

IAU Division A

Fundamental astronomy – Astronomie Fondamentale

Annual report for 2022

Daniel Hestroffer (Paris obs., Paris, FR) – president
Bonnie Steves (GCU, Glasgow, UK) – vice president

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The steering committee of Division A (2021-2024) is composed of:

Daniel Hestroffer (President)	FR
Bonnie Steves (Vice-President)	UK
Norbert Zacharias (Advisor)	US
Christopher S. Jacobs (Commission A1 President)	USA
Zinovy M. Malkin (Commission A2 President)	RU
Susan Gessner Stewart (Commission A3 President)	USA
Christos Efthymiopoulos (Comm. A4 President)	IT-GR
Fabrizio Bernardi (Commission X2 President)	IT
Marcelo Assafin (member)	BR
Anthony G.A. Brown (member)	NL
Andrzej J. Maciejewski (member)	PL
Elke Pilat-Lohinger (member)	AT
Vladislav Sidorenko (member)	RU

Commissions and Working Groups

The Division webpage https://www.iau.org/science/scientific_bodies/divisions/A/info/ lists various information together with the Division Commissions and Working groups. There are currently five Commissions with respective working groups, including one cross division commission, and six Working groups including interdivision ones. The Division’s Commissions and functional Working Groups have been renewed for a 6 years term.

[Commission A1 Astrometry](#)

[Commission A2 Rotation of the Earth](#)

[Commission A3 Fundamental Standards](#)

[Inter-Division A-F Commission Celestial Mechanics and Dynamical Astronomy](#)

[Cross-Division A-F Commission Solar System Ephemerides](#)

The following are division’s WGs that are *functional* working groups, with tasks achieved regularly, including two inter-division WG.

[Division A WG Numerical Standards in Fundamental Astronomy \(NSFA\)](#)

[Division A WG Standards of Fundamental Astronomy \(SOFA\)](#)

[Division A WG Time Metrology Standards](#)

[Inter-Division A-F WG Cartographic Coordinates & Rotational Elements](#)

[Inter-Division A-F WG Near Earth Objects](#)

and additional

[Division A WG Astrometry by Small Ground-Based Telescopes](#)

[Division A WG Multi-waveband International Celestial Reference Frame \(optical+VLBI\)](#)

While most of the working groups are directly under Division A, Commission A2 ‘Rotation of Earth’ has also two (joint) working groups:

- Joint IAU-IAG (International Association of Geodesy) - Improving Theories and Models of the Earth’s Rotation (ITMER);
- Joint IAU-IAG-IERS on the Consistent Realization of TRF, CRF and EOP

Membership

Division A has a total of 1872 individual members, of which about 10% are junior members. Let us welcome to the new members of the year, most of them being junior members. Having a yearly call for individual membership and junior membership is profitable to attract younger colleagues. Some colleagues have also passed away, sadly, we will honour the deceased members’ memory during the Division days at the General Assembly.

PhD Prizes

As noted in previous reports, the number of candidates under Division A to the PhD prize has always been rather low when compared to the other divisions. Members of Division A are strongly encouraged to disseminate the information and call, and motivate young PhDs to candidate. Topics proposed to Div. A have been generally connected to general relativity, astrometry, or celestial mechanics. Discussion and selection for year 2022 has been made

with the entire SC; the competition was tough, giving full justification to the honorary prize.

I. de Blasi (Univ. of Turin, Italy) with her PhD on « Dynamics and stability in Celestial Mechanics: from galactic billiards to Nekhoroshev estimates ».

Honorary prize to H. Ding (Swinburne Univ. of Technology, Australia) with his PhD on “Enhancing the use of Galactic neutron stars as physical laboratories with precise astrometry”.

Symposia and Focus meetings

After some discussions mostly among steering committees, there are no submission for symposium for 2024 (at the next general assembly or not) but will be proposed at the edition for 2025. Following the recent IAU changes on the procedure for proposition and selection, Division A has given recommendations after LoIs during the proposal elaboration, but no official letter of support even if requested by the proposers.

