Radio Astronomy

R. D. Shaffer and J. T. McCluskey
Control Center Operations Section

S. Gulkis, M. Klein, and T. Kuiper
Planetary Atmospheres Section

This article reports on the activities of the Deep Space Network in support of Radio Astronomy operations during the third quarter of 1981. Some results of the use of a low-noise maser on loan from NRAO are presented.

I. Introduction

Deep Space Network (DSN) 26-, 34-, and 64-meter-antenna stations are utilized in support of these categories: NASA Office of Space Science (OSS) and Radio Astronomy Experiment Selection (RAES).

II. Radio Astronomy Operations

A. NASA OSS Category

As was reported in TDA Progress Report 42-63 (March–April 1981) a K-band (18- to 25-GHz) reflected-wave ruby maser (Ref. 1) has been borrowed from the National Radio Astronomy Observatory for use on the 64-meter (DSS-43) antenna at the Tidbinbilla Tracking Station, near Canberra, Australia. The successful operation of this system is the result of an international collaboration involving scientists and engineers from JPL, National Radio Astronomy Observatory (NRAO), and Commonwealth Scientific and Industrial Research Organization (CSIRO; e.g., see Ref. 2). The first observations with this new system were made by the Planetary Radio Astronomy (OSS 196-41-73) and Interstellar Microwave Spectroscopy (OSS 188-41-55-12-55) Program. Preliminary results, which have been presented to the Astronomical Society of Australia, concentrate on water vapor and ammonia sources (Ref. 2).

During February and March 1981, spectral line observations were carried out near 22 GHz for water vapor sources and near 24 GHz for ammonia sources. For the water vapor observations, beam switching between the main beam and the reference beam at a 4-Hz rate was used. The beam-switching technique was not used for ammonia because of its wide angular distribution throughout the Galaxy; instead, each 4-min on-source observation was followed by a 4-min reference observation at a position several minutes of arc away and clear of any obvious continuum sources.

1. H_2O Sources. The water vapor observations were made in the direction of known southern OH and H_2O maser sources. All of the previously detected water line sources examined were detected. In addition, two new water vapor maser sources were discovered, G301.1+1.1 and G308.9+0.1.

The spectrum of G301.0+1.1 is presented in Fig. 1. Observations of the Parkes source G305.4+0.2 presented in Fig. 1 show it to be spatially resolved. The high-velocity feature at -90 km s^{-1} that was found by Batchelor, et al. (Ref. 3) appears in the Tidbinbilla reference beam (and hence appears as a negative feature), accompanied by a component at -40 km s^{-1}. These spectra are reproductions of the data produced at the telescope and have not had baselines removed.

2. **Ammonia Sources.** Six ammonia sources were found: G291.3-0.7, G305.4+0.2, G322.2+0.6, G327.3-0.5, G333.6-0.2, and G268.4-0.8. Spectra of two of these sources, G291.3-0.7 (RCW 57) and G305.4+0.2, are presented in Fig. 2. Both show clearly the presence of the quadrupole splitting satellite lines that will allow the determination of NH_3 optical depths in these clouds. An analysis of the conditions in the ammonia clouds is presently under way.

References

1. Moore, C. R., and Clauss, R. C., *IEEE Trans. Microwave Theory Tech., MTT-27*, 249, 1979.

2. Jauncey, D. L., Batty, M. J., Gay, G. J., Moore, C. R., Batelaan, P., Clauss, R., Dickinson, D., Gaulkis, S., Klein, M., Kuiper, T., Morris, G., Neff, D., Ricketts, W. B., and Swanson, P., "18-25 GHz Low-Noise Line Receiver for the Tidbinbilla 64-m Antenna." Prepared for submission to *Proceedings of the Astronomical Society of Australia*, June 1981.

