Commission J

2008-2011 Triennial Report

S.Ananthakrishnan (Chair)

Budget 2008-2011: EUR 9,000

1. Commission J Statement of Accounts

Budget: €9000 (for 2008-11 triennium)
€3000 (special grant for travel support to the General Assembly)
Expenditure: €2350 Mode B meeting support
€9650 travel support to General Assembly, distributed to 11 scientists.

Balance carried forward: € 0

2. Meeting Support

Three meetings were given financial support by Commission J during the triennium as below:

code	details meeting	mode	allocation in Euro
100317J	3rd Workshop on RFI Mitigation in Radio Astronomy, Groningen, The Netherlands, 17-19 March 2010	B	EUR 750
100922ABCDEFHJK	AP-RASC'10: 3rd Asia-Pacific Radio Science Conference, 22-25 September 2010, Toyama, Japan	B	EUR 1,000

110712CJ IconSpace2011 'Towards Exploring The Equatorial' - 2011 International Conference on Space Science & Communication, 12-13 July 2011 Malaysia B EUR 600

Total : EUR 2,350

3. Publications in the Radio Science Bulletin

1. "The Square Kilometer Array (SKA) Radio Telescope: Progress and Technical Directions", Hall, P.J., Schilizzi, R.T., Dewdney, P.E.F and Lazio, T.J.W., Radio Science Bulletin, No. 326, pp 3, Sept., 2008.

4. URSI General Assembly, Istanbul, August 2011

Scientific Sessions
A full program of talks and posters has been prepared on the following topics:
A total of 134 papers have been distributed amongst oral and poster sessions.
J01: Low Frequency Radio Astronomy I – (LOFAR, LWA, MWA, GMRT, any other) 7
J02: Low Frequency Radio Astronomy II 7
J03: Technology Development for the SKA Program 11
J04: Space and Moon Science and Technology 6
J05: Sun and Solar System Science 6
J06: Signal Processing, Calibration and Imaging in Radio Astronomy 10
J07: Observatory Reports 21
J08: Spectrum Management Issues and RFI Mitigation 7
JG: Ionospheric Calibration for Radio Astronomy 3
J10: Mm and Sub-mm Science and Technology with a Special Focus on ALMA 11
J11: New Observations and Results 7
JP: Poster sessions 38
JT: Tutorial J 1
While oral presentations have remained roughly the same, there is a significant drop in the poster presentations in Istanbul, as compared to Chicago 2008 GA.
Thanks are due to the Conveners for excellently organizing the sessions and thanks to Prof. Justin Jonas for his help in organizing the poster session.

Dr. Aaron Parsons will give the tutorial lecture in JT session on "Exploring the Epoch of Reionzation (EoR) with Low Frequency Radio Telescopes".

Medals and Awards
This year, the Grote Reber Medal is being awarded to Prof.Jocelyn Bell Burnell. Congratulations to this distinguished scientist!

Young Scientist Support

Following a call for proposals for travel support, eight young scientists were selected from Commission J to receive grants supporting their travel to the General Assembly.

5. Inter Union Committee for the Allocation of Frequencies, IUCAF (Chair: Masatoshi Ohishi)

Introduction

IUCAF (The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science) was formed in 1960 as the "Inter-Union Commission on Frequency Allocations for Radio Astronomy and Space Science" by its sponsoring Scientific Unions, URSI, the IAU, and COSPAR. It operates as an ICSU inter-disciplinary committee, and is a Sector Member of the International Telecommunication Union (ITU). The International Telecommunication Union (ITU)1 is an international organization under the United Nations, which establishes and maintains international rules on frequency use. Each national radio act is based on the decisions made by the ITU.

IUCAF participates directly and independently in ITU groups and studies. Its main goal is to represent the international astronomical community at the ITU, to ensure the protection of radio frequencies allocated to astronomy and passive space sciences and minimize interference to these scientific observations and measurements.

