

# Commission J

## 2005 – 2008 triennium report

Richard Schilizzi (Chair)

### 1. Commission J Statement of Accounts

*Budget:* €11000 (€9000 grant for 2005-8 triennium + €2000 carry-over from 2002-5)  
\$5000 (special grant for travel support to the General Assembly)

*Expenditure:* €7000 Mode B meeting support  
€3450 travel support to General Assembly  
\$5000 travel support to General Assembly

*Balance carried forward:* €550

### 2. Meeting Support

Two meetings were given financial support by Commission J during the triennium:

“Astrophysics in the LOFAR era”, Emmen, The Netherlands, April 07

“From Planets to Dark Energy: the Modern Radio Universe”, Manchester, UK, October 2007

### 3. Publications in the Radio Science Bulletin

- "Enhancing the Sensitivity of Radio Telescopes Using Fiber-Optic Networks", Roshene McCool, Ralph Spencer, Suresh Kumar, Ron Beresford, Steven Durand, Yasuhiro Koyama, Steve Parsley, Alan Whitney, and Peter Maat, Radio Science Bulletin, No. 317, June 2006, pp. 9-18.
- "Advances in Radio Astrometry" E. B. Fomalont and H. Kobayashi Radio Science Bulletin, No. 318, September 2006, pp. 13-29.
- "Mitigation of Radio-Frequency Interference", M. J. Kesteven, Radio Science Bulletin, No. 319, March 2007, pp. 9-18
- "Square Kilometre Array", P. J. Hall, R. T. Schilizzi, P. E. Dewdney, T. W. J. Lazio (about to be submitted)
- "Phased arrays in Radio Astronomy", A. van Ardenne (Commission J Tutorial, 2008), in preparation
- "Paths to Discovery in Radio Astronomy", R. D. Ekers (in preparation)

### 4. URSI General Assembly, Chicago, August 2008

#### *Scientific Sessions*

A full program of talks and posters has been prepared on the following topics:

- Future Large Telescopes
- Aperture and focal plane arrays in radio astronomy,
- Mm and sub-mm radio astronomy
- Radio Frequency Interference, problems and solutions (joint with Commission F)
- Observatory reports
- Low frequency radio astronomy and the ionosphere (joint with Commission G)
- Radio astronomy in space and on the Moon; and
- Signal processing, calibration, and imaging in radio astronomy

Ninety one oral presentations and 116 posters will be presented - a total of 207 papers - an increase of 49 over the 2005 General Assembly.

Thanks to the convenors for their organization of the sessions, and to S. Ananthkrishnan for his organization of the poster sessions, including the Special Poster Session on the Giant Metre-wave Radio Telescope.

Jim Cordes will give one of the three General Lectures at the General Assembly entitled "Pulsars, General Relativity and Gravitational Waves", and Arnold van Ardenne will give the Commission J Tutorial entitled "Phased Arrays in Radio Astronomy".

#### *Medals and Awards*

This year, Commission J members were honoured with two of the five URSI Awards. Jack Welch will receive the Balthazar van der Pol Gold Medal, and Alan Rogers will receive the John Howard Dellinger Gold Medal. Congratulations to both these distinguished scientists!

#### *Young Scientist Support*

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

### **5. Inter Union Committee for the Allocation of Frequencies, IUCAF (Chair: Wim van Driel)**

#### *Introduction*

The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science, IUCAF, was formed in 1960 by its sponsoring Scientific Unions, URSI, the IAU, and COSPAR. Its brief is to study and coordinate the requirements of radio frequency allocations for passive (i.e., non-emitting) radio sciences, such as radio astronomy, space research and remote sensing, in order to make these requirements known to the national 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).

#### *Membership*

In the period following the 2005 URSI General Assembly, the IUCAF membership was:

##### *URSI*

S. Reising (Com F), USA  
U. Shankar (Com J), India  
W. Swartz (Com G), USA  
A. Tzioumis (Com J), Australia  
W. van Driel (Com J; Chair), France

##### *IAU*

H. Chung Korea  
R.J. Cohen [† 11/2006], United Kingdom  
D.T. Emerson, USA  
M. Ohishi, Japan  
K.F. Tapping, Canada  
A. Tiplady, South Africa

##### *COSPAR*

J. Romney, USA

##### *at large:*

W.A. Baan, Netherlands  
K. Ruf, Germany

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.