3. Batchelor, R. A., et al., *Lett. Astron. J.*, USSR Acad. Sci., *2*, 467 (1976).

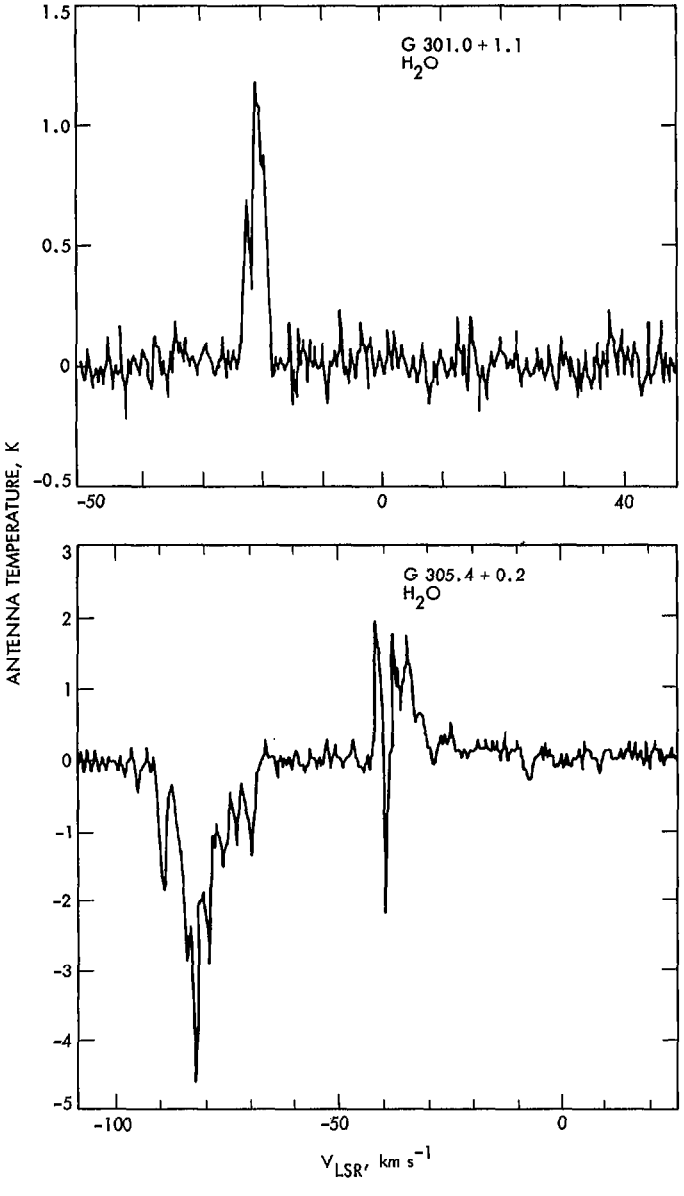

Fig. 1. Spectra of the (6_{16} - 5_{23}) transition of H_2O(ν_0 = 22.235 GHz) taken with the 64-m antenna in March 1981 in the direction of two galactic sources. Galactic coordinates of sources are indicated on the figure.

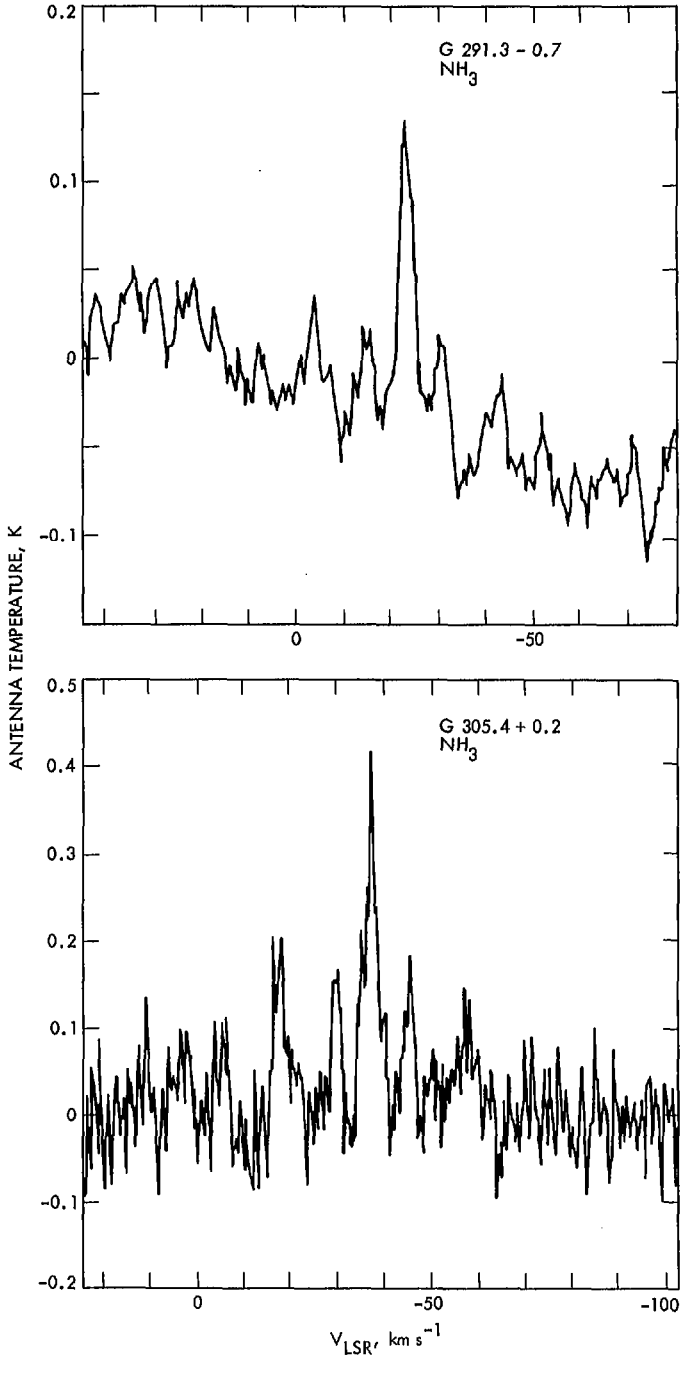

Fig. 2. Spectra of the (1, 1) transition of NH_3(ν_0 = 23.694 GHz) taken with the 64-m antenna in March 1981 in the direction of two galactic sources. Galactic coordinates of sources are indicated on the figure.