



## Monthly Newsletter of International URSI Commission J – Radio Astronomy

February 2019

### Officers

Chair: Richard Bradley

ECRs: Stefan Wijnholds

Vice-Chair: Douglas Bock

Jacki Gilmore

Prepared by R. Bradley, Chair, Commission J, [rbradley@nrao.edu](mailto:rbradley@nrao.edu)

---

### News Items

Greetings Commission J Members!

The Pacific Radio Science Conference (AP-RASC) is upon us! The Conference will be held in New Delhi, India from 09 – 15 March, 2019. A list of the Commission J sessions are given below. On behalf of URSI and the Organizing Committee, thank you for supporting AP-RASC 2019!

This is your last chance to suggest workshop and session ideas for the 2020 URSI General Assembly and Scientific Symposium in Rome. The [final draft](#) of the 2020 GASS Commission J program is given below. Your input is needed – consider convening a session!

How far would you go for good data? Our Spotlight this month is on PRIZM - Probing Radio Intensity at high-Z from Marion, a cosmic dawn experiment that has been operating since 2017 on the remote island of Marion. H. Cynthia Chiang takes us on an adventure to this tiny island and describes the low frequency radio astronomy research she is conducting from this location. Thank you, Cynthia, for writing this wonderful article for our Newsletter.

I kindly request your ideas, articles, news, photos, etc. for upcoming editions of Newsletter. Let's keep it interesting and informative! I thank all of you who have already contributed.

*Submitted by R. Bradley*



---

## **2019 URSI Pacific Radio Science Conference (2019 AP-RASC)**

9 -15 March 2019, New Delhi, India

See <http://aprasc2019.com/> for details. The Commission J sessions are listed below.

**J01: Evolution/Latest Results from uGMRT (Contributions and Felicitation of Govind Swarup)**

*Conveners: Subra Ananthkrishnan and Yashwant Gupta*

**J02: Updates from Existing Radio Astronomy Facilities – I**

*Conveners: Jayaram Chengalur and Douglas Bock*

**J03: Updates from Existing Radio Astronomy Facilities – II**

*Conveners: R Ramesh and Douglas Bock*

**J04: VLBI: Current Status and Future Prospects**

*Conveners: B C Joshi and Sergeyi Gulyaev*

**J05: Radio Astronomy Instrumentation & Techniques – I (Rcvr Systems: Analog/Digital/Optical Fibre)**

*Conveners: B Ramesh and S Srikant*

**J06: Radio Astronomy Instrumentation & Techniques - II (Data Processing: Imaging, Big Data)**

*Conveners: Dharam Vir Lal and Veeresh Singh*

**JGH7: Recent Scientific Results on Solar, Solar Wind and Space Weather Observations**

*Conveners: P Subramanian, Yihua Yan and P Janardhan*

**J08: Recent Scientific Results on Galactic, Extra-Galactic, Star Formation, Transients**

*Conveners: Ishwar Chandra and Kenta Fujisawa*

**J09: The Early Universe (EoR Experiments and Related Results)**

*Conveners: Abhirup Dutta and Tirthankar Roy Choudhury*

**J10: Future Radio Astronomy Facilities (including Square Kilometre Array)**

*Conveners: Divya Oberoi and Ramesh Bhat*

**EFGHJ-6: Upcoming Areas in Interference and Interference Mitigation**

*Conveners: Hanna Rothkaehl, Uttama Ghosh Dutta and Stefan Wijnholds*

**E07: RFI Mitigation in Radio Astronomy**

*Conveners: Subra Ananthkrishnan, Kaushal Buch and Tasso Tzioumis*

**EACFJ-8: EM Spectrum Allocation and Management**

*Conveners: Anjana Jain, Tasso Tzioumis and Jean-Benoit Agnani*

**JOS: Any Other Aspect of Radio Astronomy**

---

**2020 URSI General Assembly and Scientific Symposium (2020 URSI GASS)**

*Rome, Italy*

***We are now actively planning for the next URSI General Assembly and Scientific Symposium.***

Volunteer to convene a session or organize a one-day topical workshop around an important area of research. Let's work together to maintain the long tradition of excellence that the GASS provides to the radio science community.

