

Effelsberg Newsletter

September 2015



Call for Proposals: Deadline - October 1, 2015, 15:00 UT

p2

Technical News:

- New Technical Department for Digital Signal Processing
- New Workshop Building for the Observatory
- Mark6: A New VLBI Recorder for Effelsberg

p3

p5

p5

Science Highlights:

- Twisted magnetic loop in the Giraffe galaxy IC 342

P6

Magnetic-Field Discovery Gives Clues to Galaxy-Formation Processes

Call for Proposals

Deadline: October 1, 2015, 15:00 UT



Credit: Norbert Tacke

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.

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) (e.g. to NRAO for the VLBA).

After October, the next deadline will be on February 3, 2016, 15:00 UT.

by Alex Kraus

TECHNICAL NEWS

New Technical Department for Digital Signal Processing

Bonn-Rhein-Sieg University of Applied Sciences and Max Planck Society sign Agreement on Cooperation that establishes a new department

by Norbert Junkes



Fig. 1 (left to right): Prof. Dr. Michael Kramer, the Executive Director of Max-Planck-Institut für Radioastronomie, Prof. Dr. Bernd Klein, Prof. Dr. Hartmut Ihne, the president of Bonn-Rhein-Sieg University of Applied Sciences. © Eva Tritschler/H-BRS

The Bonn-Rhein-Sieg University of Applied Sciences is one of the first Universities of applied Sciences in Germany collaborating with the Max Planck Society via an official cooperation agreement with the Max-Planck-Institut für Radioastronomie (MPIfR). Valid from April 01, 2015, this contract allows Prof. Bernd Klein the establishment of a technical department for Digital Signal Processing at MPIfR. While he will continue giving courses and examinations in the

Electrical/Mechanical Engineering Department of Bonn-Rhein-Sieg University of Applied Sciences, he sets up this strategically important department with the help of Dipl.-Phys. Udo Beckmann.

With this new fruitful collaboration, the Bonn-Rhein-Sieg University of Applied Sciences and the Max Planck Society will establish a local

network of excellence in research and education in the field of radio astronomy and connected technologies. "Collaboration with external research facilities provides an important impulse and enables science transfer for our University", says Hartmut Ihne, president of the Bonn-Rhein-Sieg University of Applied Sciences.

"The 40 year history of Universities of Applied Sciences in Northrhine-Westfalia (NRW) is a success story", says Svenja Schulze, science minister in NRW. "This is now proven by the Bonn-Rhein-Sieg University with its exemplary cooperation with the Max Planck Society, which is setting new standards. The Universities of Applied Sciences are a central part of the educational background in our state. We need them in order to master present and future challenges."

Professor Dr. Michael Kramer, Executive Director at MPIfR, points out that the institute had already benefited from Professor Klein being affiliated with the MPIfR as guest scientist previously. Even earlier, Klein had been the Head of the Digital Laboratory at MPIfR before he moved to the University at St. Augustin. According to Kramer, the new department will build on this successful relationship by becoming a technologically-based department for instrumentation that will support the other technology departments at MPIfR in the development of new receivers. "We are thus bringing together groups which had been working in different technological departments before."

"I view the new job as winning a jackpot in a lottery", says Bernd Klein. His new department for Digital Signal Processing will concentrate knowledge and will be essential for the vastly increased challenges in the field. "It will be particularly attractive for me because in my role as scientific head of the new department I shall not only coordinate the work of the whole institute in Digital Signal Processing, but also perform new projects in Research and

Development and bring in my own ideas." His recent research activity in radio astronomy brought him on board of the airborne observatory SOFIA (Stratospheric Observatory for Infrared Astronomy) participating in research flights from New Zealand at 13 km altitude.

Personal Data:

Professor Dr. Bernd Klein (age 47) started industrial training after finishing school and subsequently studied electrical engineering/technical informatics at Gießen-Friedberg University of Applied Science with a diploma degree in engineering. He continued with electrical engineering at Siegen University writing a diploma thesis, entitled "Einsatz und Programmierung eines Digitalen Signalprozessors" at Max-Planck-Institut für Radioastronomie. His PhD thesis, also at MPIfR, was on pulsar research with the title "Suche nach hochdispergierten Radio-Pulsaren in Richtung des Galaktischen Zentrums". A degree of 0,2 ("magna cum laude") could be called "galactic". Bernd Klein was head of the digital group at MPIfR. In October 2009 he started as professor for Electrical Circuit and Microprocessor Technology in the Electrical/Mechanical Engineering Department of Bonn-Rhein-Sieg University of Applied Sciences. Bernd Klein is married and lives in Alfter with his family.

