Annual Report for 2024

# IUCAF

##### THE SCIENTIFIC COMMITTEE ON FREQUENCY ALLOCATIONS

 **FOR RADIO ASTRONOMY AND SPACE SCIENCE**

**(ISC - IAU - URSI - COSPAR)**

1. **INTRODUCTION**

The Inter-Union Committee on the Allocation of Frequencies (IUCAF) was formed in 1960 by the International Astronomical Union (IAU) and the International Union of Radio Science (URSI), at the behest of URSI. The Committee on Space Research (COSPAR) joined the two Unions in supporting IUCAF around 1972, with a consequent change of name (but not the acronym).

The IUCAF brief is to study and coordinate the requirements of radio frequency spectrum allocations for passive radio sciences – radio astronomy, space research and remote sensing – and to make these requirements known to the national and international bodies that regulate the use of the radio spectrum.

IUCAF, like COSPAR, is an Affiliated Body and a Class 4 Member of the International Science Council (<https://council.science/what-we-do/affiliated-bodies/>) where IAU and URSI, like other scientific unions, are Class 1 members. IUCAF is a Sector Member of the International Telecommunication Union’s Radiocommunication Sector (ITU-R) with observer status at the Space Frequency Coordination Group (SFCG) and its Lunar-Martian Spectrum Group (LMSG), see <https://www.sfcgonline.org/home.aspx>.

IUCAF is a global forum where spectrum management concerns of passive radio science in all ITU-R Regions are regularly addressed in a comprehensive manner. The group is expert in the underlying science, in the spectrum management needs of the science and in the workings of the spectrum regulatory regime that allocates spectrum and makes the rules for radio spectrum use. IUCAF has supported radio astronomy and passive radio science in Geneva since its inception in 1960 when the first spectrum band was allocated for exclusive use by passive research at 1 400 – 1 427 MHz.

IUCAF is online at <http://www.iucaf.org>. The first 40 years of IUCAF’s history are summarized at [www.gb.nrao.edu/sd03/talks/40\_years.pdf](http://www.gb.nrao.edu/sd03/talks/40_years.pdf).

1. **MEMBERSHIP AND MEMBER AFFILIATIONS WITH OTHER BODIES**

The IUCAF membership from the three adhering bodies during 2024 was:

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| URSI: | Dr. Haiyan Zhang | China |
|  | Dr. Steven Reising | USA |
|  | Dr. Ingemar Häggström | Sweden |
|  | Dr. Anastasios Tzioumis | Australia |
| IAU: | Dr. Harvey Liszt (Chair) | USA |
|  | Dr. Masatoshi Ohishi | Japan |
|  | Dr. Adrian Tiplady | South Africa |
| COSPAR: | Dr. Yasuhiro Murata | Japan |

The ITU-R Counselor for Study Group 7 (Science Services), Dr. Vadim Nozdrin, is a member ex-officio as specified in IUCAF’s Terms of Reference (see below).

A new committee member from IAU will be welcomed in 2025.

IUCAF members participate in the activities of other bodies. Tiplady is a member of CRAF, the European Committee on Radio Astronomy Frequencies of the European Science Foundation (<https://www.craf.eu/>). Zhang, Ohishi and Tzioumis are members of the Radio Astronomy Frequency Committee in the Asia-Pacific region (RAFCAP; see <http://www.atnf.csiro.au/rafcap/>). Tzioumis stepped down as Chair of ITU-R Working Party 7D (Radio Astronomy) in September 2024 after 15 years. Ohishi, IUCAF’s Immediate Past Chair, is the official liaison between the IAU and the ITU and is a past President of IAU Commission F3 (Astrobiology). Liszt is a member of the American Astronomical Society’s Committee for the Protection of Astronomy and the Space Environment (COMPASSE) and the IAU Executive Committee on WG Dark and Quiet Sky Protection and served on the Steering Committee of the IAU Inter-Division Commission C.B4 on Protection of Existing and Potential Observatory Sites.

