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FOR IMMEDIATE RELEASE

GRANT GIVEN TO CALTECH FOR
SUBMILLIMETER-WAVE TELESCOPE

A $3.9 million grant for Caltech's new radio astronomy telescope--the first in the world to be designed specifically for submillimeter-wave astronomy--has been given to the Institute by the National Science Foundation (NSF).

The new 10.4-meter (34-foot) telescope will be located on 13,796-foot Mauna Kea in Hawaii, one of the world's highest, driest observatory sites--chosen because of the telescope's extreme sensitivity to water vapor in the earth's atmosphere, which weakens the signals from astronomical sources.

A relatively new field, submillimeter-wave astronomy covers one of the few unexplored regions of the electromagnetic spectrum and promises to be a major contributor to the exploration of our galaxy and other galaxies. Until now, no telescope has had either the high surface accuracy needed to focus the waves, or the high-frequency radio detectors to measure them.

According to Caltech Professor of Physics Thomas G. Phillips, the director-designate, the new telescope has both the

-more-extremely high surface accuracy and a new generation of detectors, including superconducting and bolometer detectors, that will enable high-sensitivity studies of both spectral lines and continuum radiation. The telescope will be able to scan wavelengths from one millimeter down to 300 micrometers--one-eightieth of an inch--which is one-third the radio wavelength detectable by any other radio telescope.

The new telescope, which is expected to be in operation by 1986, was designed and constructed by Caltech Professor of Physics Robert Leighton. Funding for the project has been furnished by previous NSF and NASA grants, by the Kresge Foundation of Troy, Michigan, and by a gift from Francis L. Moseley of Flintridge, California and Prince Charitable Trusts of Chicago. Environmental impact studies and the dome design were initiated with Caltech funding, under the auspices of Caltech Provost Rochus Vogt, then chairman of the Division of Physics, Mathematics and Astronomy.

The new NSF funds will be used primarily for the construction of a 60-foot dome to house the telescope. Although the Mauna Kea location provides clear, dry air for optimum operation, wind and snow in the area make the protective dome necessary. A covering is usually not needed for radio telecopes, such as those at Caltech's Owens Valley Radio Observatory in California.

The dome has two novel design aspects--large, lightweight doors that slide back to expose the full dish antenna to the sky, and an internal wall and floor structure housing the controls, data collection, and support systems for the telescope, and rooms for the astronomers, all of which will rotate so that the telescope will always point through the open doors.

The dome and the telescope dish are being built on the Caltech campus. After being fully tested, they will be shipped to Hawaii and reassembled on the Mauna Kea site.

The backup structure of the new antenna is a network of steel tubes. The reflecting surface consists of hexagonal aluminum honeycomb panels machined to an accuracy of about a thousandth of an inch. The panels are insulated with layers of foam to help reduce distortion from fluctuating air temperatures. A small optical telescope will be mounted on the backup structure to aid in pointing the telescope more accurately.

Over the last two decades, astronomers studying the telltale emission lines in spectra taken at radio and infrared wavelengths have found that the space between the stars is inhabited by dozens of different molecules--including carbon monoxide, formaldehyde, ammonia, methanol, and other compounds of hydrogen, nitrogen, carbon, and oxygen. Research in the submillimeter range will greatly enhance these studies.

Most of the lighter of such molecules emit energy at specific wavelengths in the submillimeter wave region, as their individual atoms change from one rotational mode to another. And many of these interstellar molecules, such as hydrides of magnesium, calcium, aluminum, and silicon, as well as hydrogen chloride, are extremely difficult to observe at all, except within the wavelength range of the new Mauna Kea telescope.

Using the new telescope, astronomers will be able to study the distributions of metals through the galaxy by detecting their hydrides. Thus they will gain insight into the chemistry of the clouds between the stars, which is dominated by the chemistry of these metals.

Astronomers will also have access to submillimeter emissions from atomic carbon, and from such heavy molecules as carbon monoxide, hydrogen cyanide, and formaldehyde. Such molecules will provide insights into conditions within interstellar clouds.

The high resolution of the new telescope may also enable astronomers to resolve at submillimeter wavelengths such structures as spiral arms in other galaxies. The studies of distant galactic clouds containing carbon monoxide, and formyl radical could reveal the sites of bursts of star formation in other galaxies.

In addition to the detection of spectral lines from molecules, the new telescope will also enhance studies of continuum light from quasars and other violent galactic centers, and from regions in molecular clouds where stars are forming.

Mauna Kea is a well known observatory site, already accommodating four large optical/infrared telescopes--one belonging to Canada, France, and Hawaii, one to the United

Kingdom, one to NASA, and one to the University of Hawaii. The site for the new submillimeter-wave telescope, gives an excellent view of the galactic plane, including the galactic center. Groundbreaking ceremonies were October 28.

Caltech and the University of Hawaii expect to use approximately 50 percent of the observing time on the new telescope; the rest will be made available to the national astronomy community. Support, engineering, and maintenance staff will be based in Hawaii. Major technical developments will be carried out at Caltech.

The telescope represents the fourth such instrument built at Caltech; the other three, which have lower precision, are installed as an interferometric array at Caltech's Owens Valley Radio Observatory and are used for millimeter-wave studies.

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