IUCAF Activity in 2008 - 2011

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Abstract

IUCAF activity between 2008 and 2011 is reported. IUCAF members actively participate in relevant studies conducted in the International Telecommunication Union towards protection of radio astronomy, Earth observations, and other passive radio sciences. IUCAF members also attended to and presented papers in international, regional, and national URSI and COSPAR meetings. IUCAF held the 3rd Summer School on Spectrum Management in Tokyo, Japan.

1. Introduction

The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science, IUCAF, was formed in 1960 by its sponsoring Scientific Unions, COSPAR, the IAU, and URSI. Its brief is to study and coordinate the requirements of radio frequency allocations for passive (i.e., non-emitting or receive-only) radio sciences, such as radio astronomy, space research and remote sensing, in order to make these requirements known to the national administrations and international bodies that allocate frequencies. IUCAF operates as a standing inter-disciplinary committee under the auspices of ICSU, the International Council for Science. IUCAF is a Sector Member of the International Telecommunication Union (ITU). Figure 1 describes relation among IUCAF/URSI/IAU/COSPAR and the ITU.

In this paper, I will describe the latest activity of IUCAF in protecting radio environment for radio astronomy, passive remote sensing, and other radio sciences.

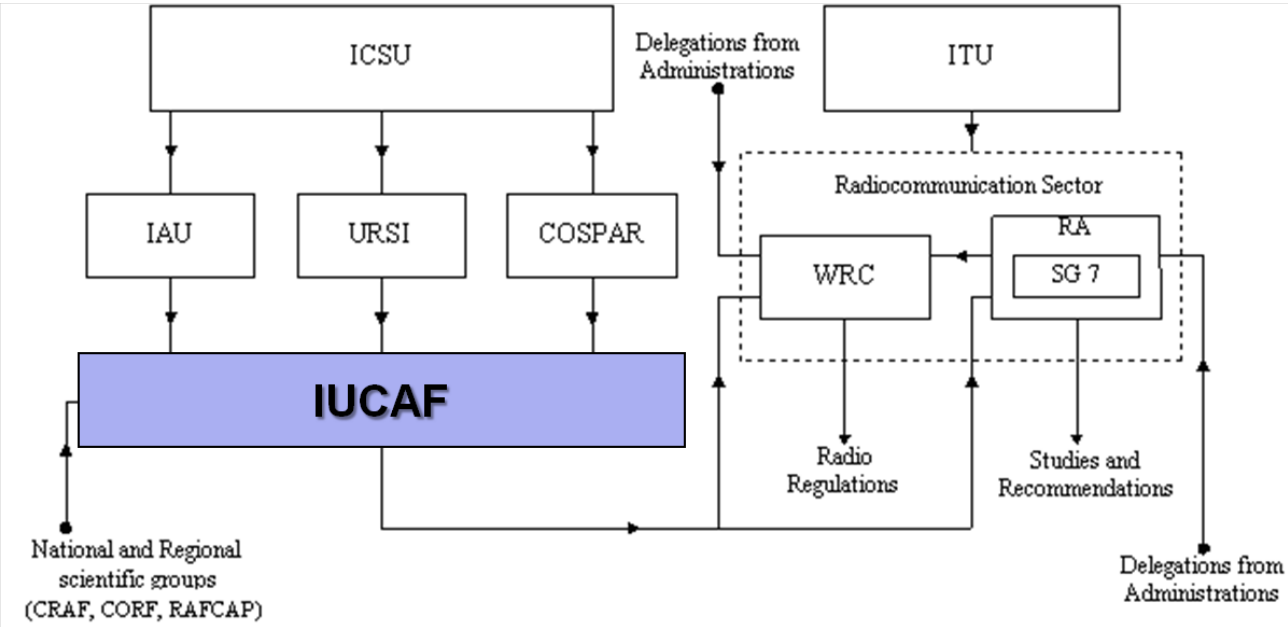

Figure 1. A Diagram Showing Relations among IUCAF/URSI/IAU/COSPAR and the ITU

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2. Meetings towards Protection of Passive Services

Since the frequency is a limited natural resource and should be shared with various people in the world, the Radiocommunication Sector of the ITU (ITU-R) establishes international rules how to use the frequency resource, which has been regularly updated in every 4-5 years. Passive science services (radio astronomy, Earth observations, and so on) have been recognized in the ITU-R. Some frequency bands are allocated to passive services, where passive science services are eligible to claim protection from other active (transmitting) radio services.