New Workshop Building for the Observatory

by Alex Kraus

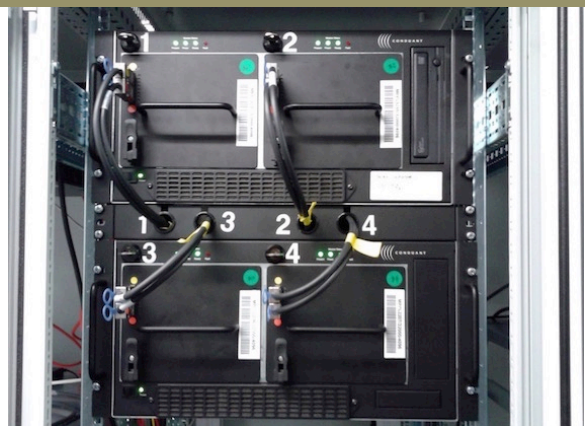


In spring this year, the construction of the new workshop building close to the 100-m telescope has been finished. All machinery which was located in the basement below the telescope has been moved into the new building, giving the observatory's personnel far better working conditions, easier access and a modern infrastructure. Included in the building is also the "receiver room" - our storage for prime focus receiver boxes which are not in use.

Mark6: A New VLBI Recorder for Effelsberg

by Uwe Bach

The Mark6 VLBI data recorder has been developed by Haystack Observatory as a successor of the Mark5 disk-based VLBI data recording system. It is based on high-performance COTS hardware and open-source software and able to record data at a rate of up to 16 Gbps. In May 2015 a Mark6 has been installed at the Effelsberg observatory to record data from the European VLBI Network (EVN) backend, the DBBC. Since the Mark6 carries four disk modules with currently up to 32 TB each it will be mainly used as a raid system with fixed disk modules that stay at Effelsberg and are not being shipped. The recorded data is transferred over the internet to the correlators at Bonn and JIVE to which Effelsberg is connected via a fast optical fibre link (10 GE). Data will be transferred to Socorro also as soon as a faster connection is available.



Recording on the Mark6 was first tested during the EVN Session in May/June in parallel to the normal Mark5B recording system. The test data was transferred to JIVE and has been successfully correlated. The Mark6 recorder is now fully integrated in the Effelsberg VLBI system and the next EVN Session will be recorded mainly on the new Mark6 – the Mark5 recorder will be kept as a backup only.

Science Highlights

Twisted magnetic loop in the Giraffe galaxy IC 342

Magnetic-Field Discovery Gives Clues to Galaxy-Formation Processes

Magnetic fields exist everywhere in the Universe, but there is still little idea how important they are for the evolution of cosmic objects. Radio waves are an ideal means to measure magnetic fields in galaxies. In a long-standing effort, Rainer Beck from the Max Planck Institute for Radio Astronomy (MPIfR) in Bonn, Germany, gathered a huge data set of the nearby galaxy IC 342 from observations with two of the world's largest radio telescopes, NRAO's Very Large Array and the 100-m radio telescope of the MPIfR, at four different wavelength bands, from 2.8 cm to 21 cm. An ordered magnetic field mostly aligned along the optical spiral arms was discovered. The discovery helps to explain how galactic spiral arms are formed. The same study also shows how gas can be funneled inward toward the center of IC 342.

The results are published in the current online issue of the journal "Astronomy & Astrophysics".

Astronomers making a detailed, multi-telescope study of a nearby galaxy have discovered a magnetic field coiled around the galaxy's main spiral arm. "This study helps resolve some major questions about how galaxies form and evolve," says Rainer Beck, of the Max-Planck Institute for Radio Astronomy (MPIfR), in Bonn, Germany.

The scientists studied a galaxy called IC 342,

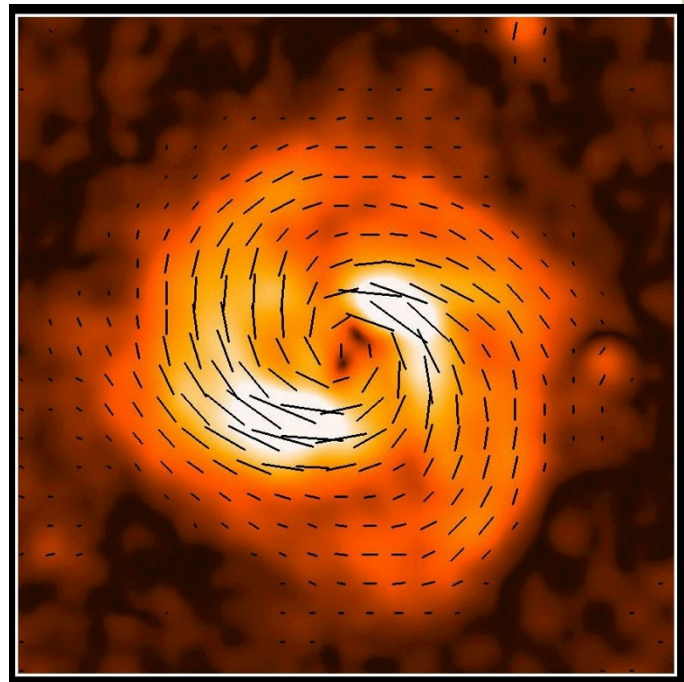


Fig. 1: Large-scale polarized emission from IC 342 at 6 cm wavelength, observed with the 100-m Effelsberg telescope at a resolution of 3 minutes of arc. The field size is $0.75^\circ \times 0.75^\circ$, the angular diameter of 0.5° for IC 342 is comparable to that of the full moon in the sky. The lines show the magnetic field orientations.