#### *International meetings*

Since the 2005 URSI General Assembly, IUCAF has been represented by its members and correspondents in the following international meetings:

11/2005 ITU-R Working Party 7D (radio astronomy), Geneva, Switzerland  
04/2006 ITU-R Task Group 1/9 (Compatibility between passive and active services), Geneva, Switzerland  
07/2006 36th COSPAR Scientific Assembly, Beijing, China  
08/2006 XXVIth General Assembly of the International Astronomical Union, Prague, Czech Republic  
08/2006 ITU-R Working Party 7D (radio astronomy), Geneva, Switzerland  
09/2006 ITU-R Task Group 1/9 (Compatibility between passive and active services), Geneva, Switzerland  
09/2006 Space Frequency Coordination Group meeting SFCG-26, Bonn, Germany  
02/2007 ITU-R Working Party 7D (radio astronomy), Geneva, Switzerland  
02/2007 ITU-R Conference Preparatory Meeting, Geneva, Switzerland  
09/2007 Space Frequency Coordination Group meeting SFCG-27, Maspalomas, Spain  
10/2007 ITU World Radiocommunication Conference WRC-07, Geneva, Switzerland  
04/2008 ITU-R Working Party 7D (radio astronomy), Geneva, Switzerland

IUCAF has face-to-face committee meeting before each of these meetings, with the purpose of discussing issues on the agenda of the meetings in preparation for the public sessions. During these sessions ad-hoc meetings of IUCAF were held to discuss further its strategy.

Although such face-to-face meetings have been convenient and effective, throughout the year much IUCAF business is undertaken via e-mail communications between the members and correspondents.

Additionally, many IUCAF members and Correspondents participated in numerous national or regional meetings (including CORF, CRAF, RAFCAP, the FCC etc.), dealing with spectrum management issues, such as the preparation of input documents to various fora.

#### *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.

URSI: IUCAF members have played an active role in the redaction of the URSI White Paper on Solar Power Satellites (SPS). IUCAF's objective was to ensure that it presents a balanced discussion of the SPS technology, including an evaluation of the risks involved, in particular to radio science. Unwanted radio emissions from SPS systems must be suppressed sufficiently to avoid interference with other radio services and applications, in accordance with the provisions of the Radio Regulations of the ITU.

IUCAF members have been actively involved in the work of the URSI Scientific Commission on Telecommunication (SCT), whose brief is to form a liaison in matters of spectrum management between URSI and the International Telecommunication Union (ITU).

For the 2008 URSI Scientific Assembly, IUCAF has been organizing its open meeting during session J07, and IUCAF members have been actively involved in the organization of the session on Solar Power Satellites. Each year, IUCAF members also actively participated in national URSI meetings.

IAU: In view of a the possibility of including frequency allocations in the infrared and optical wavelength domain in the ITU-R Radio Regulations, which form the framework for international spectrum management, IUCAF continued its consultations with members of the optical/infrared astronomy community.

The IUCAF Chair, W. van Driel, is a member of the Organizing Committee of IAU Commission 50 on the Protection of Existing and Potential Observatory Sites, IUCAF member A. Tzioumis is Chair of the Working Group on Radio Frequency Interference of IAU Division X (radio astronomy), and IUCAF member M. Ohishi chairs the Working Group on Astrophysically Important Spectral Lines of Division X.

*COSPAR*: 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. At the 2006 COSPAR Scientific Assembly, IUCAF organized an open session on its activities and potential links with COSPAR, and at the 2008 COSPAR Scientific Assembly, IUCAF will organize Scientific Event E110 on "Spectrum Management and COSPAR: Keeping Passive Radio Observations Free of Interference".

