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Call for proposals

Deadline Sep 28, 2023, UT 15.00

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) observations.

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 MK6 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.

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: https://www.evlbi.org/using-evn/ .

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).

Important Remarks

Please note, that the Effelsberg Programme Committee (PKE) is composed of several scientist with different backgrounds. It is hence advisable to write the proposals in a way that they could be understood by readers who are not working in the particular field.
Furthermore, it should be noted that all proposals are treated confidentially. Therefore, it is not necessary to withhold or obscure information, which on the contrary might lead to a downgrading of the proposal.

The following deadlines will be on Feb 5th, 2024 and on May 30th, 2024.

Opticon-RadioNet-Pilot Transnational Access Programme

The new Opticon-RadioNet-Pilot (ORP) project (see https://www.orp-h2020.eu) includes a coherent set of Transnational Access (TA) programs aimed at significantly improving the access of European astronomers to the major 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 personal aid from the Transnational Access (TA) Program of the ORP. 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.

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 https://www.orp-h2020.eu/TA-VA .

After completion of their observations, TA supported scientists are required to submit their feedback to the ORP project management and the EU. Publications based on these observations should be acknowledged accordingly:

The research leading to these results has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004719 [ORP].

by Alex Kraus


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News from the observatory

Project to renew the main axes drive control continues

As reported earlier (issue 1/2023 of this newsletter), we recently initiated a project to renovate the main axes drives, including the power units and the corresponding control systems.

The project started in January this year, and we had the Critical Design Review in July. All tasks are well on track and we are optimistic that we will stick on the schedule. It is planned to have the new hard- and software installed in summer 2024. That will lead to an interruption of the operations. However, we expect to have this break outside the planned VLBI sessions and for not longer than a few weeks.

We will keep you posted on this project in the next issues of this newsletter.

New UBB receiver under commissioning

A new Ultra-Broad-Band receiver for the prime focus is currently under commissioning. The double-polarization system covers a frequency range of 1.3-6 GHz – eventually, it will be possible to access the full band instantaneously. First tests of the receiver were very promising and showed a system temperature of about 20-25 K throughout the band.

The UBB will be the first receiver which will be fully equipped with the new EDD-System ("Effelsberg Direct Digitization"). The frontend unit of the EDD is adapted to the receiver requirements and digitizes the RF signal already in the receiver cabin. Over a high speed link the data is transferred to the backend unit of the EDD which consists of a high-performance computer cluster with dedicated software flexibly realizing various backends modes.

We expect to have the receiver available for observations at the next deadline in February 2024. A detailed report on the UBB receiver and the EDD system will be presented in the next issue of this newsletter.

Open Door

On Sep 9, the observatory opened its doors for the public – due to the pandemic, the last such event took place exactly six years ago. About 2000 visitors took the opportunity to visit the observatory.

The possibility to enter 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 prepared 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.

A new view of the Universe

Clock-like precision of pulsars opens a new window in the gravitational wave spectrum

A PRESS RELEASE OF JUNE 29, 2023 BY THE MPIFR

An international collaboration of European astronomers including scientists from the Max Planck Institutes for Radio Astronomy (MPIfR) and Gravitational Physics (Albert Einstein Institute, AEI), together with Indian and Japanese colleagues, have published the results of more than 25 years of observations from six of the World's most sensitive radio telescopes. Along with other international collaborations, the European and Indian Pulsar Timing Arrays have independently found evidence for ultra-low-frequency gravitational waves, expected to come from pairs of supermassive black holes found in the centres of merging galaxies. These results are a crucial milestone in opening a new, astrophysically rich window in the gravitational wave spectrum.

