Annual Report 2021/2022
IAU Division A Working Group
Astrometry by Small Ground-Based Telescopes

Chair	Anatoliy Ivantsov
Co-Chair	Marcelo Assafin
Members	Alexandre Humberto Andrei,
	Jean-Eudes Arlot,
	Goran Damljanovic,
	Christine Ducourant,
	Charlie Thomas Finch,
	Wenjing Jin,
	Nadiia Maigurova,
	Jose L. Muinos Haro,
	Dan Pascu,
	Thierry Pauwels,
	Yuri Protsyuk,
	Olexander Shulga,
	Richard Smart,
	Jean Souchay,
	Magdalena Stavinschi,
	Zheng Hong Tang,
	Francois Taris,
	Ramachrisna Teixeira,
	William Thuillot,
	William Van Altena,
	Roberto Vieira Martins,
	Norbert Zacharias

Jean-Eudes Arlot (IMCCE, Paris Observatory, France) reports on the observation of mutual events of the Galilean satellites which provide high-quality data allowing to reach an unprecedented resolution in the satellites' dynamical models. A worldwide campaign

of observations of the mutual events of the Galilean satellites was conducted by IMCCE, Paris, France and Sternberg Astronomical Institute, Moscow University, Moscow, Russian Federation in 2021. The magnitude of the Galilean satellites is sufficiently bright to allow observations with very small telescopes that increases the possibility of their observations. 37 observers from 18 different sites of observation observed 85 phenomena in spite of many difficulties: the campaign must be conducted only during the occurrence of the events (when the Earth and the Sun pass through the equatorial plane of Jupiter) and during the opposition of Jupiter as seen from the Earth. Unfortunately, the maximum of events occurred during the conjunction of Jupiter with the Sun. A publication of the results is in preparation.

Jean-Eudes Arlot reports on the ongoing digitizing project of photographic plates at IMCCE, Paris Observatory, France. From 1890 to 1990, astronomical observations were taken mostly using photographic plates at small telescopes with apertures from 30 cm-refractors to 2 m-telescopes. The project will consider some of these plates, reduction of them using new accurate star catalogues such as GAIA for astrometry, so it will be possible to measure the past observations with today's accuracy. The works conducted at the present time are related to natural satellites astrometry and Be stars spectroscopy.

Marcelo Assafin and Roberto Vieira-Martins report on the astrometric and photometric use of the T0.6m and T1.6m telescopes at the Observatorio do Pico dos Dias (OPD), Brazil. 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 for the prediction and observation of stellar occultations. The Uranus system was observed with the technique of mutual approximations between the main satellites (Santos-Filho et al., 2019). Astrometry of Jupiter irregular satellites was also made. They attempted also observation of all 15 mutual events of the Galilean satellites plus Amalthea and Thebe that were visible at OPD for the 2021 season.

Charlie Thomas Finch (U.S. Naval Observatory, USA) reports that astrometric and photometric observations continue with the Deep South Telescope (DST) after a long pause in 2020 due to the COVID-19 pandemic with 10,298 exposures taken in 2021. The main goal is to monitor a select list of extragalactic celestial reference frame sources (AGN, QSOs) in hopes of better understanding the radio-optical position offsets. The

principal instrument (Sophia 4K CCD) has been down for repairs and a stop gap CCD camera (Marana) has been installed. The Sophia 4K is planned to be reinstalled on DST within a few months. An IR camera is planned for the optical IR port on DST supporting an ICRF photometric characterization and monitoring effort, as well as southern-sky priorities for infrared-bright objects. A USNO Bright Star Catalog paper has been submitted to the Astronomical Journal using data obtained from both the USNO Robotic Astrometric Telescope (URAT) and UBAD project using the 1.55-meter telescope at the Naval Observatory Flagstaff Station.

Thierry Pauwels and Peter De Cat (Royal Observatory of Belgium, Belgium) report that in 2017 the dome of the Ukkel Schmidt Telescope (main mirror 1.2 m, diaphragmed to 85 cm) has been restored, and during that period no observations were possible. After the telescope was available for observations again, the number of still to be discovered asteroids in the range of our equipment (mag limit 20-20.5 in the best case) had decreased too much to justify the cost of the maintenance and to motivate the observers. There are no plans for the moment to resume the observations. They provided a summary of the achievements of the RUSTICCA project (Revalorising the Ukkel Schmidt Telescope by Installing a Ccd CAmera), which started in 1993, and was operational 1996—2016. 24531 astrometric positions of asteroids and 71 astrometric positions of comets have been published in the MPCs, with a few hundred still waiting to be published. 217 asteroids, including 1 PHA and 3 Trojans, have been discovered by the equipment, with another 10-20 on the waiting list to be recognized as such. 300 astrometric positions of minor planets (NEOs) and comets have been published in the Minor Planet Electronic Circulars. Also, 29 light curves of mutual phenomena of the Galilean satellites of Jupiter (1997, 2003, 2009, 2014, and 2015), and 9 light curves of mutual phenomena of an asteroid and its satellite (2006—2008) have been recorded, and precise timings of disappearance and reappearance of 8 stellar occultations by asteroids have been derived. In total, the archive contains 30967 images and films.

William Thuillot (IMCCE, Paris Observatory, France) reports on the activity related to astrometry by small ground-based telescopes, focused on monitoring Gaia alerts for solar system objects (SSOs). As soon as Gaia detects an uncatalogued mobile source, an alert is triggered via a public website to the Gaia-FUN-SSO network. At the time of writing, about 300 uncatalogued SSOs, either newly detected or with imprecise orbits, have been observed and their astrometry provided to the IAU Minor Planet Center. These

observations were made by telescopes of one meter diameter or less at the Las Cumbres Global Telescope, Observatoire de Haute-Provence, C2PU at Calern-OCA, Terskol, Kyiv Comet Station, Odessa-Mayaki, Abastumani (Carry et al., 2021).

The Working Group besides Division A and Division B is supporting the IAU Focus Meeting 10 “Synergy of Small Telescopes and Large Surveys for Solar System and Exoplanetary Bodies Research”, https://iaufm10.org, to be held at the XXXI IAU General Assembly in Busan, Republic of Korea on August 2-22, 2022. The SOC is comprised of three members of this WG (Marcelo Assafin, Anatoliy Ivantsov and William Thuillot).

Concluding Remarks

Small telescopes with apertures less than 2 m are still useful for getting accurate astrometric measurements of Small Solar System Bodies, natural satellites and extragalactic sources either through direct imaging or using photometric measurements of mutual events. The Working Group is actively facilitating the exchange of information, coordination of campaigns and setup of telescope networks. Further details are provided on the continuously updated webpage at https://iau_wgnps.imcce.fr.

Anatoliy Ivantsov & Marcelo Assafin
Chair & Co-Chair of Working Group

References

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Santos-Filho, S., Assafin, M., Morgado, B.E., Vieriera-Martins, R., Camargo, J.I.B. et al. 2019, Mutual approximations between the five main moons of Uranus, MNRAS, 490, 3464-3475; doi: 10.1093/mnras/stz2841.