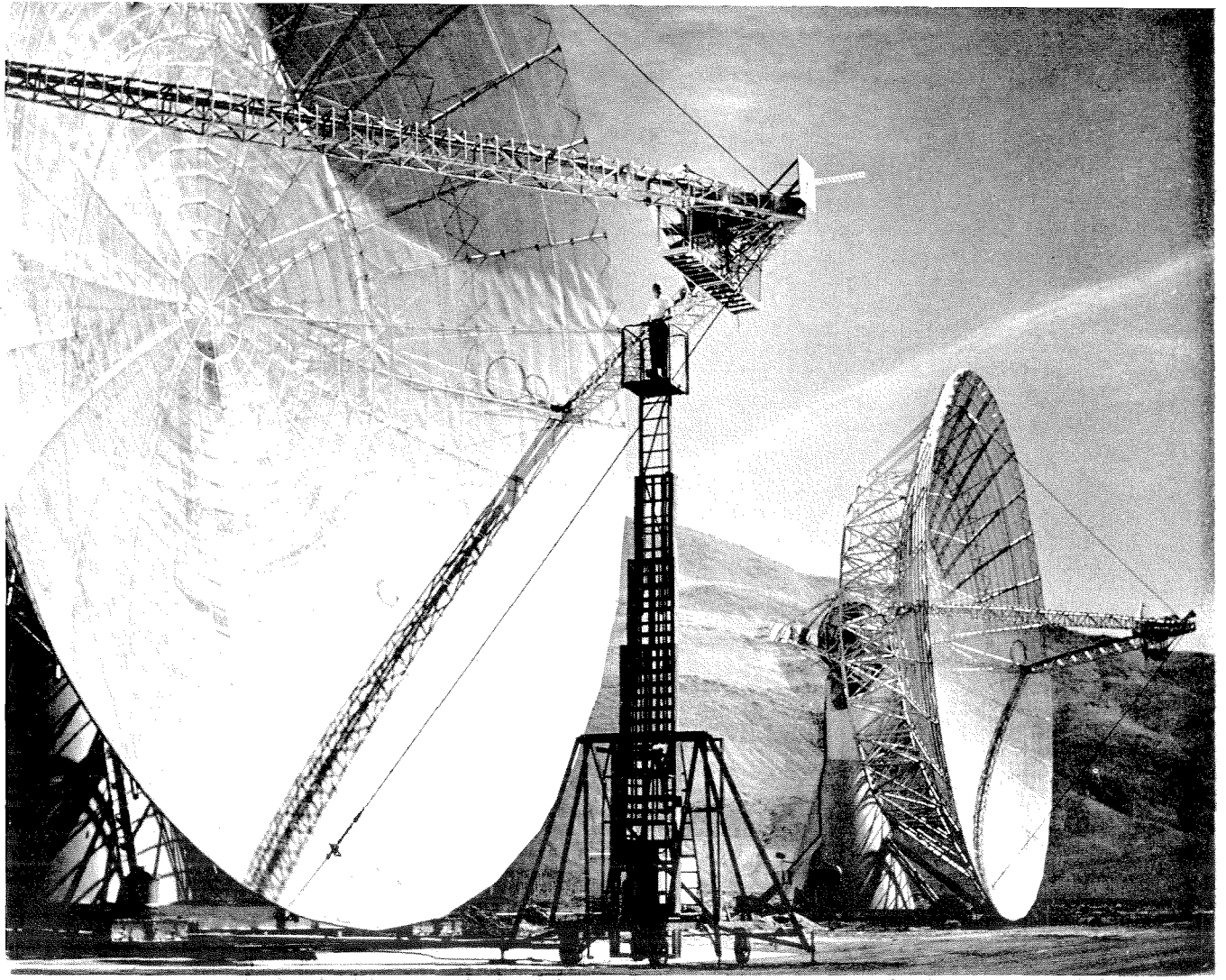

An astronomer uses a hydraulic lift to reach the delicate electronic equipment at the focus of one of the twin 90-foot dishes, to make adjustments before beginning the night's observation.

The First True Radio Star

The first true radio star ever found by astronomers has been identified by Caltech's Radio Observatory, and confirmed by the 200-inch telescope on Palomar Mountain.

