Effelsberg Newsletter

May 2014

Photo Credit: Norbert Tacken

Call for Proposals: Deadline - June 4, 2014, 15:00 UT p2

Technical News:

- First Light Observations with the New K-Band Receiver p3
- Status of the Effelsberg VLBI Equipment p5
- All Those Little Helpers p6

Science Highlights:

- Award-winning Research with Effelsberg p7

Who is Who in Effelsberg? – Klaus Bruns p9

Public Outreach – The 100-m Radio Telescope on Display in Heidelberg p10

Call for Proposals

Deadline: June 4, 2014, 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

Observers are especially encouraged to visit the wiki pages!

Observing modes

Possible observing modes include spectral line, continuum, pulsar, and VLBI. Available backends are a FFT spectrometer (with 2 x 32768 channels), a digital continuum backend, several pulsar systems (coherent and incoherent de-dispersion), 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 new 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 June, the next deadline will be on October 6, 2014, 15.00 UT.

RadioNet Transnational Access Programme

RadioNet (see http://www.radionet-eu.org) includes a coherent set of Transnational Access programmes 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. Observing time at Effelsberg is available to astronomers from EU Member States (except Germany) and Associated States that meet certain criteria of eligibility. For more information:

http://www.radionet-eu.org/transnational-access

Time on these facilities is awarded following standard selection procedures for each TNA site, mainly based on scientific merits and feasibility. New users, young researchers and users from countries with no similar research infrastructure, are specially encouraged to apply. User groups who are awarded observing time under this contract, following the selection procedures and meeting the criteria of eligibility, will gain free access to the awarded facility, including infrastructure and logistical support, scientific and technical support usually provided to internal users and travel and subsistence grants for one of the members of the research team.