Membership

At the end of 2010 the membership for IUCAF was:
URSI
S. Ananthakrishnan (Com J), India
S. Reising (Com F), USA
I. Häggström (Com G), Sweden
A. Tzioumis (Com J), Australia
W. van Driel (Com J), France
IAU
H. Chung, Korea (Republic of)
H.S. Liszt (Vice Chair), USA
M. Ohishi (Chair), Japan
K.F. Tapping, Canada
A. Tiplady, South Africa
COSPAR
Y. Murata, Japan
at large:
W.A. Baan, the Netherlands
and D.T. Emerson, USA

IUCAF also has a group of Correspondents, in order to improve its global geographic representation and for issues on spectrum regulation concerning astronomical

observations in the optical and infrared domains.

ITU-related Meetings

During the period of August 2008 to April 2011, IUCAF participated in 18 international meetings related to many ITU working parties, space frequency coordination meetings, spectrum management, IAU GA, etc.

4. Protecting Radio Astronomy and Passive Space Sciences

At the ITU, the work in the various Working Parties of interest to IAU was focused on the relevant agenda items that were adopted in 2007 for WRC-12 of the ITU, the World Radiocommunication Conference in 2012, as well as on the creation and maintenance of various ITU-R Recommendations and ITU-R Reports.

A 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.

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 radio astronomers 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 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).

It should be noted that the disturbance caused by PLC systems has been an issue in Com. E of URSI.

5. 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.

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.

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.

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.

IUCAF has been recognized in the ICSU as an international body, however, it has been categorized into “Data and Information” group, which has not been correct. The chairman contacted the ICSU several times, and is now categorized into a “Thematic Organization”. See at http://www.icsu.org/about-icsu/structure/interdisciplinary-bodies-1 .

7. Conclusions

The WRC-12 is scheduled from January 23 to February 17, 2012 to be held in Geneva,

Switzerland. Several radio astronomers are expected to participate in the WRC-12.

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 24/79 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.

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.

6. Global Very Long Baseline Interferometry Working Group (Chair: Steven Tingay)

Discussions in the early part of this triennium identified the GVWG as struggling to play a role of relevance in the modern world of global VLBI. A conclusion of this discussion was that, rather than the GVWG continue to exist but be an unused forum, the GVWG should be disbanded under both URSI and IAU umbrellas. This was a consensus view of the GVWG members. Thus, actions to disband the GVWG within URSI were initiated and the GVWG will be formally closed as an URSI Working Group at the August 2011 URSI meeting in Istanbul. The GVWG members recognized the substantial important work that the GVWG had undertaken over the years, particularly related to assisting to coordinate assets for the VSOP Space VLBI Programme.

7. Reports from National Committees:

Triennial report from China (Yihua Yan)

The Five hundred meter Aperture Spherical Telescope (FAST) in 0.3-5.1GHz range, with a sky coverage of 40 degrees from the zenith, was formally approved by the National Development and Reform Commission of China in 2008. On Dec 26, 2008, a foundation laying ceremony was held on the construction site. Nanshan 25m station is contributed IVS, EVN, Russian VLBI network as a member participating regularly VLBI observations, also take part in the Chinese VLBI Network (CVN). Some observations of about 10 pulsars at S band with MARK 5B system using 40m radio telescope at Yunan Observatory have been made. Radio Science Receiver is being developed and installed in VLBI stations to track the open-loop Doppler of lunar and other planetary spacecrafts. It