#### *Protecting the passive radio science services*

At the ITU, in the period 2005-2007 the work in the various Working Parties of interest to IUCAF was focused largely on the preparations for WRC-07, the ITU World Radiocommunication Conference, which lasted for 4 weeks, from October 22nd to November 16nd, in Geneva, Switzerland. WRC-07 was attended by well over 3000 delegates from over a 180 nations and accredited organizations, including 7 IUCAF members and correspondents, and 9 other astronomers and astronomical spectrum managers.

The main goal of a WRC is the revision of the ITU Radio Regulations, which define the worldwide framework for spectrum management, including protection criteria for the radio astronomy service from unwanted emissions into its allocated frequency bands. WRCs are held every 3 to 4 years, and its agenda items are adopted at the previous WRC.

Of greatest relevance to IUCAF was an agenda item on the protection of the radio astronomy service and the Earth exploration-satellite (passive) service from unwanted emissions of active services in adjacent and nearby bands. This has resulted in an update of the tables of threshold levels used for consultation between the passive and active radio services in Resolutions 738 and 739. Of particular, and long-standing, concern to IUCAF was the case of the 1610.6-1613.8 MHz band, which contains important spectral lines of the interstellar OH molecule. It was decided that "The protection of the radio astronomy service in the 1 610.6-1 613.8 MHz band is ensured and will continue to be in accordance with the bilateral agreement between the Russian Federation, the notifying administration of the GLONASS/GLONASS-M system, and IUCAF, and subsequent bilateral agreements with other administrations." Among the preliminary agenda items adopted for the next WRC in 2011, the one most relevant to radio astronomy concerns the use of the radio spectrum between 275 and 3000 GHz. No allocations for the use of this frequency band will be made at WRC-11, but the radio astronomy community has to identify a list of specific bands of interest.

IUCAF member M. Ohishi is Chair of ITU-R Working Party 7D (radio astronomy) and IUCAF member H. Chung is Vice-chair of ITU-R Study Group 7 (Science Services).

IUCAF members participated actively in the Task Force on Regulatory Issues of the international Square Kilometre Array (SKA) project, advising on criteria for a Radio Quiet Zone for this future giant global radio telescope.

#### *IUCAF-sponsored meetings*

IUCAF organizes and sponsors international meetings on spectrum management and RFI mitigation. Following the first Summer School in Spectrum Management for Radio Astronomy, held in Green Bank, USA, in 2002, and the second School held in Castel San Pietro, Italy, in 2005, IUCAF has been working towards its 2009 Summer School on Spectrum Management for Passive Radio Sciences, planned to be held in Korea.

#### *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.

#### *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 and giant radio telescope use. Current priorities, which will certainly keep us busy through the next years, include the use of 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 and high-frequency power line communications (HF-PLC) on all passive services, 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. 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: Jon Romney)**

This triennium began with an action to re-create the GVWG's Terms of Reference, which had been lost over the years since the Group was established in 1990. Fortunately, the archives of one long-term member yielded a copy of the original memorandum by R. D. Ekers, which was found to coincide quite well with current practice and areas of interest. New Terms of Reference, based on modern conditions, were drafted and accepted by both URSI and IAU (see <http://www.ursi.org/J/workinggroup.htm>).

Simultaneously, GVWG membership was renewed through a poll of all previous members, who were asked either to confirm their continued membership or to propose replacements. The new membership was selected with an eye toward balanced representation in both a geographic sense, and in terms of expertise. Geographic balance was based on three longitude regions: Asia & Australia, Europe & Africa, and the Americas. Expertise available among current GVWG members spans areas including scientific studies in astrophysics, astrometry, and geodesy; and techniques including e-VLBI and Space VLBI. (See <http://www.ursi.org/J/workinggroup.htm> for the names of the GVWG members.)

It was not possible for the GVWG to meet as a group until the end of this triennium, at the current General Assembly of URSI. It is not clear whether the past practice of holding GVWG meetings during General Assemblies of these international Unions remains tenable, but other options are also problematic, in view of the diversity of interests among the membership, and the graduation of VLBI beyond the specialized-technique category for which periodic international "VLBI meetings" were appropriate.