1. **IUCAF TERMS OF REFERENCE (Revised 2015)**

A revision to the statement of IUCAF’s composition, operating practices and Terms of Reference, originally dating to 1972 when IUCAF was the Inter-Union Committee on Allocation of Frequencies, was approved by ICSU’s Executive Board in 2015, see <http://www.iucaf.org/IUCAF_Terms_Of_Reference.pdf>.

1. **INTERNATIONAL & REGIONAL SPECTRUM MANAGEMENT MEETINGS IN WHICH IUCAF PARTICIPATED DURING 2024**

IUCAF members attended the following in-person international meetings in 2024:

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| 03/19-03/22 | ITU-R Working Party 7D | Geneva |
| 05/06-05/07 | CCSDS/NIST Lunar Interoperability Forum | Washington, DC |
| 05/14-05/24 | ITU-R Working Party 5B | Geneva |
| 09/17-09/28 | ITU-R Working Party 7D  | Almaty, Kazakhstan |
| 10//03-10/11 | ITU-R Working Party 5D | Geneva |
| 10/10-10/18 | ITU-R Working Party 4C | Geneva |
| 10/21-10//25 | ITU-R Working Party 4A | Geneva |

Members also participated in national spectrum management proceedings, working in their capacities as spectrum managers at their respective institutions.

##### IUCAF BUSINESS MEETINGS

IUCAF business was discussed by email as matters arose during the year and during in-person attendance at meetings in Geneva and Kazakhstan.

##### FINANCES

The IUCAF account is held and managed by URSI. Sustaining financial contributions of €5,000, €2,000 and €1,000 were gratefully received from IAU, URSI, and COSPAR, respectively, for calendar year 2024. These funds will be used to support travel to Geneva for ITU-R meetings and in support of the upcoming Spectrum Management School (see 7.D).

##### IUCAF’S work in 2024

**A**. **ITU-R input contributions related to the WRC-27 Agenda**

2024 marked the beginning of the 4-year work cycle associated with the 2027 ITU-R World Radiocommunication Conference (WRC-27) to be held in Shanghai, China in October and November 2027. Much of the work at the beginning of a WRC cycle is exchange of information between ITU-R Working Parties in support of the numerous WRC-27 Agenda Items affecting radio astronomy. To this end IUCAF contributed the majority of the drafts for the liaison and reply liaison statements by which Working Party 7D communicated with other working parties concerning the technical and operational characteristics and protection criteria that will be needed for sharing and compatibility studies with radio astronomy. In all, eight such documents were contributed and used with minor modifications for their intended purposes.

**B**. **Achieving the deserved level of protection of spectrum bands allocated exclusively to passive services**

A matter of great general concern to IUCAF has been the gradual degradation of protection of the frequency bands that are allocated exclusively to radio astronomy and other passive services subject to RR No. 5.340 (an article of the Radio Regulations) stating that all emissions are prohibited in those bands. In practice, this condition cannot be entirely observed: Owing to the imperfect nature of the electrical apparatus used to generate radio signals, some level of soi-disant unwanted emissions is produced outside the intended bandwidth. Unwanted emissions can encroach on protected bands and must be controlled.

It is a problem for radio astronomy that its protection criteria allow the same degree of encroachment into the already-noisy bands that are shared with transmitting services and the supposedly quiet bands that aren’t. Moreover, radio astronomy’s protections have allowed an ongoing accumulation of interference that has proven to be beyond the ability of radio astronomy to influence or control. Paradoxically, some of the supposedly quietest spectrum bands are now subject to the strongest encroachments and the ill effects of this problem were on abundant display at the World Radiocommunication Conference in 2023, WRC-23.

IUCAF has attempted to rewrite and augment the defective regulatory protections for more than a decade, with limited success in the face of opposition by active services. This effort is continuing.