has been test in Chinese Lunar mission of Chang'E-1/2, etc. A Single Station-Single Frequency (SSSF) observing system was set up recently at the 25 m radio telescope in Urumqi Astronomical Observatory. The data acquisition and processing systems were developed. Some sources were observed at 18 cm during 2008 - 2009, and partly published [1, 2]. A new Single Station-Dual Frequency (SSDF) observing system has been developed and in commissioning late 2010 at the 50 m radio telescope in Miyun Observatory, which will be the only SSDF mode system for IPS working at S/X and UHF in China. A 3x3 w-band (85-115GHz) focal plane array heterodyne receiver has been built for Delinha 13.7m millimeter telescope in Qinhai China. The Fourier transform spectrometer has been developed for site testing in Dome-A Antarctica. It was installed in Dome-A in 2009 and has been successfully operated remotely for one year[3]. The Shanghai 65m radio telescope is with a shaped Cassegrain configuration, covering a wide frequency range (from 1.4 GHz to 43 GHz) with a total of 8 receivers. The primary active surface will be installed to improve the efficiency at high frequencies. It will be in full operation in 2015 with the first commissioning observations in 2012. The Chinese Spectral Radioheliograph (CSRH) is being built at Mingantu town in Inner Mongolia of China[4]. The project was approved to start construction in the autumn of 2008. At the end of 2010, the first phase of CSRH (CSRH-I, 0.40-2.00 GHz) finished the installation of the 40 antennae with 4.5 m. According to the schedule, the first test-observation of CSRH-I will be carried out in the summer of 2011, and CSRH-II, at frequency of 2.00 – 15.00 GHz will start to construct from the autumn of 2011 and complete in 2013. The 21 Centimeter Array (21CMA) has been formally in operation since 2007 in Xinjiang, west China and starts to collect the weak 21 cm background signals. The array consisting of 81 pods along two perpendicular arms (6km+4km) allows us to reach an angular resolution of 4 arc-min and a sensitivity of about 1 mK per day. Detection of 21 cm emission / absorption signatures of neutral hydrogen at z=6-50 against cosmic microwave background will provide a unique tool for study of formation of first stars/QSOs in the universe, for understanding of re-ionization histories and for mapping of 3D matter distribution at high red-shifts.

Triennial Report from France (Andre Deschamps)

- The main URSI-France activity this year 2011 was the scientific Workshop “ The Next Radio Telescope Generation”. The benefits from the worldwide development of projects and from the application of the most advanced technologies are shared with all radio sciences.
- The Millimeter Array located in Plateau de Bure (French Alps) is the French part of IRAM. The next generation of spectroscopy array receivers will allow the study of galactic low column density CO, and further the samples mapping of nearly galaxies in 13CO, HCN, and HCO+. The arrival of ALMA calls for a competitive equivalent on the northern hemisphere (NOEMA project). The goal is to double the number of 15 m antennas from 6 to 12, extend the baseline from 0.8 to 1.6 km and increase the IF bandwidth from 8 GHz to 32 GHz.
- Located in the center of France, the Radio Telescope of Nancay is the French historical site, and one of the EMC cleanest sites in Europe. The French LOFAR station (FR606)

was installed in Nancay, it has been tested and used both as a standalone instrument as well as a part of ILT. Nancay is working on a concept “LOFAR Super Station” which consists in analog phased arrays of about 20 antennas increasing the sensivity by a factor of 10. Nancay station is concerned with SKA by developing R&D projects as SKADS and PrepSKA. Using a huge range of antennas from 200 m to single dishes, Nancay is developing a large field of radio science: cosmology, quasars, pulsars, cosmic rays, the sun, magnetic fields in the galaxy, ...
- Developments at LERMA range from R&D activities in the submillimeter to Terahertz domain (SIS, HEB and Schottky) and receiver design for space projects (EJSM-JGO mission, CIDRE balloon-borne 2.7THz, EUFAR meteorological airborne instrument)

Triennial report from India (Ishwara Chandra)

A major focus over the last three years has been the upgrade of the GMRT. The upgraded GMRT will have an instantaneous bandwidth of 400 MHz, a substantial increase from the 32 MHz that is currently available. The feeds and front ends will also be replaced to provide near seamless coverage between 150 MHz and 1450 MHz. The servo system will be upgraded to replace the current brushed motors with brushless DC motors. Each antenna will have a 0-2GHz dual channel analog optical fiber link for direct transport of the RF signal from the antenna to the central control building as well as gigabit ethernet connections for monitor and control. A new hybrid (FPGA, CPU/GPU) is also being developed for processing the 400 MHz bandwidth. In addition the existing GMRT ASIC based 32 MHz correlator has now been replaced by a much more flexible pure software based correlator.
The ORT is also being upgraded to substantially increase its bandwidth and field of view. Regular observations with the GMRT continue in parallel with the upgrade activities. Typically between 70- 80 proposals are received for each six month scheduling cycle, with the over subscription rate being about 2.5. A wide range of programs including solar observations, observations of extra solar planets, ISM and pulsar studies, HI observations of nearby galaxies, studies of AGN, halos and relics in galaxy clusters etc. have been carried out. Major programs during this period include observations of the Epoch of Reionization and an all sky 150 MHz survey.

