# Max-Planck-Institut für Radioastronomie Bonn

## General Information

A significant portion of the activities of the Max-Planck-Institut für Radioastronomie (MPIfR), which was founded in 1966, is based on observations made with the 100m radio telescope in Bad Münstereifel-Effelsberg. The telescope has been successfully in operation since August 1972. With its diameter of 100m it is still one of the two largest fully steerable radio telescopes. The very high surface accuracy enables a use down to a shortest wavelength of 3.5mm. Numerous high-sensitivity and low-noise receiver systems for the wavelength range between 3.5mm and 35cm for the 100m radio telescope have been developed in the laboratories of the institute.

This observing facility is offered not only to Institute members, but also, for up to 40% of the available time, to visiting scientists. For many years frequent use of this possibility has been made by scientists from German universities and from numerous foreign institutes. In addition, there is extensive cooperation between the Institute and scientists from foreign countries, including the United States, the People's Republic of China, France and Argentina.

The 100m telescope is capable for radio observations in different observing modes, in agreement with the distinct research groups at the MPI für Radioastronomie. These observing modes are:

— Observations in radio continuum. The investigation of galactic and extragalactic sources in broad bands at several wavelengths. This research group also comprises investigations in the 21cm line of neutral hydrogen (HI).
— Spectroscopic investigations of galactic and extragalactic sources.
— Investigation of the radio radiation from pulsars at very high time resolution.
— VLBI (Very Long Baseline Interferometry). An observing method which allows to obtain exceptionally high angular resolution images of radio sources.

Regularly, the institute participates in observations within the VLBI framework, a global network of radio telescopes. Since the beginning of 1978, a special processor has been available for the reduction of data from these experiments in order to obtain exceptionally high angular resolution images of radio sources. This facility has been steadily upgraded and is now the European Center for VLBI data analysis. This equipment is complemented by several processing computers at the 100m telescope and a larger computer network at the Institute in Bonn including many scientific workstations. These are used both for data reduction and analysis and for theoretical studies.

In order to extend the astronomically usable wavelength range, the MPIfR led a project to build a 30m radio telescope for observations in the lower mm wavelength range, which is inaccessible to the 100m telescope. The construction of this telescope below the summit of Pico Veleta (Sierra Nevada in Southern Spain) was finished in 1985. At that time the 30m telescope was handed over to a newly founded Institute for Radio-Astronomy in the Millimeter wavelength range (IRAM), located in Grenoble, France. With its excellent surface accuracy the 30m telescope can be used down to a wavelength of 0.87mm.

Receiver systems for the sub-mm wavelength range have been developed at the Institute in Bonn since 1981. In the beginning, these receivers were used on large optical telescopes or in flying observatories. On September 18th, 1993 a special sub-mm radio telescope of 10m diameter was inaugurated on Mt. Graham (3200m in Arizona). In honour of the discoverer of radio waves it was named Heinrich-Hertz-Telescope (HHT).

APEX (Atacama Pathfinder Experiment) is a new submm telescope of 12 m diameter, built at 5000 m altitude in the Chajnantor plane (Atacama desert, Chile). Starting in 2004, it is operated in collaboration with Onsala Space Observatory, Sweden, and the European Southern

Observatory ESO. APEX is capable to perform astronomical observations down to shortest wavelengths below 0.3 mm (submm and Terahertz range). Scientists of the MPIfR have now access to the whole radio wavelength range usable from the surface of the Earth.

This unique set of observatories with the full range of radio astronomical tools allows a broad range of investigations. Many current astronomical research topics are represented within the MPIfR staff. To name but a few: Study of the early evolution of our universe, e.g. by means of gravitational lenses; Investigations of the cores of radio galaxies and quasars (virtually stellar objects with giant energy production in an extreme distance), particularly using VLBI techniques. As an example: radio galaxy Cygnus A. Analysis of the intra-day variable radio radiation from compact radio sources; Speckle-interferometric investigations of young stellar objects, late-type stellar population and active galactic nuclei in the optical and infrared wavelength range; Analysis of jets in galaxies; Observations of the continuum and line emission of extragalactic systems; study of magnetic fields in extended galaxies; Investigation of magnetic fields in extragalactic systems. Examples of this work are the Andromeda galaxy (M31) and NGC 6946. Analysis of the regular short-period radio emission from pulsars; Observations of the continuum and line emission of our Milky Way in order to investigate its structure and its physical properties, as well as its chemical composition and the chemical evolution; Observations and theoretical studies of star formation and stellar evolution; Physics of the Galactic centre; Studies of the structure and composition of comets and asteroids.

*Currently the Max-Planck-Institut für Radioastronomie has 190 employees including 60 scientists. In addition, some 30 scientific visitors, fellows and scholarship holders work at the Institute.*

*The MPIfR Board of Directors includes Prof. Dr. Michael Kramer, Prof. Dr. Karl M. Menten, Prof. Dr. Gerd Weigelt, and Prof. Dr. J. Anton Zensus.*

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