by Alex Kraus

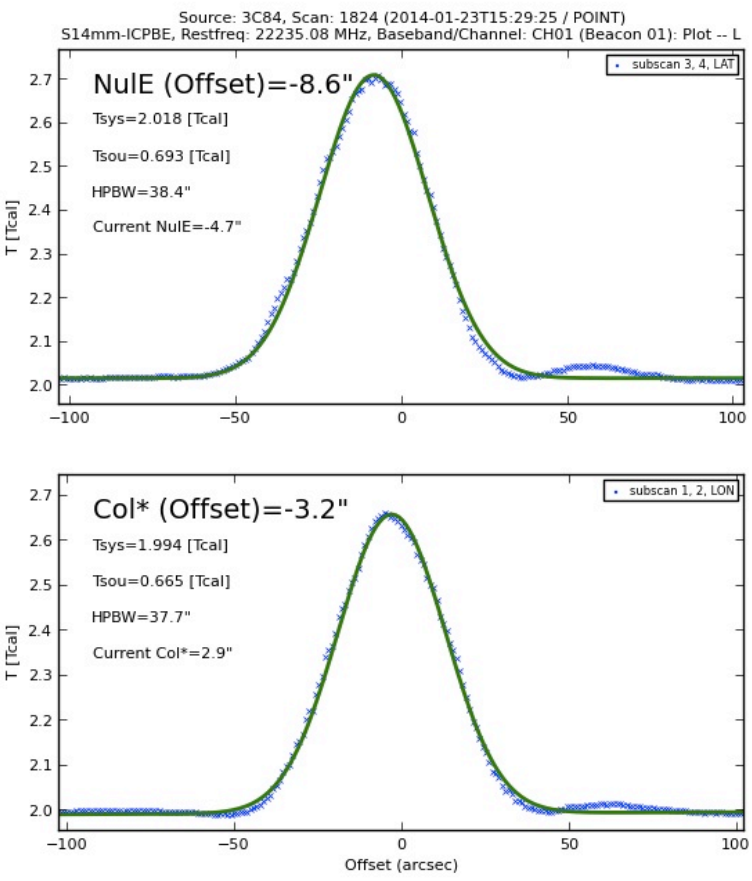
TECHNICAL NEWS

First Light Observations with the New K-Band Receiver

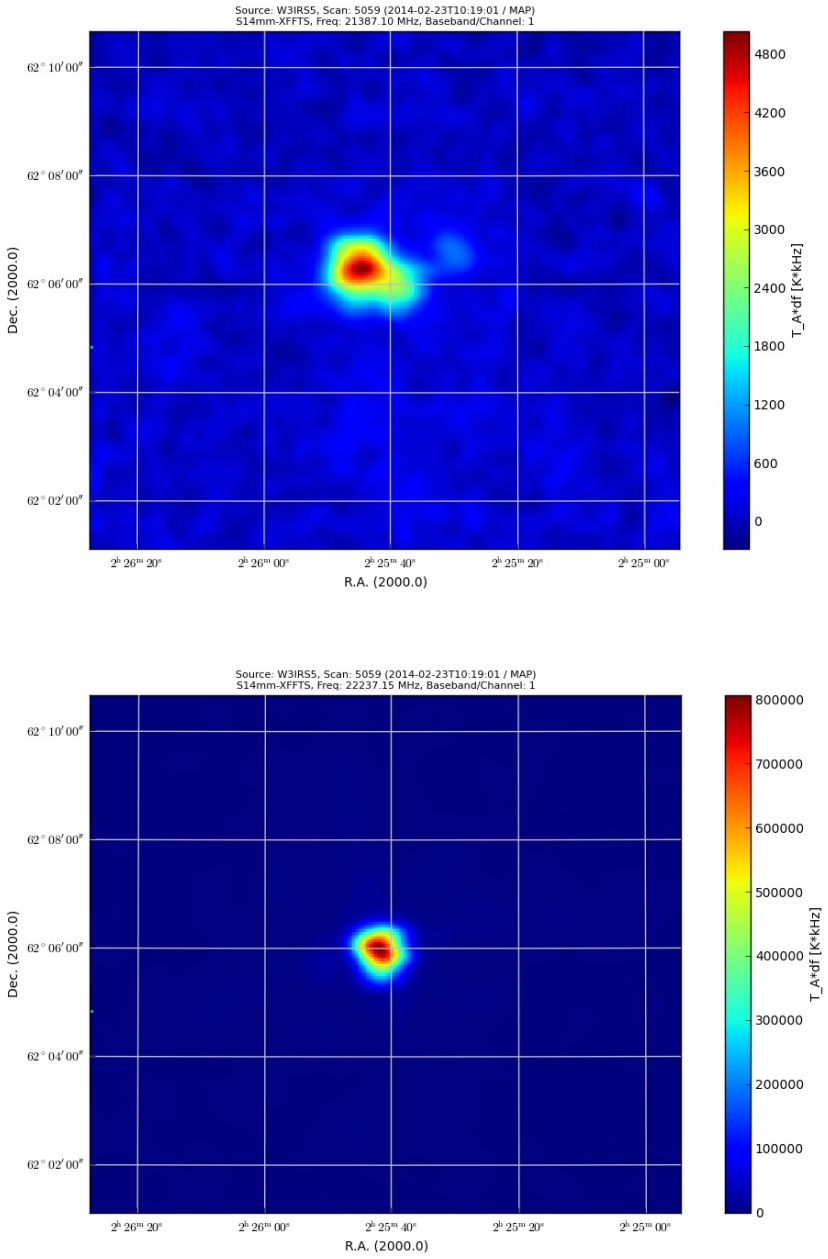
By Benjamin Winkel on behalf of the K-Band Rx project team

In the last issue of this newsletter we presented the new K-band receiver that will be available to the community by autumn 2014. In its final setup, this instrument will offer 8 GHz of instantaneous bandwidth with more than one million spectral channels in total. In January this year, the receiver was installed at the 100-m telescope and saw first light. For our first test observations the receiver was connected to our standard 32-k XFFTS backend. Observations went amazingly smooth with the first cross-scan being only few arcseconds offset from the pointing model. We also did some hours of calibration measurements. The receiver temperature is less than 20 K over the whole band, leading to zenith system temperatures (under moderate weather conditions) of 40-60 K. Compared to the old secondary-focus K-band receiver which it replaces, the new instrument has about a factor of two better system equivalent flux density (SEFD)!

To test long-term stability and mapping capabilities we also did a shallow survey of the W3 star-forming region which is known for its wealth of spectral lines. As an example we present here maps of the H67α radio recombination line as well as the H_2O maser emission towards W3IRS5.



First-light pointing (cross-scan) being amazingly close to the prediction of the pointing model.



Both maps show the W3 star-forming region. The top panel shows the H67α radio recombination line, the bottom panel exhibits the strong water maser in W3IRS5.

