Effelsberg Newsletter

September 2017

Photo Credit: Michael Kramer

Call for Proposals

Deadline: October 4, 2017, 15:00 UT

Observing proposals are invited for the Effelsberg 100-meter Radio Telescope of the Max Planck Institute for Radio Astronomy (MPIfR). The Effelsberg telescope is one of the World's largest fully steerable instruments. This extreme-precision antenna is used exclusively for research in radio astronomy, both as a stand-alone instrument as well as for Very Long Baseline Interferometry (VLBI) experiments. Access to the telescope is open to all qualified astronomers. Use of the instrument by scientists from outside the MPIfR is strongly encouraged. The institute can provide support and advice on project preparation, observation, and data analysis. The directors of the institute make observing time available to applicants based on the recommendations of the Program Committee for Effelsberg (PKE), which judges the scientific merit (and technical feasibility) of the observing requests.

Information about the telescope, its receivers and backends and the Program Committee can be found at http://www.mpifr-bonn.mpg.de/effelsberg/astronomers (potential observers are especially encouraged to visit the wiki pages!).

Observing modes

Possible observing modes include spectral line, continuum, and pulsar observations as well as VLBI. Available backends are several FFT spectrometers (with up to 65536 channels per subband/polarization), a digital continuum backend, a number of polarimeters, several pulsar systems (coherent and incoherent dedispersion), and two VLBI terminals (dBBC and RDBE type with MK5 recorders). Receiving systems cover the frequency range from 0.3 to 96 GHz. The actual availability of the receivers depends on technical circumstances and proposal pressure. For a description of the receivers see the web pages. Please note, that observing proposals for the new Phased-Array-Feed cannot yet accepted – the system is still being commissioned.

How to submit

Applicants should use the NorthStar proposal tool for preparation and submission of their observing requests. North Star is reachable at

https://northstar.mpifr-bonn.mpg.de/

For VLBI proposals special rules apply. For proposals which request Effelsberg as part of the European VLBI Network (EVN) see:

http://www.evlbi.org/proposals/.

Information on proposals for the Global mm-VLBI network can be found at

http://www3.mpifr-bonn.mpg.de/div/vlbi/globalmm/index.html.

Other proposals which ask for Effelsberg plus (an)other antenna(s) should be submitted twice, one to the MPIfR and a second to the institute(s) operating the other telescope(s) (eg. to NRAO for the VLBA).

After October, the next deadline will be on February 5, 2018, 15:00 UT.

RadioNet Transnational Access Programme

RadioNet (see http://www.radionet-org.eu/) includes a coherent set of Transnational Access (TA) programs aimed at significantly improving the access of European astronomers to the major radio astronomical infrastructures that exist in, or are owned and run by, European organizations.

Astronomers who are based in the EU and the Associated States but are not affiliated to a German astronomical institute, may also receive additional aid from the Transnational Access (TA) Program of "RadioNet". This will entail free access to the telescope, as well as financial support of travel and accommodation expenses for one of the proposal team members to visit the Effelsberg telescope for observations.

The Transnational Access program is one of the activities of "RadioNet", an Integrated Infrastructure Initiative (I3) funded under the ECs Framework Program Horizon2020, that has pulled together all of Europe's leading astronomy facilities to produce a focused, coherent and integrated project that will significantly enhance the quality and quantity of science performed by European astronomers.

One - in exceptional cases more - scientists who are going to Effelsberg for observations can be supported, if the User Group Leader (i.e., the PI - a User Group is a team of one or more researchers) and the majority of the users work in (a) country(ies) other than the country where the installation is located. Only user groups that are allowed to disseminate the results they have generated under this program may benefit from the access.

For more details see http://www.radionet-org.eu/ .

After completion of their observations, TNA supported scientists are required to submit their feedback through the TNA web pages.

by Alex Kraus

Workshop Invitation: Science with the 100-m telescope

The Max-Planck-Institute for Radio Astronomy is happy to invite you to the workshop

"The Big Impact of a Big Dish: Science with the Effelsberg 100-m Telescope"

which will be held on

February 20-21, 2018 at the MPIfR in Bonn.

