THE LINK BETWEEN FUTURE GAIA CRF AND ICRF AND THE OBSERVING FACILITIES OF THE 60 cm ASV TELESCOPE

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1. Introduction

The cornerstone mission Gaia of the European Space Agency (ESA) was successfully launched at the end of 2013. The Gaia is going to revolutionize our knowledge of the Milky Way. It is the first space-based astrometry mission after the Hipparcos. So, the Gaia is the next step of European pioneering high-accuracy astrometry. The Gaia will map the entire Galaxy (repeatedly, during its 5-year lifetime); over one billion stars and about 500 000 quasars (QSOs). It means, all objects with apparent V magnitude between 5.6 and 20; the result will be a unique time-domain space survey.

The main task is to make a dense optical QSO-based Gaia Celestial Reference Frame (Gaia CRF). The link between future Gaia CRF and International CRF, with high accuracy, is of importance. For now, 90% of the ICRF sources are not suitable for mentioned link (Bourda et al. 2010, 2011; Taris et al. 2013; Petrov 2011, 2013) because: the objects are not bright enough in optical domain, they have significant extended radio emission, etc.

It is necessary to "check" other sources. They are week extragalactic radio sources (ERS) with bright optical counterparts, and we need to investigate these objects. The displacements of the optical photocenter (of mentioned objects) could be the result of its astrophysical processes, and the variations of light curves of objects are in line with their coordinates (via photocenter); it is of importance for good link. Because of it, the observation of 47 objects (mostly QSOs) are going on. We took a part of that job (in B,V,R bands) using new telescope at the Astronomical Station Vidojevica (ASV) of Astronomical Observatory in Belgrade (AOB); D/F=60cm/600cm. Preliminary photometric results of some QSOs in frame of that investigation are presented.

2. Instruments and results

In collaboration with Bulgarian colleagues, we are using the Rozhen telescope of National Astronomical Observatory (NAO), Bulgarian Academy of Sciences (BAS) for investigation of morphology of ICRF objects interested for Gaia astrometry. Also, the 60cm ASV telescope of AOB, is useful for photometry investigation. Both instruments are between other telescopes for these subjects. The main information of mentioned two telescopes are:

1. ASV (AOB)	λ=21.º5	CCD camera - Apogee Alta U42
Cassegrain	φ=43.º1	2048x2048 pixels, scale=0."46
60cm/600cm	h=1150m	13.5x13.5μm pixel size, FoV=15.'8x15.'8
2. Rozhen (NAO BAS)	24.7	VersArray 1300B
Ritchey-Chrétien	41.7	1340x1300, 0.26
200/1600	1730	20x20, 5.6x5.6

The information of the first column are: site,telescope and D[cm]/F[cm]. In the second column, the geographic coordinates (longitude - λ, latitude - φ) and altitude (h) of site are presented. The field of view (FoV) and CCD cameras are in the third column. The 60 cm ASV telescope is presented in Fig.1, and 2 m Rozhen one in Fig.2. In the near future (during next year), a new 1.4 m telescope will be installed at ASV in the frame of Belissima project (http://belissima.aob.rs).

GD defined a joint research project "Observations of ICRF radio–sources visible in optical domain", in the frame of bilateral cooperation between Serbian Academy of Sciences and Arts and BAS, which partly deals with Gaia CRF-ICRF link investigation; that 3-year project started in 2014 and its obvious benefits are in using the telescopes of both countries for these tasks.

The 60cm ASV telescope was used for optical observations of 47 objects, mostly QSOs, and photometry investigation (for the link Gaia CRF - ICRF) since mid-2013. Until now, all objects were observed (some of them 4 or 5 times) and we did it in the B,V,R bends (three CCD images per filter). Here, we present some preliminary photometric results of objects QSO 1212+467 (in Fig. 3) for June 27th 2014, and BL 1722+119 (in Fig. 4) for July 9th 2013. One of our observations with 60cm ASV is presented in Fig. 3. The standard bias, dark and flat-fielded corrections were done. Also, hot/bad pixels were removed. Via http://www.lsw.uni-heidelberg.de/projects/extragalactic/charts/ the comparison stars C1,C2,C3,C4 (in Fig. 4) were used. In our data, C1 was saturated in V and R. In B there is not input magnitude data. For 1212+467 we determined the calibration stars and calculated their B,V,R values using u,g,r,i,z ones (from SDSS catalog) and transformations (Chonis and Gaskell 2008). The calculated magnitude is an average value with standard error. Our photometry results are:

		M a g n I t u d e (standard error)			
JD-2456000	1212+467	2	3	4	5
B 836.38924	18.15(.03)	16.462(.014)	16.537(.008)	16.984(.018)	17.836(.014)
V 836.39287	17.94(.03)	15.871(.005)	16.052(.005)	16.356(.005)	17.130(.012)
R 836.39652	17.78(.01)	15.543(.006)	15.753(.008)	15.994(.005)	16.664(.005)
JD-2456000	1722+119	C1	C2	C3	C4
B 483.48651	-	-	-	-	-
V 483.48129	15.32(.02)	-	13.218(.005)	14.100(.006)	15.667(.008)
R 483.49204	14.87(.01)	-	12.625(.005)	13.623(.005)	15.153(.007)

Fig.1. The 60 cm ASV telescope

Fig.2. The 2 m NAOR telescope

Fig.3. The object 1212+467 (1), and comparison stars (2-5)

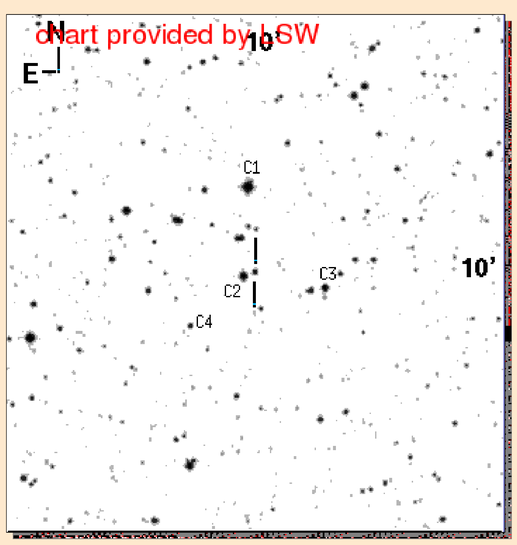

Fig.4. The comparison stars (C1,C2,C3,C4) around 1722+119

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