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High Sensitivity Radio Telescope Technology

A 45-meter, large-diameter, high-precision parabolic antenna-type radio telescope in the millimeter-wave band, which had previously been considered difficult to apply to radio astronomy, was developed and installed at the National Astronomical Observatory in Nobeyama in 1982, and became the first practical application in the world. Since about 1990, radio astronomy has been improved by the cooperation of radio telescopes placed in satellite orbit and radio telescopes on the ground, and a space VLBI system using the radio astronomy satellite "Haruka" has been developed. In the 2010s, in the international ALMA telescope project, a demonstration of a real-time correction system for antenna deformation that can withstand extremely weak submillimeter wave observations was successful. These radio telescope technologies have greatly contributed to the observation of the birth of galaxies and planetary systems and the origins of life.

ALMA: Atacama Large Millimeter/submillimeter Array

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Fundamental Research on Millimeter-wave Technology

In the 1960s, through pioneering research on circular TE01 mode waveguides for millimeter-wave waveguide transmission systems, phenomena such as transmission mode conversion at discontinuous points in the waveguide were clarified. In the 1980s, to solve the problem of increased transmission loss due to mode conversion, the NRD guide was invented, a dielectric line that is bent and discontinuous and does not generate unwanted radiation. These research achievements also contributed to the subsequent development of optical fiber communications. In addition, basic research on optical fiber feed millimeter wave transmission systems and optical/millimeter wave conversion circuit technologies that combine millimeter-wave technologies and optical fiber transmission technologies was advanced. These research results are expected to contribute to the development of millimeter-wave communication.

NRD: Non-radiative Dielectric