For the edition of year 2024, Division A has received 1 proposal directly coordinated by the division, and proposed to comment and ranked (H-M-L) 6 proposals in total as primary or secondary coordinator.

Recent meetings, short report

No symposium has been organized by Div. A in the past year. The post-pandemic general improvements made it possible to organize the IAU general assembly in Busan and scientific meetings. The Division A days have been successful, with a total of 28 talks and contributions, and a proportion of about half/half given in person. This albeit - or in consequence of - many last minute changes for travels and participation to the venue given the post-pandemic situation and travel restrictions. Some focus meetings were of interest to Division A, FM7 and FM10 were coordinated by the Division.

• **Division days** (August 5 and 8, 2022)

The final programme, booklet of abstracts, and copies of all contributions are available on the Division A permanent webpage

https://www.iau.org/science/scientific_bodies/divisions/A/meeting2022/

The days were divided in 5 main sessions, trying to accommodate time schedule for speakers on-remote in various time zones:

- PhD prizes talks (3 laureates and one honorary guest)
- Gaia eDR3 and DR3 (mini focus meeting)
- News from Commissions and WGs
- Reference Frames and Rotations (mini focus meeting)
- Highlights of Focus Meetings (FM7, FM8 and FM10)

Thanks again to all participants (speaker or not, on site and on-line) for their contributions, and to the speakers for having rapidly sent their presentation.

• **FM7 [Anthony Brown]**

Programme and presentations are available on <https://zenodo.org/communities/iau-ga-2022-fm7/>

The meeting had 29 contributions (invited and contributed) of which seven female speakers, distributed in 5 sessions.:

- Astrometry science highlights
- Astrometric techniques
- Dense and accurate reference frames [...]
- Future astrometric surveys
- Synergy between astrometric, photometric, and spectroscopic surveys

The headline review was presented by one of the 2022 Shaw Prize winners (Lennart Lindegren).

Scientific highlights :

- Lindegren presented an overview of modern astrometric techniques emphasising the enormous advances made with the Gaia mission and how this provides a unifying framework for the various ground and space based astrometric facilities.
- Invited talks highlighted the advances in the accurate calibration of the distance scale (Beaton), the revolution in the studies of stellar streams (Koposov) and the solar system (Tanga) thanks to Gaia. The invited contribution by Queiroz provided an excellent example of synergies between Gaia and ground based photometric and spectroscopic surveys, leading to accurate catalogues of astrophysical properties of stars, including precise distances.
- Astrometry with interferometric techniques in the radio and optical were discussed by Reid and Lacour, while Massari and Mignard discussed the importance of accurate astrometric reference frames in the upcoming era of extremely large telescopes.
- Future prospects for precise astrometry in the radio and optical/IR domains were discussed by Dodson (SKA prospects) and Hobbs (GaiaNIR mission).
- The contributed talks highlighted the broad impact of astrometry on astronomy and astrophysics.

• **FM10 [Anatoliy Ivantsov]**

The programme is available on the meeting website kept updated at <https://iaufm10.org>. The meeting had 26 talks (invited and contributed) of which six female speakers, and 19 addition e-talks and e-posters. The list of participants, grants, gender and geographic distribution is provided.

The scientific programme was distributed in 6 sessions, chaired by SOC members:

- Astrometry science highlights
- Astrometric techniques
- Dense and accurate reference frames [...]
- Future astrometric surveys
- Synergy between astrometric, photometric, and spectroscopic surveys

With general conclusions :

- Machine and deep learning are used frequently in the classification and detection of exoplanets using large sets of parameters and data.
- While large surveys produce homogeneous data over a greater area of sky, small telescopes can be suitable instruments for the follow-up of various objects suspected in either variability or motion.
- While there are plenty of possibilities for calibration of small telescope measurements, the Gaia data releases provide the most accurate ones, and, thus, are highly recommended.

