and multi-messengers, which in turn can serve as important inputs for the future missions.

E1.16 X- and Gamma-ray Counterparts of New Transients in the Multi-messenger Era

MSO/DO: Lorenzo Natalucci (INAF, Italy), Marica Branchesi (Gran Sasso Science Institute, INFN, Italy)

Organizing Committee: TBA

Event Information: The groundbreaking discoveries of the past decade, made possible by observations of different messengers as sources of gravitational waves (GW), cosmic neutrinos and ultra-high energy cosmic rays (UHECR) are bringing new science and extending the range of the explored physics of extreme phenomena. Multimessenger observations have impacted many astrophysical fields stimulating a wealth of theoretical studies and the development of new technologies targeted to innovative space-born and ground-based instruments. New important insights into the knowledge of the engines which power high-energy transients, the formation and evolutionof compact objects and their connection with the evolution of galaxies, the cosmic ray origin are expected in the forthcoming years. This scientific event aims at reviewing

instruments, observations and theoretical modelling of X-ray/gamma-ray transients, and discuss perspectives and challenges of the high-energy astronomy in the multi-messenger context. In particular, we will present and discuss: (a) results from current observing facilities; (b) perspectives of future X-ray/gamma-ray instrumentations observing in synergy with GW observatories, cosmic neutrinos and UHECR instruments; (c) current models for compact object mergers and their multi-messenger emission, different scenarios for astrophysical sources of neutrinos and cosmic rays, models for fast radio bursts and tidal disruption events.

E1.17 Small Satellites and Constellations for Astrophysics and Planetary Exploration

MSO/DO: Alessandra Di Cecco (ASI, Italy), Maria Cristina Falvella (ASI, Italy)

Organizing Committee: Colleen Hartman (National Academies of Sciences, Engineering and Medicine, USA) Gustavo Medina Tanco (Instituto de Ciencias Nucleares, UNAM, Mexico), Pietro Ubertini (INAF, Italy)

Event Information: Small satellites are a powerful tool to investigate the Universe from space with low cost missions. This turn on creating new opportunities for the scientific community involved in space science as wellas for the participation of academies or new space actors. The increasing perfomances of small devices and miniaturized technologies have also given a significant boost to the development of smallsat constellations, that lie on distribute innovative solution for a synergetic effect. Thanks to these advantages, several recent missions based on smallsats have been launched or proposed for the study of different scientific topics. For instance, single or multiple nano-satellites (CubeSats) have been considered for Low-Earth Orbits (LEO) missions devoted to Earth observation (TEMPEST-D, NOVASAR), fundamental physics (SPRITE, HERMES constellation) and stellar astrophysics (SPARCS, BRITE).Moreover, CubeSat missions have also been selected for deep space missions, such as for planetary and small-body exploration (MarCO, LICIACube). The numerous launchopportunities offered for small satellites, as secondary payloads, have also started a new era of technological demonstrators in space (polarimeters, radiometers, etc.). In order to open new scientific scenarios, this Event aims to discuss selected or proposed space missions based on small satellites, and their constellations, including nano- and micro technological demonstrators.

E1.18 Twenty Years of AGN Discoveries with Space Observations: Main Results and Perspectives on AGN in the High-energy Sky

MSO/DO: Gabriele Bruni (INAF-IAPS, Italy), Angela Malizia (INAF-IASF Bologna,Italy)

Organizing Committee: TBA

Event Information: This event aims at reviewing the results that paved the way to the AGN study from X-ray to gamma-ray band, and in particular the impact of INTEGRAL, Swift and the high energy space observatories in the field in the last two decades of activity. A number of talks will be reserved to key speakers from the high energy community,showing main results and synergies with otherbands, from radio to optical. Further foreseen topics are the results from recent satellites likeFermi and eRosita, future developments with CTA, and multi-messenger studies with the next generation of GW antennas and neutrinos detectors. Topics outline: Accretion/ejection coupling: jets and outflows launching in the high-accretion regime and its comparison with low-frequency selected AGN samples; Broad-band studies from Seyfert to Blazars; The multi-messenger challenge: neutrinosfrom jets and their EM follow-up. The gravitational waves sky with the next generation of GW antennas: binary supermassive black holes mergers 20 years of AGN with INTEGRAL: heritage and future perspectives.

E2.1 Solar and Stellar Magnetic Flux Ropes

MSO/DO: Alexander Nindos (University of Ioannina, Greece), Brigitte Schmieder (Observatoire de Paris, LESIA, France)

Organizing Committee: Xin Chen (Nanjing, China), Jeremy Drake (CfA, USA), Cristina

Mandrini (IAFE, Argentina), Teresa Nieves Chinchila (NASA GSFC, USA), Spiros Patsourakos (Ioannina, Greece)

Event Information: Solar magnetic flux ropes are coherent structures of magnetic fieldlines that collectively wind about a central, axial field line. Their loss of equilibrium may lead to large coronal mass ejections (CMEs), which may affect the heliosphere in many ways. The presence of flux ropes has also been conjectured in Sun-like stars. Despite the routine recording of proxies to solar flux ropes, there are many questions about their physics which have not been addressed adequately. To this end, we propose this event with the aim to discuss their formation (both observationally and with the aid of simulations), twist and helicity, eruption in the framework of CME initiation, and propagation into the inner heliosphere. Special emphasis will also be given to the discussion of stellar magnetic flux ropes and their possible connection to powerful stellar flares and CMEs, as these phenomena may have implications for the physical conditions of orbiting exoplanets.

E2.2 Catalyzing Progress in our Understanding of the Physics of Solar and Stellar Eruptions via Data Driven Simulations

MSO/DO: Georgios Chintzoglou (Lockheed Martin Solar and Astrophysics Laboratory, USA), Miho Janvier (Institut d'Astrophysique Spatiale, France)

Organizing Committee: Maria Kazachenko (University of Colorado, Boulder, USA), Jens Pomoell (University of Helsinki, Finland), Michael S. Wheatland (University of Sydney, Australia), Satoshi Inoue (Nagoya University, Japan), Feng Chen (Nanjing University, China) Manolis Georgoulis (Academy of Athens, Greece), Lidia van Driel-Gesztelyi (University College London, UK), Mark C.M. Cheung (Lockheed Martin Solar and Astrophysics Lab, USA)

Event Information: Recent advances in computational power and theoretical understanding of solar magnetic fields have enabled the simulation of sunspots all the way to the formation of fully-developed Active Regions (ARs), and even successfully produce eruptive flares in the simulated solar corona. Radiative 3D MHD simulations, and, in particular, evolutionary data-driven Modelling efforts, driving with observed time sequences of vector magnetograms simulations of eruptive events are being explored and developed. This session invites contributions on solar and stellar AR Modelling in balance with contributions from an observational standpoint to cover multiple aspects of (1) the physics of AR formation and evolution, (2) the formation of pre-eruptive structures, and (3) the initiation of solar/stellar eruptions. Understanding the role of the evolution of magnetic fields is key in determining why some ARs are not strong sources of space weather while others pose dangers for space exploration, our modern civilization, or for exoplanet habitability.

E2.3 Seismology of the Sun, Stars and their Atmosphere

MSO/DO: Tom Van Doorsselaere (KU Leuven, Belgium), Anne-Marie Broomhall (University of Warwick, UK)

Organizing Committee: Paul Cally (Monash University, Australia), Sarbani Basu (Yale University, USA), Guy Davies (University of Birmingham, UK)

Event Information: In this session, we will bridge the gap between helioseismology, asteroseismology and solar/stellar atmospheric seismology. While there is a difference in time scales, observations and geometry, many of the observational and mathematical toolsare common in all three fields. Despite this common ground between the different communities, it is rare to have joint conferences and sessions. Thus, it makes sense to bring together the respective communities in those fields. We envisage to have overview talks ondata analysis techniques for period detection in solar and stellar time series, numerical modelling efforts for wave perturbations in an astrophysical context and analytical tools that are common in all fields. These overview talks will set the ground for in-depth discussions onrecent advances in the three fields.

E2.4 The Dynamic Sun at Small Scales

MSO/DO: Kostas Tziotziou (NOA, Greece), Maria S. Madjarska (MPI for Solar System Research, Germany)

Organizing Committee: Georgia Tsiropoula (Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing, NOA, Greece), Brigitte Schmieder (LESIA, Observatoire Paris, France), Vasilis Archontis (University of St. Andrews, UK), Robertus Erdélyi (University of Sheffield, UK), Ioannis Kontogiannis (Leibniz-Institut für Astrophysik Potsdam AIP, Germany)

Event Information: The Sun, even at smallest scales, exhibits a rich diversity of dynamic phenomena throughout the solar atmosphere such as magnetic bright points, spicules, vortices, explosive events, network bright-enings, dynamically evolving loop structures producing jets, Ellerman bombs, UV bursts, small scale coronal loops (coronal bright points), mini-filament eruptions, “campfires” etc., with some of them related to each other. Nowadays, there is a consensus that such, often ubiquitous, structures have profound effects on the mass, momentum and energy transport in the solar atmosphere and solar wind generation. With the advent of new observational facilities, such as the Solar Orbiter mission and the Daniel K. Inouye Solar Telescope, together with existing novel space/ground instrumentation, we are entering a new era in solar observations, modelling, and state-of-the -art simulations. This COSPAR 2022 Scientific event aims to gather observation and theory/simulations (e.g., wave and reconnection) experts to foster our understanding of the intricate nature of small-scale structures, as observed both from space and ground.

E2.5 Abundance Variations andFunda-mental Questions in Solar and Stellar Physics

MSO/DO: Deborah Baker (University College London, Mullard Space Science Lab., UK), J. Martin Laming (NRL, USA)

Organizing Committee: Lidia van Driel-Gesztelyi (UCL/MSSL, UK), Katalin Olah (Konkoly Observatory, Hungary), Zsolt Kovari, (Konkoly Observatory, Hungary), Marco Stangalini (ASI, Italy), Paola Testa (CFA, USA), Gherardo Valori (MPS, Germany)

Event Information: Element abundance patterns have long been used as diagnosticsof physical processes in many areas of astrophysics. Work in recent decades has revealed that the solar coronal composition varies with location, time and magnetic activity compared to the photosphere. Stellar coronae and winds also show a range of composition differences from their photospheres. This ses- sion is devoted to discussion in a synergistic manner of the implications of variable elementabundances throughout the Sun and stars and their winds. Topics to include: Observations and models of the FIP and Inverse FIP effects and the impact of wave physics on our understanding of coronal abundances; the effects of flaring on short term modulation and of spots on long term, cyclic modulation of abundances in solar and stellar coronae andwinds; connection of coronal abundances and stellar dynamos.

D2.1_E3.1 Exploring the Cradle of the Solar Wind withPSP/SolO/Proba-3: What Do We Really Know about the Inner Solar Corona?

D2.2_E3.2 Connecting Solar and Stellar Coronal Mass Ejections: Lessons Learned, Challenges and Perspectives

D2.3_E3.3 Parker Solar Probe: Ushering a New Frontier in Space Exploration

D2.4_E3.4 Magnetic Reconnection in the Turbulent Plasmas from the Sun through the Heliosphere to Galaxies

D2.5_E3.5 Probing the Sources of Solar Wind and Energetic Particles and Tracking their Journey into the Heliosphere

D2.6_E3.6 Space Climate: From Past to Present and into the Future

B6.1_E4.1 Exoplanet Detection and Charact-erisation: Current Research,

Future Opportunities and the Search for Life Outside the Solar System

F0.1 Scientific Commission F Overview Talks

MSO/DO: Tom Hei (Columbia University Medical Center, USA)

Organizing Committee: TBA

Event Information: Solicited presentations only. Please do not submit an abstract for this event unless requested to do so by the organizers.

F1.1 Gravity Perception and Response in Plants and Fungi: Ground and Space Studies

MSO/DO: Chris Wolverton (Ohio Wesleyan University, USA), John Z. Kiss(University of North Carolina-Greensboro, USA)

Organizing Committee: TBA

Event Information: Understanding gravity perception, transduction, and response in plants and fungi is a fundamental, cross-cutting topic for biologists. The distinctions and interactions between statolith sedimentation and movement, mechanosensory processes, and subsequent growth responses remain unclear. Experiments under weightlessness and clinorotation and related techniques as well as studies with numerous mutants have improved the understanding of gravitropism and are increasing in pace and importance with the advent of more robust genome sequencing and editing technologies. The sessions will present the current state of the field with a focus on the function of acceleration-sensitive structures and their role in the perception and transduction of thegravity signal and ensuing responses. The role of statoliths, the cytoskeleton, ion fluxes, and related molecular events such as light perception, gene transcription and expression, and physiological responses will be considered as well as the interaction among tropisms. In addition, ground-based and spaceflight experimentation results in unicellular systems and flowering plants will be presented in thesesessions.