Please note, that the workshop was originally planned for November 2017, but had to be postponed due to the World Climate Conference which will take place in Bonn at the same time.

Even more than 40 years after its inauguration, the 100-m telescope is still one of the two largest fully-steerable radio telescopes in the world, and – due to continuous efforts by the institute and the Max-Planck-Society – in an excellent shape. It is heavily used for astronomical observations and accessible by users from all over the world due to its "Open Skies" policy.

This meeting is intended to bring together various user groups of the 100-m telescope with the support staff of the observatory and the technical developers. We are looking forward to the opportunity to discuss recent observational results and technical developments with the users of the 100-m telescope. Furthermore, this meeting will give us the possibility to learn about new ideas for observing projects and will allow us to plan technical and software development for the next years.

The deadline for registration and abstract submission will be December 1, 2017.

More information about the meeting and the registration process could be found on our meeting webpage https://events.mpifr-bonn.mpg.de/indico/event/48/overview

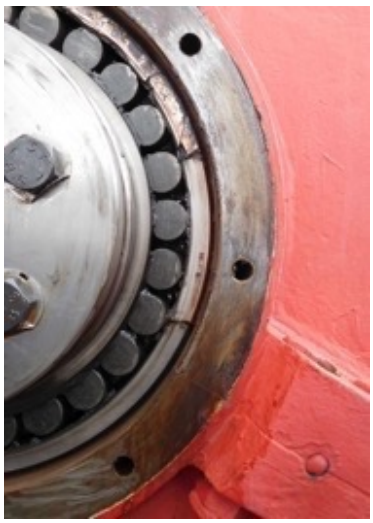
For questions, please contact us at effws2018@mpifr.de.

We hope to meet you in Bonn in February!

SOC: Matthias Kadler (University of Würzburg, Chair), Andreas Brunthaler (MPIfR), Paulo Freire (MPIfR), Fabrice Herpin (University of Bordeaux, France), Gemma Janssen (ASTRON, Netherlands), Alexander Karim (University of Bonn, Germany), Alex Kraus (MPIfR), Thomas Krichbaum (MPIfR), John McKean (University of Groningen & ASTRON, Netherlands)

LOC: Olaf Wucknitz (Chair), Busaba Kramer, Eduardo Ros and Ute Runkel

News in Brief



A fortunately quick repair of a serious failure

During the night of July 26/27, the telescope operator on duty noted some strange noise from the azimuth drive no. 13. Because the exact reason for this noise was unclear, he stopped the telescope operation preventively. A thorough check on July 27 revealed a broken roller bearing of one of the 32 azimuth wheels – a major failure which has not happened at Effelsberg since 1994 and never on a driven wheel.

Immediate actions to prepare the repair were undertaken and it turned out that the staff of the 100-m telescope was able to solve this problem which seemed to cause a long stop of operations within just a few days.

The biggest challenge was to get the proper repair tools for Effelsberg in a very short time. That was successfully accomplished and on July 31, the repair work started. For this, the part of the undercarriage with the broken bearing was lifted up hydraulically by about 1cm. After that, the housing cover of the wheel bearing was carefully removed to access the broken bearing.

With a special tool, it could be removed, and a new one was inserted, greased, and adjusted. After the reinstallation of the housing cover, a driving test was performed on August 2nd. As this was successful, the telescope was already back in operation again only seven days after the discovery of the crack.

Science & Technical Highlights

Phased Array Feed at Effelsberg

by Xinping Deng

Fig. 1 The Phased Array Feed frontend installed at primary focus of Effelsberg 100m telescope.

In a collaboration the CASS of Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the MPIfR have embarked on a project to install and utilize a Phased Array Feed (PAF) on large-gain, single-dish telescope with significant direct access for astronomers. A PAF significantly enlarges the Field-of-View (FOV) of the telescope, enabling especially large-area surveys and/or searches for pulsars or Fast Radio Bursts (FRBs).