Among the three basic tasks specified in the GVWG's Terms of Reference, work was concentrated in the Space VLBI area during this triennium, in preliminary work related to the VSOP-2 mission. This effort was carried out by the Chair individually at this early stage. Guidance, developed in consultation with the Chair of Commission J (who is a past Chair of GVWG), was provided to the mission in two areas: on compiling a suitable list of ground radio telescopes (GRTs) whose participation would be valuable to the mission, and on issuing invitations to the institutions operating those telescopes. As of this date, a substantial list of suitable GRTs exists, but the invitations have not yet been issued by the mission. The mission itself strongly favours GRT coordination through the GVWG, but agreement on this has not yet been reached with the major GRT networks. An overall resolution of this issue will have to be a major focus for the Group early in the coming triennium.

The Chair was appointed, on an ex-officio basis, as a member of the VISC-2 mission advisory committee, and participated in that group's first face-to-face meeting in Bonn in May 2008, in a limited meeting during this GA, and in a number of VISC-2 teleconferences.

After 6 years in the job, the Chair tendered his resignation at the end of this triennium.

## **7. Reports from National Committees**

### **Australia (David DeBoer)**

URSI activities centre around the Workshop on Applications for Radio Science (WARS) conference and participation in the Delhi General Assembly. The last WARS was held at the Gold Coast of Queensland 11-12 February 2008 and was well attended by government and industry. The focus was on the new instruments for radio astronomy, with the ASKAP and MWA instruments under development.

### **Brazil (Pierre Kaufmann)**

- The solar submillimeter-wave telescope (SST) receivers and reflector were upgraded improving overall gain by a mean factor of ten. This program is carried jointly by Mackenzie Presbyterian University, Brazil and Complejo Astronomico El Leoncito, Argentina.
- Geodetic VLBI observations with the 12-m radio-telescope were carried regularly out at Northeast Space Radio Observatory, Eusébio (near Fortaleza), Ceará State, sponsored partially by a contract between Mackenzie and NASA, in cooperation with Brazil National Space Research Institute (INPE).
- The upgrade of Mackenzie 13.7-m Itapetinga telescope, Atibaia, São Paulo State, was completed. It continues to be operated within an agreement with INPE.
- At São José dos Campos, São Paulo State, INPE operates a solar radio spectrograph and develops a large decimeter-wave interferometer.

### **China (Yihua Yan)**

- In China, the Five-hundred-meter Aperture Spherical telescope (FAST) project has been approved by the central government in 2007.

- Two new antennas, one 40m antenna in Kunming and one 50m antenna in Beijing, were built in 2006 to form the Chinese VLBI Network, and a data processing center was established recently in Shanghai.
- A huge array of 10160 2-meter log periodic antennas for measurement of the 21 cm mission from reionization epoch has been set up in Xinjiang, west China.
- The Chinese Spectral Radioheliograph (CSRH), which consists of a 0.4-2 GHz array of 40 4.5m antennas and 2-15 GHz array of 60 2m antennas, is being built in a radio quiet zone in Inner Mongolia, China, to achieve high spatial, temporal and spectral resolutions and high sensitivity in dm-cm bands.

### **France (André Deschamps)**

#### 1) Operations

- First cosmic ray detection with logarithmic antennas
- VLB interferometry around 60 MHz ( LOFAR)
- Participation in SKA project
- Participation in ALMA project ( Channel 7 and 8 prototypes, very large band auto-correlators)
- HERSCHEL / HIFI Channel 1

#### 2) Meetings and Workshops

- Organization of the workshop « Pulsars » (Jan 2006, May 2007)
- Preparation and organization of ISSTT 2006 ( Paris, May 2006)
- SKA meetings ( Paris 2006-2007)

#### 3) URSI representation

- ANFR (French Agency for Frequency Regulation, Paris). New rules for suppression of taxes for scientific frequency bands in France. Inscription of radio astronomy bands up to 270 GHz to the BR at Geneva.
- ITU (Geneva). URSI representation at WRC07, and WP7D.
- RSPG (Brussels). Participation in sessions on “Scientific Use of Radio Spectrum” and “SRR at 24 GHz”

