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Call for proposals – Deadline June 4, 2019, UT 15:00

by Alex Kraus

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 https://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.

Please note, that observing proposals for the new **Phased-Array-Feed** cannot be accepted yet – the system is still being commissioned. The new 20mm receiver is fully usable, however.

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 June, the following deadline will be on October 2, 2019, 15:00 UT.

RadioNet Transnational Access Programme

by Alex Kraus

RadioNet (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.

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

A new Ku-Band (12-18 GHz) receiver for the 100m-telescope

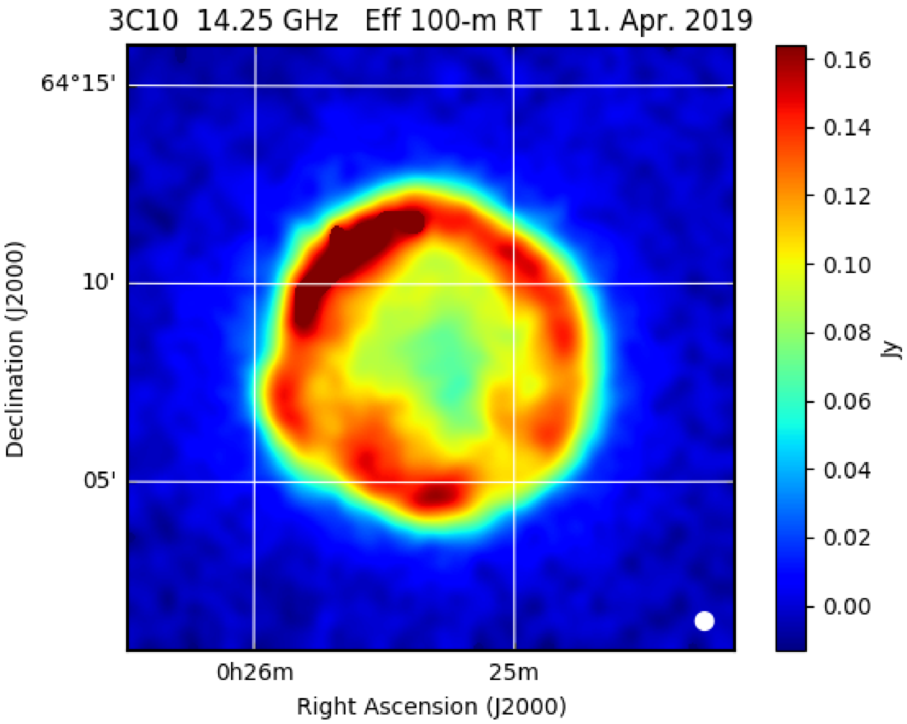
by Alex Kraus

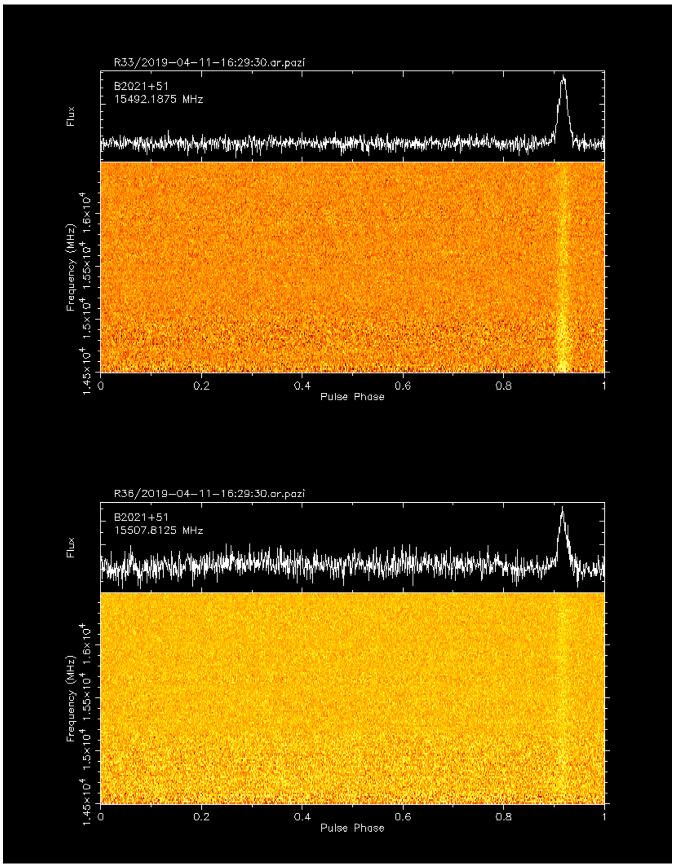
On April 2, a new Ku-Band receiver has been installed in the secondary focus of the 100-m telescope. This two-pixel system covers the frequency range from 12-18 GHz and could be used for continuum, spectroscopy, pulsar and VLBI observations.