F2.1 Biological Effects of Space Radiation and Co-stressors: from Basic Research to Practical Recommendations

MSO/DO: Christine Hellweg (DLR - Inst. of Aerospace Medicine, Germany), Alexandros G. Georgakilas (National Technical University of Athens (NTUA), Greece)

Organizing Committee: Sarah Baatout (SCK-CEN, Belgium), Jerry Shay (UTSW, USA), Marco Durante (GSI, Germany), Anna Fogtman (ESA EAC, Germany), Laure Sabatier (CEA, France), Sylvain Costes (NASA Ames Research Center-ARC, USA), Insa S. Schroeder (GSI, Germany)

Event Information: Space radiation re- mains a major health risk for long-term space missions beyond Low Earth Orbit (LEO). Depending on dose, dose rate, radiation quality, affected tissue, genetic background and other factors, early, late and chronic effects might be induced after space radiation exposure. The extents of these risks and the underlying mechanisms have to be further elucidated. The objective of this session is to present and discuss the current status of the multidisci- plinary approach based on data from physical interaction to biological response. Radiation interaction with molecules and track structure geometry are important determinants for the biological outcome. On cellular and tissue level, the complex interplay of cellular responses, starting with DNA damage induction or damage to other cellular components (e.g. membranes, organelles, proteins) and leading to signal transduction, DNA repair, altered gene expression (including microRNA), cell cycle perturbations, cell death, chromosomal aberrations, genomic instability, senescence, differentiation and transformation has to be elucidated. Damage escape strategies as well as adaptive responses and bystander effects will also be outlined. Also, cell-type, tissue and organ specific effects of protons and heavy ions resulting in dysfunctions are addressed (such as cataract, and cardiovascular and central nervous system effects). The radiation effects on the immune system and its influence on the radiation response in other tissues are important topics in this session. Systems biology approaches includingdatabase mining, artificial intelligence (AI) and machine learning (ML) approaches are

essential to understand the complex biological responses to space radiation exposure and identification of target molecules or pathways for pharmaceutical countermeasures. On organismal level, the effects of space relevant radiation qualities not only on mammalian and other vertebrate animal models, but also on plants and invertebrate animals such as insects and nematodes, are topic of this session. This session also covers surveys with human subjects, e.g. detection of chromosomal aberrations in blood lymphocytes. The interdisciplinary session addresses researchers from the fields of biology, biotechnology, biochemistry, bioinformatics, neuroscience, chemistry, physics and medicine dealing with the effects of space relevant radiation qualitiesalone or in combination with other spaceflight environmental factors on cells, tissues, organs and organisms. Experiments performed in space and ground-based studies are discussed in this session.

F2.2 Space Radiation Risk, Quality of Radiation and Counter-Measures: Physical and Biological Mechanisms, Modelling and Simulations

MSO/DO(s): Francis Cucinotta (University of Nevada Las Vegas, USA), Giorgio Baiocco (Università di Pavia, Italy), Livio Narici (Università di Roma 'Tor Vergata', Italy)

Organizing Committee: TBA

Event Information: The general objective of this session is to discuss the results of research activities that can improve space radiation risk assessment. This includes the design of biological and physical countermeasures in order to reduce cancer risk and understand if non-cancer risks, including cataracts, degradation of cognition and circulatory diseases, will occur for specific space missions. Particular attention will be given to the mechanisms underlining the dependence of biological effects on the quality of radiation and rates. The session will discuss physical and biophysical multi-scale Modelling and simulations with the aim of: Integrating activities carried on by scientists of different disciplines (physicists, biologists, etc.); Developing predictive models of the behavior of complex biological systems exposed to radiation; Allowing abetter understanding of the risks to health from exposure to radiation as well as evaluate counter-measures; Reducing the uncertainties in risk predictions. Examples of Specific topics are: Physical interaction models and transport and track structure codes, code verification and validation with experimental data; Multi-scale mechanisms, Modelling and simulations (at sub-cellular, cellular, tissue and organism levels) of the biological response to radiation; Systems radiation biology; 'Omics' investigation of biological systems after radiation exposure; Development and implementation of counter-measures, in different mission scenarios; Advanced shielding materials and development of active shielding; Risk assessment for cancer morbidity andmortality, with emphasis on chronic exposures and non-targeted effects; Risk assessment of early onset effects that have the potential to impact performance during long duration missions, including CNS and cardiovascular diseases, and possible counter-measures; Computational neuroscience applied to space radiation exposures; Application of space particle and dosimetry measurements to radiation protection; Possible synergies between space radiation exposures (low fluence) with Hadron therapy (high fluence); Non-targeted effects, including bystander effects and the role of immune responses in cancer progression and degenerative risks.

F2.3 Space Radiations: Dosimetric Measurements and Related Models, Detector Developments and Ground-Based Characterization

MSO/DO: Thomas Berger (DLR, Germany), Yukio Uchihori (Private Individual)

Organizing Committee: Daniel Matthiae (DLR, Germany), Ramona Gaza (NASA, USA), Cary Zeitlin (Leidos, USA)

Event Information: The space radiation environment and the relevant radiation exposure from the various sources is one of the limiting factors for long duration human space missions. The event will present the newest radiation measurement results gathered onboard

various manned space crafts as for example the International Space Station ISS. Further on it will provide information about the radiation field parameters measured in interplanetary missions as to the Moon and to Mars, being the precursor missions for future human exploration. These results shall be compared and benchmarked applying various radiation transport codes and newest results for model developments shall be discussed. Emphasize shall be further givento the development of new radiation detectors to be applied for long duration humans space missions (as to the Moon and Mars) andtheir ground based characterization applying various accelerator facilities and sources.

F2.4 Genetic Epigenetic and Metabolic Changes in Spaceflight and Simulated Spaceflight

MSO/DO: Yeqing Sun (Dalian Maritime University, CAS, China), Honglu Wu (NASA Johnson Space Center-JSC, USA)

Organizing Committee: TBA

Event Information: It addresses changesat the molecular level in living organisms in response to spaceflight and simulated space-flight environment with technologies for large scale DNA, mRNA, miRNA, methylation and protein-expression measurement. Results collected from spaceflight experiments and experiments using ground-based facilities that simulate the spaceflight environment (bio re-actions, charged particle radiation, hindlimb suspension model, etc.), the development of spacetechnologies for on orbit monitoring of biological processes and analysis of biological samples, and the synergistic effect of radiation and microgravity are included and welcome.

F3.1 Chemical Complexity of Molecular Universe

MSO/DO: Ankan Das (Indian Centre for Space Physics, India), Cristina Puzzarini (Università di Bologna, Italy)

Organizing Committee: Paola Caselli (MPI for Extraterrestrial Physics, Germany), Nigel Mason (University of Kent, UK), Victor Manuel Rivilla (Centro de Astrobiologıa, Spain), Bhalamurugan Sivaraman (PRL, India), Takashi Shimonishi (Niigata University, Japan)

Event Information: Our Universe is filled with a wide variety of chemical species. Somewhere it is vibrant and varied in organic inventory. Recent advancement in the space-based and ground-based observational facility has resolved the understanding of the Universe at an accelerating stride. Parallelly with the modern experimental facility, the theoretical investi-gation can now comply with the observational yields. This conference will provide a platform to revisit some of the new developments made on this subject. In the present meeting we would like to discuss the following issues more elaborately:-(a) Numerical simulations to study the collapse and fragmentation of star-forming regions.(b) Chemical evolution during the process of star formation.(c) Fate of molecules in some exotic environments (super-hot, super-cold, superdense, etc.).(d) Chemical diversity ina protoplanetary disk(e) Advancement in Laboratory and observational aspects toaddress the most relevant astrochemical issue.

F3.2 Astrobiology

MSO/DO: Petra Rettberg (DLR - Inst. of Aerospace Medicine, Germany), André Antunes (Macau University of Science and Technology, China)

Organizing Committee: TBA

Event Information: Astrobiology is an interdisciplinary research area aiming at the understanding of the origin and evolution of life on Earth to enable the search for life on other planets and moons in our solar system and beyond. Different complimentary approaches are necessary to identifiy the physicaland chemical limits of life as we know it and toobtain a better understanding of habitability in general. Laboratory studies allow the in-depth investi-gation of biological phenomena ina standardized and reproducible environment.Field studies are necessary for the analysisof natural communi-ties adapted to their specific, often extreme environment and the interactions and depend-encies between the community members. Space experiment, e.g. on the ISS, allow the investi-gation of theresponse of organisms and communi-

ties to the space environment and to combined simulated space conditions, e.g. of Moon and Mars or of the icy moons in the outer solar system. For this session we invite contributions covering astrobiological research in laboratories, in planetary and space simulation facilities, in field studies, and in space.

F3.3 Habitability of Mars

MSO/DO: Javier Martin-Torres (University of Aberdeen, UK), Sushil K. Atreya (University of Michigan, USA)

Organizing Committee: TBA

Event Information: (This session is dedicated to the memory of Dr Rafael Navarro-Gonzalez) Mars exploration has bloomed as one of the most important targets of scientific-technical and strategic interna- tional interest. We live in the Golden Age of Mars Exploration, and data collected from past and current spacecraft missions to Mars and those anticipated in the future allow us to assess scientifically whether habitable environments are present today or existedin the past. Furthermore, they provide important clues into the potential of Mars environments for both sustaining life in thefuture and for providing in situ resource utilisation (ISRU) for future human missions. Determining where, when, and how such environments occur will play a crucial role in guiding future exploration efforts. This session welcomes abstracts on observational, modelling and laboratory studies relevant to past, present and future habitability on Mars. Potential topics include but are not limited to the following: Martian environments and habitability in the past and present; Identification of potential habitats for life and habitatsfor human Mars exploration; The search for Martian ISRU for future habitability of the planet; Search for organics on Mars; Trace gases, oxidants, and chemical elements of interest to the habitability of Mars and any other topics related to the habitability of Mars, such as Primary locations of minerals hosting water;The history of water and energy sources on Mars; BrinesRadiation levels

F3.4 Biosignatures and Biomarkers - Searching for Traces of Prebiotic Organic Compounds

MSO/DO: Michel Viso (CNES, France), Petra Rettberg (DLR - Inst. of Aerospace Medicine, Germany)

Organizing Committee: TBA

Event Information: One goal of the Mars2020 mission is the search for signs of ancient life. With the arrival of the rover 'Perseverance' on Mars, the first step of the Mars Sample Return campaign was succesful. Subsequently, Mars samples will be brought to Earth and will be analyzed with sophisticated instruments and methods. Details about how to analyze the samples have to be discussed and planned now. Other ideas and proposals are arising to search for prebiotic organic molecules, biomarkers and biosignatures relevant for some icy satellites ofthe giant gaseous planets, such as Europa and Enceladus. For this session we invite contributions covering the identification of potential biosignatures and biomarkers for Mars and the icy moons, methods and technologies for their detection, terrestrial analogs as testbed for new instruments and training, as well as laboratory research in planetary and space simulation facilites.

F3.5 Simple and Complex Molecules in Star-forming Regions

MSO/DO: Robin Garrod (University of Virginia, USA), Gianfranco Vidali (Syracuse University, USA)

Organizing Committee: Arnaud Belloche (MPI for Radioastronomy, Germany), Eric Herbst (University of Virginia, USA), Izaskun Jimenez-Serra (Centro de Astrobiologıa (CSIC/INTA), Spain), Jeong-Eun Lee (Kyung Hee University, Korea), Maria Elisabetta Palumbo (Istituto Nazionale di AstroFisica, Italy), Klaus Pontoppidan (STScI, USA), Nami Sakai (RIKEN, Japan), Stephan Schlemmer (University of Cologne, Germany), Ian Sims (Université de Rennes 1, France)

Event Information: This event will bring together astronomical observers, laboratory researchers, theorists and computational modelers to discuss gas-phase and solid- phase molecules in star forming regions and interstellar clouds. The ALMA telescope has brought

exceptional spatial resolutionand sensitivity to the detection of gas-phase molecules in the interstellar medium, especially for complex and potentially pre-biotic molecules. The upcoming James Webb Space Telescope now offers a similar opportunityto transform our knowledge of interstellar solid-phase chemistry, and to understand the relationship between solid and gas, between simple and complex molecules. New experimental data and models continue to deepen our understanding of both the fundamental microscopic processes and the large-scale physical evolution that influence interstellar chemistry. We will provide a forum for the discussion of recent observational detections, Modelling predictions, and laboratory chemistry and spectroscopy results. We will strongly encourage participation by young researchers from under-represented countries.

