PROPOSAL FOR THE CREATION OF A COMMISSION ON SPACE-BASED ASTRONOMY WITHIN DIVISION B: FACILITIES, TECHNOLOGIES AND DATA SCIENCE

ABSTRACT:

Activity in Space-based Astronomy is expanding rapidly world-wide and within the IAU. From the development of small satellite missions to the medium and large space observatories that engage large swaths of the astronomical community, scientists engaged in this research share problems and interests but lack a dedicated scientific body to assist coordinated actions. We propose to create a Commission devoted to Space-based Astronomy to address these needs, which are especially relevant at this time, when access to space is becoming widespread. This document describes the need and the objectives for the creation of the Commission and its operation within Division B.

Rationale

There are many reasons to carry out astronomy from space. The Earth's atmosphere and motion hinders astronomical observation from the ground. A necessarily short enumeration of these effects includes:

- the atmosphere blocks most of the radiation reaching the Earth;
- the atmosphere alters the signal through turbulence and other effects;
- the background from the night sky limits the sensitivity of telescopes;
- the orbital motion of the Earth prevents the observation of the whole sky on short time scales;
- the Earth's rotation prevents the monitoring of astronomical sources on time-scales which are fundamental for some astronomical studies;

To these long-standing difficulties, new problems are being added by the exponential development of space technology resulting in the rapid occupation of the near-Earth outer space by spacecraft and satellite constellations; they are affecting not only all the Earth-based but also low-Earth orbit based astronomical observatories[1]. Thus, space-based (including Lunar) observatories are going to be crucial for professional astronomers in the coming decades.

There is also a vibrant generation of young astronomers who are familiar with data from space-based observatories, have participated in the large consortia behind space agency projects, and have engaged in the development of sub-orbital, cubesat, and small satellite missions.

[1] See, for instance, "The impact of satellite trails in Hubble Space Telescope observations" by Sandor Kruck, Pablo García-Martín, Marcel Popescu et al. published in 2023 in Nature Astronomy (vol 7, p 262-268)

Thus, there is a need for an IAU based body that coordinates the information exchange and supports the activity of IAU astronomers involved in space-based observatories.

This need manifests itself in many ways but, probably, the most evident is the growing number of IAU astronomers who are channeling their space-related activity to the International Astronautical Federation (IAF) or the Committee on Space Research (COSPAR) rather than the IAU; both organizations welcome space astronomy and facilitate the tools for global coordination. The IAF does it through the Space Astronomy Technical Committee (SATC) which "*serves as a forum for the exchange of information and interaction between the scientific community, space industry, and space agencies involved in the preparation and the future development of new astronomy missions" (sic)*. The Scientific Commission E of COSPAR is devoted to Research in Astrophysics from Space and "*deals with obtaining, sharing and analyzing data taken from space-borne platforms that are associated with the study of stars, galaxies and the universe at large" (sic)*. However, neither of these space-specific, technology-led, organizations address the wider relationship and coordination with ground-based astronomy or the underpinning theoretical and simulation work.

The IAU had a Commission devoted to space astronomy in the past: Commission 44. After the re-structuring of the IAU in 2015, Commission 44 was discontinued and its role was taken over by the Division B, devoted to Facilities, Technologies and Data Science. Indeed, the charter of Division B states clearly that is intended to be the "*new home for the scientists and engineers who design, develop, deploy, and operate the ground- and space-based hardware and software tools and systems necessary to advance our knowledge of the cosmos*" (sic). Thus, it is timely and very much needed to create a Commission for Space-based Astronomy within Division B.

Today, Division B hosts a Working Group (WG) devoted to Ultraviolet (UV) Astronomy, a native space astronomy since the UV range is blocked by the atmosphere. However, the need for coordination extends to all spectral ranges, as indicated by the UV Astronomy WG in its last renewal request. Also, it is important to keep in mind that, by definition, WGs have a limited duration, since their purpose is to carry out specific tasks within a well-defined time frame. Furthermore, the community needs coordination through a stable structure that extends beyond the three-year period renewal of the WGs. The creation of a Space Astronomy Commission will also put the IAU on a par with the IAF and COSPAR, in the framework of astronomy-specific research.

Objectives

The Space Astronomy commission will have the responsibility to foster collaboration and discussions on astronomy at large from space, including, e.g., the topic of surfaces of planetary bodies, etc. It will

also generate policy documents towards preservation, access and best practices for continuation of multi-wavelength astronomy from space. The Space-based Astronomy commission within Division B will spearhead and steer, in collaboration with other divisions, the effective utilization of data generated from large space missions and training of astronomers from countries with less access to space. A Space-based Astronomy commission of IAU that is active and vibrant will be extremely useful to generate white papers as and when a necessity arises.

The specific objectives of the new Commission on Space-based Astronomy will be:

1. To assist the communication between the IAU community and the space community at large, including agencies and industry.
2. To improve the exchange of information on advances in space-related technology for future missions, including the NewSpace journal.
3. To assist scientific data exchange for small space missions and define standards for this purpose.
4. To assist global coordination for the coming Lunar observatories.
5. To contribute to the global coordination of efforts in order to avoid that the access to vital spectral ranges is discontinued for generations.
6. To promote the training of new members of the space community, through capacity building events and hands-on summer schools and workshops.
7. To disseminate the activity of IAU members in Space related activities.
8. To encourage a sustainable approach to space-based astronomy. This can include estimates of the carbon footprint of new space missions, including ground segments, application of compensating mechanisms to offset carbon emissions and consideration of other environmental impacts (e.g. debris control and pollution).

Activities to be carried by the Commission.

1. Creation and curation of a registry of astronomical space missions at global scale that ranges from small cubesat-like missions to the flagship missions from the space agencies, including clear indications of the spectral range of operation, the instrumentation and links to the missions' website and science data archive (if available).

2. Proposal and organization of IAU Symposia and Focus Meetings on Space-based astronomy

3. Organization of conferences, workshops, and ‘summer schools’ targeting early career researchers. These meetings will cover specific topics for the community, e.g, the e-workshop organized yearly by the Network of UV Astronomy, to keep astronomers and technologists working in the field updated on the latest advances

and to provide an avenue to bring new scientists and engineers into the field of space-based astronomy.

4. Coordinate the organization of joint events with IAF and COSPAR and other bodies interested in Space-based Astronomy and its technology.

5. Assist coordination between ground-based observatories and space-based observatories.

6. Promote international collaboration in scientific missions through the organization of periodic meetings in association with the Committee on Space Research (COSPAR).

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