SCIENTIFIC OBJECTIVES OF A SMALL SIZE CATALOGUE BASED ON THE SPACE-BORN OPTICAL INTERFEROMETRIC MISSION

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ABSTRACT. The Russian space born interferometric mission CELESTA is aimed at construction of the 5000 stars' catalogue of positions and proper motions accurate on the microarcsecond level. The paper presents the arguments for astrometric significance of such a relatively small catalogue.

1. CONCEPTION OF ASTROMETRY FOR THE "CELESTA" MISSION

Space born astrometric mission "CELESTA" is based on the double interferometer-arcmeter OSIRIS (A.A.Boyarchuk et al., 1999). The first step of the mission - foundation of reference system in optical on several brightest stars directly measured in ICRS relatively to its quasars. Positions of "celomer" stars will construct hard frame of triangles, so it will global astrometric frame. The ICRS realization in optic on celomer stars will be presented as set of instant positions of these stars measured in monitoring mode. This will allow to calculate coordinate of any celomer star for any moment with micro-arcseconds accuracy irrelative to nature of its motion.

As the celomer stars are distributed over the whole sky and included to Hipparcos catalogue, their positions may be used for improvement of the Hipparcos proper motions. The rest of the ~5000 stars will be measured in the frame of celomer stars directly tied to the extragalactic reference frame.

The main goals of the mission are as follows:

Establishing Inertial Coordinate Systems in optical with microarcsecond accuracy based on extra Galaxy point-like objects - quasars;

Measuring individual parallaxes of some thousand of stars up to 100 kps for revising the astronomical Distance Scale on the solid basis of direct triangulation;

Providing astrophysics with high precision distances of selected objects.

The main scientific problems to be solved by the OSIRIS project are follows:

A catalogue of positions for ~5000 astronomical objects with sub-millisecond accuracy.

Determination of absolute parallaxes for any type of objects in the Galaxy and, possibly, converting to the determination of parallaxes of extragalactic objects.

Construction of an inertial coordinate system to which the motion of solar system bodies and stars of the Galaxy can be related.

Study of the geometry of the Universe (improvement of the distance scale in the Galaxy and outside of it, study of the galactic rotation) in order to improve the knowledge of the dynamics of the Galaxy (refinement of the value and distribution of its mass including a qualitative estimate of visible and invisible components).

New possibilities allow to solve the following astronomical problems:

Detection of binaries.

Search for dark companions and planets around nearest stars.

Study of the orbital motion in binary and multiple stellar systems.

Study of kinematics and dynamics of stellar clusters.

Determination of motions of the nearest galaxies and the distribution of galaxies in the Universe.

The 4-years working out of the "CELESTA" project finishes stage "A", and the decision of beginning of stage "B" will be done in 2004. The total time of manufacturing astrometric probe and its launching is estimated as 4 years. The duration of the mission is planned to be 5 years and will continue till satellite will be operated. The probe will be low-masses (about 450 kg total) astrometrical satellite, which will be launched to high-altitude elliptical orbit with the apogee 200000-300000 km.

2. NECESSITY OF CHECKING AND IMPROVEMENT OF THE CURRENT REALISATION OF THE ICRS IN OPTICAL

The primary objective of the fundamental astrometry is construction of the distortion free system of the proper motions. The distortions of the Hipparcos system was a priori claimed 0.1 mas for positions and 10 mas/cy for proper motions. The first widely discussed indication that the Hipparcos proper motion system cannot be regarded as an ideally rigid standard is the anomalously small correction to the IAU 1976 precession constant inferred from direct comparison with the ground-based compiled catalogues. The next one is investigation of its systematic differences with respect to the ground-based catalogues. When a large subset of catalogues is incorporated into comparison it is appeared that the Hipparcos system of positions is in dramatic discrepancy with the modern ground-based catalogues as a whole. The level of systematic deviations is by two orders larger then claimed 0.1 mas. It is hard to imagine the source of an error systematically affecting absolutely all ground-based catalogues. When compared with the sequence of the FK catalogues on the 85-year interval it is clearly seen the evolution of the Hipparcos system in time that confirms that the Hipparcos system is not consistent not only with modern catalogues, but with all the catalogues of the 20^{th} century embedded into FK5, FK4 and FK3.

These evidences prove that, since discrepancy of the Hipparcos with respect to ground-based astrometry is not explained, there is still no convincing evidence of the declared high quality of the HIPPARCOS proper motion system in the sense of the global astrometry. This, in turn, leads to the idea that even a small catalogue of several thousands stars directly tied to the extragalactic reference frame during space-born interferometric mission will be of great importance for checking and improving of the HIPPARCOS proper motion system.

3. REFERENCES

Boyarchuk A.A, Bagrov, A.V., Mikisha A.M., et al., 1999, Cosmic Research, Vol.37, No 1, pp. 1-9.