F3.6 Quest to Detect Extraterrestrial Life: Scientific Approaches and Cultural Impact of Discovery

MSO/DO: Nectaria Gizani (Hellenic Open University, Greece), Giorgos P. Veldes (University of Thessaly, Greece)

Organizing Committee: Frank Drake (SETI Institute, USA), Michael Garret (Jodrell Bank Centre for Astrophysics, UK), Claudio Grimaldi (Ecole Polytechnique Fédérale de Lausanne, Switzerland), Heino Falcke (Radboud University Nijmegen, Netherlands), Paul Kalas (UC Berkeley, USA), Eric J. Korpela (Astronomy Dept and Space Sciences Lab, USA), Joseph Lazio (JPL-Caltech, USA), Claudio Maccone (International Academy of Astronautics, France), Ian Morrison (Curtin Institute of Radio Astronomy, Australia), Sara Seager (MIT, USA), Andrew Siemion (Breakthrough Listen Lab, USA),Jill Tarter (SETI Institute, USA), Beatriz Villarroel (Nordic Institute for Theoretical Physics, Sweden), Claire Isabel Webb (MIT, USA), Dan Werthimer (Astronomy Dept and Space Sciences Lab, USA), Jason, T. Wright (Penn State Extraterrestrial Intelligence Center, USA)

Event Information: Life on our planet manifests in normal environments for carbon-based organisms as well as in environmental extremes. It leaves biosignatures and technosignatures. We, humans living in and observing our ever changing evolutionary developed ecosystem, naturally pose questions like “Is there life beyond Earth”. As a result, scientists search in radio and optical frequencies for technologically advanced civilizations capable of transmitting intentional/ transitory technosignatures. The probe of biosignatures contributes equivalently to the Search for ExtraTerrestrial Intelligence (SETI) methodology. For example, infrared signals associated with greenhouse gases hint presence of surface life, phosphine in planetary clouds suggest primitive life, habitability of discovered exoplanets of nearby stars is being studied. The quest for the priceless “ET needles”, in the “cosmic haystack” is currently been empowered by multidisciplinary technologically advanced instruments, associated techniques and Big Data analysis methods. However if extraterrestrial life is discovered what steps are scientists taking to prepare for that event?

F4.1 Advanced Life Support Technologies and Test Bed Facilities

MSO/DO: Christophe Lasseur (ESA, Netherlands), Chloe Audas (Private Individual)

Organizing Committee: TBA

Event Information: Future exploration of space will require advancements in Environmental Control and Life Support System (ECLSS), to improve the loop closure of air, water and food, which in fine will reduce the resources need by the crew, as well as the wastes accumulation. To reach this goal will require system study, new technologies, optimization and robustness, as well as research and test facilities on Earth and ultimately in space. This session will provide a forum for life support scientists and engineers to presenttheir findings.

F4.2 Influence of Spaceflight Environments on Biological Systems

MSO/DO: Galina S. Nechitailo (Inst. of Biochemical Physics RAS, Russia), Alexey Kondyurin (Ewingar Scientific, Australia)

Organizing Committee: Tomita Yokotami Kaori (University of Tsukuba, Tsukuba, Japan), Tatyana Borisova (National Academy of Science,

Ukraine), Liu Min (China Academy of Science, China), Jinying Lu (China Academy of Space Technology, China)

Event Information: Orbiting spacecraft is a unique physical, chemical and biological environment, which affects living organisms in many different ways. Lack of gravity, temperature and chemical gradients, magnetic and electrical fields, spectral composition and intensity of light and high-energy cosmic radiation influence many important metabolic and physiological processes in animals, plants and microorganisms, as well as transfer phenomena in and around them. Success of future manned space missions depends on understanding the effects of these factors on biological organisms and developing appropriate countermeasures, aimed on improving growth, development and reproduction in microgravity. The program of the symposium will include presentations on the influence of the entire complex of physical factors associated with spaceflight on biological systems, including detailed analysis of the impact of the microgravity on the organism, as well as the effects of electic and magnetic fields. Both spacecraft and ground-based studies will be covered. The goal of this symposium is to bring together scientists interested in the above problems for a productive exchange of ideas.

F4.3 Space Food and Nutrition

MSO/DO: Naomi Katayama (NagoyaWomen's University, Japan), Yoshiaki Kitaya (Osaka Prefecture University, Japan)

Organizing Committee: TBA

Event information: We are looking for a wide range of abstracts on the theme of space food and nutrition. A solid life-suporting environment is necessary for human beings to stay in outer space for a long period of time. Therefore, a balanced diet is essential for life support. In order to provide a balanced diet, it is necessaryto grow plants and secure animal protein. Therefore, in this session, we would like to ask researchers in plant cultivation who are using space or in the stage of ground experiments to make a presentation. Furthermore, we would like researchers to make presentations to secure animal proteins (amimals, fish, insects, etc) using outer space. Of course, we also welcome the presentation of ground research that explores the possibilities for securing food, which has not yet gone to the use of outer space. In addition, presentations of physiological research (taste, smell, mastication, swallowing, hormones, water transfer, etc) necessary for life support in outer space are also welcome. For now on, human beings will stay at the luna base ofr along time and move to Mars migration. Researchers (we) also need advice on the safe, hygienic and long-term storage of food.

We hope that researchers in various fields will actively exchange opinions. We invite abstract submission form researchers who are interested in the topic of food in space and astroponics. In particular, this event will cover the study of plants which are be cultivated in space, space food as future research topics, health in space through nutrition, and the role of food in space in maintaining the immune system and as medicine. Food in space and astroponics will be increasingly studied fields and essential for future long-duration manned missions, and we hope many researchers will contribute abstracts for and participate in this Assenbly event.

F5.1 Molecular, Cellular and Physiological Changes in Response to Spaceflight and Ground-based Analogues

MSO/DO: Elizabeth Blaber (Rensselaer Polytechnic Institute, USA), Dieter Blottner (Charité Universitätsmedizin Berlin, Germany)

Organizing Committee: TBA

Event Information: This session aims todiscuss the cellular, molecular and physi- ological changes that occur in response to spaceflight. We will focus primarily on flight experiments that have been conducted using cell culture and animal hardware in space, however we also invite research conducted using ground-based analogues. Included will be space and ground based physiological ex- periments that deal with spaceflight induced deconditioning, as well as those that show how different interventions could be used to alleviate spaceflight induced deconditioning. This session will also include studies focusing on synthetic biology and

developmental biology in space and using ground-based analogues. We will also have a session on new spaceflight hardware and therefore would like to invite speakers from both space agencies and industry to present on previously flown or newly developed spaceflight hardware and upcoming flight opportunities.

F5.2 Exploring the Space Exposome and Approaches for Cumulative Risk Assessment of Spaceflight-Associated Human Health Risks

MSO/DO: Zarana Patel (NASA/JSC, USA), Janice Huff (NASA Langley Research Center, USA)

Organizing Committee: TBA

Event Information: This session addresses the concept of the space exposome and use of cumulative risk assessment for evaluating multi-stressor spaceflight risks to human health and performance. The main health hazards of spaceflight are radiation, microgravity, isolation/confinement, closed/hostile environments, and distance from Earth. Each is associated with physiological and performance risks that must be assessed and managed. These hazards are not experienced independently so evaluating their combined impact is important.

The space exposome is a unifying paradigm for considering these spaceflight hazards in concert with lifetime environmental exposures and non-genetic factors. Exposome interaction with individual genetics will then determine the whole-body response to spaceflight. Cumulative risk assessment offers a comprehensive framework to model multiple stressors and predict health risk profiles for individual astronauts.

Topics for this session include:

- The space exposome encompassing all the environmental stressors that an astronaut will experience during spaceflight
- High-priority "red" risks for spaceflight, including both in-mission risks and late health complications resulting from exposure to the main spaceflight hazards
- The use of cumulative risk assessment to quantify the combined risks to human health from multiple spaceflight hazards
- Human systems engineering approaches for risk management
- Using personalized medicine for individualized risk assessments and mitigation strategies
- The role of bioinformatics in cumulative risk assessment
- Adverse outcome pathway approaches to organize information on multiple spaceflight stressors and how this mechanistic approach can inform risk assessment and mitigation strategies
- Strategies to maximize use of ground and flight analogs to acquire data on spaceflight hazards

G0.1 Gravitational Effects on Physico-Chemical Processes

MSO/DO: Jeff Porter (Universidad Politécnica de Madrid, Spain), Taishi Yano (Kanagawa University, Japan)

Organizing Committee: TBA

Event Information: This session is dedicated to research into the effects of gravity in fluid and material sciences. A wide range of basic processes and systems are of interest including: transport, mixing, multiphase flows, solidification, miscible or immiscible layers, interfacial instabilities, bubbles, drops, evaporation, boiling, particle motion and accumulation, convection, thermocapillary flows, jets, electrocapillarity, Kelvin-Helmholtz, Rayleigh-Taylor, Rayleigh-Bénard, Marangoni-Bénard, etc. A complementary concern of this session is in practical and industrial applications such as material processing, separation methods, oil recovery and cleanup, life-support and propulsion systems, and biomedical engineering. The general aim is to provide a productive and stimulating forum where scientists from universities, industry, and other research institutions can discuss exciting new results and share their experience. Results from experiments carried out on microgravity platforms such as the International Space Station,

sounding rockets, drop towers, parabolic flights, etc., are welcome, as are results from numerical studies examining the effects of gravity.

G0.2 Drop Tower Days

MSO/DO: Marc Avila (ZARM, University of Bremen, Germany), Thorben Könemann

(ZARM Fab mbH, Germany)

Organizing Committee: TBA

Event Information: The Drop Tower Days session is mainly concerned with latest results of short-term microgravity experiments and displays an excellent platform to share experimental know-how. Ideas and proposals for microgravity experiments in drop towers or any further (ground-based) research platforms are also discussed. All scientific or technological subjects are treated to facilitate an interdisciplinary discourse among the participants. The Drop Tower Days session is addressed to all scientists who conduct research under conditions of weightlessness (including partial gravity) and those who operate and manage gravity-related facilities.

G0.3 Influence of Free Space Environment on the Behaviour of Materials

MSO/DO: Alexey Kondyurin (Ewingar Scientific, Australia), Joseph Minow (NASA MSFC, USA)

Organizing Committee: Kim de Groh (NASA Glenn Research Center, USA), David Edwards (NASA, USA), Lev Novikov (Moscow State University, Russia), Yugo Kimoto (JAXA, Japan)

Event Information: The free space environment is destructive for all materials used in the construction of space systems such as satellites, space stations, spaceships, and future space bases. The destructive factors of the space environment include high vacuum, large temperature variations and gradients, high energy ionising radiation, ultraviolet radiation, meteoroids and orbital debris and atomic oxygen. These factors are significantly different from our experienceon the surface of the Earth. The ability to replicate the effects of the space environment on material performance using ground based laboratory facilities is difficult. Space flight experiments that characterise the temporal response of material parameters during space exposure help to validate ground-based testingmethodology. The understanding of physical-chemical processes in the construction of spacematerials is a key factor for our success in space exploration in the future. The scientific event, Influence of Free Space Environment on the Behaviour of Materials, will include presentations on: The composition of the free space environment; Modelling the free space environment; The influence of the free space environment on material behaviour including physical-chemical processes associated with the construction of space materials; Results of space flight materials experiments and ground-based testing capability to emulate the free space environments' influence on material behaviour. New material development demonstrating a high tolerance to space environmental effects.

G0.4 Advanced Materials and their Technologies for Space Exploration

MSO/DO: John Vlachopoulos (McMaster University, Canada), Spiros Anastasiadis (Foundation for Research and Technology-Hellas, Greece)

Organizing Committee: TBA

Event Information: Research presentations on materials and their technologies, which may be used for solving challenges relating

to extreme heat or cold, radiation, weight saving, impact and strength. One session will be devoted to high performance polymers, like Polyether Ether Ketone (PEEK), Poly-imide (PI, Kapton), Ultra High Molecular Weight Polyethylene (UHMWPE) as well as composites involving advanced polymers, reinforcements and additives, e.g., carbonfibers, carbon nanotubes or graphene, focusing on investigations of physical, mechanical, thermal properties and their degradation in harsh environments. Moreover, materials for high temperature packaging that can replace existing solutions or new materials for thermal insulation, such as

aerogels can be included. The second session will be devoted to additive manufacturing technologies (e. g., fused filament fabrication and selective laser sintering). Investigations may involve advanced polymers and nanocomposites or lunar regolith simulants for building structures on the moon or other planetary bodies. Moreover, high-performance cost-effective materials for solar generator elements for space applications as well as materials for RF space qualified components, self-healing materials and non-destructive testing innovations will also be included.