### **India (Subramaniam Ananthakrishnan)**

- The GMRT was used for more than 200 scientific proposals, both national and international. Among these studies the highlights are the following: detection of a 61.86 millisecond pulsar using GMRT in the supernova remnant G21.5-0.9 and inferring a characteristic age of ~4900 years for this pulsar which has the second highest spin-down luminosity after the Crab pulsar, discoveries of three new pulsars, three new HI 21 cm absorption systems towards damped Lyman-alpha candidates at  $z > 1$  and one new double-double radio galaxy (NCRA); extensive studies of rotation and hence dark matter studies in the smallest known galaxies and follow up of X-ray binaries, extragalactic supernovae, and magnetars as targets of opportunity which helped in constraining models of their radio emissions.
- The shape of the density turbulence spectrum of cometary plasma in the comet 73P/Schwassmann-Wachmann 3-B from the observations of the occultation of a compact radio source by its plasma tail, using the Ooty Radio telescope, was reported;
- Study of Gamma ray burst afterglow for almost five years showing the deceleration of the expanding fireball from an initial ultra-relativistic phase to a non relativistic one has been reported.
- Development of a radically new model for the formation and temporal evolution in pulsar wind nebulae, identification of the existence of collimated particle beams from pulsars' magnetic poles and demonstration of free precession of the central compact object to account for many aspects of the time variability have also been reported.

### **Italy (Roberto Ambrosinin)**

- Commission J in Italy has supported meetings and research activities in the framework of the national participation in some of the most important international projects such as ALMA, SKA, LOFAR and Herschel.
- The Commission is participating also in the research activity carried out for the development of the Sardinia Radio Telescope (SRT). This instrument based on novel technologies such as active surface and flexible frequency coverage, up to 100GHz, is expected to be completed by the end of 2009.

### **Japan (Hideyuki Kobayashi)**

- URSI Commission J in Japan had two workshops related to the ALMA project and the future plans for Japanese astronomy.
- Commission J sent a recommendation letter supporting the next space VLBI mission to Japanese space agency, JAXA. The mission was approved in 2007 as Astro-G mission.
- Commission J supported on-going projects, ALMA, VERA, ASTE, NANTEN, and Nobeyama.

### **Netherlands (Arnold van Ardenne)**

- The Dutch national URSI committee now operates under the auspices of the KNAW, the national academy of science, thereby improving its scientific status and visibility.
- It has set up a foundation for the purpose of organizing scientific meetings and symposia and has co-organized yearly workshops two of which have been together with the Belgian national committee. Commission J members gave presentations on new technical and scientific developments in radio astronomy. National Committee member, Wolfgang Wild, moved to ESO/ALMA to become European Project Manager.
- NOVA/SRON developed the ALMA band 9 receivers.
- The European SKA design study (SKADS) coordinated by ASTRON through the national chairman of Commission J, successfully passed its Mid-term review in 2007 and has now entered its last year. Its activities emphasize the use of Phased arrays for radio instruments, in particular for the SKA. SKADS has made important contributions to the technical and scientific potential of the SKA. An associated EC-funded Marie Curie program also coordinated by the URSI Committee chairman, has been successful in interesting many young engineers and scientists in radio astronomy. It is hoped that many will participate in the development and use of instruments like LOFAR and the SKA.
- A new program called Apertif involves the development of focal plane arrays for the Westerbork Synthesis telescope in close cooperation with similar developments in Canada and Australia.
- A continuation of the RadioNet collaboration in the seventh EC Framework Program has been approved. It is now being led by ASTRON.
- For VLBI, the European xPreS program, led by JIVE in the Netherlands, was approved.

### **Peru (Walter R. Guevara Day)**

- Two antennas systems have been built at VLF radio frequencies and installed in locations of Lima and Piura to observe solar activity using a variation of phase in the D layer. This is an international project called SAVNET leading by "Centro de Radioastronomia y Astrofisica de Mackenzie" (CRAAM) of Brazil, PI is Dr. Jean Pierre Raulin, and this is part of the activities associated with the International Heliophysical Year 2007-2009.
- Three courses in VLF propagation waves and Solar Physics are now offered, as well as courses in Solar Radiophysics at "Universidad Nacional Mayor de San Marcos" and the National Commission for Aerospace Research and Development (CONIDA).
- seminars on solar radio astronomy have been offered to undergraduate and graduate students in Solar Radioastronomy.

