IAU Commission A2 "Rotation of the Earth" : Current activities and outlook

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Historic dates

- **1919**, Brussels Conference
  Standing Committee 19 on Latitude Variations

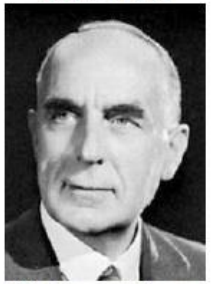
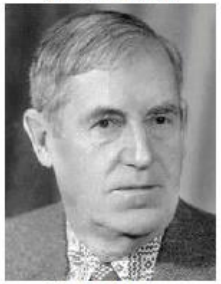
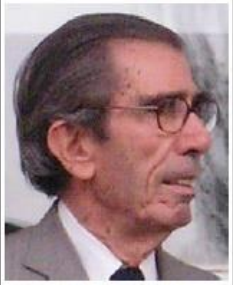
- **1922**, 1st IAU General Assembly
  IAU Commission 19 "Variation of Latitude"

- **1964**, XIIth IAU General Assembly
  IAU Commission 19 "Rotation of the Earth"

- **2015**, XXIXth IAU General Assembly
  IAU Commission A2 "Rotation of the Earth"

For more details on the C19/CA2 history see
Malkin Z., et al. On the eve of the 100th anniversary of IAU Commission 19/A2 "Rotation of the Earth". In: Proc. IAU, 2019, Vol. 13 (Symposium S349), pp. 325-331. ADS: 2019IAUS..349..325M

C19/CA2 Presidents

1922 – 1935	1936 – 1948	1948 – 1955	1955 – 1961	1961 – 1967	1967 – 1970	1970 – 1973	1973 – 1976
							
H Kimura	H. Spencer Jones	P. Sollenberger	E. Fedorov	B. Guinot	P. Melchior	H. Smith	C. Sugawa
1976 – 1979	1979 – 1982	1982 – 1985	1985 – 1988	1988 – 1991	1991 – 1994	1994 – 1997	1997 – 2000
							
R. Vicente	P. Pâquet	Y. Yatskiv	W. Klepczynski	M. Feissel	B. Kolaczek	J. Vondrák	D. McCarthy
2000 – 2003	2003 – 2006	2006 – 2009	2009 – 2012	2012 – 2015	2015 – 2018	2018 – 2021	2021 – 2024
							
N. Capitaine	V. Dehant	A. Brzeziński	H. Schuh	C. Huang	R. Gross	F. Seitz	Z. Malkin

Objectives of Commission A2 are to:

- Encourage and develop cooperation and collaboration in observation and theoretical studies of Earth orientation variations.
- Serve the astronomical community by linking it to the organizations that provide the International Terrestrial and Celestial Reference Systems/Frames and Earth orientation parameters (EOP): IAG, IERS, IVS, IGS, ILRS, and IDS.
- Develop methods for improving the accuracy and understanding of Earth orientation variations and related reference systems/frames.
- Ensure agreement and continuity of the reference frames used for studying Earth orientation variations with other astronomical reference frames and their densification.
- Provide ways of comparing observational and analysis methods and results to ensure accuracy of data and models and encourage the development of new observation techniques.

General CA2 activities

- CA2 played and plays important role in IAU activity coordinating international cooperative efforts in improving our knowledge about the Earth's rotation, and establishing and maintaining the celestial and terrestrial reference frames.
- CA2 initiated or supported many important resolutions related to the theory of precession-nutation, celestial and terrestrial reference system and frame, time scales and other topics of general scientific and practical interest.
- CA2 works in cooperation with other International organizations such as IUGG and IAG and thus provides link between these organizations and IAU.
- CA2 was co-organizer and collaborator of several international services such as IERS, IDS, IGS, ILRS, IVS.
- CA2 organized or co-organized many Working Groups incuding intercommission and interunion ones.

CA2 Structure in 2021-2024

President: **Zinovy M. Malkin** (Russia)
VP (elected): **Alberto Escapa** (Spain)
Secretary: **Laura I. Fernandez** (Argentina)
Advisor (Past President): **Florian Seitz** (Germany)

At-large OC members (elected):
Laura I. Fernandez (Argentina)
David A. Salstein (USA)
Jean Souchay (France)

Second-term OC members:
Hadia Hassan Selim (Egypt)
Shuanggen Jin (China, Nanjing)
Jolanta Nastula (Poland)

Non-Voting Representatives to CA2 OC:
Robert Heinkelmann (IAG Representative)
Daniela Thaller (IERS Representative)
Oleg A. Titov (IVS Representative)

114 Commission Members

https://www.iau.org/science/scientific_bodies/commissions/A2/

CA2 Working Groups

IAU Commission A2 (co-)organized or participated in several IAU and inter-union WGs:

- Joint IAU-IAG-IERS WG Consistent Realization of TRF, CRF and EOP (JWG CRTCE).
- Joint IAU-IAG WG Improving Theories and Models of the Earth's Rotation (JWG ITMER).