A World Radiocommunication Conference 2012 (WRC-12) agenda item which is most relevant to radio astronomy concerns is the use of the radio spectrum between 275 and 3 000 GHz. This frequency range is used for radio astronomy observations of important spectral lines and continuum bands used in studies to understand the Universe. New receiver technology and new instruments (both ground-based and space based) being used in the 275-1 000 GHz region are helping to refine the results of radio astronomy observations in this spectrum range, while similar developments in the 1 000-3 000 GHz range are leading to a better understanding of specific spectral lines and atmospheric windows that are of interest to radio astronomers. Significant infrastructure investments are being made under international collaboration for the use of these bands between 275 and 3 000 GHz. For example, the Atacama Large Millimeter/submillimeter Array (ALMA), a facility currently under construction in northern Chile, will provide new insights on the structure of the universe through observations in the 30-1 000 GHz range. Space-based highly sensitive telescopes observe spectral lines from a variety of molecules and atoms and continuum thermal radiation from very small particles (cosmic dust).

No frequency allocations for the use of this frequency range will be made at WRC-12, but the radio astronomy community has to identify a list of specific bands of interest. This list was established in close collaboration with the IAU Working Group on Important Spectral Lines, and a new ITU-R Recommendation RA.1860 (Preferred frequency bands for radio astronomical measurements in the range 1-3 THz) was published on February, 2010. Terrestrial use of frequencies in this range is strongly constrained by the Earth's atmosphere. This is especially true above 1 000 GHz, where atmospheric absorption at sea level sites can exceed thousands of dB per km due to the effects of water vapor and oxygen. A new Report ITU-R RA.2189, which was published in 2010, utilized these physical conditions and reports that this frequency range can be used both by the passive (receive-only) and active (transmitting) radio services with little possibility of interference. IUCAF members actively participated in the drafting and approval process of these important Recommendations and Reports.

The work towards a new ITU-R Report on "The essential role and global importance of radio spectrum use for Earth observations and for other related science applications", which contains a description of benefits from spectrum use by radio astronomy and space research, has been completed, and the Report ITU-R RS. 2178 was published in October, 2010.

Power Line Communications (PLC) utilizing the 2-30 MHz frequency range is a technology to send electrical signals through power lines for communication purposes. This technology enables broadband Internet access and home LAN by means of "existing" power lines. Since the power lines are designed and installed to carry current at 50/60Hz only, there has been serious concern that the electromagnetic field radiated by the power lines may cause harmful interferences to the radio communication services such as broadcasting, communication, and radio astronomy observations. In this regard IUCAF members submitted to ITU-R Working Party 1A (spectrum management) several contribution papers containing measurement results of actual harmful interference from PLC and theoretical analyses. These study results were welcomed by the ITU-R Working Party 1A, and were adopted in 2009 as a part of the ITU-R Report SM.2158 (Impact of power line telecommunication systems on radiocommunication systems operating in the LF, MF, HF and VHF bands below 80 MHz). The Report was further updated in 2010, by incorporating new IUCAF contributions.

IUCAF member, A. Tzioumis, is the Chair of ITU-R Working Party 7D (radio astronomy), and IUCAF member, H. Chung, is the vice-chairman of ITU-R Study Group 7 (Science Services).

4. The 3rd IUCAF Summer School

The 3rd IUCAF summer school on spectrum management for radio astronomy was held between May 31st and June 4th, 2010, at the Mitaka campus of the National Astronomical Observatory of Japan (NAOJ), located about 20 km from central Tokyo. There were 44 participants from 13 countries: Japan (21), Germany (3), UK (2), Denmark (1), the Netherlands (2), Portugal (2), USA (5), China (2), South Korea (2), Australia (2), Malaysia (1) and Nigeria (1). There were about 10 young (under 35 years old) people that were new to the spectrum management and seven regulators from Japan, China and Europe.

The summer school program covered introductions to radio astronomy and Earth observations, radio science and related technologies and procedures on how to use (allocate) frequency resources. This includes the structure and role of the International Telecommunication Union (ITU) and regional telecommunities (CEPT, CITEL, APT); the roles of science bodies to protect radio astronomy and Earth observations (IUCAF, CRAF, CORF, RAFCAP); interference mitigation techniques; and radio interference topics such as Power Line Telecommunications (PLT), RFID, Ultrawideband (UWB) devices, Software-Defined Radio (SDR), Cognitive Radio Systems (CRS), and others. There was also a lecture on the SKA project and radio quiet zones for future radio astronomy. The summer school program and the presentation files used at the summer school are available from the IUCAF's web page at http://www.iucaf.org/SSS2010/presentations/SS2010_presentations.htm .