The Indian Institute of Astrophysics is in the process of modifying its existing radioheliograph at the Gauribidanur radio observatory near Bangalore in India to probe the solar corona with higher angular resolution and better sensitivity. In its new configuration, the array will have a maximum baseline length of about 3 km, yielding an angular resolution of about 2 arc min at 150 MHz. This is Phase-I of the expansion programme.In Phase-II, the array length will be extended to 10 km. For comparision, the upcoming Murchinson Widefield Array (MWA) in Australia is expected to have a resolution of about 4 arc min at the same frequency. While the MWA is expected to observe over the band 80-300 MHz, the GRH observations are over 30-150 MHz.
No other radio telescopes for dedicated observations of the solar corona are in operation in this low frequency range close to the limit of radio observations from the ground.

- A 3m Submillimeter Telescope Prototype (3mSTeP) is being built at the Raman Research Institute. The primary goal is to demonstrate the utility of a novel optical arrangement presented in 2004 (MNRAS 354, 1189B) to realise large submillimeterwave telescopes economically.
  - An 8 GHz wideband hybrid FFT spectrometer is under construction for use with 3mSTeP. Sampling speed and other aspects of the system has been optimised to reduce the overall cost per GHz of spectral processing.
  A Thomson X-ray polarimeter has been developed for a small satellite mission has been developed at RRI. This instrument works in the 5-30 keV band and has a sensitivity to detect 3% polarisation in a 50 mCrab X-ray source in a million second exposure. A space qualified unit is under fabrication, that can be launched in about two years. About 50 hard X-ray sources like accretion powered pulsars, binary black holes etc. will be observed with this instrument.
  A new class of extragalactic radio sources without obvious active galactic nuclei and jets in them was formed based on low-frequency observations.
  Multi-frequency observations of halos and relics in galaxy clusters were carried out to study particle acceleration in these systems with implications to cluster merger activities.
  RRI is a partner institution in a major effort that involves the Murchison Widefield Array (MWA), concentrating on the 80-300 MHz frequency range, under construction in the radio-quiet area of Western Australia. This project is an international collaborative effort involving the MIT Kavli Institute and the Harvard-Smithsonian Center for Astrophysics in the U.S., a group of universities and research institutions in Australia, and the Raman Research Institute in India. The activities at RRI focuses on digital receiver system, imaging the EoR signal and also transients.
  Design and development of an instrument to detect global signature of EoR is under development at RRI.

Triennial Summary for Ireland (Anthony Murphy)

A number of university groups in Ireland are pursuing both instrumental and observational research in radio astronomy. Examples include research at University College Cork focused on Very Long Baseline Interferometry studies of relativistic jets emerging from Active Galactic Nuclei, and at the Dublin Institute for Advanced Studies (DIAS) on jets and ionized winds from low mass young stars using observations with e-MERLIN in C and K band, as well as LOFAR and AMI. Radio continuum observations of small clouds and cores show anomalous cm emission, presumably due to spinning dust. DIAS is also part of a collaboration using the Mopra Telescope and NANTEN/NANTEN2 to map TeV gamma-ray sources, while observations have been carried using ATCA of disks around young stars. Instrumentation projects include Maynooth's contribution both to the optical design, analysis and calibration of the HIFI instrument for the Herschel Space Observatory as well as Bands 5 and 9 of the Atacama Large Millimeter Array. Maynooth has also been involved in a number of cosmic

microwave background experiments including the ESA Planck satellite, QUaD, an experiment located at the South Pole designed specifically to image the CMB polarisation and QUBIC, a proposed bolometric interferometer instrument dedicated to specifically to B-Mode polarisation.