- There are observational programmes for small telescopes that are open for collaboration today (Gaia Follow-Up network, LSST contribution programme, and other observational networks).

All speakers were suggested to submit manuscripts. Only 3 manuscripts have been submitted because of lack of interest and too small number of pages allocated.

It was also possible to organise during this year 2022 some workshops, reconvene large meetings, and regular scientific venues, such as: CELTA ASI Summer School 2022, regular in-person, Skye (UK) ; CelMec VIII *hybrid*, Roma (Italy).

Commissions and Working groups reports.

Commissions A1, A2, A3, cross-division commission X2, and inter-division commission A4 ; Working groups SOFA, WGASGBT, WGTMS, WGMwICRF, inter-division WGCCRE, WGNEOs have provided their annual report. Reports have different formats but all are showing scientific and programmatic activities either as functional entities, and/or as holding meetings exchanging information, and supporting IAU plan. We highlight a few points below.

Commission A1 notes that 2022/2023 has been a year full of successes in the field of astrometry, reporting progress in both global and differential astrometry, at optical/IR and radio wavelengths, with notably Gaia and VLBI. Many other programmes are listed, in an attempt to give an overview of developments in astrometry over the last year.

One can note first results from JWST or VLTI, and future from UKIRT, LSST, Gaia-NIR, JASMINE, LLR, CART, SKA, etc. The Focus Meeting on ‘Multi-wavelength Astrometry’ proposed for next IAU-GA 2024 is supported by Division A.

Commission A2 helps linking the astronomical community to other scientific organizations such as the International Association of Geodesy (IAG), International Earth Rotation and Reference Systems Service (IERS), and space geodesy technique services largely contributed to the monitoring and investigation of the Earth's rotation, such as International VLBI Service for Geodesy and Astrometry (IVS), International GNSS Service (IGS), International Laser Ranging Service (ILRS), and International DORIS Service (ILRS). During the last year CA participated or has organised several scientific meetings, it also worked on the IAU resolutions B1 and B2 approved by the XXXI IAU-GA.

The non-functional WGASGBT working group reminds in its conclusion that small telescopes with apertures less than 2 m are still useful for getting accurate astrometric measurements of solar system bodies, and extragalactic sources. The Working Group is actively facilitating the exchange of information, coordination of campaigns and setup of telescope networks.

The WG-SOFA service continues its task of establishing and maintaining an accessible and authoritative set of algorithms and procedures that implement standard models used in fundamental astronomy. SOFA is in a “maintenance” mode after its last major release in 2021. The report provides some last news and statistics, and encourage all our users to acknowledge their use of SOFA. The WG board reminds that it needs a new Chair to take SOFA forward.

The WG-TMS has issued two information letters sent to members. It has contributed to ITU-

R Working Party 7A (WP7A) with texts providing information of the use of UTC in astronomy ; This work is part of Resolution 655 of the World Radiocommunication Conference 2015 (WRC-15) for the future of Coordinated Universal Time UTC.

The inter-division WG-NEO continues its task of monitoring and participating to the international activities focused on planetary defense, of representing the IAU in international groups, such as the UN-endorsed IAWN. It also highly contributes to public outreach efforts, noting that NEOs and planetary defense are of high interest for the public. Results from space missions DART, Hayabusa2, Osiris-REX are presented, as well as missions and programmes in development. No less than twelve workshops and meetings relevant to NEO and planetary defense activities are listed for year 2022 and 2023.

The inter-division WGCCRE is hoping to do progress on inviting new members to join and in getting their next main report written and published. It points some discussions and recommendation needed on Mars and Lunar orientation updates. It also expresses its need of a long-term support as a Functional WG, with the increasing number and complexity of community inquiries. It will continue to increase the community awareness of their work and recommendations with presentations at appropriate scientific meetings.