H0.1 Commission H Highlight Talks

MSO/DO: Claus Laemmerzahl (ZARM, University of Bremen, Germany)

Organizing Committee: TBA

Event Information: The main purposeof this session is to give space for highlight talks from all sessions which are of general interest for all commission H. This covers gravitational physics including gravitational waves, condensed matter, space missions, enabling technologies and practical applications of space. With this event we plan to create mutual interest. These talks will be commission H plenary talks, that is, there will be no parallel event for these talks. The selection of the talks will be done in collaboration with the organizers of the events H.02 - H.06.

H0.2 Gravitation, Dark Energy and Dark Matter

MSO/DO: Orfeu Bertolami (Universidade do Porto, Portugal), Frederico Francisco (Universidade do Porto, Portugal)

Organizing Committee: TBA

Event Information: This event aims to discuss some of the most challenging questions of contemporary cosmology, namely the existence and the nature of dark energy and dark matter. Indeed, unraveling the properties and the nature of dark energy and dark matter are the main goals of recentobservational programmes and of forthcoming space missions such as, for instance, Euclid. Furthermore, the relevant issue of accounting for the observations beyond the framework of General Relativity, that is, in the context of specific alternative theories of gravity, will be also addressed in this event.

H0.3 Space Missions for Fundamental Physics

MSO/DO: Paul McNamara (ESA-ESTEC, Netherlands)

Organizing Committee: TBA

Event Information: As the development of enabling technologies improves, in both performance and mass/power, the prospect for performing fundamental physics experiments in a space environment has become a reality. The space environment offers many advantages when it comes to precision measurements, such as low gravity, long baselines, and low seismic noise, as well as interesting regions of space such as the Sun-Earth saddle point which cannot be replicated in an Earth-bound laboratory. Drag-free technologies are now well established and precision measurements can be done using a variety of techniques (laser interferometry, SQUIDs, capacitive sensors, matter wave interferometers). These techniques open up a wealth of physics tests which up until now could not be probed in conventional experiments, such as tests of quantum decoherence, dedicated tests of General Relativity, or tests of alternative theories of gravitation in the weak field environment that space offers. Examples of past, and current, fundamental physics missions are the European Space Agency's LISA Pathfinder and ACES, the CNES mission, Microscope, NASA's Gravity-Probe B, as well as the tests of General Relativity using LAGEOS, LARES and Galilleo GNSS satellites. This symposium aims to bring together a global community working in this field and to look to the futureideas coming from them.

H0.4 Gravitational Wave Astrophysics

MSO/DO: Michele Vallisneri (JPL, USA)

Organizing Committee: TBA

Event Information: Gravitational waves, a topic recently honored with the Nobel Prize, provide a new window to astrophysical phenmena but also constitute its own subject of research.

Crucial for the evolution of the field is the development and operation of improved and new gravitational wave detectors on ground (LIGO, Virgo, etc.) and in space (LISA, etc.) based on laser interferometry, also with squeezed light, or on other proposed devices like atom interferometers, or other methods like pulsar timing arrays. With these systems one may detect the gravitationalwaves of merging Newtron Stars, astrophysical Black Holes up to supermassive Black Holes, but also relic gravitational radiation from the early Universe. All these systems may be used to better understand the concept of a Black Hole and to perform high precision test Black Hole physics like the no-hair theorem, of the physics of Neutron Stars and of the underlying Standard Model for elementary paricles,and also of various gravitional theories.This session will discuss the scientific payoff, technological implementation, and international context of space-based gravitational-wave observatories, and it will stress the unity and complementarity of detection efforts across allfrequencies with all types of instruments. The ground-based, space-based, pulsar-timing, and cosmic-microwave-background programshave a strong history of cross-fertilization in theory, data analysis, and experiments, and their future success will depend crucially on continued productive collaborations.

H0.5 Advanced Methods for Geodesy, Metrology, Navigation and Fundamental Physics

MSO/DO: Roberto Peron (IAPS-INAF, Italy), Jürgen Müller (Leibniz University of Hannover, Germany)

Organizing Committee: TBA

Event Information: In this Scientific Event,we discuss advanced methods applied to the precise measurement of the gravitational field on ground and in space. These include applications in gravimetry, gradiometry, reference systems realization, time standards, high-precision frequency comparisons, precise orbit determination, possible variation of fundamental 'constants', testing equivalence principle and theories of gravitation. We invite presentations to illustrate the principles and state of the art of these novel techniques, like atom interferometry, optical clocks, relativistic geodesy with clocks or chronometric levelling, quantum optics, inter-satellite links, interplanetary laser ranging, planetary gravimetry. We also welcome presentations on further applications and invite contributions covering the theoretical description of these new methods, introducing novel theoretical concepts as well as new modelling schemes. The Event will be organized as a joint one together with the IAG (International Association of Geodesy) project 'Novel Sensors and Quantum Technology for Geodesy (QuGe)'.

H0.6 Enabling Technologies for Fundamental Physics Experiments and Missions

MSO/DO: Ernst Maria Rasel (Leibniz Universität Hannover, Germany), Sven Herrmann (ZARM, University of Bremen, Germany)

Organizing Committee: TBA

Event Information: The fundamental physics program for space experiments offers a wide range of exciting topics. They range from quantum mechanics, to general relativity, gravity and gravitational waves, just to mention a few. This session should provide an overview and bring together the worldwide activities aiming at the advancement of key technologies enabling the ambitious missions in these fields. State of the art of optical and cold-atom technology, atom interferometry, metrology and novel sensors, for example quantum sensors and novel clocks, and the related mission proposals will be presented.

LR.1 Latest Results

MSO: Jean-Claude Worms (COSPAR)

Event information: The Latest Results session is intended to highlight some recent, outstanding results, through a series of selected presentations by world-class scientists, able to convey to a large audience the content and importance of these results covering various space research domains. The paper selection is made by the COSPAR Executive Director, the COSPAR President and the Chair of the Assembly Scientific Program committee. The session will immediately precede the roundtable discussion of space agency leaders, followed by the opening ceremony. There being no conflict with any

other event, the Latest Results session may be attended by all Assembly participants and by the media.

PCB.1 Capacity Building

MSO/DO: Carlos Gabriel (COSPAR, Spain), Mariano Mendez (University of Groningen, Netherlands)

Organizing Committee: Diego Altamirano (University of Southampton, UK), Raffaella D'Amicis (INAF, Italy), Alexi Glover (ESA, Germany)

Event Information: The COSPAR Capac- ity Building Programme started in 2001 with the organisation of highly practical workshops in developing countries. In 2009 a Fellowship associated to the workshops was added. The Programme today covers a large number of space science disciplines with a cadence of 3 workshops per year. A re-organisation of the Panel took place during the GA in Pasadena in 2018. The new Panel started this period with the main aim of continuing the successful path of past years, adding new elements: a) creation of Alumni, to increase the feedback on careers of workshopparticipants; b) homogenization of the workshops in the different areas, procedurizing the different steps of their organization and conduction; c) introduction of a new type of workshop, specifically in the area of small satellites. This half-day session should discuss the advances made with respect tothese three elements in the last 4 years, include experiences fromworkshops and fellowships and discuss further objectives for the next 4 years period.

PCB.2 Small Satellites for Capacity Building

MSO/DO: Carlos Gabriel (COSPAR, Spain), Amal Chandran (Nanyang Technological University, Singapore)

Organizing Committee: Alexi Glover (ESA, Germany)

Event Information: We are working on the creation of a new type of capacity building workshops, centered on Small Satellites, targeting younger students (undergraduates, even upper secondary school students). The opportunity for attracting younger generations to space sciences in general through participating in projects around nanosatellites isunique and timely, especially in developing countries. We have started to coordinate efforts with the International Satellite Program in Research and Education (INSPIRE), a well-established initiative with an experience of years in Capacity Building in this area. We invite therefore especially people with experience in the field of Small Satellites, particularly those having dealt with young student teams around nanosatellite projects, to submit abstracts for sharing their experiences and thoughts, with the aim of discussing the establishment of a capacity building initiative around them.

PEDAS.1 The Science of Human-Made Objects in Orbit: Space Debris and Sustainable Use of Space

MSO/DO: Carolin Frueh (Purdue University, USA), Carmen Pardini (ISTI/CNR, Italy)

Organizing Committee: TBA

Event Information: The PEDAS.1 sessions will address advances on the science of human-made objects in orbit with respect to space situational awareness and space traffic management. This includes active satellites and space debris in orbit around the Earth and in other regions of space, such as the Lunar and Martian region. Of interest are scientific advances concerning the following four areas: Information collection and their processing: active and passive sensing and observation collection, including astrometry and characterization information such as operational state, shape, attitude and materials, estimation, data fusion and inversion techniques; Environment models in their effecton the human-made objects: effects of natural perturbations on the orbit and attitude evolution, debris and micrometeoroid flux, hypervelocity impact models and shielding, astrodynamics; End-of-life concepts: short- term and long-term sustainability, mitigation methods and their effectiveness, national and international debris mitigation standards and guidelines; Solutions to pressing operational challenges: object identification and characterization, orbit

determination, collision avoidance, methods for ranking critical objects and space debris indexes, criteria for assessing the environmental impact of new space systems, such as small satellites and large constellations, re-entry predictions and risk assessments. Selected papers are automatically recommended for publication in *Advances in Space Research*.

PEX.1 Establishing a Framework for Scientifically-based Stewardship of Celestial Bodies

MSO/DO: Frances Westall (CNRS, France), John Rummel (Friday Harbor Partners LLC, USA)

Organizing Committee: TBA

Event Information: In the present climate of scientific exploration and potential scientific/ commercial exploitation of celestial bodies ranging from the Moon and Mars through asteroids and comets, it is incumbent on humankind to consider environmental stewardship as an essential aspect of 'planetary sustainability'. Accepting that future exploit-ation of celestial bodies can provide an essential ingredient in the survival of the human species, and that outer space is not limitless with respect to the investments required, now is the time to address the condi tions under which those investments will best be made, as well as the mechanisms that will be effected to avoid negative, and potentially irreversible changes, resulting from human activities. This future calls for discussion of the benefits of scientific exploration of the celestial bodies potentially in forming a basis for the evaluation of future investments and their collateral economic aspects, coupled to legal considerations of what measures can, and should, be undertaken to assure sustainable stewardship and use of celestial bodies. We welcome contributions addressing any of these wide-ranging topics, and in particular viewpoints from commercially-oriented contributors.

PEX.2 A Shared Vision for Global Exploration of Moon, Mars, Near Earth Asteroids and Beyond

MSO/DO: Bernard H. Foing (ESA/ ESTEC, Netherlands), Agata Kolodziejczyk (Analog Astronaut Training Center, Poland)

Organizing Committee: TBA

PE.1 Space Explorers in Schools – Empowering the Next Generation of Researchers

MSO/DO: Rosa Doran (NUCLIO-Núcleo Interactivo de Astronomia, Portugal), Gustavo Rojas (NUCLIO, Portugal)

Organizing Committee: TBA

Event Information: Space Exploration is one of the key areas having a huge growth inthe 21st century. Empowering and preparing students for future space related careersis crucial in order to keep up with major developments in the field. On the other hand, preparing educators for this mission is a huge task. COVID-19 brought to light a known problem, the poor competence profile of educators and learners to cope with digital technology during the mandatory school years. Not to speak about modern ICT possibilities such as virtual reality, augmented reality,artificial intelligence, machine learning, etc., a reality that unfortunately is very far from the daily experience of most schools in the world. Enriching the science capital of school communities can only be achieved when proper support is materialized. PE.1 aims to bridge the gap between educators and researchers in the field of space exploration. COSPAR is the perfect stage to enable these interactions and bring both worlds, education and research, closer together in a mutal beneficial relationship. During this event a series of training events will be offered to the participants supported and implemented by researchers in the field of space exploration and education. This event is specially devoted to exchange of best practices for STEAM education with a focus on Space Exploration in schools. This event is open to experts interested in presenting activities, tools andother educational resources to educators from primary to secondary educators. Besides the usual slots during the COSPAR 2022 there will be a parallel event for educators co-organized by the LOC and local institutions devoted to science outreach and education in Greece.

PE.2 Current Trends, Initiatives and Research in Education and Outreach for Space Sciences

MSO/DO: Michel Boër (CNRS, France), Rosa Doran (NUCLIO, Portugal)

Organizing Committee: TBA

Event Information: This session will address the issues in related to research in education for Space Sciences. It will feature also the various initiatives from teachers, educatorsand scientists engaged in education and public outreach in COSPAR related fields. We will also address the following topics: Current trends for eduction and outreach in space science; Citizen space sciences; Space literacy; Use of small and nano satellites; Use of Big Data in the classroom and for outreach; Effective open access for schools; User friendly software for education; Space Sciences in the curricula; Space in our modern life. We call for research studies and experiences from educators and researchers in the above mentioned fields.

