Here we receive radio waves from the Universe.

What can we learn?
Using optical telescopes, the most familiar type of telescope, we can see celestial objects which emit visible light. However, in space there are also cold (about -260°C) gas and dust, which comprise the interstellar medium and do not emit light. Astronomers think the materials for star formation and the origins of life are hidden in this interstellar medium. The interstellar medium emits radio waves with various wavelengths based on its components. Radio telescopes receive these radio emissions.

What can we see?

Optical telescopes and radio telescopes
A collaboration between these two types of telescopes reveal various aspects of the Universe.

Let’s compare the optical and radio images of “The Triangulum Galaxy (M33)” located about 2.5 million light-years from the Earth.

Optical image
Radio image

Observation by the Subaru Telescope (NAOJ)
Observation by the Nobeyama 45-m Radio Telescope and ASTE (NAOJ)

Stamp here!!

Nobeyama Radio Observatory

Awaken your curiosity!

Contact
Address: 462-2, Nobeyama, Minamimaki, Minamisaku, Nagano, 384-1305
Phone: +81-267-98-4300
Homepage: http://www.nro.nao.ac.jp/en/

Visiting
The visitors’ area is open free of charge. The self-guided tour takes about 1 hour.
Open Time: 8:30 ~ 17:00 (standard)
8:30 ~ 18:00 (summer, Jul.20 ~ Aug.31)
Open every day except for the New Year’s season (Dec.29 ~ Jan.3)
Open House Day: Nobeyama Campus holds a special open house day once each summer to introduce our facilities and the latest radio astronomy.

Access
JR Koumi-Line: 40 minute walk from Nobeyama Station.
Via the Chuo Expressway
about 20 km from the Nagasaka Exit,
about 30 km from the Sutama Exit.
Via the Chubu Odan Expressway
about 30 km from the Yachio Kogen Exit.

(2021.5)

Star clusters appear bright when observed by an optical telescope. This image is similar to what our eyes would see. In contrast, radio telescopes observe the cold gas and dust (interstellar medium) invisible to optical telescopes, showing us the distribution. In this way, we can study the Universe more thoroughly with observations by different kinds of telescopes.

NAOJ Nobeyama Radio Observatory works to advance “Radio Astronomy” which can resolve the enigmas of the Universe.
Let’s converse using parabolic dishes!

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Visitors’ Areas

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The Nobeyama Radio Polarimeters observe the strength and degree of circular-polarization of microwaves coming from the Sun. Continuous observations exceeding 60 years are rare in the world; this unique data is very important for investigating the long-term variation of the Sun. The data is open to the public and used for global education and research.

Nagoya University Nobeyama Radioheliograph

Diameter: 80 cm
Weight: about 600 kg
No. of Antennas: 84
Frequencies: 17, 34 GHz
Angular Resolution (max.): 0.0014° (corresponding to a decimal visual acuity of about 12)

The Nobeyama Radioheliograph uses 84 parabolic antennas to obtain radio images of the Sun. In 2015, the Solar-Terrestrial Environment Laboratory at Nagoya University assumed operation of the Radioheliograph.

45-m Radio Telescope

Diameter: 45 m
Weight: about 700 t
No. of Antennas: 1
Frequency: 1 ~ 150 GHz
Angular Resolution (max.): 0.004° (corresponding to a decimal visual acuity of about 4)

The 45-m Radio Telescope collects extremely weak signals from celestial objects. We developed the antenna, one of the largest for millimeter wavelength observations, and the state-of-the-art receivers on our own. More than 30 years after it was established in 1982, this telescope continues to be active at the forefront of research unveiling the Universe.

Nobeyama Millimeter Array

The Foundation of ALMA

Diameter: 10 m
Weight: about 35 t
No. of Antennas: 6
Frequency: 80 ~ 230 GHz
Angular Resolution (max.): 0.0003° (corresponding to a decimal visual acuity of about 60)

Why in Nobeyama?

Absorption by water vapor in the air weakens the already faint radio waves from celestial objects. The basic conditions for a radio astronomy site are little vapor, high altitude, and few artificial radio signals. Nobeyama is ideal because of its fine climate and location surrounded by mountains.

Please help to maintain good radio conditions!!

Artificial radio signals from smartphones, in-vehicle millimeter wave radar, and so on, are useful in everyday life, but unfortunately they can disturb the radio observations. In cooperation with industry and the Ministry of Internal Affairs and Communications, NAOJ tries to arrange radio frequency allocation for the coexistence of science and industry. As part of this cooperation, please turn off your mobile phone while on site.
What kind of observations does the Nobeyama 45-m Radio Telescope perform? What types of celestial objects are astronomers interested in? Let’s look for them in the star chart.

The celestial objects in this star chart are always above us. Celestial objects which appear in the daytime can’t be seen because they are drowned out by daylight. But radio waves from them can be received with radio telescopes even in the daytime. The observation season at NRO is mainly winter (Dec. – May), when the radio sky conditions are very good. We explore the Universe non-stop around-the-clock during the season.

Watching the Birth of a Star

Study of Star Formation
[in the constellation Orion]

This study aims to elucidate the star-forming mechanism by detailed radio observations of the interstellar gas which becomes the material for stars.

Radio Image of M42, a birthplace of many stars in Orion. This shows the distribution of the molecular gas.

Pursuing the Origins of Life

Study of Interstellar Molecules
[in the constellation Taurus]

Various types of molecules, such as water and ammonia, are scattered throughout interstellar space. Astronomers use radio observations of these molecules to investigate chemical processes in outer space, in pursuit of the components for life.

Important Result from the 45-m Telescope

Discovery of a Black Hole
[in the constellation Canes Venatici]

Through 45-m Radio Telescope observations, astronomers discovered a rapidly-rotating (1000 km/sec) disk of gas. Investigations based on this result were the first in the world to prove the existence of a black hole.

Catch the Beat of the Galaxy

Study of the Galactic Center
[in the constellation Sagittarius]

Radio observations revealed unique phenomena in the Galactic center region. Here astronomers investigate the dynamic activities of the Galactic central black hole and its surrounding environment.

Conceptual drawing of the Galactic nucleus. Observations revealed that the Galactic circumnuclear disk consists mainly of relatively simple molecules (lower right) and nearby giant molecular clouds consist of complex ices (lower left).

A Map for the Next Generation

The Galactic Plane Survey
[the area between the constellations Aquila and Cygnus]

This is a project to take wide-field radio images along the Milky Way and make a distribution map of the molecular gas which serves as the material for stars. This map will serve as a valuable ‘atlas’ for new studies to look for star-forming regions or explore the Galactic history.

Radio Image of the Milky Way in summer. This shows the detailed distribution of molecular gas.