After first commissioning observations on the Parkes 64-m telescope (Chippendale et al. 2017; Deng et al. 2017; Reynolds et al., in press) the PAF was shipped to Effelsberg and first tested in Spring this year. In order to commission the PAF, it was installed in the primary focus of Effelsberg 100-m telescope from 3rd August to 10th August.

A PAF receiver is a dense array of antenna elements at the focus of a reflector telescope and the output of these elements can be combined to form beams on the sky. The direction of these beams is controlled by varying the weighting of individual elements of the PAF. The PAF system described here was designed for the Australian Square Kilometer Array Pathfinder (ASKAP) telescope, but modified for use on the Effelsberg telescope. As there is more radio-frequency interference (RFI) at Effelsberg than at the ASKAP site, we used narrower bandpass filters in the PAF to reject interference from mobile phones and lower-frequency digital television services. The PAF system used at Parkes was optimized to cover the quieter 1.2 GHz to 1.74 GHz band with two frequency bands covering 1.2 GHz to 1.48 GHz and 1.34 GHz to 1.74 GHz.

An array of 188 connected “chequerboard” antenna elements is distributed over approximately a 1.2m diameter circle. It is a dual-polarization receiver and each polarization has 94 elements. The analog signals from all elements, each of up to 600 MHz bandwidth, are transmitted to the digital receiver via RF-over-fiber links and sampled there by 12 “Dragonfly” digital receivers. The digital receivers also channelize the data to 1 MHz via a multi-stage oversampled filterbank. With 16 ports per receiver this results in a 192 port digital system, with four spare ports beyond the 188 connected to the PAF. The digitized signals are processed by eight “Redback'” beamformers to form up to 36 dual-polarization beams of 384 MHz bandwidth (48 MHz per beamformer) in 1 MHz frequency channels. We stream 336 MHz of 16 bit beamformed baseband data (42 MHz per beamformer) at the full sampling rate into Graphics Processing Unit (GPU) nodes via

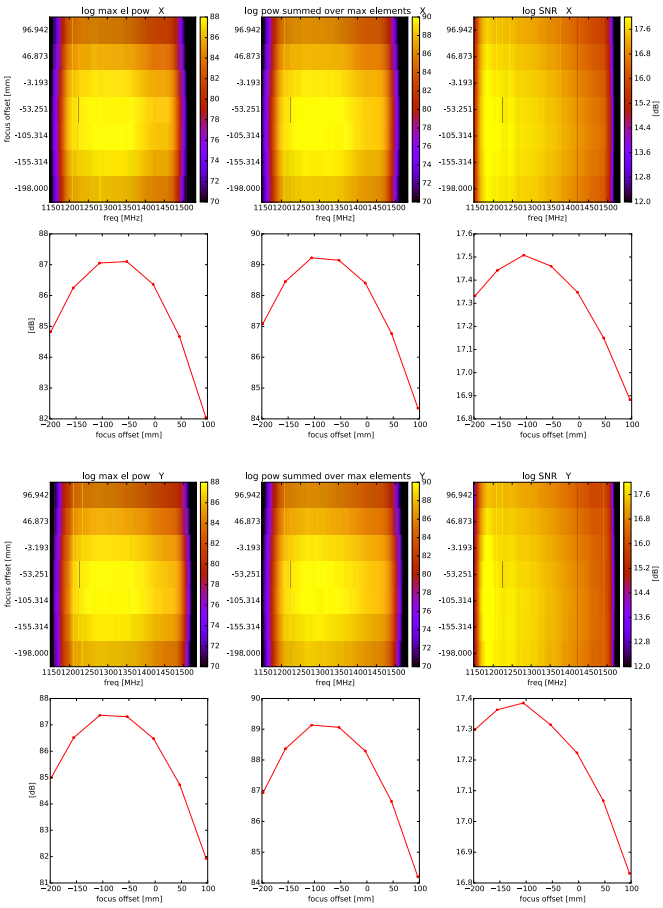


Fig. 2 Focus test for different polarisations with three different methods. The top figure is for polarisation x and the bottom figure is for polarisation y. Left: power in "hottest" element, middle: sum of power in innermost elements, right: signal-to-noise ratio with optimal beamforming.