PIR.1 Near term Exploration of the Interstellar Medium

MSO/DO: Ralph McNutt (JHU APL, USA), Robert Wimmer- Schweingruber (Christian-Albrechts-Universität zu Kiel, Germany)

Organizing Committee: Edmond C. Roelof (JHU APL, USA), Steven R. Vernon (JHU APL, USA), Michael V. Paul (JHU APL, USA), Mike Gruntman (University of Southern California, USA), Richard A. Mewaldt (Caltech, USA), Pontus Brandt (JHU APL, USA), Vladislav V. Izmodenov (Lomonosov Moscow State University, Russia), Mihir I Desai (SwRI, USA), Stamatios M. Krimigis (JHU APL, USA) and (Academy of Athens, Greece), Herbert O. Funsten (Los Alamos National Laboratory, USA)

Event Information: The scientific understanding of the interaction of the solar wind and our heliosphere with the near interstellar medium has been, and continues to be, a topic of significant interest. This Scientific Event builds upon relevant observations to date with a view to the next steps in our scientific study of our near neighborhood. With the power supplies on the Voyagers continuing to dwindle, the rapid pace of discovery of exoplanets in other stellar systems, and the evolution in our own understanding brought about results from the Voyager, Cassini, and Interstellar Boundary Explorer (IBEX) spacecraft, the time is right for looking at the next small steps we can make into our stellar neighborhood. Even as the Interstellar Mapping and Acceleration Probe (IMAP) nears its launch date and New Horizons takes a fresh look at the outer heliosphere in its extended mission of discovery, a newer and faster anchor on the 'outside', going past the Voyagers, is required for scientific progress to continue to be made, Hence, this Event is divided into (1) science of the heliosphere and and how it connects to the nearby interstellar medium, (2) instrumentation for making both remote and in situ measurements to support that science, (3) correcponding mission and spacecraft concepts, and (4) implications for and consequences of longed-lived missoins to support these scientific goals. The focus is on new measurements and science, which can be accomplished in no more than 50 years using near-term technology to reach at least least several hundred astronomical units (au) from the Sun, and potentially to 1000 au in appropriate mission extenions. The sessions thus focus on the next pragmatic and actionable steps in our scientific reach toward the stars.

PoIS.1 Monitoring and Forecasting of Space Weather Conditions

MSO/DO: Irina Kitiashvili (NASA ARC, USA), Sophie Murray (Dublin Institute for Advanced Studies, Ireland)

Organizing Committee: TBA

Event Information: The session will focus on current achievements to monitor and predict various manifestations of space weather conditions on different temporal scales, driven by SEP events, flares, CMEs, and global solar variability. The dramatic increase of observational and in-situ measurement data from the deep solar interior to the Earth's environment creates a unique opportunityto learn about the origins and evolution of the variety of solar activity processes and trace their impact on

space weather. Early warning of high-energy flux enhancement, prediction of the impact of space weather events, and the forecast of all-clear periods requires continuous monitoring of solardynamics and disturbances. Growing new capabilities to observe, process, and analyzethe multi-dimensional massive data flow allow us to make substantial progress in building a comprehensive vision on various aspects of space weather forecasting. All participants are welcome to present and discuss the current state-of-art computational, observational, data analysis, and theoretical achievements that contribute to monitoring, understanding, and predicting space weather.

PoIS.2 Mars Atmospheric Modeling Using Sparse and Disparate Data

MSO/DO: George A. Danos (Cyprus Space Exploration Organisation, Cyprus), Aura Roy (Lockheed Martin Space, USA)

Organizing Committee: TBA

Event Information: Atmospheric modelling of planets within our solar system and the impact of space weather, are based on data sets that are sparse and disparate (different sensors, missions, altitudes, seasons, time, and latitudes). This disparity is making such modelling particularly difficult. If we were able to fully understand the impact of space weather on Mars and correlate such data with what's happening on Venus and Earth, we might come a long way in understanding the impact of space weather on our own planet's atmosphere, at a time when climate change is of the utmost importance. Cross-mission and cross-planet correlation of data would be a major step towards this direction if the data could be normalised. Such comparative data analysis is particularly complex for humans. But with recent successes of Artificial Intelligence (AI) in astronomical discoveries (discovery of exoplanets that were undetectable by humans), the use of AI could be a solution in achieving the impossible. Utilising AI super-computers, and computing experts, it might be possible to formulate such an AI task. The purpose of this event is to bringtogether plasma-physicists and AI computing experts in a first attempt to create innovativenew solutions that could tackle this spaceweather problem.

PoIS.3 Infrastructure and Tools for Leveraging Exponentially Increasing Data, and Engaging the World's Next Generation of Scientists

MSO/DO: Jonny Dyer (Private Individual), Aura Roy (Lockheed Martin Space, USA)

Organizing Committee: TBA

Event Information: We are entering a unique time where the exponential growth in capabilities for managing, manipulating and analyzing large datasets is intersecting with the dramatic explosion in satellite constellations capable of collecting and moving data from space. The next decade will bea golden era for access to new and unique measurements sampled at temporal and spatial frequencies previously unimaginable. It will also see the maturing and application of modern deep learning approaches to these data sets, providing a toolset for extracting new signals and building better predictive models than ever before. The culmination of this will be large scale data-driven tools that can improve continuously and autonomously while solving applications unfathomable in older paradigms. For this event we seek inter-disciplinary presentations at the intersections of small satellite constellations, new sensor architectures, data infrastructure, deep-learned and physics-inspired deep-learned models andthe science applications that combinations of these technologies can unlock. Of special interest are presentations that "connect the dots" between capabilities that have been demon-strated and real, large scale science applications that are only possible through the benefit of these capabilities together.

PPP.1 Planetary Protection

MSO/DO: Athena Coustenis (Paris Ob-servatory, France), Niklas Hedman (United Nations Office for Outer Space Affairs, Aus-tria)

Organizing Committee: TBA

Event Information: This session will include reports on recent planetary protection studies, colloquia/workshops and agency activities with relevance to the COSPAR Policy on Planetary Protection and implementation guidelines. Recent adaptations and updates of the Policy proposed by the COSPAR Panel on Planetary Protection and validated by the COSPAR Bureau following the Panel's recentmeetings and based on documented studies will be presented. Planetary protection from an overall policy perspective will also be discussed.

PPP.2 Planetary Protection Mission Implementation and Status

MSO/DO: Masaki Fujimoto (Institute of Space and Astronautical Science, Japan), Gerhard Kminek (ESA, Netherlands)

Organizing Committee: TBA

Event Information: This session covers reports on the planetary protection implemen-tation and status of launched, ongoing and planned missions. The session will focus on techniques, measures and procedures applied to spacecrafts, payloads and ground facilities to meet and verify the respective planetary protection require-ments.

PPP.3 Planetary Protection Research and Development

MSO/DO: Petra Rettberg (DLR - Inst. of Aerospace Medicine, Germany), Peter Doran (Louisiana State University, USA)

Organizing Committee: TBA

Event Information: This session will report on planetary protection research and development activities in view of the preparation of new mission concepts and will take into account challenging scientific endeavours, such as life detection and biohazard testing.

PRBEM.1 Empirical and Numerical Models of the Near-Earth Radiation Environment

MSO/DO: Yihua Zheng (NASA GSFC, USA), Yuri Shprits (GFZ, Germany)

Organizing Committee: Yihua Zheng (NASA/GSFC, USA), Yuri Shprits (GFZ Potsdam, Germany)

Event Information: The near-Earth radiation environment includes electrons and protons that can harm technological systems and astronauts. Our community describes these environments through numerical simulations and empirical methods, using local, regional, and global models to inform the planning, design, and testing of space systems and technology. We also engage in verification and validation efforts to compare models toeach other, to environment observations, and to radiation effects observations. We welcome contributions that describe model results, Modelling techniques, model status updates, and model validations. We are interested in all models with a climatological application: long term simulations, global numerical simulations, data assimilation models, machine learning models, and statistical models.

PRBEM.2 Radiation Belt Missions, Data Sets, Data Processing, and Inter-calibration

MSO/DO: Ingmar Sandberg (SPARC-Space Applications and Research Consultancy, Greece), Seth Claudepierre (Aerospace Corporation, USA)

Organizing Committee: TBA

Event Information: The lifeblood of radiation belt studies is observations. Following the flagship Van Allen Probes and Arase missions, the primary source of radiation belt measurements in solar cycle 25 is expected to come from dedicated experiments onboard upcoming CubeSat missions, and from numer-ous radiation monitors as hosted payloads. Understanding a mission's sensors and the nature of its orbit and operation are required for the optimal use of its data. Moreover, the intercalibration of multiple datasets is essential for scientific analyses and the con- struction of consensus radiation belt models based on combined observations. Lessons learned and data processing best practices facilitate efficient and optimal extraction of value from scarce data. In this session, we invite presentations on these topics asthey relate to recent, active, and

upcoming missions that will make observations of the radiation belts, along with the methods and tools used for the processing and analysis of these datasets.

PRBEM.3 Extending the Prediction Horizon of Earth's Radiation Belts: from Science to End-users Space Weather Services

MSO/DO: Ioannis A. Daglis (National and Kapodistrian University of Athens, Greece), Antoine Brunet (ONERA, France)

Organizing Committee: Sebastien Bourdarie (ONERA, France), Christos Katsavrias (NKUA, Greece), Yoshizumi Miyoshi (Nagoya, Japan), Ingmar Sandberg (SPARC, Greece), Ondrej Santolik (IAP, Czech)

Event Information: Relativistic electrons and protons in geospace form the Van Allen radiation belts, and pose a major space weather threat to spacecraft operations and functionality. Their emergence and loss are largely influenced by plasma waves of various frequencies trough wave-particle interactions. Understanding these processes and linking their occurrence and intensities with dynamical solar structures and interplanetary transients in sufficient detail is a key point toproduce a more accurate and reliable forecasting of the potentially disruptive emergence of relativistic electrons and protons. This session invites relevant studies using in-situand ground based observations, physics-basedmodels, machine learning and/or numerical simulations.

PSB.1 Scientific Ballooning: Recent Developments in Technology and Instrumentation

MSO/DO: Mattias Abrahamsson (Swedish Space Corporation, Sweden), Sandip Kumar Chakrabarti (Indian Centre for Space Physics, India)

Organizing Committee: TBA

Event Information: Balloons are used in scientific research in the fields of astrophysics, solar and space physics, planetary and earth sciences and atmospheric science. They are designed and operated for a wide variety of mission types. They drift in the troposphere, in the lowermost or medium stratosphere fora duration ranging from hours to months. A research mission can be accomplished in a single or multiple coordinated balloon flights. As an example, a mission can be designed to test innovative space borne instruments or to complement space-borne systems, and to calibrate and validate satellite instrument by in-situ measurements in the atmosphericscience field. It can also be designed as a self-standing experiment, taking benefit of the unique capabilities of the balloon flight profiles. The balloon borne experiments benefit from new technologies in the area of instrumentation, in particular on the aspects ofminiaturization, as well as from the advances in the balloon system design. A dialog between scientists and balloon system designers is very helpful. One of the main goals of this panel is to help advance this dialog. The panel is organized according to the following topics: 1. Presentation of national programs. 2. Mission concepts (Earth and planetary). 3. Scientific Instruments. 4. Balloon system design, analysis and performance. 5. Gondola design and service systems. 6. Meteorological balloons for professional Atmospheric science and Astrophysics. 7. Small sized (<10 000 cu.m) balloons for scientific experiments and/or testing (e.g payloads, cube/ nanosats). 8. Public outreach and education of new generation of scientists.

