



# Report from the event supported by RadioNet

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**TITLE** *IAU SYMPOSIUM 333, "PEERING TOWARDS COSMIC DAWN"*

**DATE:** *2 – 6 OCTOBER 2017*

**LOCATION:** *DUBROVNIK, CROATIA*

**MEETING WEBPAGE:** *<https://iaus333.irb.hr>*

**HOST INSTITUTE:** *RUBER BOŠKOVIĆ INSTITUTE, ZAGREB, CROATIA*

**RADIONET  
BENEFICIARY / NO:** *TO BE FILLED BY MANAGEMENT*

# Report:

## 1. SCIENTIFIC SUMMARY

The results from the current Epoch of Reionization (EoR) experiments (using e.g. LOFAR, MWA and PAPER) are currently under way. These very deep observations will not only set constraints on when and where the first sources formed in the early Universe and began (re)ionizing the predominantly neutral all-pervasive intergalactic medium, but they are also providing high-quality data for cutting edge auxiliary foreground science.

Obviously studying the physical origin of the foregrounds, whether Galactic or extragalactic, is a very exciting field in its own right and is of fundamental importance for perfecting the foreground removal techniques in the cosmological experiments.

This symposium discussed both through: (i) giving the clearest and widest possible view on the EoR; (ii) showing the richness of data and presenting the state-of-the-art foreground science; and (iii) discussing challenges of upcoming and planned radio facilities (e.g. HERA and SKA).

Based on presented results of the major low-frequency radio telescopes there is substantial overall progress towards the detection of the cosmological 21cm signal. However, the effort required is much more demanding than it previously thought. Issues related to precision calibration of the instruments and subtle systematic biases are mainly hindering detection at present. Different teams are now working on resolving some of these issues. In the coming months, the LOFAR-EoR team expects to set soon the best upper limits on the EoR signal, ruling out some unusual reionization history scenarios.

Recent low frequency observations also revealed a bewildering variety of Galactic structures in polarization. Some of them are very long and straight filaments that resemble the observed HI fibers and correlate well with the magnetic field probed by the Planck mission. Their origin is still not known. This clearly calls for a multi-frequency study which, probes different physical quantities of the interstellar medium and its complicated structure.

Deep EoR observations started to reveal the true underlying distribution of very faint extragalactic sources. Theoretical source counts predict a significant contribution of star-forming galaxies at sub-mJy flux densities, but there is also the possibility of an unknown distribution of radio sources that might dominate at these flux densities. Combining these deep low-frequency radio data with observations at other frequencies will allow a detailed study of the formation and evolution of galaxies as a function of cosmic time and their environment.

This symposium highlighted the accomplishments of several RadioNet associated facilities, in particular LOFAR as the premier instrument to probe the signal of the EoR and simultaneously measure all emission from the contaminating (but scientifically very interesting) foregrounds.

The symposium topics were:

- (a) Cosmic Dawn and Epoch of Reionization: theory and simulations
- (b) Epoch of Reionization: observations and challenges
- (c) The first stars/galaxies and Epoch of Reionization
- (d) Galactic foreground science and multi-wavelength approach
- (e) Extragalactic foregrounds science, multi-wavelength approach and cosmic evolution
- (f) Foreground removal techniques

Dissemination of knowledge about these topics was given by the participants who come from different areas of radio astronomy and was a very important result of this meeting, as well as, spreading the notion that the RadioNet facilities are supporting fore-front science.

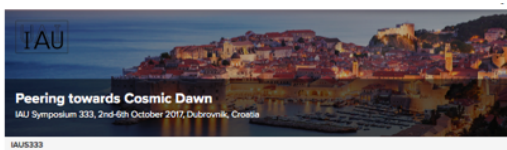
The scientific programme of the symposium was organized in 15 x 90min sessions, consisting of 8 invited reviews, 12 invited talks and 48 contributed talks. There were 3 posters and a 60min discussion.

The outreach programme of the symposium was directed to the general public and high school students. V. Jelic (RBI) gave a public lecture followed by stargazing. This event was organized at The Museum of Modern Art in Dubrovnik in collaboration with the Technical educational association of the city of Dubrovnik and the Astronomy Club Korčula. Several local and national media followed this event, reaching more than 50 000 viewers/readers.

IAUS333 remained well attended up to and including the last sessions on Friday with lively discussion during the sessions and the coffee and lunch breaks. Immediate feedback from many participants indicated that overall IAUS333 was experienced as a successful and timely meeting, generating many new ideas and forging new collaborations.



**IAUS333 website (<https://iaus333.irb.hr>)**



**Welcome**

The results from the current Epoch of Reionization (EoR) experiments (e.g. LOFAR, MWA and PAPER) are expected in coming years. These very deep observations will not only set constraints on when and where the first sources formed in the early Universe and began reionizing the predominantly neutral all-pervasive intergalactic medium, but will provide high-quality data for cutting edge auxiliary foreground science.

Obviously studying the physical origin of the foregrounds, whether Galactic or extragalactic, is a very exciting field in its own right and is of fundamental importance for perfecting the foreground removal techniques in the cosmological experiments.

This symposium, aimed at discussing both, is perfectly timed for: (i) getting the clearest and widest view possible on the EoR; (ii) showing the richness of data and presenting the state-of-the-art foreground science; and (iii) discussing challenges of coming and planned facilities (e.g. HERA and SKA).

Proceedings submission deadline 10 Dec 2017

[IAUS333 Programme](#)

**EXPLORE IAUS 333**

- Scientific Rationale and Topics
- Committees and Organisers
- Invited Speakers
- Programme
- Conference Venue and Lodging
- Participants
- IAU Travel Grants
- Public Outreach
- Code of Conduct
- Sponsors





## 2. AGENDA OF THE EVENT

The detailed programme of the IAUS333 symposium is attached to this report.

It was organized in 15 x 90min sessions, consisting of 8 invited reviews, 12 invited talks and 48 contributed talks. There were 3 posters and a 60min discussion.

## 3. PARTICIPANTS

The list of participants (name/institutes/countries) is attached to this report.

In total 83 participants attended the conference: 62% from Europe, 11% from North America, 11% from Asia, 12% from Australia, and 4% from Africa. The fraction of female participants was 26.5%. The fraction of students and young researchers was around 60%. Four students from Europe (2 female and 2 male) were supported by RadioNet.

There were 20 invited speakers: 55% from Europe, 15% from North America, 15% from Australia, 10% from Asia and 5% from Africa. The fraction of female invited speakers was 50%. Two invited speakers from Europe (1 female and 1 male) were supported by RadioNet.



#### **4. RADIONET FINANCIAL CONTRIBUTION**

1. Two invited speakers received 1500 EUR
2. Four students and young researchers received 2500 EUR
3. Organizational costs were supported with 500 EUR

TOTAL 4500 EUR

#### **5. PUBLICATIONS**

The proceedings of IAUS333 will be dedicated to Prof. dr. Ger de Bruyn (1948-2017), who has been a leading figure in radio astronomy in the last few decades and has been instrumental in the development of LOFAR, especially the LOFAR-EoR key science project. The proceedings will be published as an International Astronomical Union Proceedings Series within six months of the symposium by Cambridge University Press.