**C**. **Protection of radio astronomy and passive science in the shielded zone of the Moon**

Articles 22.22 – 22.25 of the Radio Regulations (RR) protect passive radio science in the shielded zone of the Moon (SZM), defined as the lunar surface and the adjacent volume of space not in direct line of sight of a sphere of radius 100,000 km centered on the Earth. In the SZM, emissions in spectrum bands not necessary to support lunar operations may not produce harmful interference to radio astronomy observations at any frequency up to 3 THz. In this way, and because terrestrial services are not allocated to operate in space, a purposeful lack of inter-operability is built into the Radio Regulations to prevent the export of the Earth’s cluttered, peculiar (subject to the influences of the atmosphere, ionosphere …) and haphazardly-constructed spectrum environment to the Moon and its surroundings.

Lunar radio astronomy could be compromised if the protections of the Radio Regulations are not incorporated in lunar radiocommunication infrastructure or if the infrastructure is not designed to minimize its impact. This could for instance happen if widely-scattered frequency bands are used for the same purpose, preventing coherent radio astronomy observation over broad bandwidths. Frequency use for the practical implementation of lunar radiocommunication is discussed by space agencies in the SFCG’s Lunar-Martian Spectrum Group where IUCAF provides guidance on the impacts to scientific use of the SZM. New frequency allocations for lunar radiocommunication are the subject of Agenda Item 1.15 (WRC-27).

To this end, IUCAF prepared a document proposing a definition of the thresholds for harmful interference in the shielded zone of the Moon and prescribing the manner in which they would be applied, to be discussed at ITU-R in 2025.

**D. Preparations for IUCAF’s 6th international school on spectrum management for radio astronomy**

The school, originally scheduled to be held at the California Institute of Technology in Pasadena, California (USA) 7-11 July 2025, was postponed until late September 2025 and moved to Alcala de Henares, Spain during the writing of this report.

1. **IUCAF CONCERNS IN 2024 AND BEYOND**

WRC-27 Agenda Item 1, most directly dealing with new frequency allocations, is unusually fully populated with issues of concern to science services and agenda items for which they are directly responsible. The space research and space operations group WP 7B is responsible for Agenda Item 1.15 revising frequency allocations for lunar radiocommunication: IUCAF formulated a response as noted at section 7C above. WP 7C (remote sensing) is responsible for three items including 1.18 shared with radio astronomy to extend a table of harmful interference thresholds from satellite emissions above 71 GHz. The radio astronomy group WP 7D is responsible for two items including AI 1.16 dealing with the impact of satellite mega-constellations on radio astronomy and radio quiet zones.

Of special concern is the advent of direct satellite – cell (DtC) phone communication that heretofore has not been allowed by the Radio Regulations. Several national spectrum regulatory agencies have individually authorized DtC and it is the subject of Agenda Items 1.12-1.14 at WRC-27. Allowing ordinary cell phones to communicate with satellites upsets basic tenets of radio astronomy’s operating model, which gains access to unallocated spectrum by observing at remote locations and in radio quiet zones. This quieting of the terrestrial electromagnetic environment is mooted if the sky becomes noisy at the same frequencies.

Closer to home, succession planning and matters of engagement continue to be of concern. Recruitment is difficult when many nations having major investments in radio astronomy are unrepresented in international radio astronomical spectrum management and few observatories have even one person fully devoted to such concerns.

1. **ACKNOWLEDGEMENTS**

IUCAF is grateful for the support of the International Science Council and the Science Council’s interest in IUCAF’s work, organizing and planning during 2024 for the Council’s General Assembly in Oman in January 2025. IUCAF is also grateful for the organizational and financial support that has been given by IAU, URSI and COSPAR over the past 60 years, especially the URSI secretariat. IUCAF also recognizes the enormous support given by radio astronomy observatories, universities and national funding agencies to the individual IUCAF members, allowing them to participate in the vital work of the committee.

Respectfully submitted,

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Charlottesville, Virginia, USA

30 April 2025

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