PSD.1 Satellite Dynamics: NewDevelopments and Challenges for Earth and Solar System Sciences

MSO/DO: Heike Peter (PosiTim UG (haftungsbeschraenkt), Germany), Shuanggen Jin (Shanghai Astronomical Observatory, CAS, China)

Organizing Committee: Adrian Jäggi (Astronomical Institute University of Bern, Switzerland), Francesco Topputo (Polytechnico di Milano, Italy)

Event Information: The aim of the Panel on Satellite Dynamics is to support activities related to the detailed description of the motion of artificial celestial bodies. This goal should be achieved by improving the current theories of motion and by evaluating their determining forces in a more sophisticated way. Detailed

theoretical understanding of the dynamics of satellites should coincide with the results of precise tracking in order to obtain the most precise knowledge possible of the orbit and the corresponding orbital positions. The scope of the Panel on Satellite Dynamics entails the positioning of a wide range of objects in space, including Earth orbiting satellites for Earth observation suchas GRACE-FO, Swarm, Jason series, and the Copernicus Sentinels, and navigation satellite systems such as GPS, GLONASS, Galileo, Beidou, QZSS or tracking systems such as SLR and DORIS. In addition, positioning plays an important role in the success of the continuously growing number of today's and tomorrow's missions to explore the Solar System. Recent and future missions have to deal with complex trajectories and innovative propulsion and breaking techniques to visit multiple bodies (e.g., Cassini, Dawn, JUICE), small unconventional bodies (e.g., Rosetta, OSIRIS-REx, Lucy), and harsh and unknown environmental conditions challenging our technical capabilities (e.g., Messenger, Venus Express, BepiColombo, JUNO). Both advances in the Modelling of spacecraft dynamics and the theoretical understanding of space observables (e.g., range, Doppler, VLBI, optical) are required to allow for a more efficient exploration and a deeper understanding of our Solar System. Limiting errors in Precise Orbit Determination (solar radiation pressure, time variable gravity fields, phase center corrections, attitude variations, etc.) are of critical interest for many stakeholders. Moreover, formations of satellites are being realized and proposed for Earth observation and fundamental sciences, that impose very severe constraints on (relative) positioning and orbit and attitude control solutions (e.g. micro-propulsion). Mini-satellites and CubeSats also represent a new frontier forboth Earth and planetary exploration, posing new challenges as well as new opportunities. Satellite orbit determination requires the availability of tracking systems, well established reference frames and accurate station coordinate solutions, detailed force and satellite models, and high-precision time and frequency standards. Contributions covering all recent developments and plans in ground, satellite or probe positioning and navigation are solicited as well as contributions on current progress on establishment, maintenance and improvement of reference systems in Geo- and planetary sciences.

PSSH.1 Engaging Space in Society

MSO/DO: Isabelle Sourbès-Verger (CNRS, France), Jean-Claude Worms (COSPAR)

Organizing Committee: Ram Jakhu (McGill University, Canada), Kazuto Suzuki (University of Tokyo, Japan), Piero Messina (ESA)

The COSPAR Strategic Plan 2019-2023 recommended the creation of a new panel to engage with the Social Sciences and Humanities (SSH) community, to address subjects of critical importance to society. This dialogue should also extend to consideration of the UN's Sustainable Development Goals, and to the critical need of being able to explain to the public and to decision makers the relevance and importance of space science and applications for the future of the planet and for the people who inhabit it. Particular consideration should be given to the challenges associated with the identification, assessment and prediction of the impact of anthropogenic activity and natural phenomena on the Earth system and the role of space observations and research.

With PSSH, COSPAR expects to help open new areas of international cooperation involving a variety of scientists of diverse disciplines from natural and social sciences. For the SSH communities, the panel will offer a larger audience and provide opportunities for novel research in a highly dynamic field, but also benefit from the recognition of their key role in promoting interdisciplinary research and collaboration.

The PSSH was created in 2021 and covers such topics as space policy, history, geography, law, ethics, economics, etc. The Athens Assembly will be the first occasion to gather interested scholars to debate these subjects at the interface of very different scientific approaches, e.g. history of COSPAR and space research; the analysis of the "COSPAR spirit" from Cold War

times to today; the future of space research in the "*NewSpace*" era; issues linked to Planetary Protection as seen from the society's perspective; Responsible Research and Innovation (RRI) and space research, and Diversity, Equality and Inclusiveness; the role of science in preserving the peaceful and sustainable uses of outer space; impact of climate change on society and remediation scenarios; etc.

Message from Organizers to Authors: Topics such as those described above, but also views on bi- or multilateral space cooperation and international governance, global societal challenges, or space culture and art, are also welcomed. For this first PSSH scientific session the organizers will privilege oral contributed presentations that offer perspectives for the new panel in terms of its activities, engagement and influence.

PSW.1 Space Weather Nowcasting and Forecasting Capabilities for Improved Space Weather Services: The Role of Validation and Performance Assessment in Enabling R20 and O2R

MSO/DO: Alexi Glover (ESA, Germany), Maria Kuznetsova (NASA GSFC /Heliophysics Science Division, USA)

Organizing Committee: TBA

Event Information: In developing and providing space weather services, clear understanding of the expected accuracy and performance of those services, including their constituent components is essential. Within the space weather community, prototype services frequently operate as capability demonstrators and a full verification of their ability to reproduce/predict elements of thespace environment under a range of space weather conditions, from the moderate to the extreme, has yet to be completed. Validation and performance assessment, in the context ofsuitability for transition to operations, is being addressed by numerous international activities, but as yet a community-wide consensus on how to address this for the wide range of space weather capabilities involved has not been reached. In addition, feedback from operational service provision, and associated performance assessment, can provide valuable information for model and tool developers leading to targeted improvements addressing genuine service needs. This event encourages dialogue between modellers, application developers and service providers in order to review current performance assessment activities, to build upon successes, to identify challenges, and to develop a strategy, supported by actions, for continuous assessment of space weather predictive capabilities as recommended in the COSPAR Space Weather Roadmap. Presentations from International Space Weather Action Teams focusing on capability assessments are encouraged as are all presentations addressing both coordinated validation frameworks and individual case studies. This event will also include a discussion panel focussing on techniques to characterise progress towards operational readiness and on enabling feedback from operations to the research domain

PSW.2 Space Weather at Planetary Bodies in the Solar System

MSO/DO: Reka Winslow (University of New Hampshire, USA), Zhonghua Yao (Private Individual)

Organizing Committee: TBA

Event Information: Space Weather effects are significant throughout the solar system and the ability to predict and design around them is essential for planetary exploration. We welcome descriptions of measurements of space weather effects made in planetary environments or interplanetary space, as well as models, comparisons and methods for improved prediction. We will also explore the way that the space weather environment at other solar system bodies modifies the design criteria for instruments and missions. We particularly welcome presentations which consider the topic of planetary space weather in the context of the recent COSPAR space weather roadmap.

PSW.3 Ionospheric Indices and Scales for Applications

MSO/DO: Norbert Jakowski (DLR, Germany), Tim Fuller-Rowell (University of Colorado, USA)

Organizing Committee: TBA

Event Information: This session will continue the discussion of ionospheric indices and scales and their use in ground- and space-based radio systems applications for telecommunication and navigation. Current ionospheric indices are mostly associated with or based on solar or geomagnetic conditions, rather than their capability to detect, monitor, or predict ionospheric perturbations or impacts. The connections between the current indices and ionospheric impacts are at best qualitative, with no systematic or quantitative connection to concrete applications. In the proposed session, specific use cases shall be addressed to estimate scales for describing the degree of ionospheric perturbations. In order to estimate the suitability of indices and scales, specification of user needs is requested from customers, and intensification of the dialog and collaboration of researchers with customers is encouraged. Best practice experience obtained in weather/ionospheric weather services should be presented. Because ionospheric indices and their scaling are of interest for studying other space weather phenomena, the session is open for related studies in all fields of space weather.

PSW.4 Space Weather Information Architecture and Innovative Solutions

MSO/DO: Arnaud Masson (TelespazioUK for ESA, ESAC, Spain), Shing Fung (NASA GSFC, USA)

Organizing Committee: TBA

Event Information: Research analysis and modelling efforts to understand and forecast the space weather impact of solar eruptive events rely largely on the preservation, accessibility and usability of diverse heliophysics and space weather data products (space-based and ground-based). The growing data complexity and volume, and the distributed nature of data repositories, imply the need for a coherent information architecture that uses data standards to support data and information flows effectively. Standards for data models, metadata and data access protocols, coordination of python libraries, can enhance data distribution and support data mining and data-model comparison. Another key aspect of nowadays research analysis in heliophysics and space weather is the growing use of innovative solutions. This session welcomes contributions on data tools and services that can be standardized to support access and exchange of multi-disciplinary data resources. It also encourages contributions on innovative data analysis including artificial intelligence, machine learning or data assimilation.

PSW.5 COSPAR International Space Weather Action Teams (ISWAT): Progress and Plans

MSO/DO: Maria Kuznetsova (NASA GSFC/ Heliophysics Science Division, USA), Mario M. Bisi (Rutherford Appleton Laboratory, UK)

Organizing Committee: TBA

PSW.6 COSPAR Space Weather Roadmap as a Community-Driven Effort

MSO/DO: Mario M. Bisi (Rutherford Appleton Laboratory, UK), Maria Kuznetsova (NASA GSFC/Heliophysics Science Division,USA)

Organizing Committee: TBA

PSW.7 Panel Discussion: Global Coordination in SpaceWeather and Interfacing with User Groups

MSO/DO: Ian Mann (University of Alberta, Canada), Richard Marshall (Australian Bureau of Meteorology, Australia)

Organizing Committee: TBA

Event Information: This panel discussion will focus on two important space weather topics in two sessions: (i) Review of the latest developments and opportunities for improved global coordination in space weather from representatives of national and internationalagencies and projects, including recent actions within the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS); and (ii) Address improved interfacing with user groups in the delivery of actionable data and services which meet space weather user needs. Such information

is also a key element of the actions to update the 2015-2025 COSPAR/ILWS Space Weather Roadmap toincorporate the latest science knowledge, targeted to updated user needs. The session will be formulated as two panel discussions, with presentations from invited panelists in advance of active question and answer sessions. Join us in active discussion to address someof the latest developments in international coordination in the space weather domain, and recent efforts to better address user needs in space weather products, information, and services. Key questions include: How might operational services be improved and updated based on the best/latest science available? How can user needs be better incorporated into an agile research-to-operations and operations-to-research cycle in space weather? What strategies should be adopted to promote this on a national, regional, and global scale?

PSW.8 The Use of Ground-Based Instrument Arrays in Support of Space Missions

MSO/DO: Hermann Opgenoorth (Umeå University, Sweden), Jesper Gjerloev (JHU APL, USA)

Organizing Committee: TBA

Event Information: Since the beginning of the space age the spatio-temporal ambiguity of single—or even sometimes closely spaced multiple—spacecraft has severely complicated the interpretation of the measurements. The evolution of moving boundaries, which is a common phenomenon in the solar wind as well as in planetary plasma environments, can only with great difficulty and simplifying assumptions be discerned and understood in such data.

In studies of most geo-space phenomena, in the Earth magnetosphere and ionosphere, the usage of regional and global networks of ground-based instrumentation has historically been the workhorse. For more than 40 years these observations have helped to augment satellite measurements and managed to provide context to the fast orbiting s/c and bring these into their proper temporal and spatial context, with respect to developing events of solar wind /magnetosphere /ionosphere interactions.

In this session we will discuss how regional and global sets of coordinated ground-based data from e.g. magnetometers, radars (both coherent and incoherent systems), auroral cameras, ionosondes, riometers and ground-based GNNS receivers, can be utilised for the augmentation of localised but very detailed satellite data. Such measurements provide much needed context to the point measurements of satellites and have proven to be of critical importance even for multi s/c missions such as Cluster, Themis, MMS and the Van Allen Storm Probes. As a special newcomer we might even be addressing similar studies now also possible at Mars, as the only other planet in the solar system, where complicated solar wind planetary interaction can be studied both with a number of coordinated satellites and a growing number of ground-based instruments and rovers.

PSW.9 International Space Weather Missions and Coordination: Current and Planned Missions

MSO/DO: Juha-Pekka Luntama (ESA, Germany), James Spann (NASA MSFC, USA)

Organizing Committee: Elsayed Talaat (NOAA, USA)

Event Information: Space weather is a hazard with potential adverse impacts on our infrastructure and society globally. We do not have means to control our Sun, divert high speed solar wind streams or solar energetic particles, or deflect interplanetary coronal mass ejections in the case of Earth directed solar events. In the near future space weather will be playing increasingly important role also in human space exploration when we return to the Moon and travel for the first time to Mars. The best and only way for us to take action to mitigate the impacts of space weather are timely and accurate space weather services based on high quality observation data and underpinning scientific understanding of the solar and heliospheric physics. The objective of this session is to provide a comprehensive overview of the current and planned space missions targeting provision of measurement data for operational space weather applications and related research. The presentations in the session are expected to

provide inputs for a discussion about how well the current and planned missions cover the needs of the data users and developers of predictive models and decision-making tools, what observations are missing and what new coordinated observations would make a significant improvement in forecasting, and how the long-term co-ordination of space weather monitoring could be improved. The session welcomes abstracts covering all types and sizes of space weather monitoring missions with a particular interest on missions in place or being planned by private industry.

