

A RADIO SURVEY FOR GRAVITATIONAL LENSES IN THE SOUTHERN HEMISPHERE

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We are undertaking an imaging survey with the Australia Telescope Compact Array (ATCA) to find gravitational lens candidates in flat-spectrum Parkes Catalogue radio sources. Flat-spectrum radio sources typically possess a single high brightness temperature nucleus of milliarcsecond size. Such sources, if lensed, will show multiply imaged nuclei with separations that are large compared to their milliarcsecond sizes. Our flat-spectrum sample was selected using the criteria $\alpha_{2.7/5.0} > -0.5$ ($S(\nu) \propto \nu^\alpha$), $S_{2.7} > 0.34\text{Jy}$ and $\delta \leq -20^\circ$, and comprises a total of 461 sources.

Survey observations were made with the ATCA in “cuts” mode (with typically 7 “cuts” per source) at 3 and 6 cm simultaneously. The 3 cm observations allow images to be made at 1 arcsec resolution which, when combined with the 6 cm data, enable spectral index information to be obtained. Simulations show that a 1 min “cut” per source every 2 h over a ~ 12 h period is sufficient to detect a close (~ 1 arcsec) double. This method of observation allowed us to observe ~ 80 sources per day.

The data were edited and calibrated within AIPS and imaged using the Caltech Difmap program (Shepherd et al. 1995). The final self-calibrated images yielded typical dynamic ranges in excess of 100:1. The ATCA data provide source positions with sub-arcsec accuracy and so make the identification of optical counterparts feasible. The COSMOS/UKST Southern Sky Catalogue (see Drinkwater et al. (1995) for a description) has proven invaluable in this task.

To date we have identified three lens candidates, images of which are shown in Figure 1 and described below. Follow up work, including observa-

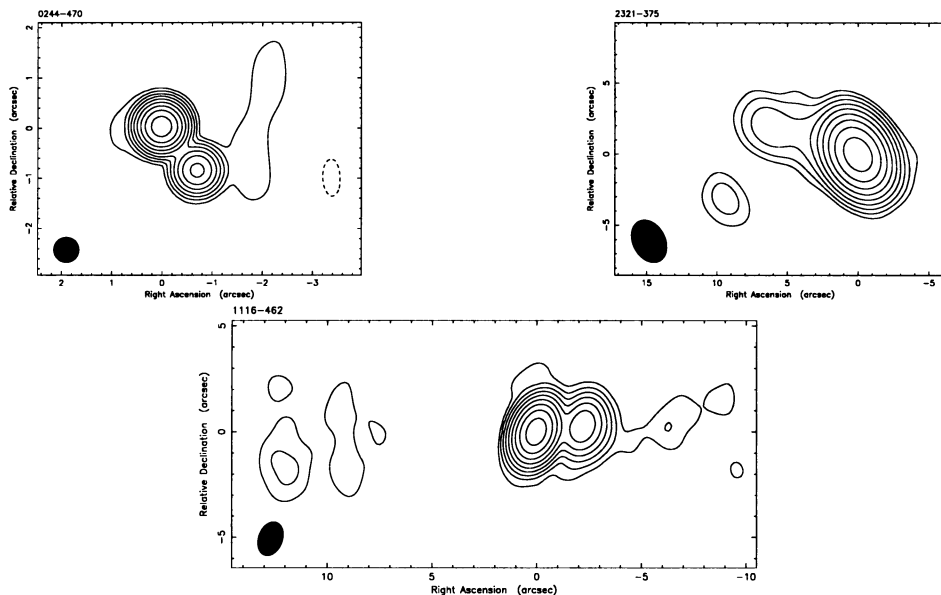


Figure 1. A 3 cm image of PKS 0244-470 super-resolved to reveal the compact nature of the two components (top left), PKS 2321-375 at 6 cm (top right) and PKS 1116-462 at 3 cm (bottom). Contour levels are 0.25,0.5,1,2,4,8,16,32,64 % of the peak for each source.

tions with the Australian Long Baseline Array and optical CCD imaging, is being carried out on these objects.

PKS 0244-470 is a 1 arcsec compact double. The flux density ratio of the two components is approximately 3:1 with a peak flux density of ~ 1 Jy. Both components possess a flat spectrum, suggesting that this object may be a doubly imaged quasar.

PKS 1116-462 appears as a flat-spectrum double source at the ATCA, thus making it a radio lens candidate, and yet appears as a point source at I, V and B bands at the Anglo Australian Telescope. This may indicate that, if the source is a gravitational lens, then one component may be reddened by an intervening galaxy.

PKS 2321-375 consists of a compact flat-spectrum core with a steep spectrum “jet” to the east and a weak flat-spectrum component to the south-east of the “jet”. This object could be in a lensing system where the compact core of a quasar has been doubly imaged.

References

- Drinkwater, M., Barnes, & Ellison, 1995, PASA, in press
 Shepherd, M.C., Pearson, T.J., & Taylor, G.B., 1994, BAAS, 26, 987