A NEW WAY OF TYING TOGETHER THE HIPPARCOS FRAME TO THE VLBI EXTRAGALACTIC FRAME : ASTROMETRIC OBSERVATIONS OF STELLAR MASER SOURCES +

A. Baudry, J.M. Mazurier, Y. Requième
Observatoire de l'Université de Bordeaux et LA 352 du C.N.R.S.
33270 Floirac, France

The Hipparcos (H) reference system will contain 100 000 stars whose positions and proper motions will be known with an accuracy of 0".002 and 0".002/yr respectively. Because a residual rotation of the H system may exist and because a VLBI extragalactic frame is being constructed one must (i) determine an eventual rotation of the H rigid frame, (ii) link the H system to the VLBI extragalactic frame. VLBI observations at JPL (Fanselow *et al.*, 1981) have provided a catalogue of about 100 quasars with internal accuracy of ∿ 0".001.

One major difficulty in tying together the H reference system to the VLBI frame follows from the fact that extragalactic radio sources have faint optical counterparts : fainter than 17 mag in general, with one well known exception, 3C273B. Because objects fainter than ∿ 12 mag are not accessible to Hipparcos bright link stars must be observed with respect to faint extragalactic sources. This can be achieved by Space Telescope. However, simulations (Froeschlé and Kovalevsky, 1982) have shown that a direct link to the VLBI frame by means of radio stars also observable by Hipparcos is a more promising method. An accuracy of ∿ 0".002 is expected provided that stars and radio sources coincide.

Radio *continuum* stars have been proposed to link optical and radio systems (e.g. Walter, 1977). Non thermal emitters associated with RSCVn type stars are a priori good candidates because the radio emission size is thought to be comparable with that of the optically unresolved binary system. However, these link stars may not be always appropriate : they show unpredictable radio flares ; most of them are weak radio sources (S_{5GHz} is often < 5-10 mJy) ; their spatial structure is unknown at the milliarc second level.

Maser *line* sources associated with late type stars may also be used to tie together the optical and radio frames of reference. Several Mira variables and late type supergiants exhibit strong (fluxes > 10-50 Jy) OH, H_2O and SiO maser emission. Unification of the H and VLBI systems is achieved as follows : (1) optical measurements of maser stars with ground-based astrometric facilities and during the Hipparcos mission at a favou-

+ Discussion on page 465

R. Fanti et al. (eds.), VLBI and Compact Radio Sources, 355–356.

https://doi.org/10.1017/S0074180900078463 Published online by Cambridge University Press

rable period of the light cycle ; (2) radio interferometer position measurements with respect to extragalactic objects of those maser bright spots that are closely related to the photospheric activity of stars. In two previous papers (Baudry *et al.*, 1979, and Soulié and Baudry, 1983) we have suggested that observations of H_2O and SiO masers are especially promising.

In a preliminary work the 33 cm astrograph of the Bordeaux Observatory was used to derive with respect to AGK3 reference stars positions of 11 late type stars (Soulié and Baudry, 1983). The Bordeaux automatic meridian circle is now used for repeated observations of radio continuum and maser stars. In this paper we present our very first results concerning maser stars. Positions are referred to FK4 stars. (About 30 fundamental stars are observed each night.) Taking into account all measurements

Name	α(1950.0)	Epoch	Number of obs.	δ(1950.0)	Epoch	Number of obs.
VY CMa	$7^h20^m54^s.667$	1983.14	4	-25°40'13".96	1983.13	3
R Cnc	8 13 48.478	1983.16	10	11 52 51.95	1983.16	10
R LMi	9 42 34.756	1983.17	5	34 44 33.62	1983.17	5
R Leo	9 44 52.222	1983.16	6	11 39 40.43	1983.16	6
S Vir	13 30 23.129	1983.30	7	- 6 56 18.35	1983.27	6
RX Boo	14 21 56.729	1983.40	10	25 55 47.24	1983.40	10
S CrB	15 19 21.549	1983.42	10	31 32 45.61	1983.42	9
RU Her	16 08 08.485	1983.44	5	25 12 00.23	1983.45	4
U Her	16 23 34.695	1983.44	10	19 00 17.67	1983.44	9

the internal mean errors are : $\varepsilon_\alpha \cos\delta$ = 0".117 and ε_δ = 0".151. The position accuracy is of the order of $\varepsilon/\sqrt{N}$ where N is the number of observations for each star. Comparison of our astrograph and meridian circle measurements gives position differences in the range : $|\Delta\alpha| \simeq 0^s.001$ to $0^s.020$ and $|\Delta\delta| \simeq$ 0".03 to 0".30. For VY CMa the differences are larger and mostly due to the presence of a faint companion and of a small nebulosity.

References

Baudry, A., Delannoy, J., Lequeux, J. : 1979, J. Optics 10, 359.

Fanselow, J.C., Sovers, O.J., Thomas, J.B., Bletzacker, F.R., Kearns,T.J., Purcell, G.H., Rogstad, Jr., D.H., Skjerve, L.J., Young, L.E. : 1981, Reference Coordinate Systems for Earth Dynamics, p. 351 (eds. Gaposchkin, E.M., Kolaczek, B., Reidel, Dordrecht).

Froeschlé, M., Kovalevsky, J. : 1982, Astron. Astrophys. 116, 89.

Soulié, G., Baudry, A. : 1983, Astron. Astrophys. Suppl. Ser. 52, 299.

Walter, H.G. : 1977, Astron. Astrophys. Suppl. Ser. 30, 381.