Ethernet switches in 7MHz frequency chunks. The beamformed data is converted to filterbank format files on these GPU nodes for further processing.

As PAF frontend can only be installed outside of primary focus cabin, we cannot use the focus offset of other receivers (which are installed inside primary focus cabin) to observe with PAF. Observations to Cas A have been done with different focus offsets and three different methods were employed to analyze these observations to find the optimal focus offset for two polarizations. We can see from Fig. 2 that no matter which method is used to analyze the observation, the optimal focus offset for both polarizations is always around 100mm.

In order to get a first impression of Radio Frequency Interference (RFI) at Effelsberg, we scanned the antenna over 35˚ to 393˚ in azimuth at a variety of fixed elevations and recorded 1 MHz resolution spectra from the coarse filterbank (CFB) of the digital receiver. Here we show a summary of all azimuth scans generated by, at each azimuth, taking the sum over all PAF elements of the 90th percentile power over the passband in each element. Further improved version of these scans will be used to determine the optimal telescope position for PAF operations.

We measured the system temperature over efficiency of PAF central beam with on and off-source observations to Cas A. Fig. 4 presents the result with RFI channels manually deleted. We can see that the system temperature over efficiency is around 70 K for the central band. The system temperature increases towards the edges of band, with much better performance between 800 and 1400 MHz. Again, similar observations will be used in the future to determine the optimal usage of the PAF during normal operations.

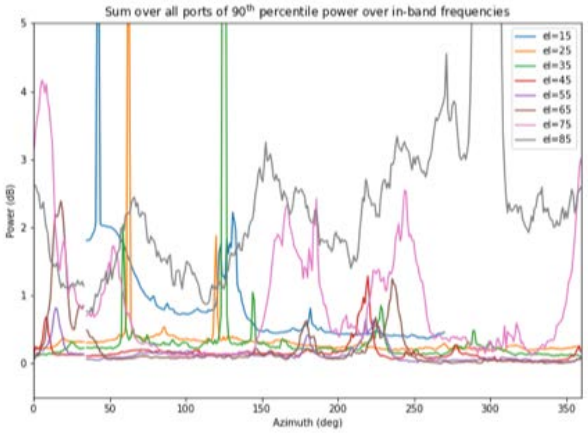


Fig. 3 Azimuth scan summary.

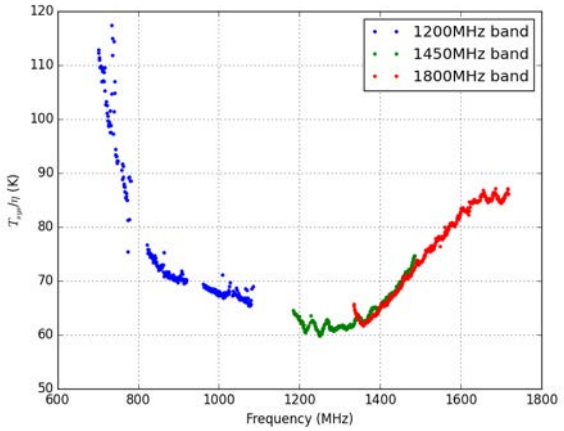


Fig 4 System temperature over efficiency of PAF central beam.