**\*\*\* Final Draft Program for Commission J – GASS 2020 \*\*\***

**Sessions:**

New Telescopes on the Frontier

Recent and Future Space Missions

*Conveners: Joseph Lazio, Heino Falcke, Yuri Kovalev*

Single Dish Instruments

Very Long Baseline Interferometry

Millimeter/Submillimeter Arrays

Receivers and Radiometers: Design and Calibration

Digital Signal Processing: Algorithms and Platforms

Short-Duration Transients and Pulsars: Observations, Techniques, and Instrumentation

Solar, Planetary, and Heliospheric Radio Emissions (Commissions HJ)

Ionospheric Models and their Validation (Commissions JG)

Characterization and Mitigation of Radio Frequency Interference (Commissions JEF GH)

Spectrum Management (Commissions ECJ)

Historical Radio Astronomy

*Conveners: Richard Schilizzi*

Latest News and Observatory Reports

*Conveners: Rich Bradley and Douglas Bock*

**Workshops:**

Space Weather (Commissions GHJ)

---

## Meeting and Workshop Announcements

\*\*\* Registration open for a meeting on the History of the SKA: 1980s to 2012 \*\*\*

Dear colleagues,

We would like to draw your attention to a meeting on the History of the SKA from the 1980s to 2012, to be held from 3 to 5 April 2019 at the SKA Organisation Headquarters at Jodrell Bank.

More information, including a registration form, is available at

<https://indico.skatelescope.org/event/518/>

Richard Schilizzi, Ron Ekers, and Peter Hall  
(Convenors)

-----  
Cerenkov Telescope Array Symposium  
“Science opportunities with CTA”  
Bologna, 6-9 May 2019

Dear colleagues,

Registration for the First CTA symposium is now open. Participants can register online at <http://www.cta-symposium.com/registration>. Your registration will be confirmed by the workshop secretary as soon as the registration fee has been received.

The workshop registration fee is 300 Euros before 20 March, 2019 and 350 Euros after this date. A special rate of 200 (250 after 20 March) euros is available for students.

The theme for the First CTA Symposium is “Science opportunities with CTA” and will take place at the historical Teatro Duse in Bologna 6-9 May 2019 (<https://www.cta-symposium.com>). The meeting specifically addresses the larger Multi-Wavelength/Multi Messenger communities and aims to set up new channels of communication with those communities. It will feature a combination of invited and contributed talks. The preliminary programme is available on the symposium webpage.

We are also opening a call for contributions to the First CTA Symposium in the following areas:

- Cosmic particle acceleration
- Compact objects and relativistic shocks
- Role of cosmic particles in galaxy evolution and star-forming systems
- Gamma rays as cosmic probes
- Fundamental physics
- Multi-wavelength and multi-messenger observations

Or any other topic connected to the scientific possibilities of CTA.

Submit your abstract on <http://www.cta-symposium.com/abstract-submission/> - please make your submissions comprehensible to a broad astrophysical audience as some of the attendees may be unfamiliar with the specifics of your field.

**The deadline to submit abstracts is February 20, 2019.** The scientific organising committee (SOC) will consider the submission for inclusion in the preliminary programme and will notify the authors whether their contribution has been selected for an oral/poster presentation by March 15, 2019.

Confirmed invited speakers include:

Marco Ajello	Jamie Holder
Roger Blandford	Takaaki Kajita
Catherine Cesarsky	Robert Laing
Federico Fiuza	Julie McEnery
Giancarlo Ghirlanda	Andrii Neronov
Gabriele Ghisellini	Subir Sarkar
Francis Halzen	Anatoly Spitkovsky
Werner Hofmann	Rai Weiss
	Wolfgang Wild

We look forward to seeing you in Bologna in May.