First tests went very smoothly and showed the good performance of the receiver – system temperatures in zenith are about 30-40 K. Therefore, the system is available for observations immediately.

For continuum and spectroscopy observations bandwidths of 2x2x2.5 GHz (two basebands, left- and right-circular polarization) or of 2x300 MHz are available (with 65535 channels per baseband and polarization in spectroscopic mode). Pulsar observations in timing mode were successful and so was also a VLBI observations together with NRAO's VLBA.

Top: Transport and Installation of the receiver in the secondary focus cabin.
Bottom: The new receiver in the telescope (the two blue horns in the center).





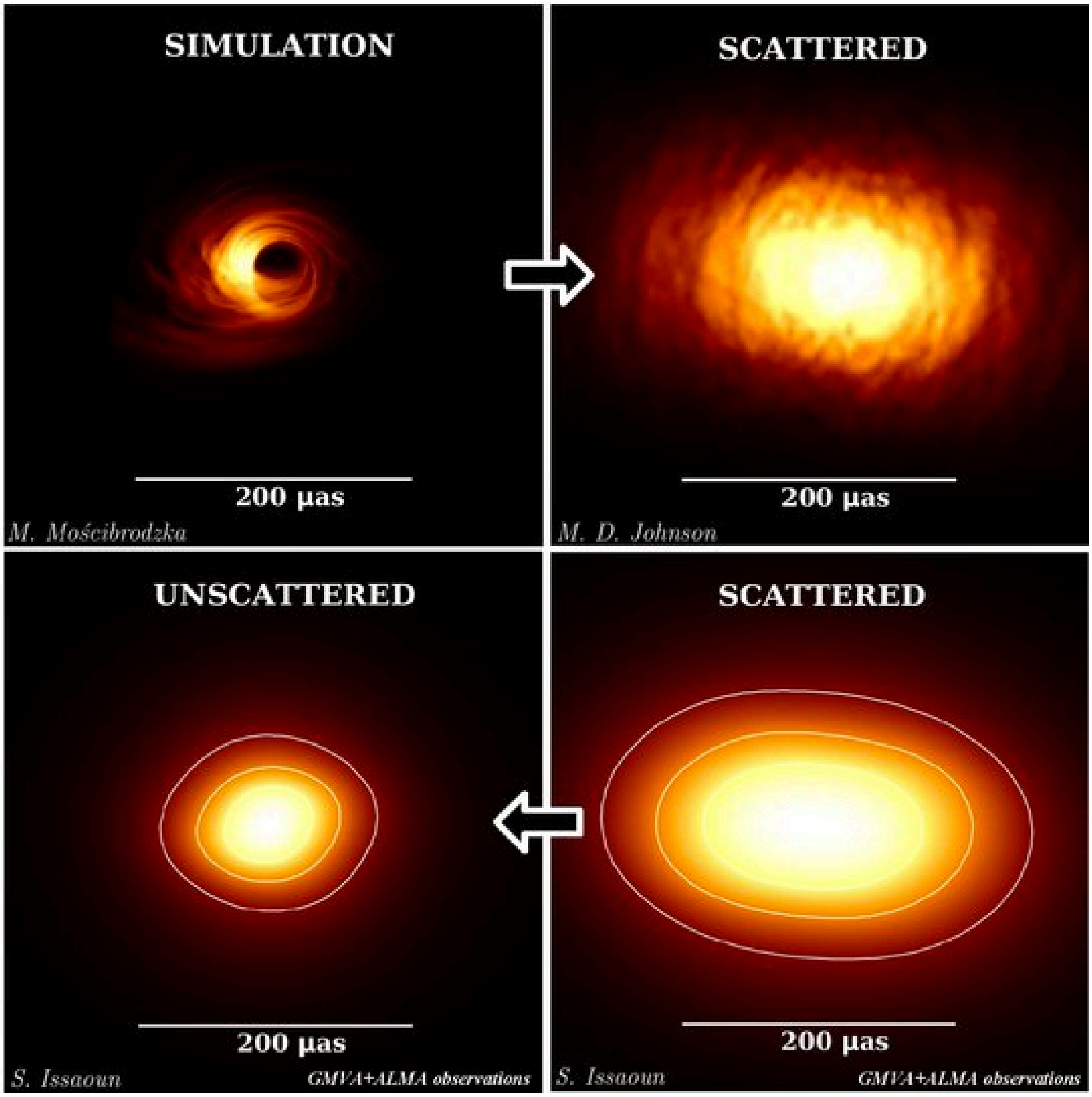
Top: Continuum map of Tycho's SNR (3C10) at 14.25 GHz *(by Alex Kraus)*
Bottom: First pulsar observations with the new receiver
(PSR B2020+51 *by Ramesh Karuppusamy*)

