THE SOUTHERN HEMISPHERE VLBI EXPERIMENT (SHEVE)

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ABSTRACT

Six radio telescopes were operated as the first southern hemisphere VLBI array in April and May 1982. Observations were made at 2.3 and 8.4 Ghz. This array produced VLBI images of 28 southern hemisphere radio sources, high accuracy VLBI geodesy between southern hemisphere sites, and sub-arcsecond radio astrometry of celestial sources south of declination -45 degrees. This paper discusses only the astrophysical aspects of the experiment.

Observations were performed for a two week period between 20 April and 3 May 1982. Three of the six sites -- Tidbinbilla (NASA Deep Space Station 43), Parkes, and Fleurs -- form an approximately equilateral triangle with antenna separations of about 250 km. The other two Australian antennas, Hobart and Alice Springs, are separated from the small triangle by about 1000 km and 2000 km, respectively. The sixth antenna, Hartebeesthoek, is located in South Africa about 9700 km from the small triangle.

All six antennas participated in the fine-scale mapping of celestial radio sources. The data from the five Australian antennas were used to

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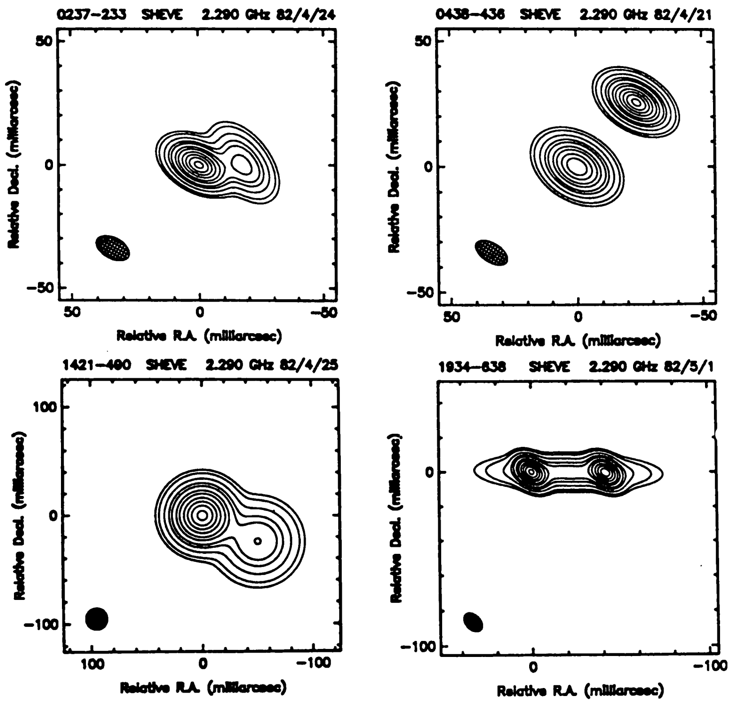
produce hybrid maps and models of sources with minimum fringe spacings of about 12 milliarcseconds and an angular resolution of about 5 milliarcseconds, an improvement of almost four orders of magnitude over existing southern hemisphere radio mapping instruments.

The baselines from the five Australian antennas to the South African antenna yielded fringe spacings of about 3 milliarcseconds. These baselines provided information on the extremely fine scale structure of each source. These data were included directly in the modelling of the sources but not in the hybrid mapping due to the disparity in length between the baselines to South Africa and those within Australia, as well as due to the limited u-v coverage obtained with the former.

The compact structure of 27 southern hemisphere sources was investigated at 2.3 GHz. These sources included Centaurus A (the nearest active galaxy; see Meier et al., this volume), the flaring binary star system Circinus X-1, the Vela pulsar, and the most distant known radio quasar (2000-330). In addition, Sagittarius A, the center of our galaxy, and Centaurus A were observed at 8.4 GHz on the Parkes-Tidbinbilla baseline.

Each source was observed for periods totalling 3 to 15 hours, with the observing periods usually being shared with alternating observations of another source. The final schedule was a compromise between the need to produce a general idea of the angular structure of a large number of new (to VLBI) southern sources, and the desire to provide detailed maps of a small number of selected sources. Consequently detailed maps are available only for four sources, while general models have been derived for a further 25.

FIGURE 1. Examples of Source Models



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