- Recently, the Geophysical Institute of Peru (IGP) is implementing a radio telescope for galactic and extragalactic research. This antenna was donated by a Spanish company (Telefonica) and developed by the National Astronomical Observatory of Japan.
- The Catholic University of Peru proposes to build a radio telescope for astronomical observation.
- Finally CONIDA are continuing with the SAVNET project on solar radiophysics with the construction proposed of two VLF system to be installed on ICA and Moquegua, which are integral parts of the network SAVNET. The construction of a solar radio telescope at high frequencies is also proposed.

### **Portugal (Luis Cupido)**

- participation in the national URSI symposium (also with Spanish participation) where radio astronomers provided a small session of oral presentations and posters.
- participation in the URSI national meetings in preparation of the national symposium for 2008, and encouragement for the submission of articles to the GA;
- contact has been made with all people involved in research on radio astronomy in Portugal and they are now fully aware of the URSI existence and Portuguese representation.

### **Russia (Igor Zinchenko)**

Radio astronomical activities in Russia included development of new facilities and upgrade of existing ones, development of new methods and astrophysical studies of various objects. The main results can be summarized as follows:

#### *1. Facilities and methods*

The following developments have taken place:

- Completion of the national VLBI network "Quasar". The system comprises 3 stations based on 32-m antennas. It is included in the international IVS network and performs measurements for astrometry and geodynamics, in particular in the framework of the CONTO5 program;
- A new broadband 16-channel receiver for the RATAN-600 radio telescope;
- For the "Radioastron" mission, a new hydrogen maser frequency standard and new methods of multi-frequency VLBI measurement analysis;
- At the 64-m Kalyazin radio telescope, a new data acquisition system with time resolution of 10 ns and 10 hours recording time. Super-giant pulses from the pulsar in the Crab nebula were detected (5-6 MJy with 20-30 ns duration);
- The proposal of a new precise astronomical time scale based on measurements of the sample of reference pulsars at Arecibo and Kalyazin observatories;
- VLBI radar Doppler measurements of the 2004XP14 asteroid were performed.

#### *2. Extragalactic studies*

- A non-Gaussian component in CMBR anisotropy was found.
- Statistical studies of the spectra and structure of several tens thousands radio sources in the flux range from 1 Jy to several mJy were performed in preparation for the Radioastron and Planck missions.
- Radio flares from AGN at millimeter waves correlated with optical activity were observed.

#### *3. Galactic studies*

- A series of pulsar studies was performed at Pushchino observatory. In particular, radio pulses from the X-ray pulsar 1RXS J2143.7+065419 at 111 MHz were detected. This strongly constrains possible models of these objects.

- Interstellar turbulence was studied on the basis of the scintillation measurements of extragalactic radio sources. Several components in interstellar plasma are identified with different levels of turbulence.
- Studies of the structure and kinematics of star forming regions by observations of molecular radio lines and dust emission provide new data on radial profiles of physical parameters and small scale clumpiness in these regions.
- Transition frequencies for several important interstellar molecules (C18O, 13CO, HNCO, HNC, OCS, etc.) were improved using laboratory and radio astronomical measurements. Typical uncertainties are  $\sim 1$  m/s.
- Studies of interstellar molecular masers were performed in several observatories. In particular, rapid fluctuations of water masers were detected (tens of percent on the time scale of 5-10 min in W33B). Methanol masers associated with low mass protostars were found. Very narrow ( $\sim 30$  m/s) emission features were detected in 9.9 and 104 GHz methanol masers which indicated an unsaturated regime with a gain  $> 100$ .

#### *4. Solar research*

- Inductive interaction of coronal magnetic loops was found from modulation of microwave emission of solar flares.
- Parametric resonance between 5 min photospheric oscillations and acoustic waves in coronal magnetic loops was found by observations of several corresponding frequencies.
- From observations of solar flares at NAOJ NRO it was found that the electron injection happens at the bottom of the magnetic loop.
- The amount and properties of hot and cold plasma in active regions were studied with the Pulkovo radio telescope.