Status of the Effelsberg VLBI Equipment

by Uwe Bach

During the last years the analog MKIV and VLBA VLBI terminals were replaced by new digital back-ends. The MKIV was replaced by the European DBBC (Digital Base Band Converter) and a Mark5B+ disk recorder. In digital down converter mode (DDC) it provides 8 tunable base band converters (BBCs) with upper (USB) and lower side band (LSB) at bandwidths of 1 to 32 MHz. The recording rate depends on the number of selected base band channels, the maximum data rate is 2048 Mbps using 16x32 MHz channels. The DBBC can also be operated in a poly-phase filter bank mode (PFB) that provides 16 or 32 BB channels at fixed frequencies (8/16 dual or 16/32 single pol. of 32 MHz bandwidth) and a recording rate of 2048 or 4096 Mbps. It is recommended to use the DBBC for any EVN, global VLBI, and geo observations that are correlated in Bonn or JIVE.

The VLBA terminal was replaced by two NRAO (Roach Digital Back End) RDBE and a Mark5C disk recorder. It can be used in a poly-phase filter bank mode (PFB) that provides 16 BB channels at fixed frequencies (8 dual or 16 single pol. of 32 MHz bandwidth) and a recording rate of 2048 Mbps. There is also a digital down converter mode (DDC) available that provides 8 tunable base band channels at variable bandwidth between 1 and 128 MHz and corresponding recording rates. The BB channels can be either LSB or USB. Since the maximum recording rate is limited to 2 Gbps, at 128 MHz band width a maximum of 4 BB channels can be used. The RDBEs are used for all VLBA+Eb and HSA observations that are correlated in Socorro.

Backend	DBBC	RDBE
PFB	*16 x 32 MHz or 32 x 32 MHz (LSB or USB)*	*16 x 32 MHz (LSB or USB)*
DDC (up to)	*8 x 1, 2, 4, 8, 16, or 32 MHz (USB+LSB)*	*8 x 1, 2, 4, 8, 16, 32, 64 MHz (USB or LSB) or 4 x 128 MHz*
DDC Geo Mode	*14 BBCs 1 bit sampling*	
Recording Rate	*max. 4 Gbps*	*max. 2 Gbps*

DBBC: From top to bottom the Mark5B+ data recorder, the DBBC, and the control PC.

RDBE: From top to bottom, the Mark5C data recorder, two RDBEs, 10GE eVLBI switch, IF control unit, and IF up-converter for the VLBA IF.

All Those Little Helpers: Part I

By Benjamin Winkel

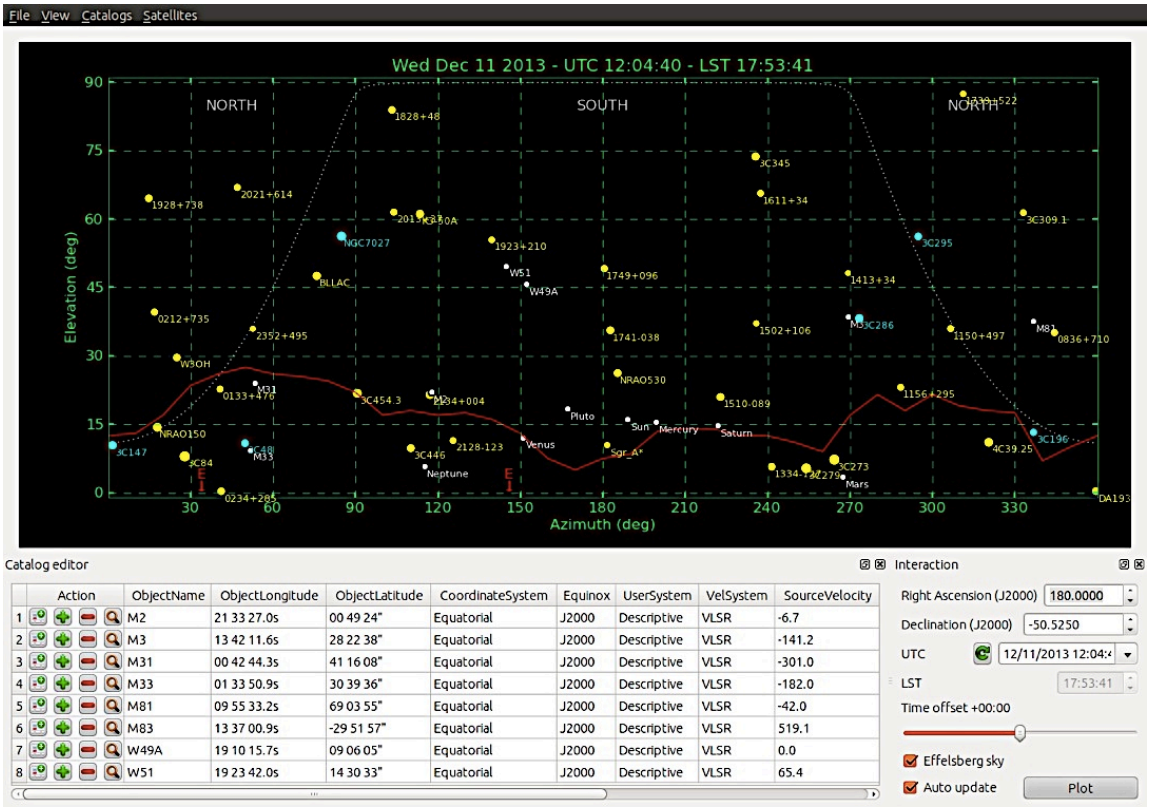
At Effelsberg we constantly try to improve the user experience for observers and our own staff. Back in 2010 a new telescope control software was implemented, being shipped with an easy-to-use graphical user interface. According to the feedback by our visitors, this new software is very much appreciated. After this major refurbishment we now concentrate more on various smaller tools which make everyday life easier. Among these are a new Online-Plotter, an observation logger, and a source catalog editor. We are going to present these within the next few issues of the newsletter.