S.1 Come and Learn about COSPAR and this Assembly

MSO/DO: Michel Viso (CNES, France), Jean-Louis Fellous (Private Individual, France)

Organizing Committee: TBA

Event Information: COSPAR is your science organization to explore space related activities in a wide range of fields. This event is dedicated to new-, or not-so-new, comers at a Scientific Assembly. A few presentations will describe the history and the future of COSPAR as well as the various ways for any Associate to participate and proudly support the Science and the Committee. Associates are invited to take the floor or to present through posters how they discovered COSPAR, how COSPAR helps them in their science career or to foster cooperation and initiate new projects.

This event will help everyone to acknowledge the new stance of COSPAR. We will demonstrate the importance of publishing in *Space Research Today*, *Advances in Space Research*, and *Life Sciences in Space Research*. We will answer to Everything You Always Wanted to Know About COSPAR* (*But Were Afraid to Ask)!

TGCSS.1 Small Spacecraft - Big Science

MSO/DO: Daniel N. Baker (LASP, University of Colorado, USA), Rudolf Von Steiger (ISSI, and University of Bern, Switzerland), Amal Chandran (Nanyang Technological University, Singapore)

Organizing Committee: TBA

Event Information: The Committee on Space Research (COSPAR) has had a long history of bringing the nations of the world together to undertake creative space endeavours. In 2017, COSPAR assembled a group of researchers, managers, and policy makers to examine the question of how small satellites might be used to advance technology, science research, and space applications. The two-year COSPAR study led to a scientific roadmap that gave specific guidance concerning small spacecraft utilization. These recommendations were directed to the science community, to the space industry, to various space agencies, and broadly to policy makers around the world. Ultimately, the study team recommended that COSPAR take the next logical step and lay out goals, rules, and a viable approach for international smallsat research. In 2019, COSPAR established a Task Group on the Establishment of a Constellation of Small Satellites (TGCSS). COSPAR intends to facili-tate a process whereby international teams can come together to define science goals and rules for a modular, international small satellite constellation. The role of COSPAR is one of an honest broker, coordinating not funding. The results of an international effort to build small satellite constellations would be valuable for all participants and would be more valuable than the individual parts. This session will focus on research results growing out of the TGCSS activity.

COSPAR Scientific Commission (SC) and Panel Structure

SC A on Space Studies of the Earth's Surface, Meteorology and Climate

Chair: Ralph Kahn (USA)
Vice-Chairs: Jérôme Benveniste (ESA/ESRIN)

- Task Group on GEO (TG GEO)

Sub-Commission A1 on Atmosphere (incl. Troposphere and Stratosphere), Meteorology and Climate

Sub-Commission A2 on Ocean Dynamics, Productivity, and the Cryosphere

Sub-Commission A3 on Land Processes and Morphology

SC B on Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System

Chair: Maria Teresa Capria (Italy)
Vice-Chairs: Bernard Foing (ESA/ESTEC), Rosaly Lopes (USA), Hajime Yano (Japan)

Sub-Commission B1 on Small Bodies
Sub-Commission B2 on International Coordination of Space Techniques for Geodesy - a joint Sub-Commission with IUGG/IAG Commission I on Reference Frames
Sub-Commission B3 on The Moon
Sub-Commission B4 on Terrestrial Planets
Sub-Commission B5 on Outer Planets and Satellites
Sub-Commission B6/E4 on Exoplanets Detection, Characterization and Modelling

SC C on Space Studies of the Upper Atmospheres of the Earth and Planets, Including Reference Atmospheres

Chair: Andrew Yau (Canada)
Vice-Chairs: Paolo Fagundes (Brazil), Duggirala Pallamraju (India), Erdal Yigit (USA)

Sub-Commission C1 on the Earth's Upper Atmosphere and Ionosphere
Sub-Commission C2 on the Earth's Middle Atmosphere and Lower Iono-sphere
Sub-Commission C3 on Planetary Atmospheres and Aeronomy
- Task Group on Reference Atmospheres of Planets and Satellites (RAPS)
- URSI/COSPAR Task Group on the International Reference Ionosphere (IRI)
- COSPAR/URSI Task Group on Reference Atmospheres, including ISO WG4 (CIRA)

Sub-Commission C5/D4 on Theory and Observations of Active Experiments

SC D on Space Plasmas in the Solar System, Including Planetary Magnetospheres

Chair: Nicole Vilmer (France)
Vice-Chairs: Agnieszka Gil-Swiderska (Poland), Jie Zhang (USA)

Sub-Commission D1 on the Heliosphere
Sub-Commission D2/E3 on the Transition from the Sun to the Heliosphere
Sub-Commission D3 on Magnetospheres
Sub-Commission C5/D4 on Theory and Observations of Active Experiments

SC E on Research in Astrophysics from Space

Chair: Tomaso Belloni (Italy)
Vice-Chairs: Eugene Churazov (Germany), Brigitte Schmieder (France), Wenfei Yu (China)

Sub-Commission E1 on Galactic and Extragalactic Astrophysics
Sub-Commission E2 on the Sun as a Star
Sub-Commission D2/E3 on the Transition from the Sun to the Heliosphere
Sub-Commission B6/E4 on Exoplanets Detection, Characterization and Modelling

SC F on Life Sciences as Related to Space

Chair: T. Hei (USA)
Vice-Chairs: Andrea Ottolenghi (Italy), Klaus Slenzka (Germany), Yeqing Sun (China)

Sub-Commission F1 on Gravitational and Space Biology
Sub-Commission F2 on Radiation Environment, Biology and Health
Sub-Commission F3 on Astrobiology
Sub-Commission F4 on Natural and Artificial Ecosystems
Sub-Commission F5 on Gravitational Physiology in Space

SC G on Materials Sciences in Space

Chair: Marc Avila (Germany)
Vice-Chairs: Katharina Brinkert (UK), Jeff Porter (Spain), Taishi Yano (Japan)

SC H on Fundamental Physics in Space

Chair: C. Laemmerzahl (Germany)
Vice-Chairs: O. Bertolami (Portugal), P. McNamara (ESA/ ESTEC), Alexander Zakharov (Russia)

Technical Panel on Satellite Dynamics (PSD)

Chair: Heike Peter (Germany)
Vice-Chairs: Adrian Jäggi (Switzerland), Shuanggen Jin (China), Francesco Topputo (Italy)

Panel on Technical Problems Related to Scientific Ballooning (PSB)

Chair: Tetsuya Yoshida (Japan)
Vice-Chairs: Mattias Abrahamsson (Sweden), Deborah Fairbrother (USA), Stéphanie Vénel (France)

Panel on Potentially Environmentally Detrimental Activities in Space (PEDAS)

Chair: Carolin Frueh (USA)
Vice-Chair: Carmen Pardini (Italy)

Panel on Radiation Belt Environment Modelling (PRBEM)

Chair: Yoshi Miyoshi (Japan)
Vice-Chairs: Antoine Brunet (France), Seth Claudepierre (USA), Vladimir Mikhailov (Russia)

Panel on Space Weather (PSW)

Chair: Maria Kuznetsova (USA)
Vice-Chairs: Joaquim E.R. Costa (Brazil), Sharafat Gadimova (UN-OOSA), Nat Gopalswamy (USA), Hermann Opgenoorth (Sweden)

Panel on Planetary Protection (PPP)

Chair: Athena Coustenis (France)
Vice-Chairs: Niklas Hedman (UN-OOSA), Gerhard Kminek (ESA/ ESTEC)

Panel on Capacity Building (PCB)

Chair: Juan Carlos Gabriel (Spain)
Vice-Chairs: Diego Altimirano (UK), Raffaela d'Amicis (Italy), Dieter Bilitza (USA), Alexi Glover (ESA/ESOC), Randall K. Smith (USA), Z. "Bob" Su (Netherlands)

PCB Fellowship Program and Alumni

Panel on Education (PE)

Chair: Michel Boër (France)
Vice-Chair: Rosa Doran (Portugal)

Panel on Exploration (PEX)

Chair: Frances Westall (France)
Vice-Chairs: Bernard Foing (ESA/ESTEC), John Rummel (USA)

Panel on Interstellar Research (PIR)

Chair: Ralph McNutt (USA)
Vice-Chair: Robert Wimmer-Schweingruber (Germany)

Panel on Innovative Solutions (PoIS)

Chair: Eric H. Smith (USA)
Vice-Chairs: George Danos (Cyprus), Irina Kitiashvili (USA)

Panel on Social Sciences and Humanities (PSSH)

Chair: Isabelle Sourbès-Verger (France)

Task Group on the Establishment of a Constellation of Small Satellites (TGCSS)

Chair: Daniel Baker (USA)
Vice-Chairs: Amal Chandran (Singapore), Ruedi von Steiger (Switzerland)

COSPAR Scientific Assembly Associated Events

As in past years, a variety of organizations will plan scientific, business, and/or social events

around the COSPAR Scientific Assembly. COSPAR encourages organizations planning such events to make them known to the Secretariat before mid-April 2022 so that if appropriate they can be referenced on the Scientific Assembly webpage, app, and/or in the program book.

IAA Day

The International Academy of Astronautics will host its regular Academy Day at the COSPAR Scientific Assembly on Saturday, 16 July 2022, 9:30–18:00. Updates on current Academy activities will be provided by IAA leaders. The highlight of Academy Day however will be a technical program comprised of four or five invited lectures on the latest results from Earth and space science research. Featured lectures will be presented by renowned scientists in the respective fields of space science including astronomy, Earth science, heliophysics and planetary science. Lectures will be tailored for a scientifically savvy audience most of whom are not experts in the particular field of the specific lectures. Details will be posted in spring 2022.

COSPAR Publishing Connect Workshop: How to Get Published

COSPAR is delighted to announce the Publishing Connect Workshop: How to Get Published at the Scientific Assembly in Athens.

During this workshop, an Elsevier Publisher will provide a presentation on how to write a good scientific paper. The presentation contains tips about how to prepare your manu-script using proper manuscript language and how to structure your article. The workshop will be co-presented by an Editor of the society journal *Advances in Space Research*. With this workshop we aim to help you increase the chances of getting your paper published.

The workshop is tentatively scheduled to take place on Tuesday, 19 July 2022, from 19.30 to 21.00. It will consist of a 40-minute presentation by an Elsevier Publisher followed by a 30-minute presentation by an Editor of *Advances in Space Research*, leaving 20 minutes for questions and open floor discussions.

The workshop is open to all participants, but is mostly aimed at early career scientists (PhD-students and postdocs). Pre-registration is recommended. The number of attendees is limited by the allocated room capacity. To register, please complete the form which will become available in the coming months through:

www.cospar-assembly.org/

COSPAR Publishing Connect Workshop: How to Review a Manuscript

COSPAR is delighted to announce the Publishing Connect Workshop: How to Review a Manuscript at the Scientific Assembly in Athens. During this workshop, an Elsevier Publisher will provide a presentation on the reviewing process in general, the role of the reviewer, things to review when reviewing a manuscript, and ethics. The workshop will be co-presented by an Editor of the society journal *Advances in Space Research*.

The workshop is tentatively scheduled to take place on Friday 22 July 2022, from 13.00 to 14.30. It will consist of a 30-minute presentation by an Elsevier Publisher followed by a 15-minute presentation by an Editor of *Advances in Space Research,* leaving 15 minutes for questions and open floor discussions.

The workshop is aimed at young researchers at postdoc level or higher who are experienced authors, but inexperienced reviewers. Pre-registration is recommended, the number of attendees is limited by the allocated room capacity. To register, please complete the form which will become available in the coming months through:

www.cospar-assembly.org/

COSPAR and Joint Awards and Medals

Anyone may submit a nomination. See the specific instructions below under each category of award or https://cosparhq.cnes.fr/awards.

COSPAR Space Science Award

The COSPAR Award honours a scientist who has made outstanding contributions to space science. All scientists working in any field covered by COSPAR are eligible for this award.

Previous recipients:

2020 - William J. Borucki
2020 - Ken McCracken
2018 - Jean-Pierre Bibring
2018 - Bruce T. Tsurutani
2016 - Charles L. Bennett
2016 - Anatoly I. Grigoriev
2014 - David J. McComas
2014 - Jean-Loup Puget
2012 - Janet Luhmann
2010 - Günther Hasinger
2010 - Steven W. Squyres
2008 - George Gloeckler
2008 - Ken Pounds
2006 - Eberhard Gruen
2006 - Atsuhiro Nishida
2004 - Jacques E. Blamont
2004 - Vasily I. Moroz
2002 - Stamatios M. Krimigis
2002 - Christopher T. Russell
2000 - Roger M. Bonnet
2000 - Donald M. Hunten
1998 - Catherine Cesarsky
1998 - Marcia Neugebauer
1996 - Norman F. Ness
1996 - Minoru Oda
1994 - Gerhard Haerendel
1994 - Joachim E. Trumper
1992 - Edward C. Stone Jr.
1990 - John A. Simpson
1988 - Konstantin I. Gringauz
1988 - S.L. Mandelshtam
1986 - Ludwig F. Biermann
1984 - James A. Van Allen

COSPAR International Cooperation Medal

This medal is awarded to a scientist who has made distinguished contributions to space science and whose work has contributed significantly to the promotion of international scientific cooperation. All scientists working in any field covered by COSPAR are eligible for this medal. This medal may also be awarded to a group of scientists.

