Radio Astronomy

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This article reports on the activities of the Deep Space Network in support of Radio Astronomy Operations during April and May 1981. Work in progress in support of an experiment selected for use of the DSN by the Radio Astronomy Experiment Selection Panel, Twin Quasi-Stellar Object VLBI, is reported.

I. Introduction

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

II. Radio Astronomy Operations

A. NASA OSS Category

During this period, 94 hours and 35 minutes of DSN station support was given for Pulsar Rotation Constancy and 77 hours and 45 minutes of support for Planetary Radio Astronomy.

B. RAES Panel Category

1. RA 175 (SS-433). On 17 and 18 May 1981, the Goldstone 64-meter station supported very long baseline interferometry (VLBI) observations of the source SS-433 (1909+04) for a total of 28 hours and 15 minutes. Continuing support of this experiment is expected to produce further resolution of the angular radio structure of this unusual object along with the possible origin of it as reported in *TDA Progress Report 42-62, January and February 1981.*

2. RA 176 (Twin Qusai-Stellar Object (QSO) VLBI, 0957+561 A, B and 1038+528 A, B; see ***TDA Progress Report 42-63, March and April 1981*).** The pair of quasars 0957+561 A, B, separated by 6 arc-sec (redshift of 1.4) almost certainly arise from a single quasar whose light has been gravitationally deflected by a foreground galaxy. The optical spectra of the quasars are essentially identical, and a foreground galaxy with an associated cluster has been found that can explain the image doubling via the gravitational lens hypothesis. A second pair of physically unrelated quasars, 1038+528 A, B separated by 33 arc-sec (redshifts of 0.678 and 2.296 respectively) are close enough to be observed simultaneously in the same antenna beamwidth. One quasar can then provide an independent reference frame, with respect to which possible superluminal motions of components in the other quasar can be detected. We have conducted observations at two epochs that have yielded or promise to yield significant return on these pairs of sources.

Observations of 25-26 February 1980. Three stations (DSS 14 at Goldstone, Calif., DSS 63 in Madrid, Spain, and the 100-m antenna at Effelsberg, Germany) conducted observations of 0957+561 A, B. The data from these observations have been reduced to show that the quasars have elliptically

shaped radio cores at S-band of 1 milli-arc-sec extent with similar axis ratios and position angles on the sky. The data place a 3% upper limit on flux density of a predicted third quasar image compared to the flux density from the core of the B image. We are currently constructing a model of the bending due to the cluster that will account for these results. We have also measured the separation of the quasar cores with an rms error of ±50 micro-arc-sec using differenced phase-delay measurements. We will submit an article containing these results by mid-September 1981.

Observations of 15-16, 17-18 March 1981. Seven stations (DSS 63, DSS 14, Onsala, Effelsberg, the National Radio Astronomy Observatory (NRAO) 40-m antenna in Greenbank, W. Va., Haystack Observatory 38-m antenna in Westford, Mass., and Owens Valley Radio Observatory (OVRO) 39-m antenna at Big Pine, Calif.) observed 1038+528 A, B at S- and X-band (17-18 March), and all stations but Haystack observed 0957+562 A, B at S-band only (15-16 March). Observations were carried out successfully at all sites; about 90% of the scheduled scans produced satisfactory recordings. We have detected (found fringes on) the sources on baselines to all stations for both epochs of observation. Correlation of the data is now underway at the Haystack Observatory's Mark III correlator. (Mark III recording terminals were used at all sites.) As of mid-June 1981 about half the data has been correlated for both pairs of sources. We expect that processing will be finished by late July, with preliminary maps of both source pairs made by the end of the summer.

C. Host Country

Many astronomically interesting objects were observed under the auspices of Host Country activities in Australia in April 1980. These observations were carried out as part of a southern hemisphere interferometer consisting of Tidbinbilla (either DSS 42 or DSS 43), Parkes, and Hartebeesthoek. A number of significant results are expected shortly.

The 64-meter antenna in Madrid (DSS 63) devoted 7 hours and 15 minutes of support to Host Country activities for an interplanetary scintillations experiment.