I. The source catalog editor

If you have been observing at Effelsberg when the old control software was still in use, you know that source catalogs were just plain ASCII files the user had to edit using a text editor. While the new control software uses a more specialized file format, an easier way to work with the catalogs was not introduced at the beginning.

In the mean time we created a nice GUI. It can not only be used to edit catalogs, but for convenience the catalog editor also displays the sources as they are located at the current Effelsberg sky. One can study rise and set times, plot sky tracks of a given source, use a SIMBAD query to automatically grab coordinate entries for your favorite source, and much more. Of course it is also possible to spin the time wheel, to find out how the sky looks like a few hours or even weeks later

A more complete list of features can be found on our Wiki. When you plan your next observing trip to Effelsberg, it's definitely worth a visit.



	Action	ObjectName	ObjectLongitude	ObjectLatitude	CoordinateSystem	Equinox	UserSystem	VelSystem	SourceVelocity
1		M2	21 33 27.0s	00 49 24"	Equatorial	J2000	Descriptive	VLSR	-6.7
2		M3	13 42 11.6s	28 22 38"	Equatorial	J2000	Descriptive	VLSR	-141.2
3		M31	00 42 44.3s	41 16 08"	Equatorial	J2000	Descriptive	VLSR	-301.0
4		M33	01 33 50.9s	30 39 36"	Equatorial	J2000	Descriptive	VLSR	-182.0
5		M81	09 55 33.2s	69 03 55"	Equatorial	J2000	Descriptive	VLSR	-42.0
6		M83	13 37 00.9s	-29 51 57"	Equatorial	J2000	Descriptive	VLSR	519.1
7		W49A	19 10 15.7s	09 06 05"	Equatorial	J2000	Descriptive	VLSR	0.0
8		W51	19 23 42.0s	14 30 33"	Equatorial	J2000	Descriptive	VLSR	65.4

