Radio Astronomy

P. R. Wolken and R. D. Shaffer
Control Center Operations Section

This article reports on the activities of the Deep Space Network in support of Radio Astronomy Operations during May, 1983. A series of experiments sanctioned by the Radio Astronomy Experiment Selection Panel was supported.

I. Introduction

Deep Space Network (DSN) 26- and 64-meter antenna stations were utilized in support of Radio Astronomy Experiment Selection (RAES) Panel experiments. Within a time span of 10 days, in May 1983 (267.75 hours total), nine RAES experiments were supported. Most of these experiments involved multifacility interferometry using Mark III data recording terminals and as many as six non-DSN observatories.

II. Radio Astronomy Operations

A. RA 180. "The Nuclei of M81 and M104" (N. Bartel, MIT)

DSS 63 supported 3 hours of observations of these objects. Six non-DSN observatories also participated. This second epoch of observations of M81 would disclose any time variability and frequency dependence in the flux density and the structure of the nucleus of this compact source. Observations of M104, a galaxy seen edge-on, would disclose whether any alignment between axes of the optical image and the radio map exists.

B. RA 181. "The Black Hole Candidate CYG X-1" (N. Bartel, MIT)

DSS 14 and DSS 63 supported this event in conjunction with RA 185 for a combined total of 33 hours. Two non-DSN facilities took part in this experiment. CYG X-1, an X-ray emitting binary system, is the best known candidate for containing a black hole. VLBI observations at a single epoch would allow conclusions to be drawn about the physical model of the source.

C. RA 183. "SS-433 VLBI" (A. Niell, JPL)

DSS 13 and DSS 14 observed this object for a total of 46.5 hours. Five non-DSN observatories also acquired data. In addition to enhancing knowledge of the small-scale structure of SS-433, these VLBI observations would investigate the energy transport beams of the object, study the spectral properties of the core, and explore the structural similarities between this galactic object and extragalactic compact radio sources.

D. RA 184. "VLBI Observations of 0957+561A, B and 1038+528A, B (Twin and Double QSOs, Second Epoch)" (M. V. Gorenstein, Harvard Center for Astrophysics)

The twin QSO phenomenon is an effect of a gravitational lens on a single source, while the double QSOs are observationally close together, but physically unrelated sources (see *TDA Progress Report 42-64, May and June 1981*). DSS 14 and DSS 63 supported 82.25 hours of observations. This large number of hours was requested because both sources are expected to have time-variable structure. Six non-DSN

observatories took part in this experiment. In the case of 0957+561A, B, the study of time variations would lead to a detection of the gravitational time delay. For 1038 + 528, the B quasar acting as a phase reference would provide a positional reference with which to study the motion of internal features of the A quasar.

E. RA 185. "Observations of the Galactic Center" (J. Marcaide, MPIR)

DSS 14 and DSS 63 supported this event for 14.75 hours in addition to the 33 hours of observations combined with RA 181. Five non-DSN observatories also participated. Some continuing debate on the existence of a core in the compact nonthermal radio source (Sgr A-W-C) in the Galactic Center would be resolved by these highly sensitive observations. In addition, mapping the source, studying day-scale time variations in some observations, and refining the known position of the source would greatly improve existing information about the Galactic Center.

F. RA 186. "The Compact Sources in M82" (N. Bartel, MIT)

The DSN 64-meter antenna stations at Goldstone and Madrid (DSS 14 and DSS 63) supported this experiment for 29.25 hours. Six non-DSN observatories also participated. This experiment would study the radio nuclei of nearby galaxies (M82 is an irregular galaxy at a distance of about 3.3 Mpc) by means of VLBI and hybrid mapping techniques.

G. RA 187. "Mapping of the Galactic Center Compact Radio Science" (K. Y. Lo, CIT)

DSS 14 spent 12.25 hours in support of this activity. Six non-DSN observatories took part in these observations. This observation of Sgr A would determine the source structure via the mapping of its brightness distribution. Recent evidence suggests an asymmetric source structure. Clarifying any relationship of the source to other phenomena at the center would help in understanding not only the nature of this source, but extragalactic sources as well.

H. RA 191. "A Search for Hyperfine Emission from Cosmic $^3He^+$" (G. M. Heiligman, CIT)

DSS 14 dedicated 20.75 hours to this spectroscopic experiment, which would determine an abundance of $^3He^+$ in the interstellar medium, which in turn would imply a helium mass-loss rate for stars and set a lower limit on the mean density of the universe. (The 64,000-channel Radio Frequency Interference Surveillance System (RFISS) was used to support this experiment. See *TDA Progress Report 42-66, September and October 1981*.)

I. RA 192. "Weak Superluminal Quasar 3C179" (R. W. Porcas, MPIFR)

DSS 14 and DSS 63 each devoted 13 hours (total 26 hours) to VLBI observations of 3C179. This observation would measure the rate of separation of the bright components of the source and check on the frequency dependence of the separation.