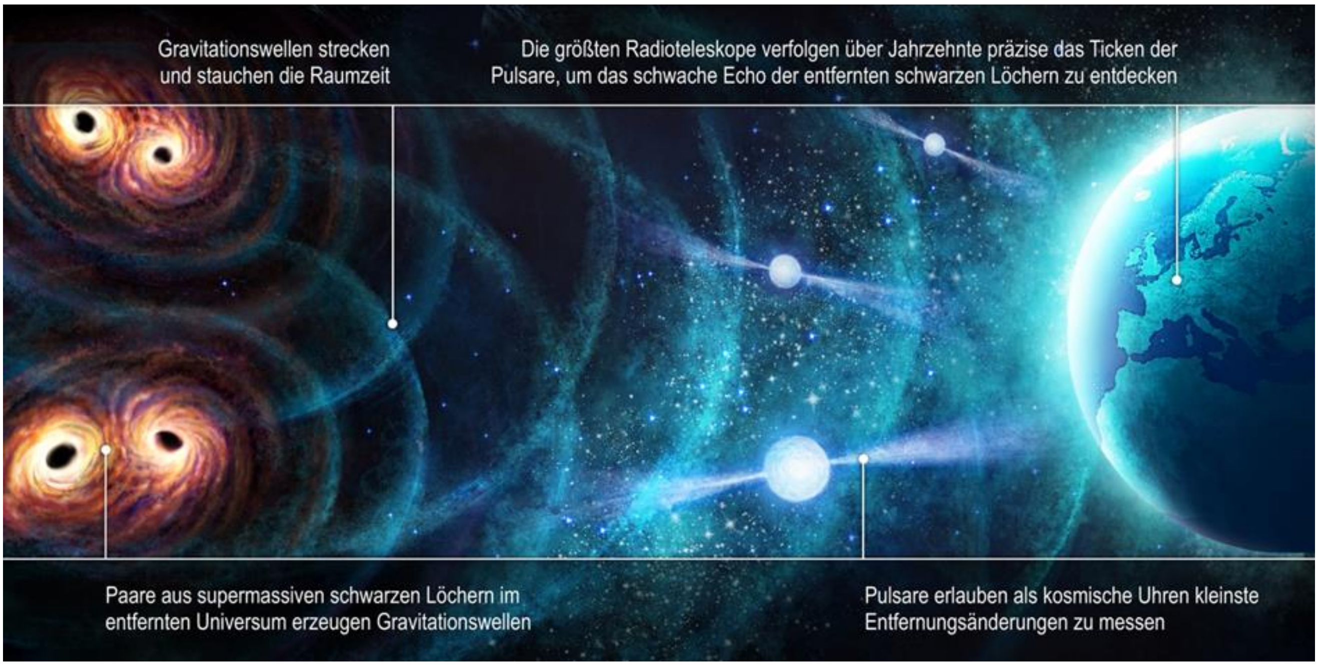

Fig. 1: A cosmic population of binary supermassive black holes generates a background of gravitational waves. Pulsars are rapidly rotating neutron stars and are the most precise clocks in the Universe. When a gravitational wave passes the Pulsar Timing Array, the arrival time of the pulses on Earth is affected by a tiny amount of less than 100 nanoseconds. The largest telescopes on Earth are used to precisely monitor the rotating ticks of these pulsars over decades to reveal the faint echoes of distant black holes.

In a series of papers published this week in "Astronomy and Astrophysics", scientists of the "European Pulsar Timing Array" (EPTA), in collaboration with Indian and Japanese colleagues of the "Indian Pulsar Timing Array" (InPTA), report on results from data collected over 25 years, which bring with them the promise of unprecedented discoveries in the study of the formation and evolution of our Universe and the galaxies that populate it.

The EPTA is a collaboration of scientists from more than ten institutions across Europe, and brings together astronomers and theoretical physicists in order to use observations of ultra-regular pulses from extinguished stars called 'pulsars' to construct a Galaxy-sized gravitational wave detector.

"Pulsars are excellent natural clocks. We use the incredible regularity of their signals to search for minute changes in their ticking to detect the subtle stretching and squeezing of space-time by gravitational waves originating from the distant Universe", explains Dr David Champion, senior scientist at the MPIfR in Bonn, Germany.

This gigantic gravitational wave detector - spanning from the Earth to 25 chosen pulsars across the Galaxy - makes it possible to probe gravitational waves frequencies much lower than those probed by other experiments, opening a new window in the gravitational wave universe.

"At the centre of galaxies lurk supermassive black holes, several million times heavier than the Sun. As the pulses from the pulsars travel to Earth they are imprinted with the faint, distant echoes of the gravitational waves emitted by these monster black holes", says Dr Aditya Parthasarathy, a researcher at the MPIfR. These echos contain information about the cosmic population of supermassive binary black holes which form when galaxies merge, marking the opening of a new window into the Universe.

These results are based on decades of coordinated observing campaigns using the five largest radio telescopes in Europe: the 100-m Effelsberg Radio in Germany, the Lovell Telescope in the United Kingdom, the Nançay Radio Telescope in France, the Sardinia Radio Telescope in Italy and the Westerbork Radio Synthesis Telescope in the Netherlands.

Prof Michael Kramer, director at the MPIfR in Bonn, Germany, emphasises, "Data from the Effelsberg telescope stretches back more than 25 years. This is important, as it makes the EPTA uniquely sensitive to the lowest frequencies probed".

"Once a month," adds Dr. Kuo Liu from the MPIfR in Bonn, "the European telescopes are additionally recording data together as the Large European Array for Pulsars (LEAP) to give an extra boost of sensitivity, comparable to the largest radio telescope on Earth". These observations have been also complemented by data provided by InPTA, leading to the development of a uniquely sensitive dataset.

Dr. Yajun Gou, researcher at the MPIfR, explains the significance, "Our telescopes have observed the pulsars very often and over a very long time. We can probe frequencies of the gravitational waves as slow as 1 oscillation every 30 years, improving the sensitivity towards black hole binary systems with orbital periods up to 50 years". In contrast, the high cadence of the data makes it possible to study frequencies as fast as 100 oscillations per month. Doctoral student Jiwoon Jang translates, "we can probe black hole systems with orbital periods of years to months."

The announcement of the EPTAs results is coordinated with similar publications by other collaborations across the world, namely the Australian, Chinese, and North-American pulsar timing array (PTA) collaborations, abbreviated as the PPTA, CPTA and NANOGrav, respectively. Astronomers are confident that what they see are signatures of gravitational waves as their results are consistent with and supported by similar data and results across all PTA collaborations.

"Analysing the data from pulsar timing arrays is complicated by the fact that PTAs use astrophysical objects as detectors," says Dr. Jonathan Gair, Group Leader in the "Astrophysical and Cosmological Relativity" department at the Max Planck Institute for Gravitational Physics (Albert Einstein Institute) in Potsdam and co-author of the study. "There are many different sources of noise intrinsic to the pulsars that must be accounted for while searching for the signature of gravitational waves. The signal itself is also stochastic, so it looks like noise."

The analysis of the EPTA data presented today is in line with what astrophysicists expect. Nevertheless, the gold-standard in physics to claim the detection of a new phenomenon is that the result of the experiment has a probability of occurring by chance less than one time in a million. The result reported by EPTA - as well as by the other international collaborations – does not yet meet this criterion. However, scientists from most of the leading PTAs are combining their data sets under the auspices of the International Pulsar Timing Array. The aim is to expand the current datasets, by exploiting an array consisting of over 100 pulsars, observed with thirteen radio telescopes, and agglomerating more than 1,000 observations for each pulsar, which should allow the astronomers to obtain irreproachable proof of having expanded the gravitational wave window on the Universe.

Fig. 2: *Artistic Impression of a Pulsar Timing Experiment*