Credit: R. Beck., A&A Vol. 578, A93 (June 2015)

some 10 million light-years from Earth in the northern constellation Camelopardalis (the Giraffe), using MPIfR's 100-meter Effelsberg radio telescope in Germany and the National Science Foundation's Karl G. Jansky Very Large Array (VLA). Data from both radio telescopes were merged to reveal the magnetic structures of the galaxy.

The surprising result showed a huge, helically-twisted loop coiled around the galaxy's main spiral arm. Such a feature, never before seen in a galaxy, is strong enough to affect the flow of gas around the spiral arm.

"Spiral arms can hardly be formed by gravitational forces alone," continues Rainer Beck. "This new IC 342 image indicates that magnetic fields also play an important role in forming spiral arms."

The new observations provided clues to another aspect of the galaxy, a bright central region that may host a black hole and also is prolifically producing new stars. To maintain the high rate of star production requires a steady inflow of gas from the galaxy's outer regions into its center.

"The magnetic field lines at the inner part of the galaxy point toward the galaxy's center, and would support an inward flow of gas", says Rainer Beck.

The scientists mapped the galaxy's magnetic-field structures by measuring the orientation, or polarization, of the radio waves emitted by the galaxy. The orientation of the radio waves is perpendicular to that of the magnetic field. Observations at several wavelengths made it possible to correct for rotation of the waves' polarization plane caused by their passage through interstellar magnetic fields along the line of sight to Earth.

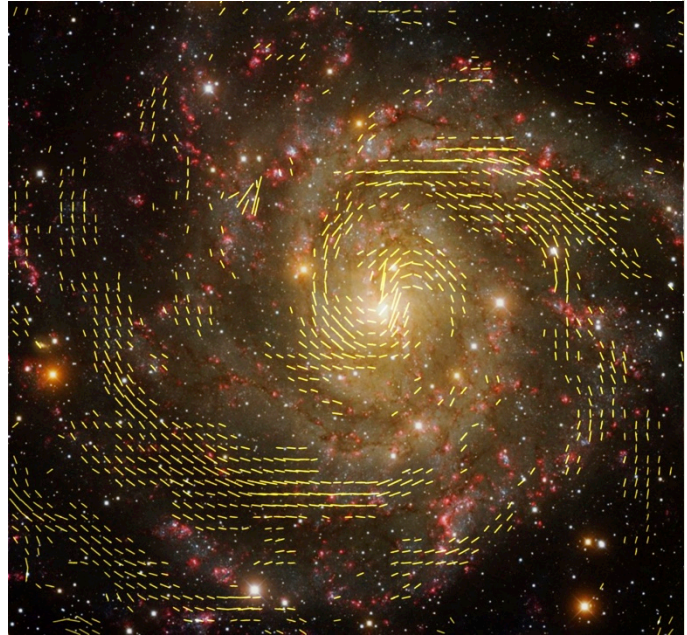


Fig. 2: Small- and large-scale polarized emission from IC 342 at 6 cm wavelength, combined from data from the VLA (5 pointings) and the 100-m Effelsberg telescope at a resolution of 25 seconds of arc. The field size is 0.27°x0.27°.

Credit: Polarized radio emission: R. Beck/MPIfR; Graphics: U. Klein/AlfA; Background Image: Kitt Peak Observatory (T.A. Rector, University of Alaska Anchorage, and H. Schweiker, WIYN and NOAO/AURA/NSF).

The Effelsberg telescope, with its wide field of view, showed the full extent of IC 342, which, if not partially obscured to visible-light observing by dust clouds within our own Milky Way Galaxy, would appear as large as the full moon in the sky. The high resolution of the VLA, on the other hand, revealed the finer details of the galaxy. The final image was produced by combining five VLA images made with 24 hours of observing time, along with 30 hours of data from Effelsberg.

Scientists from MPIfR, including Rainer Beck were the first to detect polarized radio emission in galaxies, starting with Effelsberg observations of the

Andromeda Galaxy in 1978. Another MPIfR scientist, Marita Krause, made the first such detection with the VLA in 1989, with observations that included IC 342, which is the third-closest spiral galaxy to Earth, after the Andromeda Galaxy (M31) and the Triangulum Galaxy (M33).