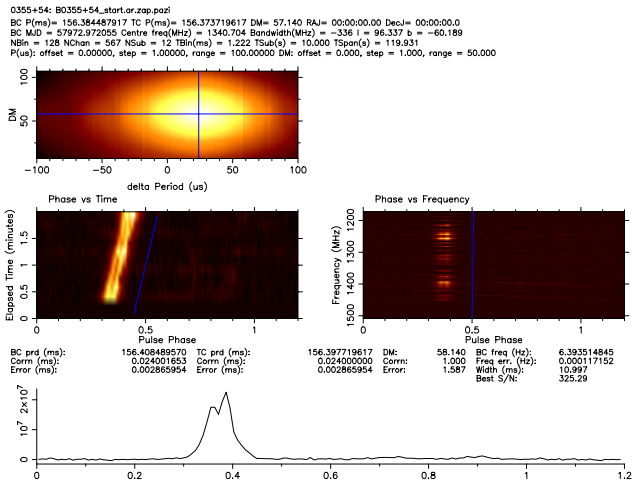


Fig. 5 Observation to PSR J0358+5413 (B0355+54) with PAF system.

Observations of strong pulsars were performed check the behaviour of an end-to-end PAF system. The result shown here is for the observation of PSR J0358+5413 (B0355+54) with the PAF's central beam. Further commissioning observations will be conducted, before first science observations are planned to commence at the end of 2017/early 2018.

This project represents the combined efforts of a large number of people. For the Effelsberg installation we are particularly grateful to (among others): Ewan Barr, Aaron Chippendale, Daniel George, Guðjón Henning Hilmarsson, Leonard Houben, Simon Johnston, Ramesh Karuppusamy, Mike Keith, Michael Kramer, Mateusz Malenta, Laura Spitler, Olaf Wucknitz, Gundolf Wieching.

We are especially grateful to the highly motivated and skilled staff at Effelsberg.

References:

Chippendale A. P., Beresford R. J., Deng X., Leach M., Reynolds J. E., Kramer M., Tzioumis T., 2016, in 2016 International Conference on Electromagnetics in Advanced Applications (ICEAA). pp 909–912

Deng X., Chippendale A.P. Hobbs G., Johnston S., Dai S, George D, Kramer M., Karuppusamy R., Malenta M., Spitler L., Tzioumis T., Wieching, 2017, PASA, 34, 26

Reynolds T., et al., in press, arXiv:170905085

Who is Who in Effelsberg ?

Majid Esmailpour Motlagh

An Operator of the 100-m Telescope

I was born in Sari, in the north of Iran, located on the south shore of Caspian Sea, one of the favorite summer vacation places in the sixties and seventies. After high school in Babol, near the Caspian Sea, I started to study Physics in Teheran.

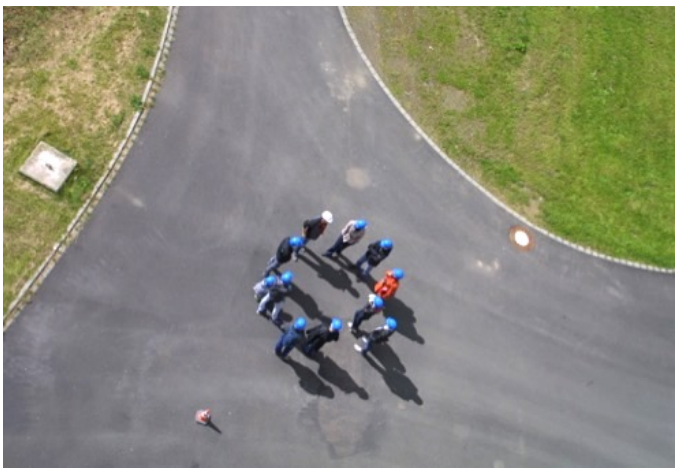
A few years later, I moved to Germany and experienced a new language, culture and politics. I have studied electrical and telecommunication engineering at Fachhochschule (University of Applied Science) Hannover. Later on, I worked for about 22 years for Deutsche Telekom, as Public Switched Telephone Network (PSTN) planer, in Cologne and Düsseldorf.

In 2012, I moved with my family to beautiful Vancouver, British Colombia, Canada, to realize a family dream “living together with family and relatives in one city”. During my English course, and part time work in North Vancouver, I gathered a lot of experience by contact with old residents and newcomers.