Triennial Summary for Netherlands (Arnold van Ardenne)

It was with great sadness that the Dutch National Committee had to acknowledge the withdrawal of its key member Prof. Brussaard as URSI President for personal reasons so soon after taking up this important role with great enthusiasm.

Radio astronomy's national flagship LOFAR expanded its border to become an International LOFAR Observatory while e.g. Space and SKA related activities and excellent university based radio science programs supported the interest in national radio science. The National Committee took it serious to stipulate the importance of Radio Science to/for Society at large, e.g. by participating in a national platform on the biological effects of e.m. radiation. Nonetheless, it was noticed that the number of (technical) scientists involved in national radio science is declining partly as a result of decreasing industrial R&D most notably in telecom related activities, as well as in combination with grand societal and educational changes. As a result, some national committees are hard to populate although most notably ie. B (Fields and Waves) and J (Radio astronomy) are faring well vis a vis the national committee.

On the financial and funding side, the need arose to actively promote sponsorship to allow to maintain and expand on the Radio Science related activities e.g. through workshops. For example, the Dutch National Committee together with the Belgian National committee took it on them to continue its yearly bilateral meetings now genuinely called yearly URSI Benelux. The aim is to primarily involve (doctoral) students and postdocs. At the same time, an involvement of other societies is sought for example the IEEE Benelux, the Dutch NERG and others. Whilst the National URSI Committee operates under the umbrella of the Royal Academy of Science, all actions involving financial and legal consequences e.g. sponsorship are channeled through the National Committees Foundation for Dutch URSI activities, an approach that so far seems to work satisfactorily potentially opening a framework for cross boundary larger radio science workshops .

Triennial summary from Norway (Per B. Lilje):

All Norwegian radio astronomy concerns the Cosmic Microwave Background, with ESA's Planck mission providing the main theme, but also with a participation in the ground based QUIET CMB polarization experiment in the Atacama Desert.

After the launch of Planck in May 2009, real science data have been recorded since August of that year. There was a very large effort in 2010 on applying data analysis methods previously developed in Norway to real data, and on modifying them after they had been tested on the real data. Emphasis is put on estimation of CMB power spectra and likelihoods and cosmological parameters with data that are contaminated by radiation from our own galaxy. The methods developed in Norway in recent years, based on the Gibbs sampling and internal template fitting, were successfully applied to the real Planck data. The resulting codes are now routinely used by many groups within the Planck collaboration.

The University of Oslo has the main responsibility for developing one of two independent data reduction pipelines in the QUIET experiment. In 2010, the first QUIET results were made public, and these put very strong constraints on the amplitude of primordial gravity waves.

Triennial summary from Russia (Igor Zinchenko):

1. Facilities and methods
1.1. The equipment complex of the Radioastron mission including the 10-m space antenna is prepared for launching. The ground station for this mission on the base of the RT-22 radio telescope is prepared.
1.2. The space observatory Millimetron is under development.
1.3. The e-VLBI technology was implemented at the “Quasar-KVO” system. A 6 station correlator ARK-6 was created for this system.
1.4. A calibration system for the large meter-wave radio telescope BSA was created.
1.5. A multi-wavelength radio heliograph consisting of 10 antennas was built on the base of
the Siberian Solar Telescope. A 100 antenna system is under development.
2. Extragalactic studies
2.1. It is found that radio bursts from AGN are delayed by a few months with respect to gamma-ray bursts from these objects. This implies that gamma-rays arise in the region of particle acceleration.
2.2. Studies of extragalactic sources with flat spectra at the RATAN-600 radio telescope show in some cases irregular flux variations on the time scale from one to a few weeks.
2.3. An analysis of pulsar timing measurements from Arecibo observatory and RXTE X-ray
observatory gives new constraints on the cosmological density of light cosmic strings, less than 0.1% of the critical density of the universe.
3. Galactic studies
3.1. From an analysis of VLBI maser observations in star forming regions the galactic rotation curve and parameters of the galactic spiral structure are determined. A new estimate of the Sun peculiar velocity relative LSR is obtained.
3.2. Variations of H2O maser spectra on the time scale of a few minutes are found.
3.3. Ionization of interstellar hydrogen by soft cosmic rays was found due to detection of radio recombination lines from cold clouds near SNR Cas A. The ionization rate is

