VLBI POSITIONS OF EIGHT STELLAR SYSTEMS

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ABSTRACT. Radio positions of eight stellar systems have been derived with accuracies of 3 to 300 milliarcseconds from MkIII VLBI observations conducted with multi-station arrays. The best accuracy was obtained during a relatively strong outburst of the RS CVn system HR 5110. The epoch J2000.0 positions are obtained in the Jet Propulsion Laboratory VLBI reference frame of extragalactic radio sources.

1. Radio star astrometry and the Hipparcos Satellite

Observations of optically bright stars using VLBI are being made to determine accurate positions (uncertainties of a few milliarcseconds) and proper motions for about 15 objects well distributed over the sky. The extragalactic radio sources which form the reference frame for these positions will then provide an inertial frame for the optical positions of 100,000 stars determined by the Hipparcos satellite. The accuracy expected for the satellite observations is 2 mas in position and 2 mas/yr in proper motion.

2. Observations and Results

Survey work has shown that only the class of stars called RS Canum Venaticorum and other close binary systems (e.g. Algol, CYG X-1, LSI61 303) are at times sufficiently strong and compact in their radio emission to be useful for the astrometric requirements. During three sessions in 1983, using arrays of 5 or 6 antennas, we determined positions for eight stars with formal uncertainties of 0".003 to 0".3 (see tables 1 and 2). No correction has been made for proper motion or parallax. The precision was limited primarily by the strengths of the sources, which ranged from 9 to 400 mJy at the times of the observations.

We have compared these results with radio positions obtained with the VLA and with optical positions after transforming the VLA and

M. J. Reid and J. M. Moran (eds.), The Impact of VLBI on Astrophysics and Geophysics, 327–328.
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https://doi.org/10.1017/S0074180900134874 Published online by Cambridge University Press

optical positions from epoch B1950.0 to J2000.0. For 5 sources the mean (and rms) of the differences (VLA-VLBI) are 0".00 (0".06) and -0".06 (0".06) in right ascension and declination, respectively. For seven stars, excluding Algol, the mean (and rms) of the differences with the optical (OPTICAL-VLBI) are 0".03 (0".08) and -0".01 (0".09). The good agreement with the optical in right ascension is fortuitous since the origin of right ascension for the radio frame has an uncertainty of 0".2 with respect to the optical (Hazard et al., 1971). However, it does indicate that the JPL VLBI radio reference frame is aligned with the preliminary FK5 frame at a level of better than 0".1. This uncertainty is limited by the systematic errors over the sky of 0".1 to 0".2 in the optical positions.

Table 1. Dates of observations

	Date	Freq	Stations
I	83/03/20	8.4 GHz	DSS14,DSS13,OVRO,Ft.Davis,Westford
II	83/07/26	5.0 GHz	Bonn,Haystack,NRAO140",Ft.Davis,VLA,OVRO
III	83/10/16	1.7 GHz	Bonn,Haystack,NRAO140",Ft.Davis,VLA,OVRO

Table 2. Positions of eight radio stars. No correction has been made for parallax or proper motion.

Star	Session	Right Ascension (J2000.0) hr mn sec		Declination (J2000.0) dg mn sec		Flux Density (mJy)
LSI61 303	III	02 40 31.686+/-0.008		61 13 45.56 +/-0.07		40
Algol	II	03 08 10.1308	0.0003	40 57 20.359	0.005	45
UX Ari	II	03 26 35.3375	0.0002	28 42 56.026	0.005	145
HR 1099	I	03 36 47.3240	0.0002	00 35 18.66	0.02	400
HR 5110	II	13 34 47.6893	0.0002	37 10 56.859	0.003	165
SigCrB	II	16 14 41.2011	0.0007	33 51 32.47	0.01	16
CygX-1	II	19 58 21.6804	0.0004	35 12 05.887	0.009	15
SZ Psc	II	23 13 23.7645	0.0005	02 40 31.31	0.04	38

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Hazard,C, Sutton, J., Argue, A.N., Kenworthy, C.M., Morrison, L.V., and Murray, C.A., 1971, Nature, 233,89.

https://doi.org/10.1017/S0074180900134874 Published online by Cambridge University Press