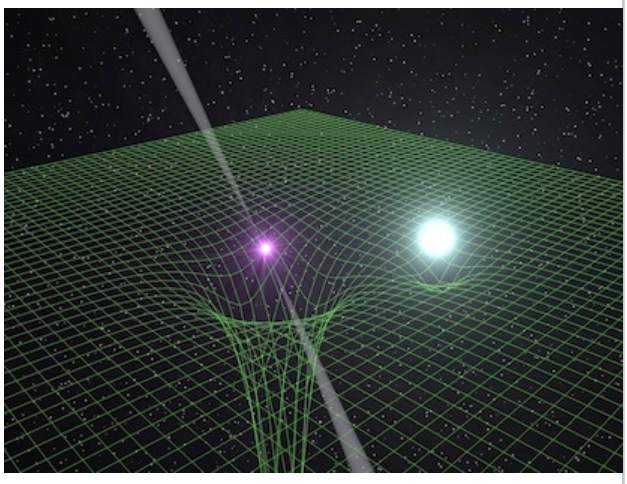
Science Highlights

Award-winning Research with Effelsberg

By Michael Kramer

John Antoniadis from the "Fundamental Physics in Radio Astronomy Group" of the MPIfR, has managed to reap multiple awards for his research work related to his doctoral thesis that he conducted within the International Max Planck Research School (IMPRS) for Astronomy and Astrophysics of the MPIfR. In April 2014, John received the "Dissertation Award" from the Sections of Gravitation and Relativity, Physics of Hadrons and Nuclei, as well as the Section for Particle Physics of the German Physics Society (DPG). In May 2014, he also received the thesis award of the Foundation for Physics and Astronomy in Bonn. Finally, he will also receive the Otto-Hahn-Medal of the Max-Planck-Society for outstanding PhD work in June at the annual meeting of the society in Munich.

John receives all these honours for his outstanding doctoral thesis that focuses on a combination of radio and optical observations of pulsar-white dwarf systems. Pulsars are rapidly rotating neutron stars. They act like lighthouses emitting flashes of radio waves,



An artist's impression of the PSR J0348+0432 binary system. The pulsar (with radio beams) is extremely compact, leading to a strong distortion of space-time (illustrated by the green mesh). The white-dwarf companion is shown in light-blue.
© Science / J. Antoniadis (MPIfR)

The radio and optical telescopes used to observe the pulsar-white dwarf binary system PSR J0348+0432. Upper row (from left): Radio telescopes: Green Bank (GBT), Arecibo and Effelsberg; Lower row (from left): Optical Telescopes: ESO Very Large Telescope (VLT), William-Herschel Telescope (WHT).

which are extremely periodical. Thus they can be considered as the most accurate clocks of any cosmic laboratory. John Antoniadis made a very exciting discovery: One of the pulsars he observed has twice the mass of our sun and therewith is the most massive neutron star that has ever been discovered, PSR J0348+0432. The observed white dwarf races around its companion in an exceptionally close and rapid orbit. This binary star system opens up new opportunities to test Einstein's General Theory of Relativity in a field of strong gravitational forces that exceeds all previous observations.

Observations presented in his thesis combined radio data from 100-m Effelsberg, the Arecibo and the Green Bank Telescope. Optical observations were made with Gemini and ESO's Very Large Telescope. Being supervised by Paulo Freire and Michael Kramer, John made lots of these observations in person, in particular those at the VLT providing the key observations to determine the mass of PSR J0348+0432, published in the Science magazine last year.

John grew up in Didymoteicho, a small town in northern Thrace, Greece. After high-school, he moved to Thessaloniki to study physics at the Aristotle University of Thessaloniki. In the context of his diploma thesis he worked on setting up a survey for finding Hot-Jupiter planets with a small optical telescope. The telescopes that he could put to such excellent use during thesis work between March 2010 and September 2013, entitled "Multiwavelength Studies of Pulsars and their Companions", were a little larger…!

Since September 2013 John works as a postdoctoral researcher at the MPIfR. He conducts his current research as part of the BEACON team, an ERC-funded project led by Paulo Freire, which aims at testing the strong-field regime of gravity with unprecedented precision using a state-of-the-art radio receiver mounted on the 100-m radio telescope.

Even if John sometimes wondered, whether he should have become a musician instead, the success speaks for itself.

Who is Who in Effelsberg?

Klaus Bruns

After studying mechanical engineering at the RWTH Aachen I started as a research engineer at an energy provider in 1991. When the product we developed was ready for mass production, it found application in power plants. In the following, system configuration, system design and project management became my duties.

In February 1998 I started working at the Effelsberg radio telescope – my family was the main reason for a career change.

At the Effelsberg radio telescope I am the head of the telescope workshop, the precision mechanical workshop and building services. With these working groups we organize the maintenance, repair and optimization activities at the Effelsberg observatory in all mechanical aspects. I also coordinate construction activities and I am the contact person for all questions related to safety at work.

It is particularly interesting to have so many different tasks and also challenges of the job at the Effelsberg observatory. (And this is indeed the main character of the work as a research engineer.)

During my studies I instructed a men's volleyball team as a player-coach and was in a youth organization, that actively implemented environmental protection measures in forests. So I enjoy especially nature-orientated holidays. For several years, I played badminton and volleyball again, but most of my free time I spend with my family.