Lifting the veil on the black hole at the heart of our Galaxy

A press release from the MPIfR of January 2019

Including the powerful ALMA into an array of telescopes for the first time, astronomers have found that the emission from the supermassive black hole Sagittarius A* (Sgr A*) at the center of our Galaxy comes from a smaller region than previously thought. This may indicate that a radio jet from Sgr A* is pointed almost directly towards the Earth.

The work, performed by an international team with participation of the Max Planck Institute for Radio Astronomy, is published in the Astrophysical Journal.



Top left: Simulation of Sgr A at 86 GHz. Top right: Simulation with added effects of scattering. Bottom right: Scattered image from the observations, this is how we see Sgr A* on the sky. Bottom left: The unscattered image, after removing the effects of scattering along our line of sight, this is how Sgr A* really looks like.* © S. Issaoun, M. Mościbrodzka, Radboud University/ M. D. Johnson, CfA

So far, a foggy cloud of hot gas has prevented astronomers from making sharp images of the supermassive black hole Sgr A* and causing doubt on its true nature. They have now included for the first time the powerful ALMA telescope in northern Chile into a global network of radio telescopes to peer through this fog, but the source keeps surprising them: its emission region is so small that the source may actually have to point directly at the direction of the Earth.

Observing at a frequency of 86 GHz with the technique of Very Long Baseline Interferometry (VLBI), which combines many telescopes to form a virtual telescope the size of the Earth, the team succeeded in mapping out the exact properties of the light scattering blocking our view of Sgr A*. The removal of most of the scattering effects has produced a first image of the surroundings of the black hole.

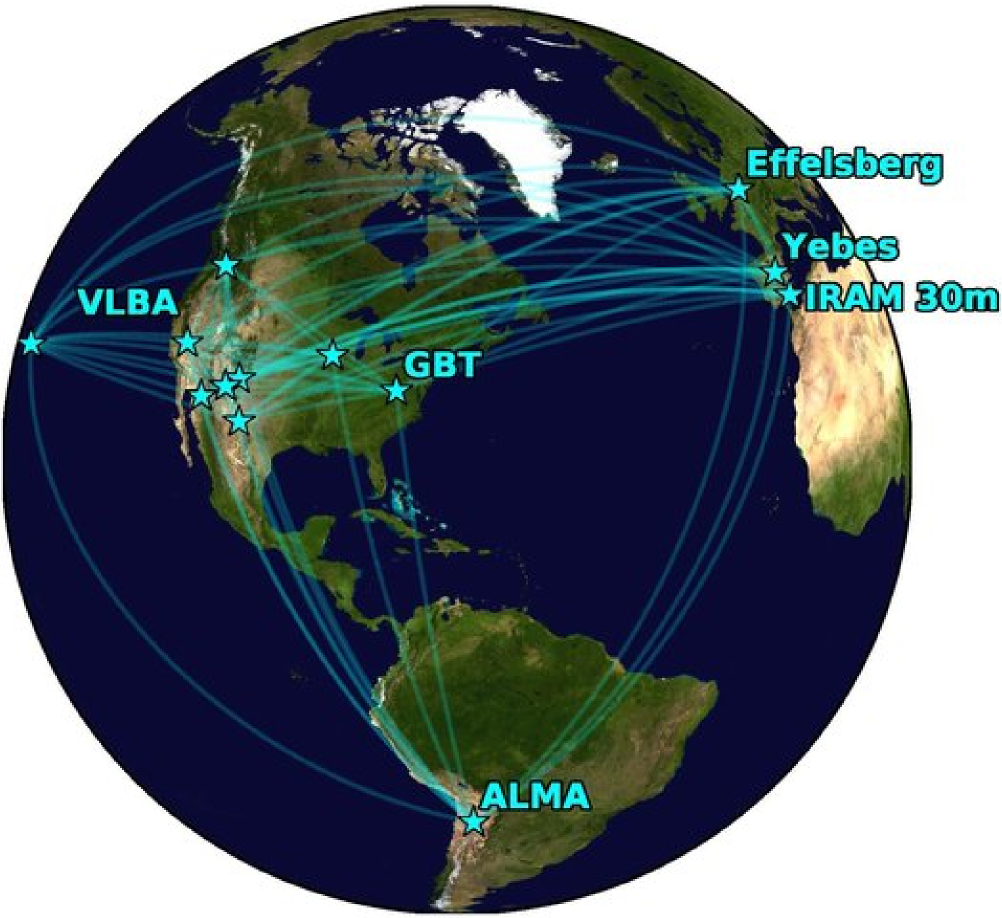
The high quality of the unscattered image has allowed the team to constrain theoretical models for the gas around Sgr A*. The bulk of the radio emission is coming from a mere 300 milllionth of a degree, and the source has a symmetrical morphology. “This may indicate that the radio emission is produced in a disk of infalling gas rather than by a radio jet,” explains Sara Issaoun, graduate student at the Radboud University Nijmegen in the Netherlands, who leads the work and has tested several computer models against the data. “However, that would make Sgr A* an exception compared to other radio emitting black holes. The alternative could be that the radio jet is pointing almost at us”.

