NEARLY MICROARCSECOND PRECISION DIFFERENTIAL ASTROMETRY [+]

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In studies of extragalactic radio sources with multiple compact
components the determination of which components, if any, are stationary
and which moving is of importance. In order to learn about the radio
properties of the individual components it is also relevant to be able to
register maps made at several wavelengths. Both tasks are usually not
possible with VLBI because of the irrecoverable corruption of the fringe
phase introduced by the propagation medium and the instrumentation. How-
ever, when two or more compact radio sources are separated by only a small
angle from each other difference techniques can be used to help tackle
both questions.

In this contribution we present relative position determinations of
the radio sources 1038+528 A, B (see Marcaide et al. in these Proceedings)
at several wavelengths for a series of observations from November 1979
through March 1981. The separation of the sources was measured between
reference points chosen in each quasar map defined by the positions of
the strongest CLEAN components. The observable used was the difference
phase-delay corrected for the source structure and the fringe ambiguity.
The details of the technique have been discussed by Marcaide (1982) and
Marcaide and Shapiro (1983).

The results of our experiments are shown in Fig. 1. The most precise
relative position determination was obtained from data from March 1981
at λ3.6 cm: The standard deviation was under 4 microarcseconds, which
corresponds to a phase-delay rms postfit residual under 2 picoseconds, or
equivalently to about half a millimeter of light travel path. A compari-
son of this separation with that obtained from data from November 1979 at
the same wavelength shows no indication of relative motion of the refer-
ence points in the maps with an upper limit of 18 microarcsecond/year.
Such a limit is consistent with the cosmological interpretation of the

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redshifts. However, such a small separation rate computed from only two epochs has to be viewed with caution (see Marcaide and Shapiro (1983) for a related discussion).

     Using this broader data base we confirm the result presented by Marcaide et al. elsewhere in these Proceedings that the separation be-tween the reference points in the maps of the A and B quasars is less at longer wavelengths of observation than at short wavelengths. We think this result is due to a wavelength-dependent location of the peak of brightness of the A quasar.
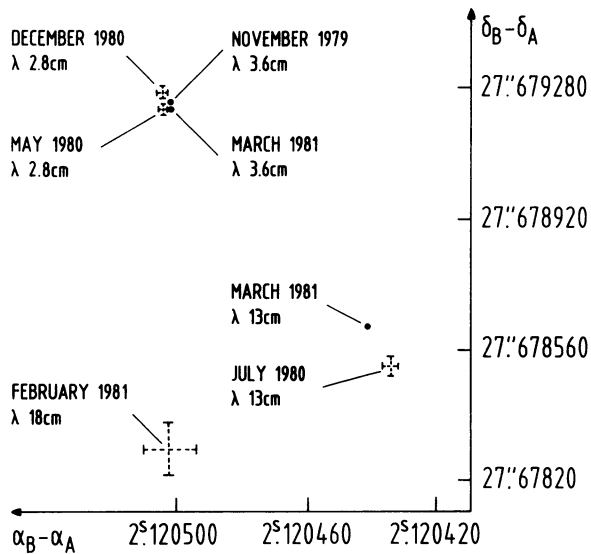

Figure 1:
Positions of the reference points chosen in the map of 1038+528 B relative to the reference points chosen in A (at the origin). The dashed error indicates that some assumption on the quasar structures was needed due to lack of information from the experiment itself. The displacement of the solution for λ18 cm observations with respect to the solutions for λ13 cm is likely due to use of an extrapolation of the structure at λ13 cm to that at λ18 cm based on an incorrect spectral index estimate for one source feature.

REFERENCES

Marcaide, J.M.: 1982, Ph.D. thesis, Massachusetts Institute of Technology
Marcaide, J.M. and Shapiro, I.I.: 1983, Astron. J. (to appear in August
     1983 issue)