Previous recipients:
2020 - John Z. Kiss & F. Javier Medina
2018 - Stas Barabash
2016 - Lev Zelenyi
2014 - Carlé McGetchin Pieters
2012 - Roger-Maurice Bonnet
2010 - Lee-Lueng Fu & Yves Ménard
2008 - Marvin A. Geller
2006 - Raymond A. Greenwald
2004 - Stephen S. Holt
2002 - Andre Brack
2000 - John H. Carver
1998 - Reimar Lüst
1996 - Anatoli I. Grigoriev
1994 - Ranjan R. Daniel
1992 - Hubert Curien
1990 - Bengt Hultqvist
1988 - Cornelis de Jager
1986 - The Inter-Agency Consultative Group
1984 - Roald Z. Sagdeev

COSPAR William Nordberg Medal

This medal commemorates the work of the late William Nordberg and is awarded to a scientist who has made a distinguished contribution to the application of space science in a field covered by COSPAR.

Previous recipients:
2020 - Daniel J. McCleese
2018 - Christoph Reigber
2016 - Gordon Greeley Shepherd
2014 - Mikhail Ya. Marov
2012 - Herbert Fischer
2010 - Kuo-Nan Liou
2008 - Joe Waters
2006 - John P. Burrows
2004 - Louis J. Lanzerotti
2002 - Moustafa Chahine
2000 - Kenichi Ijiri
1998 - Anne M. Thompson
1996 - Charles Elachi
1994 - Pierre Morel
1992 - John Theodore Houghton
1990 - Desmond G. King-Hele
1988 - S. Ichtiaque Rasool

COSPAR Massey Award

This award honours the memory of Sir Harrie

Massey, FRS, past Physical Secretary of the Royal Society and past member of the COSPAR Bureau. The award consists of a gold medal and a prize of 500 guineas. This award recognizes outstanding contributions to the development of space research, interpreted in the widest sense, in which a leadership role is of particular importance. These are the only requirements, and the award is open to candidates from any country.

Previous recipients:
2020 - Alexander Held
2018 - John Zarnecki
2016 - Fiona A. Harrison
2014 - Eugene Churazov
2012 - Neil Gehrels
2010 - Harvey Tananbaum
2008 - Giovanni G. Fazio
2006 - Charles Elachi
2004 - Yasuo Tanaka
2002 - Jacques Paul
2002 - Giovanni Bignami
2000 - Stuart C. Bowyer
1998 - Rashid A. Sunyaev
1996 - Johannes Geiss
1994 - Robert Wilson
1992 - Herbert Friedman
1990 - Hendrik C. van de Hulst

Nominations for the four awards above must be signed or endorsed by a COSPAR Bureau member, a representative of a COSPAR National or Scientific Union member, a member of the COSPAR Scientific Advisory Committee, a COSPAR Scientific Commission or Panel chair or vice-chair, or by a previous recipient of the honour.

COSPAR Distinguished Service Medal

This medal recognizes extraordinary services rendered to COSPAR over many years.

Previous recipients:
2020 - Jean-Louis Fellous
2018 - Mariano Méndez
2016 - David Halpern
2012 - Peter Willmore
2010 - Margaret (Peggy) Ann Shea
2008 - Isaac Révah
2000 - Stanislaw Grzedzielski
1996 - Richard C. Hart
1994 - Antal J. Somogyi
1993 - Jean-François Denisse
1992 - Zdzislaw Niemirowicz

Nominations must be signed by a member of the COSPAR Bureau.

Nominations for the five awards listed above will be considered by an Awards Committee appointed by the COSPAR Bureau. After considering the recommendations of the Awards Committee, the Bureau will make a final selection.

Vikram Sarabhai Medal

This medal is awarded by the Indian Space Research Organization (ISRO) and COSPAR in honour of Vikram Sarabhai, considered one of the architects of modern India. The medal is awarded for outstanding contributions to space research in developing countries. For a candidate to be eligible for this award, her or his relevant work must have been carried out mainly in the five-year period ending one year before the COSPAR Scientific Assembly at which the medal is to be presented. This medal is open to candidates from any country.

Previous recipients:
2020 - Alexi Glover
2018 - Qiugang Zong
2016 - Kohei Arai
2014 - Gurbax Singh Lakhina
2012 - Rafael Navarro-Gonzalez
2010 - Zuyin Pu
2008 - Mangalathayil A. Abdu
2006 - Marcos E. Machado
2004 - Peter Willmore
2002 - Ronglan Xu
2000 - Zhen-Xing Liu
1998 - D. James Baker
1996 - U.R. Rao
1994 - Jacques E. Blamont
1992 - C.-Y. Tu
1990 - Vladimir A. Kotelnikov

Jeoujang Jaw Award

The Jeoujang Jaw Award, bestowed jointly by the Chinese Academy of Sciences and

COSPAR, recognizes scientists who have made distinguished pioneering contributions to promoting space research, establishing new space science research branches and founding new exploration programs.

Previous recipients:
2020 - Wing-Huen Ip
2018 - Sergey K. Krikalev
2016 - Cheng Fang
2014 - Professor Sir Martin Sweeting FRS
2012 - Robert P. Lin
2010 - Calvin T. Swift
2008 - James L. Burch

Zeldovich Medals

The Zeldovich Medals are conferred by the Russian Academy of Sciences and COSPAR to young scientists under 36 on the last day of the year in which the Medals are to be presented, to recognize excellence and achievement. They honour the memory of the distinguished astrophysicist Academician Yakov B. Zeldovich. These awards consist of a medal and a certificate. One award is given for each COSPAR Scientific Commission (SC).

2020 recipients (please see the COSPAR website for recipients from earlier years):
SC A: Takatoshi Sakazaki
SC B: Michele T. Bannister
SC C: Takanori Nishiyama
SC D: Daniel B. Graham
SC E: Ildar Khabibullin
SC F: Giorgio Baiocco
SC G: Katharina Brinkert
SC H: Vitali Müller

Nominations for joint awards will be reviewed by the COSPAR Awards Committee (and Scientific Commission officers in the case of the Zeldovich Medal). The Bureau will submit a short list of candidates, in order of preference, to the relevant Academy or Agency stating the total number of candidates and explaining the reasons for ordering the list as presented.

Nominations for joint awards must be signed or endorsed by a COSPAR Bureau member, a representative of a COSPAR National or Scientific Union member, a member of the COSPAR Scientific Advisory Committee, a COSPAR Scientific Commission or Panel chair or vice-chair, a member of the sponsoring Academy or Agency, or by a previous recipient of the honour (except in the case of the Zeldovich Medal).

COSPAR Outstanding Paper Award for Young Scientists

Candidate authors must be under 31 years of age at the time the manuscript is submitted for publication in *Advances in Space Research* or *Life Sciences in Space Research*. Candidates must be a first author, although multiple author papers are eligible. Authors of papers resulting from general submissions are eligible.

2020 recipients (see the COSPAR website for recipients from earlier years):

SC A: Wenyan Ge
Pawel Hordyniec
Merlin Christopher Köhnke
Günther March
Matthias Raynal
Xiaolei Wang

SC B: Danielle M. DeLatte
Yongchao Zhu

SC C: Ronny Badeke
Stefan Gohl
Günther March
Tim Visser
Ningbo Wang

SC D: Jordan Lasuik
Katlego Daniel Moloto

SC E: Weiwei Xu

SC F: Frederico Kiffer
Krishna Luitel

SC G: Giuseppe Prete

PEDAS: Aleix Pinardell
François Sanson

PSB: Kanika Garg

PSD: Hongru Chen
Liang Fan
Eva Jalabert
Chuang Liu
Liu Xin
Tommaso Pino
Aaron Jay Rosengren
Crislaine Menezes da Silva
Kui Zeng
Rui Zhang

The COSPAR Publications Committee, relying on assistance and advice from COSPAR Scientific Commission and Panel officers, will recommend recipients for the award to the Bureau.

Nominations for all COSPAR and joint awards, except the Outstanding Paper Award, shall consist of:

- a filled-in nomination form signed or endorsed by a person authorized to nominate,

- a curriculum vitae with a general description of the space research activity of the nominee,

and

- a list of significant, selected publications, not more than about 25. The publications most relevant to the award should be clearly identified.

All nominations must reach the COSPAR Secretariat no later than end November of the calendar year preceding the Scientific Assembly, i.e., 30 November 2021 for the Assembly to be held in 2022. Further information and the nomination form are at:

https://cosparhq.cnes.fr/awards

Publication of Papers Resulting from Assembly Presentations

COSPAR encourages the publication of full papers resulting from presentations made in Athens in COSPAR´s flagship journals *Advances in Space Research* (*ASR*) and *Life Sciences in Space Sciences* (*LSSR*).

More information on these journals is at:

www.journals.elsevier.com/advances-in-space-research and

www.journals.elsevier.com/life-sciences-in-space-research/

Submission of Manuscripts to *Advances in Space Research* and *Life Sciences in Space Research*

Advances in Space Research (ASR) and *Life Sciences in Space Research (LSSR)* are the flagship journals for the COSPAR community. *ASR* and *LSSR* are indexed in ISI Web of Science and *LSSR* is also indexed in PubMed. Both journals are completely open to appropriate submissions from the scientific community, and individuals making presentations at COSPAR Scientific Assemblies are encouraged to submit their complete manuscripts to *ASR* and *LSSR*.

There are no deadlines for the submission of papers, except for Special Issues. Manuscripts must be appropriate for refereeing and should be written in good English. Draft, incomplete or poorly written manuscripts will be returned without review. Papers will be published as they are accepted with appropriate grouping by subject matter.

While there are no publication charges or page limits, papers are expected to be of a length appropriate for the subject. Manuscripts should be submitted electronically to:

www.editorialmanager.com/aisr/default.aspx or www.editorialmanager.com/lssr/default.aspx

where you can find also a Guide for Authors. Before you submit a manuscript, you must first register on one of the websites listed above. If you have previously registered as an author or a reviewer for *ASR* or *LSSR*, you should not have to register again; your log-in name and password will remain the same although you may be asked to consolidate your accounts if submitting to either issue for the first time.

Authors will be asked when submitting manuscripts to *ASR* to select an appropriate category from among the following for their paper (if not for an approved Special Issue):

Astrophysics; Solar System Bodies; Earth Sciences; Earth Magnetosphere and Upper Magnetosphere; Solar and Heliospheric Physics; Fundamental Physics and Material Sciences in Space; Astrodynamics and Space Debris; and Space Technology, Policy and Education. All authors will also be asked to propose names of 3-5 potential reviewers. Accepted papers will be given a digital object identifier (DOI) shortly after acceptance and appear in an electronic version on Science-Direct, i.e. they may be cited before being printed. Elsevier supports Open-Access as well as electronic supplements.

Scientists, engineers, and mission planners with manuscripts appropriate for *ASR* and *LSSR* are invited to submit their papers to the Elsevier editorial system for *ASR* and for *LSSR* at any time throughout the year. The journals cover all disciplines of space research.

Questions on submission procedures should be sent to the *ASR* Editor-in-Chief (Pascal Willis, pascal.willis.17@gmail.com), the *LSSR* Editor-in-Chief (Tom Hei, tkh1@cumc. columbia.edu) or any of the co-editors or associate editors, many of whom will be present at this Scientific Assembly.

COSPAR Capacity Building Program—Call for Workshop Proposals

An important COSPAR activity is the Committee's Capacity Building Program, which consists of about three training workshops for young space scientists in developing countries each year, together with a related scheme of 5-10 COSPAR fellowships each year. Substantial grants are available for each supported workshop.

All COSPAR Associates may make proposals for workshops, from which a selection is made by the Panel for Capacity Building. Proposals are evaluated in two terms yearly, end of March and end of September, and, after approval, the workshops are scheduled according to the availability of slots. This Assembly presents an ideal opportunity for participants, Scientific Commissions, and Panels to generate ideas and proposals.

Full details of this program are at:

https://cosparhq.cnes.fr/events/cospar-capacity-building-workshops

The program objectives are quite specific and it is important that proposals should be consistent with them. The description of the program includes information on the selection criteria.

Proposals may be submitted at any time to the Chair of the Panel for Capacity Building, Dr. Carlos Gabriel (email: juan.carlos.gabriel@gmail.com).