Our Research

Radio astronomy

Radio astronomy is one of the oldest kinds of radiation that we can use to study the Universe. However, we see many kinds of radiation that are invisible to the human eye. Astronomers use radio telescopes to measure the different kinds of radiation from heavenly objects. Thanks to radio telescopes, we can learn much more about the Universe than by looking at the sky with our eyes.

History of the Universe

By collecting radio waves from the Universe, we can learn more about the history of the Universe. All sorts of celestial bodies emit radio waves, such as black holes, galaxies and star clusters. The stronger the signal for a certain object, the stronger the waves that we can measure. These waves are really weak, but radio telescopes can detect them. That is why they are so powerful.

Over the years, radio telescopes have become more sensitive. They can now detect weak signals from distant objects. By doing so, they can learn more about these objects.

About ASTRON

ASTRON is the Netherlands Institute for Radio Astronomy. We investigate the signals that the Universe emits in the form of radio waves. Our mission is to make discoveries in radio astronomy happen. We therefore do not only do fundamental astronomical research, but also develop new technologies in order to increase the sensitivity and efficiency of our instruments.

Our engineers and astronomers are renowned internationally. Our astronomers conduct pioneering research on our own Milky Way and distant galaxies. Our engineers develop innovative antennas, high-tech electronics and intuitive software. Thanks to a good cooperation between technicians and scientists, even after sixty years the Westerbork Synthesis Radio Telescope (WSRT) is still one of the best telescopes in the world.

LOFAR (the LOw Frequency ARray), designed, developed and managed by ASTRON, is one unique instrument that measures the earliest phases of the universe, as well as transient flashes in the sky, rotating neutron stars and colliding black holes. ASTRON is working with other institutes to prepare for the construction of the Square Kilometer Array (SKA), which will become the largest and most sensitive radio telescope in the world. The knowledge we have gained with LOFAR and WSRT is of great importance for the design and construction of the SKA.

ASTRON is also hosts to the Optical / Infrared instrumentation group of the Netherlands Research School for Astronomy (NOVA) and JIVE, the Joint Institute for VLBI ERIC. At JIVE, signals are combined from radio telescopes from all over Europe, Asia and South Africa.

Our Technologies

Astronomers need to develop new technologies in order to observe the Universe in a better way. For example, we need to develop new high-tech systems in order to observe the Universe in a better way. For example, we need to develop new high-tech systems in order to observe the Universe in a better way. For example, we need to develop new high-tech systems in order to observe the Universe in a better way.

At ASTRON, we involve companies as much as possible in the development of new instruments and innovative high-tech systems. The technology developed in our radio astronomy research is applied in medicine (e.g. in MRI scanners), radio communication (e.g. in mobile phones), security (RFID, radio frequency identification) and even wireless internet (Wi-Fi).

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The Westerbork Synthesis Radio Telescope (WSRT) was built in 1970. It consists of fourteen telescope dishes on a 2.7 kilometre East-West line. The telescope dishes contain special receivers that can be used to receive radio waves with different frequencies. The receivers are called PAFs (Phased Array Feeds) and they are used to produce images of the sky. The WSRT has a capability 40 times larger than its predecessor, the Dwingeloo Radio Telescope (DRT), which was built in 1949. DRT has also discovered two small galaxies: Dwingeloo 1 and 2.

LOFAR, the LOw Frequency ARray, is a telescope that consists of thousands of small antennas that are combined in 51 stations in 9 European countries. It has a capability of 20 times larger than the WSRT and was the largest telescope in the world at the time with a 25-meter diameter dish. The telescope was mainly used to search for radio waves with the antennas operating in two frequency ranges: 10-90 MHz and 110-250 MHz. LOFAR is used to search for the origin of the first galaxies, black holes and gas clouds. It is also used to study the Milky Way and the formation of the first stars and galaxies, mapping of the entire sky with great sharpness and sensitivity. Apertif is linked to a special supercomputer that constantly maps the sky and searches for explosive events in the distant Universe.

Future

The European VLBI Network (EVN) becomes a major component of the Square Kilometre Array (SKA). SKA will become the world’s largest and most sensitive radio telescope for astronomical research. Different parts of the SKA will not stand on Dutch soil. The construction of the SKA will be a major challenge. This requires innovation in hardware, software and communications. ASTRON must design the infrastructure to prepare for the design, construction and operation of its founding members. The WSRT is set up by HM Queen Juliana. The European VLBI Network (EVN) becomes a major component of the Square Kilometre Array (SKA). SKA will become the world’s largest and most sensitive radio telescope for astronomical research. It is a huge power consumption and technology project and the SKA will not stand on Dutch soil. The processing and final stage of the SKA will be a huge challenge. The SKA is a partnership between science, government and business. The SKA is a unique opportunity for the Netherlands to participate in the development of the most advanced research facilities in the world.