

IAU Commission A3 - Fundamental Standards
Triennial Report 2021 - 2024

Commission A3 Organizing Committee (CA3 OC)

Susan G. Stewart, President, US Naval Observatory, USA

Jose Manuel Ferrándiz, Vice President, Universidad de Alicante, Spain

Steven A. Bell, HM Nautical Almanac Office, UK

Agnès Fienga, Observatoire de la Cote d'Azur, France

Demetrios N. Matsakis US Naval Observatory, USA (retired)

Wendy K. Puatua, US Naval Observatory, USA

Antonia J. Wilmot, HM Nautical Almanac Office, UK

IAU Division A Commission A3 (CA3) continues to fill an important and necessary role in the IAU and wider astronomical research community by identifying, researching, coordinating and communicating fundamental astronomical standards. During this term, we have also proposed new standards which will be put forth as a resolution at the 2024 General Assembly. The Commission currently has 108 members and 7 members on the CA3 organizing committee who began their tenure in 2021.

The success of CA3 relies on communication. Our primary method of communication to the community is through an actively maintained CA3 website: <https://iau-a3.gitlab.io/>. The CA3 also established an account on “X” (formally known as twitter) @IAU_CA3, which was approved by the IAU media liaison, and commission email address iauca3standards@gmail.com this term to facilitate communication. These resources will easily transfer to the next organizing committee. During this term, the CA3 OC sent three newsletters to the commission through the IAU executive committee secretary.

The CA3 has responsibility for the upkeep of the Numerical Standards for Fundamental Astronomy (NSFA), hosted on the CA3 website. The following items are intended to be updated this term on the NSFA website after being identified as developing standards for discussion:

- Mass of Ceres
- Mass of Sun / Mercury
- Mass of Sun / Mars
- Mass of Sun / Jupiter
- Mass of Sun / Saturn
- Solar Mass Parameter
- Constant of Gravitation

The CA3 presented an update during the Division A Division Days portion of the August 2022 off-cycle General Assembly in Busan, South Korea. The CA3 also held a business meeting which focused on the need for further discussion and collaboration with other standards partners in the areas of:

- Lunar standards
- Implications of upcoming continuous UT1-UTC
- Updates to the IAU 2009 constants
- Updates and addition to IAU 2006 Nomenclature

Many CA3 members were present at the September 2023 Journees meeting in Nice, France, organized by CA3 OC member Agnes Fienga. The CA3 President led a lively open discussion on lunar standards.

During this term, CA3 maintained strong ties with our international standards partner organizations. Our representative in the International Association of Geodesy (IAG) is Robert Heinkelmann (GFZ Potsdam, Germany) who interfaces with the Global Geodetic Observing System Bureau of Products and Standards (GGOS BPS) committee. He reported the CA3 activities to their annual meeting. CA3 OC member Agnes Fienga is chairing IAG Working Group 1.1.3 on Lunar Reference Frames. CA3 President Susan Stewart is also serving on this Working Group.

The CA3 OC is in regular communication with Dennis McCarthy (USNO, retired), who is the IAU representative to the Consultative Committee on Time and Frequency (CCTF) and the Bureau International des Poids et Mesures (BIPM). The CA3 OC assisted him in developing a pamphlet for the BIPM which described the practical impact on astronomy with regard of the future adoption of a constant UT1-UTC. The CA3 OC has been in frequent communication with Patrizia Tavalla, director of the BIPM Time Department. She gave valuable input on the upcoming CA3 recommendation on the need for an internationally determined lunar time standard.

CA3 OC member Steve Bell was appointed to the IAU Division A WG for Time and Metrology. CA3 OC also fostered coordination with the IAU Working Group on Cartographic Coordinates and Rotational Elements (WGCCRE) on several occasions this term. Members of the CA3 served on the interoperability of cislunar navigation Working Group between ESA and NASA with representatives from BIPM and other international standards bodies. CA3 President Susan Stewart presented on international astronomical standards at the Precise Time and Time Interval Systems and Applications (PTTI) in January 2024.

In 2023, CA3 OC sponsored the IAU Symposium proposal: *ADVANCING REFERENCE SYSTEMS, EPHEMERIS, AND STANDARDS: From the Earth and the Moon to solar system bodies*. If selected, it will be held at Universidad Nacional de La Plata, Argentina on 4-8 August, 2025. The CA3 OC developed a proposed session on astronomical standards which would focus on standards in fundamental astronomy and their potential revision and/or extension to other parameters. It would also explore potential updates of the terminology as proposals to adopt astronomical lunar standards are made. Key topics proposed:

- Current status of IAU standards
- Update of astronomical constants & terminology
- Algorithms and procedures of astronomical standards
- Lunar standards

- Standards organizations

Proposed Session Chairs are Catherine Hohenkerk (past CA3 President) and Susan Stewart (current CA3 President). CA3 OC member Antonia Wilmot is a proposed speaker for a SOFA update.

The CA3 drafted and submitted three resolutions to the IAU Resolution Committee to be considered for vote and adoption at the General Assembly in August 2024. After evaluation by the IAU Resolution Committee and edits by the CA3 OC and IAU general relativity subject matter experts, these are:

1. Resolution to establish a standard Lunar Celestial Reference System (LCRS) and Lunar Coordinate Time (TCL)
2. Resolution on the establishment of a coordinated lunar time standard by international agreement

The CA3 plans to establish a Working Group for Lunar Standards during the upcoming IAU GA. Plans are underway for a CA3 update and presentation on the above resolutions during Division A Days at the meeting. The CA3 will also hold a business meeting at the IAU GA.

During the next term, Jose Manuel Ferrándiz will transition to the role of President while Agnès Fienga, Wendy Puatua and Antonia Wilmot will serve for another term on the organizing committee.

29 Apr 2024

Susan G Stewart

President, Commission A3