The Very Large Array (VLA) is one of the world's premier astronomical radio observatories, consisting of 27 radio antennas of 25 m diameter each in a Y-shaped configuration on the Plains of San Agustin fifty miles west of Socorro, New Mexico. The National Radio Astronomy Observatory (NRAO) is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc.

Original Paper:

Magnetic fields in the nearby spiral galaxy IC 342: A multi-frequency radio polarization study, by Rainer Beck, Astronomy & Astrophysics, Volume 578, June 2015, A93 (DOI: 10.1051/0004-6361/201425572): <http://www.aanda.org/articles/aa/abs/2015/06/aa25572-14/aa25572-14.html>

Further Information:

The 100m Radio Telescope

<http://www.mpifr-bonn.mpg.de/en/effelsberg>

Karl G. Jansky Very Large Array (VLA)

<http://www.vla.nrao.edu/>

Max-Planck-Institut für Radioastronomie (MPIfR)

<http://www.mpifr-bonn.mpg.de/2169/en>

Atlas of Galaxies (Maja Kierdorf & Rainer Beck)

<http://www.mpifr-bonn.mpg.de/atlasmag>

Contact:

Dr. Rainer Beck,

Max-Planck-Institut für Radioastronomie, Bonn.

Fon: +49-228-525-323

E-mail: rbeck@mpifr-bonn.mpg.de

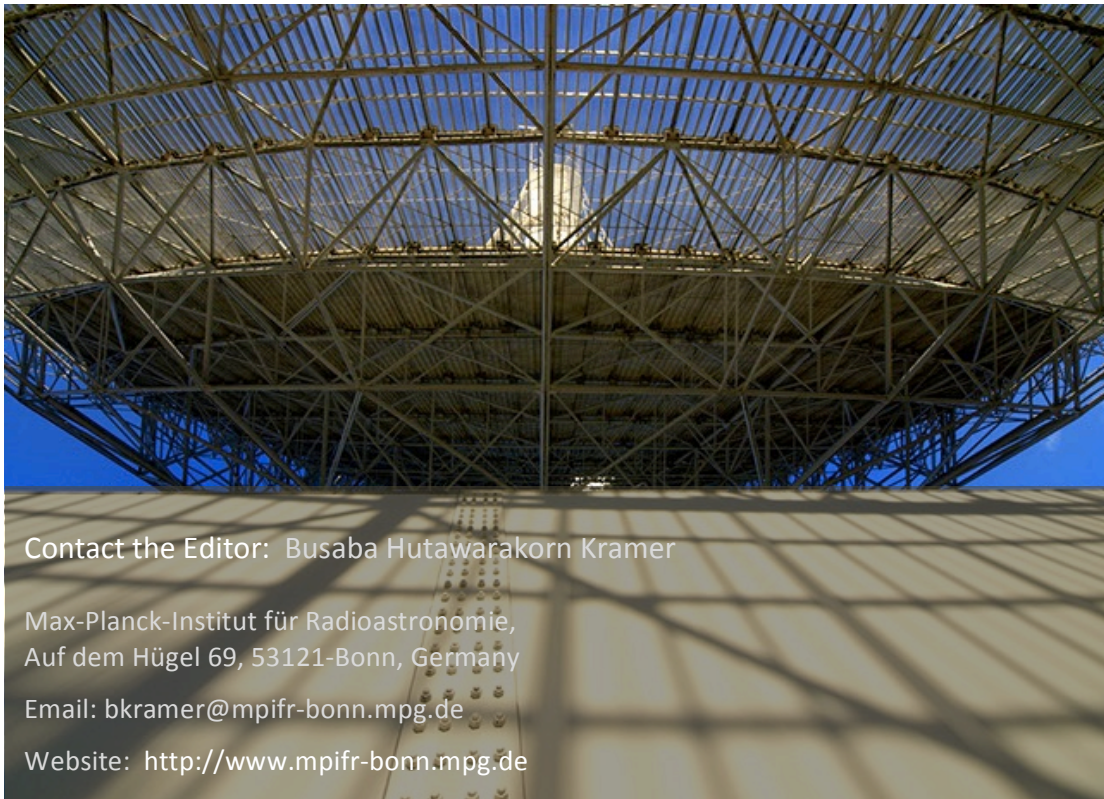
Dr. Norbert Junkes,

Press and Public Outreach,

Max-Planck-Institut für Radioastronomie.

Fon: +49(0)228-525-399

E-mail: njunkes@mpifr-bonn.mpg.de



Contact the Editor: Busaba Hutawarakorn Kramer

Max-Planck-Institut für Radioastronomie,
Auf dem Hügel 69, 53121-Bonn, Germany

Email: bkramer@mpifr-bonn.mpg.de

Website: <http://www.mpifr-bonn.mpg.de>