Members of the IAU CA2 also participated in other IAU and inter-union bodies:

- IAU Div A WG "Multi-waveband International Celestial Reference Frame (optical+VLBI).
- IAU Div A WG "Standards of Fundamental Astronomy".
- IAG Sub-Commission 1.4 "Interaction of Celestial and Terrestrial Reference Frames".
- **. . .**

CA2 activities in 2021-2022

- CA2 proposed an IAU Resolution on Improvement of the Earth's Rotation Theories and Models, which was approved by the IAU GA 2021 as IAU Resolution B2.
- CA2 together with CA1 proposed an IAU Resolution in support of the protection of geodetic radio astronomy against radio frequency interference, which was approved by the IAU GA 2021 as IAU Resolution B1.
- A. Escapa, R. Heinkelmann, J. M. Ferrandiz, F. Seitz, and R. Gross prepared an article for IAU Catalyst on these two IAU Resolutions including their detailed description and explanation.

CA2 activities: Resolutions

https://www.iau.org/science/scientific_bodies/commissions/A2/info/documents/

Resolutions adopted at the General Assemblies and proposed by Commission A2 (after 2015):

- 2018, Resolution B1: "*on Geocentric and International Terrestrial Reference Systems and Frames*"
- 2021, Resolution B1: "*in support of the protection of geodetic radio astronomy against radio frequency interference*"
- 2021, Resolution B2: "*Improvement of the Earth's Rotation Theories and Models*"

https://www.iau.org/publications/iau/information_bulletins/

6 Science Focus

6.1

Resolutions Adopted in the IAU XXXI General Assembly Business Sessions Proposed by Commission A2 on Rotation of the Earth

A. Escapa, R. Heinkelmann, J. M. Ferrándiz, F. Seitz, R. Gross

Observing and studying the Earth's rotation is fundamental to the International Astronomical Union (IAU). Along with the IAU, 32 Standing Committees were also created on July 28, 1919. One of them was Standing Committee 19 on Latitude Variations, later transformed into Commission 19 on Variation of Latitude in 1922, and then into Commission 19 on Rotation of the Earth in 1964. Since 2015 it has been designated as Commission A2 on Rotation of the Earth' (CA2) and belongs to IAU Division A Fundamental Astronomy.

The Earth's rotation connects the Earth-fixed (terrestrial) and space-fixed (celestial) reference systems that provide the fundamental framework for referencing astronomical and space-geodetic observations, and for navigating objects in space and on Earth. The associated Earth Orientation Parameters (EOP) are a key set of parameters for the realisation of those coordinate systems: that is, for the determination of the Terrestrial Reference Frame (ITRF) and the Celestial Reference Frame (ICRF). Such a set is composed of three kinds of parameters: two related to precession and nutation, one to length of day, and two to polar motion. The EOP have been observed since the 19th century, initially by astrometric optical measurements. Later, the advent of precise space-geodetic techniques paved the way for reaching near millimetre-accuracy. Corresponding EOP series are disseminated by the International Earth Rotation and Reference Systems Service (IERS).

The knowledge of the Earth's rotation is also indispensable for the realisation of time systems and precious for studying the Earth's internal structure and geophysical phenomena. A particular focus of CA2's scientific work is the theory of Earth rotation. Along with technological advancement and increased accuracy requirements, CA2 encourages the improvement of the Earth rotation theory regarding its accuracy, consistency, and ability to model and predict the essential EOP. The IAU theories of nutation and precession currently in force are IAU2000 and IAU2006, adopted in 2000 and 2006, respectively.

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CA2 activities: Resolution B1

- Resolution B1 is of relevance for Very Long Baseline Interferometry (VLBI), which is the only operational technique for the determination of the five EOP.
- The next generation of antennas, VGOS (VLBI Global Observing System), will observe with broader bandwidth and at slightly different frequencies (2 – 14 GHz).
- The increase of precision is indicated for the provision of accurate reference frames that allow for the monitoring of environmental signals, such as the sea-level change, at the required level (0.1 mm y^{-1}), also required by UN.
- IAU recognizes the importance of the EOP dataset and its application in fulfilment of the UN societal goals, and the need that the new observation bands be registered and protected by International Telecommunication Union (ITU) against radio frequency interference.

CA2 activities: Resolution B2

- Resolution B2 has its origin in, despite the impressive advancement of observing techniques, the lack of enhancement in the accuracy of EOP determination for many years.
- The activity of two successive working groups of CA2, joint with the International Association of Geodesy (IAG), showed the need of improving the underlying theories and identified different problems related to inaccuracies and inconsistencies in current EOP models, some of them going back to the early 2000s (e.g., IAU2000 and IAU2006 theories).
- Resolution B2 describes these problems and urges the astronomical community to work in their solution with intensity, and in cooperation with other concerned organizations, such as the IAG and UN.

Scientific meetings

A proposal for IAU GA 2021 Symposium "Reference systems and their ties with the rotation of the Earth and other Solar System bodies" jointly prepared by IAU Commissions A1, A2 (lead), and Inter-Division A/F WG on Cartographic Coordinates and Rotational Elements (WGCCRE) was submitted but was not approved by the IAU EC. The CA2 OC decided to work on a new IAU Symposia proposal, together with other IAU Commissions having interest in the CA2 topics.

Because of COVID-19 pandemic, there were no scientific meetings co-organized by the CA2 in 2021. Meanwhile, CA2 members participated in organization of many other scientific meetings of IAG, EGU, AGU, EVGA, and others with topics related to CA2 interests.

Welcome!

All the colleagues
interested in CA2 topics
are welcome to join our Commission!