After two years living in Canada, I came back to Germany. I started to work with Max Planck Institute for Radio Astronomy in Effelsberg as receiver engineer in November 2015. I assisted in maintaining the radio telescope receivers and developing the time signal, reference signal and IF-infrastructure.

Since summer 2016, I am working as radio telescope operator in Effelsberg, and I am enjoying the work with friendly colleagues and international researchers.

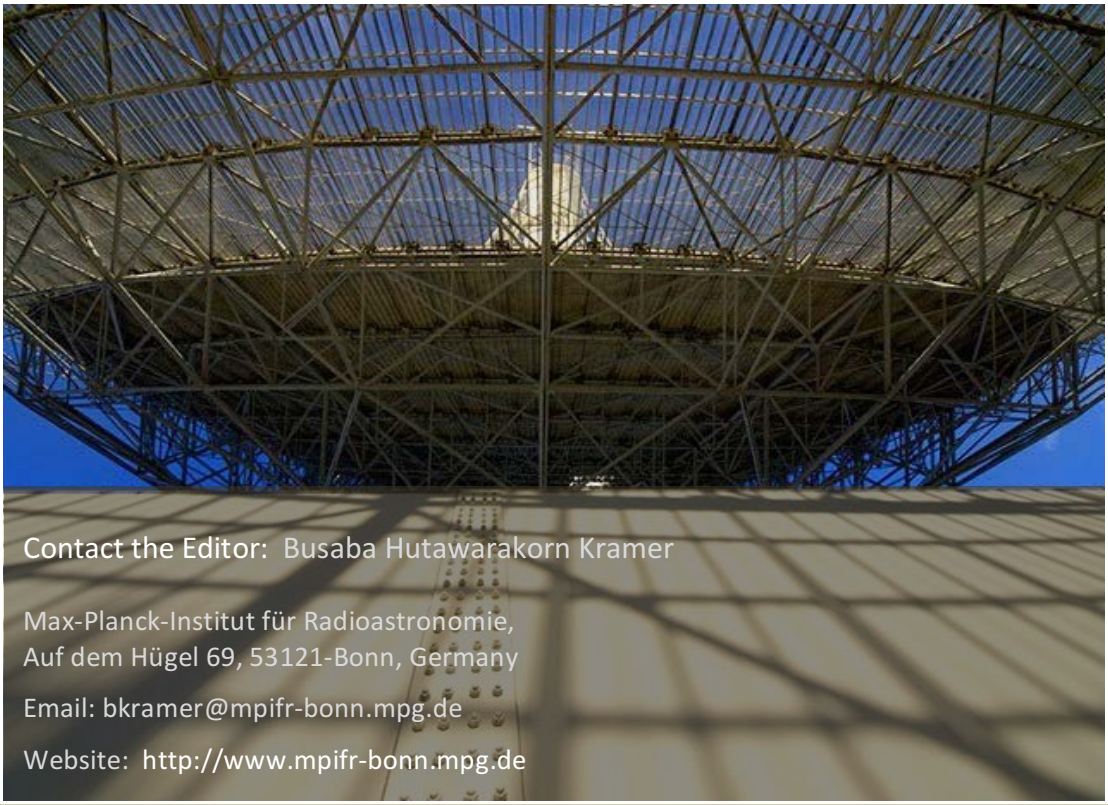
Open Door at Effelsberg Observatory



On Sep 9, the observatory opened its doors for the public – about six years after the last such event.

Despite rather mediocre weather conditions, more than 2000 visitors took the opportunity to enter the observatory. As always, the possibility to go onto the elevation platform of the 100-m telescope (in 20m height) was a highlight for all visitors. In addition to this, the staff of the observatory as well as colleagues of the institute's headquarters in Bonn did a number of presentations about their scientific and technical work, about the receiver design and construction, and showed the machinery in the workshop. Live observations (on pulsars) were performed with the 100-m telescope as well as with a 4-m telescope on the sun.

Some impressions of the event are shown here – pictures were taken by Geomarr van Tonder.



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