

Annual Report 2025

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1. Composition

The Working Group was led by Anatoliy Ivantsov (chair) and Marcelo Assafin (co-chair) in 2025. Also, Marcelo Assafin is a steering committee member for the Division A Fundamental Astronomy since 2024.

2. Meetings

There were no meetings organized by the Working Group in 2025.

3. Other activities

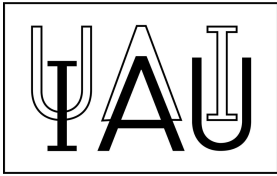
There were no other Working Group activities held in 2025.

4. Summary of state of the field within the remit of your Division/Commission/Working Group and its evolution over the reporting period

Small telescopes with apertures less than 2 m are used for getting accurate astrometric measurements of bright Small Solar System Bodies, natural satellites, and extragalactic sources. Besides direct imaging astrometry, there are a few observational techniques (occultations, eclipses, mutual events and approaches) to gain accurate mutual positions. Follow-Up networks and observational campaigns that are using small telescopes have shown their high efficiency in collecting observations of moving or/and transient objects.

Marcelo Assafin reported on the astrometric and photometric use of the T0.6 m and T1.6 m telescopes at the Observatorio do Pico dos Dias (OPD), Brazil, in 2025. Dozens of nights at each telescope were used to observe small bodies, mostly TNOs, dwarf planets, and natural satellites of Jupiter and Uranus, but also Jupiter Trojan asteroids. TNO observations were dedicated to the prediction and observation of stellar occultations. The Uranus system was observed with the technique of mutual approaches between the main satellites (Santos-Filho et al., 2019). Astrometry of Jupiter's irregular satellites was also made. They also observed mutual events between Saturn's satellites. In collaboration with many amateur astronomers around the world, small telescopes were used to observe stellar occultations of TNOs and Jupiter Trojans, allowing, as a sub-product and with the use of the Gaia catalogue, the derivation of dozens of astrometric positions with milli-arcsecond precision.

Goran Damljjanovich (Astronomical Observatory in Belgrade, Republic of Serbia) reported about 2 observing nights at 2 m Rozhen National Astronomical Observatory telescope in Bulgaria. There were observed 4 objects from the Extragalactic Radio Sources (ERS) for Gaia astrometry and photometry in line with the cooperation with Dr. F. Taris (Paris Observatory), two for the Whole Earth Blazar Telescope (WEBT) international project in cooperation with Dr. C.M. Raiteri (Torino Observatory) and 8 objects for a Ph.D. thesis by Miljana D. Jovanovic (Astronomical Observatory, Serbia). At the Astronomical Station of Vidojevica (ASV), the telescopes of 0.4 m, 0.6 m, and 1.4 m were used regularly, and a large number of CCD images have been taken for Gaia astrometry, Gaia Alerts program (now BHTOM program), and WEBT objects. The results of observations were used for publishing five papers in some leading international journals: 1) Vince, O., Raiteri, C.M., Villata, M. et al., 2025, A&A, 703, A259; 2) Dogra, K., Gupta, A.C., Raiteri, C.M. et al., 2025, ApJSS, 276, 1; 3) Otero-Santos, J., Raiteri, C.M., Tramacere, A. et al., 2025, A&A, 693, A196; 4) Merc, J., Wyrzykowski, L.,



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Beck, P.G. et al., 2025, MNRAS, 541, L14; 5) Simic, Z., Pavlovic, R., Bjelajac, D. et al., 2025, *J. Phys.: Conf. Ser.* 3116, 012003.

William Thuillot, together with a research group at the LTE (Laboratoire Espace Temps, resulting from the merger of the IMCCE and SYRTE Laboratories at Paris Observatory, France), has launched a photometric campaign to validate the presence of asteroid satellites showing an oscillation signal in Gaia measurements. Several small telescopes are being used, in particular the 1.2 m telescope at the Haute Provence Observatory in France, simultaneously with the 1 m telescope at the Lulin Observatory in Taiwan. These observations complement the Gaia Moons campaign dedicated to the observation of stellar occultations.

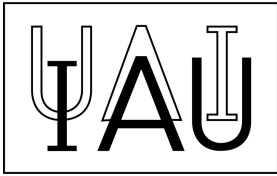
In addition, W. Thuillot (LTE), together with Th. Midavaine (French Astronomical Society), M. Dennefeld (Paris Institute of Astrophysics), and Ch. Buil (ARAS, Astronomical Ring for Access to Spectroscopy) continued to coordinate the RAPAS network (<https://rapas.imcce.fr>), established in 2022 for observation of transient objects (NEAs, SNs, etc.) following alerts as part of a professional-amateur collaboration. More than 90 transient objects were observed astrometrically and photometrically using telescopes with apertures ranging from 0.15 m to 0.8 m.

5. Other achievements or highlights

A Ph. D. Thesis “Variation of V and R magnitudes for selected quasars and the link between the Gaia CRF and ICRF systems” (in Serbian) by Miljana D. Jovanovic was defended in 2025. The thesis was supervised by Goran Damljanovich (Astronomical Observatory in Belgrade, Republic of Serbia).

Abstract. One of the main objectives of the Gaia mission of the European Space Agency is to construct a celestial reference frame at the wavelengths of the optical domain, Gaia CRF. This frame needs a link to the International Celestial Reference Frame – ICRF, which is fixed with respect to distant objects (quasars). The objects serving for linking are required to be visible in both domains (optical and radio). A set of 47 such objects has been proposed and compiled, which in the radio domain have no detected extended emission. The mentioned objects are active galactic nuclei (AGN), the brightness of which varies over the whole electromagnetic spectrum. The brightness change may be due to activity in different AGN regions, but also to external factors. Such variations can lead to changes in the photocenter position and, consequently, to changes in the object coordinates. In order to establish which objects are suitable for linking these two frames, we have examined the brightness variation in the optical domain. The objects have been observed since 2013 in the V and R bands. We have analyzed the brightness, color (V–R), and optical spectral index (α). It has been established that for the majority of objects, the brightness is variable, or possibly variable. Almost 15% of all objects have significant changes in their brightness (more than 1 mag), and only ~10% are stable with minor brightness changes of ~0.3 mag. The results concerning the change analysis of the color and α are also presented. Based on these results, 17 objects are chosen as suitable for linking ICRF to Gaia CRF. The results of the analysis, as well as the observed values, are essential for the examination of these objects because of their importance in astrometry, as well as in astrophysics. These data are relevant to a better understanding of the formation and evolution of galaxies.

We highlight the importance of observational campaigns organized at any level, international, national, or even regional. For campaigns involving small and amateur telescopes, such events spark genuine interest not only among participants but also among their science-inclined friends. This fosters a desire to contribute to science (a sense of novelty) and serves as a powerful incentive to study Astronomy and promote public support for it.



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6. Challenges encountered and recommendations to the IAU

As to the 2025 annual report form provided, we propose to have separate sections for Educational and Media activities, as both require special expertise and seem to be very important to bringing attention to our professional activities and promote public support for Astronomy. Amateur astronomers can provide substantial scientific and public support for professional astronomical activities if interaction with IAU members is established and supported. “Interaction with Amateurs” can be a section in the annual report to enforce the links with the IAU society.