(1±0.25)·10-16 s-1.
3.4. From observations of the PSR 2111+47 pulsar at 112 MHz the spectrum of interstellar
turbulence at small scales (100-300 km) was found. It is shown that the inner turbulence scale corresponds to the ion inertial scale.
4. Solar research
4.1. Variations of solar microwave emission with periods of ~ 10 min are found which are
related to large scale kink-oscillations of the coronal magnetic loops.
4.2. In the solar observations at the Nobeyama radio heliograph the effect of monotonic decrease of the loop height and length in the initial phase of a burst was found. It may indicate a relationship between the pulse phase of a burst and a strong dissipation of the electric current in the coronal magnetic loop.
4.3. Quasi-periodic (3-4 min) components are found in the dynamic spectra of the radio signals from space missions used to probe the solar wind at the heliocentric distances from 4 to 40 solar radii. They can be explained by magneto hydrodynamic waves from the Sun.
5. Astrometry
5.1. In cooperation with IERS and IVS a new reference coordinate system ICRF2 is developed. According to the IAU decision it will replace the previous ICRF (International Celestial Reference Frame) system.
5.2. Parameters of Earth rotation are determined from two-week VLBI observations at 11 observatories including “Quasar-KVO” in the framework of the CONT08 international program.

Triennial Report from Sweden (Michael Lindqvist)
- The Swedish national URSI committee operates under the KVA, the national academy of science.
- Onsala Space Observatory (OSO), the Swedish National Facility for Radio Astronomy, continues to provide scientists with equipment to study the Earth and the rest of the Universe. It operate two radio telescopes in Onsala, 45 km south of Göteborg, and take part in several international projects, such as the EVN, GMVA, IVS, Herschel, LOFAR, SKA and APEX.
- OSO hosts the Nordic ALMA Regional Centre. The main mission of the Nordic ARC node, is to provide ALMA support services to astronomers in the Nordic (Denmark/Finland/Iceland/Norway/Sweden) and Baltic (Lithuania, Latvia, Estonia) countries, and in general to help and encourage the community to make the best use of ALMA.
- Chalmers/GARD/Onsala Space Observatory has developed the ALMA band 5 receivers.
- OSO has participated in the continuation of the RadioNet collaboration in the seventh EC Framework Program.
- For VLBI, OSO participated also in the EU-program EXPReS, and its follow-up NEXPReS.
- A LOFAR station will be built at OSO during 2011.

Triennial summary from UK (Richard Davis):

This last year has seen the continued commissioning of e-MERLIN at Jodrell Bank Observatory (JBO). The first publication of the first science showing the double quasar gravitational lens has appeared. It shows the well known components but most interestingly there is evidence for another lens component: the straight through image seen for the first time. All colours giving 30GHz from each telescope are now in full operation. Work continues to commission the full bandwidth of 4 GHz from each telescope.

The competition for the SPO (SKA Project Office)has been completed for the SKA project. JBO will now be the new centre for the combined group of Manchester, Cambridge and Oxford. This will enable the e-MERLIN scientists to be brought into the SPO and the test beds of JBO to be used as precursors to the SKA.

8. Other

An electronic distribution list has been in use for the whole triennium as a means of communicating with the more than 400 Commission J members. The Commission J webpage on the URSI website has not been actively used, but contains a useful compendium of information on the Commission.

Commission J members under the leadership of Prof. Masatoshi Ohishi, as Chair of IUCAF, have tirelessly worked for protecting the radio astronomy frequency bands and deserve the appreciation and thanks of the entire URSI J community.

I would like to thank Prof.Steven Tingay for his work in leading the GVWG and also for bringing it to a decisive closure.

I thank my Interim-Vice-Chair, Prof. Justin Jonas for all his help and support.