#### **South Africa (Justin Jonas)**

- The SKA has become the main focus for radio astronomy in South Africa, particularly since Southern Africa has been shortlisted together with Australia as a suitable SKA site.
- A radio astronomy reserve has been created in the Karoo region that is protected from radio interference by an Act of parliament. This reserve includes the SKA core site proposed by South Africa, and will be the site for the 80 dish MeerKAT array, a technology and science pathfinder for the SKA.
- The Hartebeesthoek Radio Astronomy Observatory (HartRAO) continues its programme of pulsar, molecular spectroscopy and VLBI science, and real-time eVLBI experiments with the EVN were conducted for the first time in 2008 using the JIVE correlator.

#### **Taiwan (ROC) (Paul Ho)**

- The Submillimeter Array (SMA), a joint project between Smithsonian Astrophysical Observatory (SAO) and the Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), became operational in November 2003 on Mauna Kea, Hawaii. Taiwan contributed two of the 8 six-meter antennas together with all its associated receivers and instrumentations. In 2008, the SMA remains the only submm interferometer in the world, and is the fore-runner to the Atacama Large Millimeter/submillimeter Array (ALMA) under construction in Chile.
- The Array for Microwave Background Anisotropy (AMiBA), a project led by Taiwan, became operational in October 2006 on Mauna Loa, Hawaii. The AMiBA is a 7-element platform-mounted interferometer operating at 3mm to study the structure of the cosmic background radiation.
- Taiwan is also a partner with Japan and North America on the ALMA project, and operates the East Asia Front End Integration Center in Taiwan and contributes the equivalent of 2 ALMA antennas to the North American effort.

- Astronomers in Taiwan also make use of all the frontier international radio instruments, including the Nobeyama Radio Observatory, Arizona Radio Observatory, the Very Large Array, the Very Long Baseline Array, the Green Bank Telescope, the Australian Telescope, the IRAM 30 m telescope and the IRAM interferometer, the Odin submillimeter satellite, the Giant Meterwave Radio Telescope.

### **Turkey (Mehmet Özel)**

There are two main groups active in radio astronomy in Turkey:

(1) Erciyes University Astronomy Dept. established in 2000 with 3 senior (director: Assoc.Prof.Dr. I.Kucuk) and several junior level staff and researchers. They are presently building a 15m size radio telescope in Kayseri, which will basically be an educational facility to observe at 5-50 GHz frequencies.

(2) Çanakkale University Astrophysics Research Center, which has diverse interests including radio astronomy. RA group includes 2 senior (M.E.Özel, Edwin Budding) a junior scientist (Naci Erkan). Recently, the Australian Radio Telescope Facility (ATCA) is used to observe the active cool binary star system CC Eri as a part of an international multisite-multifrequency observing campaign -which includes photometric, x-ray and (4.8 and 8.6 GHz) radio observations simultaneously. Results were published recently (Budding et al., ASS, 304, 13-16, 2007). The group continues follow up observations of the system and other similar systems.

### **USA (Dave Woody)**

- US commission J had very successful winter meetings in Boulder Colorado in January 2005 and 2008. The attendance at the commission sessions averaged ~60 for both meetings and ~30 commission J members attended the business meetings.

- There was also a successful joint North American Science meeting with CNC-URSI Canada in Ottawa in August 2007.

- A new vice chair, Richard Bradley from NRAO, [rbradley@nrao.edu](mailto:rbradley@nrao.edu), was elected at the January 2008 meeting. The current vice chair, Jim Cordes from Cornell, will become the chair for the January 2009 meeting.

- Six new members were nominated and elected in USNC-URSI commission J at the January 2005 meeting and six more at the January 2008 meeting.

### **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 Wim van Driel, Mike Davis and Masatoshi Ohishi provided substantial comment on drafts of the URSI White Paper on Solar Power Satellite systems.

I would like to thank Jon Romney for his work over the past 6 years in leading the GVWG.

I would also like to take this opportunity to thank my vice-Chair, Prof. Subramaniam Ananthakrishnan for his valuable advice, hard work, and support, and wish him every success in the coming triennium.