With best regards,

Stefan Funk  
on behalf of the SOC:

Roger Blandford, Kavli Institute of Particle Astrophysics and Cosmology, Stanford University, USA; Catherine Cesarsky, CEA, France; Andrea Comastri, INAF, Italy; Emma de Oña Wilhelmi, University of Barcelona, Spain; Stefan Funk, University of Erlangen, Germany; Jim Hinton, Max Planck Institute for Nuclear Physics, Germany; Giovanni Pareschi, INAF, Italy; David Reitze, California Institute of Technology, USA; Richard Schilizzi, University of Manchester, UK; Christian Spiering, DESY, Germany; Matthias Steinmetz, IAP, Germany; Wolfgang Wild, CTAO, Italy

## **Of Mice and In-Flight Magazines**

*H. Cynthia Chiang*

*Department of Physics, McGill University*

It all started with an in-flight magazine: while taking a quick hop across South Africa, one of the airline magazine articles featured a small, little-known island named Marion. The island, which is situated halfway between South Africa and Antarctica, hosts a research base that is operated by the South African National Antarctic Programme. As the article went on to describe, the base had been used primarily for studies in biology, geology, space weather, and a few other research areas. With the combination of extreme remoteness but also the existence of infrastructure, the tantalizing possibility of Marion offering a brand new radio-quiet environment for astronomical observations gradually unfolded during that short plane flight.

At frequencies below  $\sim 150$  MHz, observations of redshifted 21-cm emission can probe the era of cosmic dawn, when the first stars ignited in the universe. The global 21-cm signal, averaged across the sky, captures the heating processes of these first stars and is expected to have a characteristic  $\sim 100$  mK dip around a redshift of 20. A possible detection of this global signal was first reported by the EDGES team in early 2018 [1]. If this detection is confirmed, it represents the opening of a completely new observational window into early times in the universe, allowing us to constrain the thermal history and energy injection processes as the first luminous objects were created.

Measuring the global 21-cm signal from cosmic dawn sounds deceptively simple at first. In order to observe total power at frequencies of tens to hundreds of MHz, one only needs an antenna the size of a coffee table, a handful of amplifiers and filters, digitizers with modest specifications, and a computer or FPGA with fairly unremarkable resource usage. Whenever a story sounds too good to be true, there's always a catch. The fine print, in this case, is that the measurement is dominated entirely by the unholy quartet of systematic errors: astrophysical foregrounds, ionosphere, radio frequency interference, and instrumental effects. As a colleague says, "the instrument is easy, but the experiment is hard." Nevertheless, for the potential payoff of exciting science coming from such a small-scale instrument, who could resist such fun?

The magazine article about the tiny island in the sub-Antarctic seeded the idea for our own team to join the global 21-cm game: Probing Radio Intensity at high-Z from Marion (PRIZM) is a new cosmic dawn experiment that has been operating since 2017. PRIZM joins the experimental effort from several teams around the world [2–4] that are attempting to weigh in on the EDGES detection using a variety of instrumental designs and observation locations. The PRIZM instrument [5] consists of two modified four-square antennas (Figure 1) operating at central frequencies of 70 and 100 MHz, and the system is read out with a SNAP-based<sup>1</sup> back end. The experiment is the first astronomy research that has taken place on

1 <https://casper.berkeley.edu/wiki/SNAP>

Marion, and with new remote sites comes a plethora of new challenges. Travel to the island is via the S. A. Agulhas II ship only once per year in April, and after the few-day voyage (while being pummeled by 5-m ocean swells), the on-island access window is a mere three weeks before the ship returns to Cape Town. Marion weather is both harsh and unpredictable: temperatures hover a few degrees above freezing, the rain is often relentless, and the wind is even more unforgiving, with sustained speeds often reaching 50 knots or more (and gusts up to 80 or 90 knots). The PRIZM observing site is located about 4 km from the main base, and the daily commute is a one-hour hike in each direction, meandering through mires and fields of ankle-twisting lava rocks. Wind- and weather-proofing the humans and hardware is a fairly conventional requirement, but perhaps the most cruel punishment that Marion inflicts upon scientific equipment is hordes of hungry mice that are eager to fill their stomachs with wire insulation, electrical tape, and heat shrink, to name a few.



Figure 1: The PRIZM 100 MHz antenna with visible front-end electronics, newly rebuilt and installed by MSc student Nivek Ghazi (left) and PhD student Liju Philip (right).

Thankfully, our team managed to keep PRIZM firmly anchored, dry, and (after a few minor electronics casualties and many artful applications of wire mesh cloth, brass scouring pads, and silicone sealant) free of mice. Despite the merciless nature of Marion, the island rewarded us with the gift of an unparalleled, radio-quiet observing location with no visible contamination within the FM band. Analysis of the PRIZM data is in progress, and observations are continuing, thanks to the heroic efforts of our overwintering team members (Figure 2) who spend 13 months at a time living on the island and taking care of our instrument.