The German astronomer Heino Falcke, Professor of Radio Astronomy at Radboud University and PhD supervisor of Issaoun, calls this statement very unusual, but he also no longer rules it out. Last year, Falcke would have considered this a contrived model, but recently the GRAVITY team came to a similar conclusion using ESO’s Very Large Telescope Interferometer of optical telescopes and an independent technique. “Maybe this is true after all”, concludes Falcke, “and we are looking at this beast from a very special vantage point.”

Supermassive black holes are common in the centers of galaxies and may generate the most energetic phenomena in the known universe. It is believed that, around these black holes, matter falls in a rotating disk and part of this matter is expelled in opposite directions along two narrow beams, called jets, at speeds close to the speed of light, which typically produces a lot of radio light. “Whether the radio emission seen from SgrA* originates from a symmetrical underlying structure, or is intrinsically asymmetric is a matter of intense discussion”, explains Thomas Krichbaum, member of the team.

Sgr A* is the nearest supermassive black hole and 'weighs' about 4 million solar masses. Its apparent size on the sky is less than a 100 millionth degree, which corresponds to the size of a tennis ball on the moon as seen from the Earth. To measure this, the technique of VLBI is required. The resolution achieved with VLBI is further increased by the observation frequency. The highest frequency to date for VLBI is 230 GHz. “The first observations of Sgr A* at 86 GHz date from 26 years ago, led by Thomas Krichbaum at our Institute, with only a handful of telescopes. Over the years, the quality of the data and imaging capabilities has improved steadily as more telescopes join.”, says J. Anton Zensus, director at the Max Planck Institute for Radio Astronomy and head of its Radio Astronomy/VLBI division.

The findings of Issaoun and her international team including scientists from two research departments (Kramer & Zensus) at MPIfR describe the first observations at 86 GHz in which ALMA also participated, by far the most sensitive telescope at this frequency. ALMA became part of the Global Millimeter VLBI Array (GMVA), which is operated by the Max Planck Institute for Radio Astronomy, in April 2017. The participation of ALMA, made possible by the ALMA Phasing Project effort, has been decisive for the success of this project.



The Global Millimeter VLBI Array (GMVA), with ALMA added
© S. Issaoun, Radboud University/ D. Pesce, CfA

The participation of ALMA in mm-VLBI is important because of its sensitivity and its location in the southern hemisphere. In addition to ALMA, twelve radio telescopes in North America and Europe also participated in the network. The resolution achieved was twice as large as in previous observations at this frequency and produced the first image of Sgr A* that is considerably reduced in interstellar scattering (an effect caused by density irregularities in the ionized material along the line of sight between Sgr A* and the Earth).

To remove the scattering and obtain the image, the team used a technique developed by Michael Johnson of the Harvard-Smithsonian Center for Astrophysics (CfA). "Even though scattering blurs and distorts the image of Sgr A*, the incredible resolution of these observations allowed us to pin down the exact properties of the scattering," says Johnson. "We could then remove most of the effects from scattering and begin to see what things look like near the black hole. The great news is that these observations show that scattering will not prevent the Event Horizon Telescope from seeing a black hole shadow at 230 GHz, if there's one to be seen."

Future studies at different wavelengths will provide complementary information and further observational constraints for this source, which holds the key to a better understanding of black holes, the most exotic objects in the known universe.

The 100-m telescope in Spring

Pictures by Norbert Tacken