The object, known as 3C-48, was identified during a survey of more than 200 radio sources in space. The Institute's Radio Observatory has only been in operation for about 20 months, but in that time it has precisely located more radio sources than all other radio observatories combined. Most of the sources are very distant galaxies, luminous gas clouds, or galaxies in collision. Our sun has been the only object thus far identified as a radio star – but the new find seems to have all the qualities of a stellar object.

The star is located in the Constellation of Triangulum, not far from the Andromeda Galaxy. As far as radio sources are concerned, the object is extremely bright, but optically it is a very faint star and astronomers need a telescope like the 200-inch to get direct photographs or spectrograms. The object had been seen on plates from the 48-inch Schmidt telescope, but showed no unusual characteristics until the 200-inch plates revealed it in greater detail.

Thomas A. Matthews, senior research fellow in radio astronomy at Caltech, determined a very precise location for 3C-48. The radio angular size, determined by the University of Manchester in England, proved to be extremely small. A strong radio signal coming from such a small area indicates an intense surface brightness. This suggests peculiarity in a stel-

Caltech's Radio Observatory investigates one of the most puzzling objects that astronomers have ever encountered

lar object, so Dr. Matthews sought help from optical astronomers to obtain a photograph of that region of the sky.

Allan R. Sandage, staff member of the Mt. Wilson and Palomar Observatories, pointed the 200-inch telescope at the location of the strong radio source and obtained photographs of an object partly surrounded by a faint luminous cloud. Dr. Sandage then took spectrograms with the 200-inch to determine the composition of the object, and photoelectric measures of the brightness and color. The object turned out to have a decidedly stellar appearance and is probably not far from the sun. It could be the remnant of a supernova – a rare, giant explosion of a star.

More detailed spectrograms were taken by Guido Munch, professor of astronomy, and by Jesse L. Greenstein, professor of astrophysics – who are both staff members of the Observatories.

The spectrograms showed a combination of emission and absorption spectral lines unlike that of any other star – ionized and neutral helium, ionized calcium, and possibly oxygen ionized many times, as well as other unidentified features. An outstanding peculiarity of the object is that the spectrum shows no hydrogen, normally the elemental fuel of stars. All in all, the star is one of the most puzzling objects that astronomers have ever encountered.

A new facility

Caltech's Radio Observatory, near the town of Bishop, has recently added a new facility which makes it even more effective in mapping the positions of other radio stars and galaxies in the heavens.

Until last September, the Observatory's twin 90-foot steerable dishes had been operating on a 1,600-foot length of east-west tracks. Mounted on railroad-car wheels, the big steel-mesh ears are moved various distances apart to listen to a particular radio source simultaneously. This procedure, called interferometry, simulates the effect of a single reflector equal in diameter to the distance between the two dishes in a given direction.

The original set of tracks limited the astronomers' findings of the diameter to the east-west direction. It also made it necessary to spend hours of observing to obtain precise measurements of the north-south position. Now north-south tracks have been installed which allow determination of north-south positions and diameters in a much shorter time and with a greater degree of accuracy.

Other great discoveries

The Radio Observatory has shared in other great discoveries – for instance, in measuring the unexpectedly high radiation from the planet Jupiter. Last year the Observatory showed that this radiation was partially polarized, and came from a belt about 200,000 miles above the planet's surface. It is somewhat similar to the earth's Van Allen radiation belt, but with radio emission on a much greater scale.

Another recent discovery was the pinpointing of the most distant object known to man. This is a far-distant galaxy, a member of a large cluster of galaxies. Identification of the object known as 3C-295 was the combined work of a number of observatories – and the 200-inch Palomar telescope. The clue to its vast distance was provided by the University of Manchester in England, where it was found that the angular size was very small and therefore it was likely that the distance was extremely great.

Two highly accurate positions for this object (which agreed extremely well) were obtained by the University of Cambridge in England and by the Caltech Radio Observatory. A picture of the galaxy was noticed first at Caltech on photographic plates from the 48-inch Schmidt camera. Later, Dr. Rudolph Minkowski, staff member of the Mt. Wilson and Palomar Observatories, photographed the galaxy and obtained spectra with the 200-inch Hale telescope at Palomar, establishing that this galaxy was indeed the most distant object yet known.

Caltech's Radio Observatory was built and is supported by the Office of Naval Research. The extraordinary ability of the Observatory equipment to locate radio objects so precisely that they can be optically identified was built into the installation by its designer and former director, John G. Bolton, who has now returned to his former position as researcher in the Commonwealth Scientific and Industrial Research Organization in Australia.