Looking ahead to the future, we are beginning to make exploratory measurements to see how low in frequency we can observe from the unique environment of Marion. The few-MHz radio sky is one of the final frontiers of radio astronomy and cosmology, with Grote Reber's measurements [6] from several decades ago still representing the state of the art. Our team installed two LWA antennas<sup>2</sup> at the PRIZM site in 2018, and the preliminary cross-correlation data show repeatable interference fringes from the sky down to about 10 MHz without any processing or cuts. We will continue to expand the low-frequency antenna installation on Marion, with the hope of gaining a new and improved glimpse of the sky at a few MHz. We are additionally exploring the possibility of new observing sites in the Canadian high Arctic, which are likely to be radio quiet and have the advantage of being accessible more than just once per year. We may have to fend off the occasional polar bear or two, but at least there won't be any pesky mice.



Figure 2: Kagiso Malepe (left; 2017) and Vhuli Manukha (right; 2018), the overwintering engineers from the South African National Space Agency who maintained and operated PRIZM during 13-month stays.

## References

- [1] J. D. Bowman et al., *An absorption profile centred at 78 megahertz in the sky-averaged spectrum*, Nature, 555, 2018.
- [2] D. C. Price et al., *Design and characterization of the Large-Aperture Experiment to Detect the Dark Age (LEDA) radiometer systems*, Monthly Notices of the Royal Astronomical Society, 478, 2018.
- [3] S. Singh et al., *SARAS 2: A Spectral Radiometer for probing Cosmic Dawn and the Epoch of Reionization through detection of the global 21 cm signal*, Experimental Astronomy, 45, 2018.
- [4] B. D. Nhan et al., *A Proof of Concept on Constraining the Foreground Spectrum for Global 21 cm Cosmology through Projection-induced Polarimetry*, submitted to the Astrophysical Journal, 2018 (arXiv:1811.04917).
- [5] L. Philip et al., *Probing Radio Intensity at high-Z from Marion: 2017 Instrument*, accepted for publication in the Journal of Astronomical Instrumentation, 2019 (arXiv:1806.09531)
- [6] G. Reber and G. R. Ellis, *Cosmic radio-frequency radiation near one megacycle*, Journal of Geophysical Research, 61, 1956.

Submitted by Hsin Cynthia Chiang

---

## **Job Postings – Radio Astronomy and Related Fields**

### **HIRAX Postdoctoral Fellowships in Radio Astronomy and Instrumentation**

The Astrophysics and Cosmology Research Unit (ACRU) at the University of KwaZulu-Natal (UKZN) is offering a postdoctoral research position in the area of radio astronomy and instrumentation. For more information, see <https://acru.ukzn.ac.za/hirax-postdoc-jan2019/>

### **Square Kilometer Array**

Signal Processing Domain Specialist (Manchester, UK)  
<https://recruitment.skatelescope.org/domain-specialist-signal-processing/>

### **Arizona State University – 3 Positions**

Research professional with expertise in radio-frequency engineering:  
<https://jobregister.aas.org/ad/a67137b8>

Postdoc in Radio Instrumentation and/or Signal Processing  
<https://jobregister.aas.org/ad/6f5685cb>

Postdoc in 21cm Data Analysis  
<https://jobregister.aas.org/ad/e56bb558>

**If your organization has an opening for a position that may be of interest to Commission J members please send the title, short description, and link for additional information to R. Bradley. Positions will only be posted by request from URSI members.**

---

## Photo from the Field



*One of two Long Wavelength Array (LWA) antennas installed on Marion Island in 2018. The LWA antennas are being used to perform exploratory measurements in a frequency range of 1.2-81 MHz. Preliminary cross-correlation data show repeatable interference fringes from the sky down to about 10 MHz without any processing or cuts. Additional antennas will be installed during the 2019 Marion voyage.*

*Submitted by Hsin Cynthia Chiang*

If you have an interesting photograph that you wouldn't mind sharing with others in the public domain I encourage you to send a copy to me along with a brief caption and the person's name or organization to whom I should credit.