It should be noted that the summer school was supported financially by IUCAF, CRAF, CORF and RAFCAP.

The summer school was run in a very friendly atmosphere and excellent weather, and the participants, especially young students, actively asked questions. In the middle of the summer school, the participants enjoyed a half-day tour to the Nobeyama Radio Observatory of NAOJ, where the 45-m millimetre-wave telescope, the Nobeyama Millimeter Array, and the Nobeyama Radio Heliograph are located.

It can be concluded that the 3rd IUCAF summer school was quite successful, and that the participants were able to learn many topics to be utilized to ensure the protection of radio astronomy and Earth observations towards better understanding of the Earth and the Universe.

5. Contact with the Sponsoring Unions and ICSU

IUCAF maintains regular contact with its supporting Scientific Unions and with ICSU. The Unions play a strong supporting role for IUCAF and the membership is greatly encouraged by their support.

Pursuing its brief, IUCAF continued its activities towards strengthening its links with other passive radio science communities, in particular in space science, and defining a concerted strategy in common spectrum management issues.

IUCAF member W. van Driel has been appointed president of IAU Commission 50 (Protection of existing and potential observatory sites). Two IUCAF members, A. Tzioumis and M. Ohishi, have joined the Organising Committee of IAU Commission 50. IUCAF member, A. Tzioumis, was Chair of the Working Group on Radio Frequency Interference of IAU Division X (radio astronomy) until August 2009, and IUCAF member, W.A. Baan, has been appointed as the new chair of this Working Group. IUCAF chair, M. Ohishi, chairs the Working Group on Astrophysically Important Spectral Lines of Division X. The IUCAF chair, M. Ohishi, has also been appointed the president of IAU Commission 5 on Documentation and Astronomical Data. He is also appointed the official liaison between the IAU and the ITU.

The preparation towards the next URSI General Assembly and Scientific Symposium (GASS), to be held in August 2011 in Istanbul, is ongoing, led by the Chair of URSI Commission J (radio astronomy), S. Ananthakrishnan, who is also an IUCAF member. Several session proposals were submitted, and a session on spectrum allocation and use issues (session J08) will be held during the URSI GASS. Many IUCAF members have already submitted papers to be presented at this GASS. IUCAF members also actively participated in national URSI meetings, such as AP-RASC 2010 held in Toyama, Japan and the USNC-URSI National Radio Science Meeting in Boulder, CO, USA.

The scientific assembly of the COSPAR was held in July, 2010, in Bremen, Germany. Some IUCAF members attended the COSPAR meeting.

6. Publications and Reports

IUCAF has a permanent web address, http://www.iucaf.org, where the latest updates on the organization's activities are made available. All contributions to IUCAF-sponsored meetings are made available on this website.

IUCAF produced a White Paper discussing extensive ITU-R items of concern to radio astronomy on the agenda of the upcoming World Radiocommunication Conference 2012 (WRC-12), which is available at http://www.cv.nrao.edu/~hliszt/RFI/CPM/IUCAFWhitePaper.pdf .

7. Conclusion

IUCAF interests and activities range from preserving what has been achieved through regulatory measures or mitigation techniques, to looking far into the future of high frequency use, giant radio telescope use and large-scale distributed radio telescopes. Current priorities, which will certainly keep us busy through the next years, include the use of powerful radars and satellite down-links close in frequency to the radio astronomy bands, the coordination of the operation in shared bands of radio observatories and powerful transmissions from downward-looking satellite radars, the possible detrimental effects of ultra-wide band (UWB) transmissions at around 24 and 79 GHz regions and high-frequency power line communications (HF-PLC) on all passive services, the scientific use of the 275 to 3 000 GHz frequency range, and studies on the operational conditions that will allow the successful operation of future giant radio telescopes.

8. Acknowledgments

IUCAF is grateful for the moral and financial support that has been given for these continuing efforts by ICSU, COSPAR, the IAU, and URSI during the recent years. IUCAF also recognizes the support given by radio astronomy observatories, universities and national funding agencies to individual members in order to participate in the work of IUCAF.