Public Outreach

The 100m Radio Telescope on Display in Heidelberg

A 1:100 scale model of the Effelsberg dish for the "Haus der Astronomie"

By Norbert Junkes

Fig. 1: *1:100 scale model of the Effelsberg radio telescope at the model builder's workshop (telescope not quite finished in March 2014).*

Fig. 2: *The "Haus der Astronomie" at the Königstuhl site near Heidelberg, in a distance of 250 km from Effelsberg. Image: Haus der Astronomie (HdA).*

The Max Planck Institute for Radio Astronomy (MPIfR) has provided a new 1:100 scale model of the Effelsberg radio telescope to be donated to the "Haus der Astronomie" (HdA) at the Königstuhl site near Heidelberg.

The model was constructed by "team6" in Wesseling, the same company who had previously built the telescope model placed in the MPIfR foyer in Bonn. There are four models of the Effelsberg telescope in that size (1 m diameter) in total. Besides the two already mentioned, both sites of the "Deutsches Museum", in Munich and in Bonn, are displaying 1:100 scale models of the Effelsberg telescope.

Figure 1 shows the telescope in the workshop in March 2014 – with some final work, e.g. surface panels, still to be completed. The model was delivered to Heidelberg in early April. The official inauguration ceremony took place on Tuesday, April 29, 2014 at the HdA (Fig. 2).

It started with a short introduction about the complementing second part of the exhibit, an information panel for the virtual station no. 19 of the Effelsberg Milky Way walk (see Fig. 3). That panel connects the original 100m radio telescope near Bad Münstereifel-Effelsberg with the 1:100 scale model at HdA. In the $1:10^{17}$ scale of the Milky Way walk (40,000 light years through the Milky Way on a distance of 4 km), the Andromeda galaxy M31 would be 250 km away, corresponding to its real distance of 2.5 million light years. The information panel no. 19 will be mounted at the entrance of the HdA.

In his review talk about the Effelsberg telescope, Michael Kramer, the Executive Director of the MPIfR, presented the successful history of the telescope over more than 40 years including latest results like the magnetar in the Galactic centre region and an outlook in the future of the telescope. More than 90 participants were attending the talk (Fig. 4).

The telescope model was unveiled in the following ceremony (Fig. 5). It is presented in the foyer of the HdA (Fig. 6), highlighting an exhibition with a number of other telescopes for the optical and infrared regime of the electromagnetic spectrum.

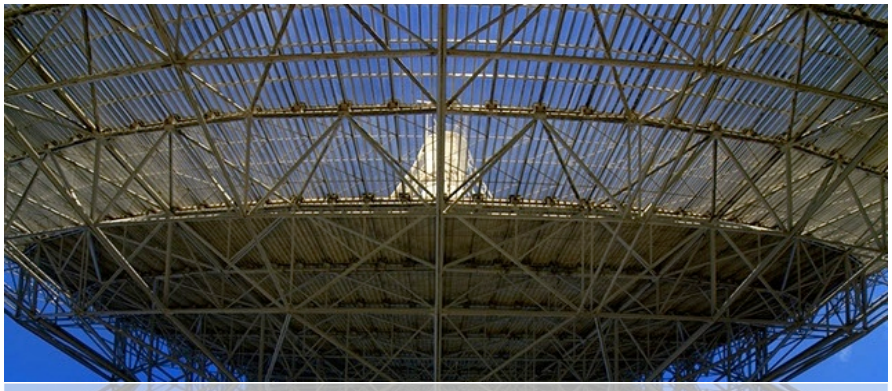
Fig. 3: *Michael Kramer, the Executive Director of MPIfR, giving his inauguration talk about the Effelsberg telescope ("The White Giant in the Eifel Mountains") for the opening of the new telescope exhibit at HdA. At the left: Information panel for station no. 19 of the Effelsberg Milky Way Walk (Andromeda Galaxy M31) in a distance of 250 km (or 2.5 million light years).*

Fig. 4: *An audience of about 90 participants listening to Michael Kramer's talk.*

Fig. 5: *The unveiling of the new exhibit at "Haus der Astronomie" on April 29, 2014. From left to right: Michael Kramer, Norbert Junkes, Alex Kraus (all MPIfR) and Markus Pössel (HdA). Photo Credit: S. Brümmer/HdA*

Fig. 6: *The 1:100 scale model of the Effelsberg radio telescope in its new environment.*

Photo Credit: *Norbert Junkes (Fig. 1, 3, 4 and 6)*



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