KINEMATICAL TEST OF THE ICRS INERTIALITY

V. V. BOBYLEV
Main Astronomical Observatory of RAS
196140, St. Petersburg, Russia
e-mail: vbobylev@gao.spb.ru

1. THE SYSTEM OF HIPPARCOS AND TRC CATALOGUES

The kinematics of the Hipparcos (ESA, 1997) and TRC (Høg E., *et al.*, 1998) stars has been tested using Ogorodnikov-Milne model (Ogorodnikov, 1965, Clube, 1972). We used the classical approach wihtout parallaxes. This approach allows to use stars with negative parallaxes. The Oort constants $A = 13.7 \pm 0.4$ km/s/kpc, $B = -13.9 \pm 0.3$ km/s/kpc, $C = -3.2 \pm 0.5$ km/s/kpc and vertex deviation $l_{xy} = 7 \pm 1^\circ$ were found using 58675 distant ($r > 0.2$ kpc) Hipparcos stars. The values of the Oort constants A and B are in good agreement with the ones recommended by IAU (1986). The value of the vertex deviation $l_{xy} = 7 \pm 1^\circ$ is in good agreement with the results of different authors, for example, Dehnen and Binney (1998). It was found that the rotation around galactic y-axis of the distant Hipparcos stars occurs with angular velocity $M_{13}^- = -0.36 \pm 0.09$ mas/yr.

On the basis of the TRC the Oort constants were determined as follows: $A = 14.9 \pm 1.0$ km s^{-1} kpc^{-1} and $B = -10.8 \pm 0.3$ km s^{-1} kpc^{-1}. The component of the model above describing the rotation around the galactic y-axis differs noticeably from zero $M_{13}^- = -0.86 \pm 0.11$ mas/yr (TRC stars).

2. CORRECTION TO THE IAU (1976) PRECESSION CONSTANT

The value $M_{13}^- = -0.36 \pm 0.09$ mas/yr can be explained as residual rotation of the Hipparcos (or the ICRS) with respect to the extragalactic inertial frame. One of the causes of this effect is the uncertainty of the luni-solar precession constant adopted during the development of the ICRF (Ma C. *et al*, 1998). With the use of this approach the corrections of the luni-solar precession constant IAU (1976) have been derived as follows: $\Delta p_1 = -3.26 \pm 0.10$ mas/yr. Table 1 gives the corrections to IAU (1976) luni-solar precession constant Δp_1 and ΔE which were found by different authors using different catalogues.

3. MOTION OF THE DISTANT OB-STARS

The value $M_y = -0.36 \pm 0.09$ mas/yr may be of nature not connected with real motions of the stars. Precession of the warp in zx-plane with angular velocity -25 km/s/kpc was proposed by Drimmel et al. (2000). As $M_{13}^- \cdot 4.74 = -1.7$ km/s/kpc, so with $r = 1$ kpc $M_{13}^- \cdot r = -1.7$ km/s, and with $r = 2$ kpc $M_{13}^- \cdot r = -3.4$ /. Fig. 1 gives the components of spatial velocity W of 4250 Hipparcos OB stars (linear velocity on z-coordinate, Drimmel et al. 2000) as a function of galactocentric distance R and velocity of fictitious rotation of the ICRS $M_{13}^- = -0.36$ mas/yr, which can explain inclination of distant OB stars in Fig. 1 (the Solar distance from the Galactic center is $R_\odot = 8.0$ kpc).

Table 1: Corrections to IAU (1976) luni-solar precession constant Δp_1 and ΔE, in mas/yr.

ISSUE	CATALOGUES	Δp_1	ΔE
Miamoto, Sôma (1994)	ACRS	$-2.7_{(0.3)}$	
Rybka et al. (1995)	PPM	$-3.1_{(0.2)}$	$-1.3_{(0.2)}$
Bobylev (1997)	PUL2–PPM	$-2.8_{(0.8)}$	
Ma et al. (1998)	VLBI	$-2.84_{(0.04)}$	
Vityazev (1999)	CGC–HIP	$-3.4_{(1.0)}$	$-3.3_{(1.0)}$
Charpont et al. (2002)	LLR	$-3.02_{(0.03)}$	
Fukushima (2003)	VLBI	$-3.011_{(0.003)}$	

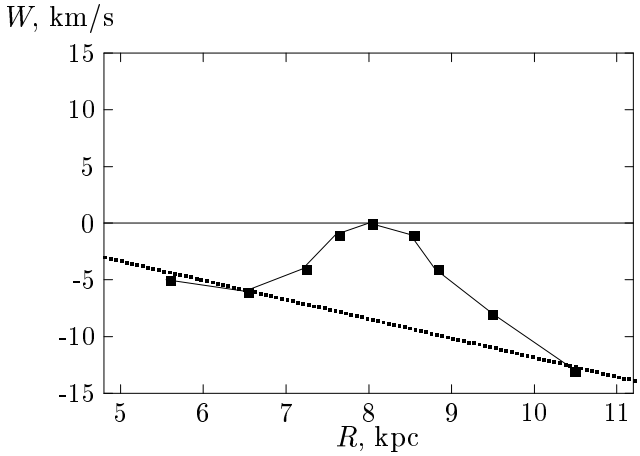

Fig. 1. Residual velocities W of 4250 OB stars as a function of galactocentric distance R by Drimmel et al. (2000). Dotted line corresponds to the vectors of the linear velocities $M_{13}^{-} \cdot r \equiv W$ obtained in this work (zero-point is shifted down).

Acknowledgement. This research has been supported by the Russian Foundation for Basic Research (grant No 02–02–16570).

4. REFERENCES

Bobylev V. V., *JOURNEES 1997*, Eds. J. Vondrák and N. Capitaine (Prague, 1997), p. 91.
Clube S. V. M., *Mon. Not. R. Astr.Soc.*, **159**, 289 (1972).
Chapront J., *et al.*, *Astron. Astrophys.*, **387**, 700 (2002).
Dehnen W. and Binney J. J., *Mon. Not. R. Astr.Soc.*, **298**, 387 (1998).
Drimmel R., *et al.*, *Astron. Astrophys.*, **354**, 67 (2000).
Fukushima T., *Astron. J.*, **126**, 494 (2003).
Høg E., *et al.*, *Astron. Astrophys.*, **333**, L 65 (1998).
Ma C., *et al.*, *Astron. J.*, **116**, 516 (1998).
Ogorodnikov K. F., *Dynamics of Stellar Systems*, (L.: Pergamon Press, 1965).
Rybka S. P., Kinemat. i Fiz. Neb. Tel. **11**, 77 (1995).
The Hipparcos and Tycho Catalogue, ESA SP-1200, (1997).
Vityazev V. V., Dr. Sci. dissertation, St. Petersburg, (1999).