

## **DIVISION A / FUNCTIONAL WORKING GROUP STANDARDS OF FUNDAMENTAL ASTRONOMY (SOFA)**

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**Maria Davis,**  
**Mickaël Gastineau,**  
**Catherine Y. Hohenkerk,**  
**Jinling Li,**  
**Wendy Puatua,**  
**Scott Ransom,**  
**Nick Stamatakos,**  
**Patrick Wallace**

### **TRIENNIAL REPORT 2021-2024**

#### **1. Introduction**

Standards of Fundamental Astronomy (SOFA) is a Functional Working Group of Division A and continues to provide an accessible and authoritative set of algorithms and procedures that implement standard models used in fundamental astronomy.

This service for the astronomical community and others is facilitated by the SOFA website at [www.iausofa.org](http://www.iausofa.org), which provides access to the Fortran and ANSI C software libraries. The content is reliant on the expertise of the international Board members. This report highlights the need for SOFA to continue.

#### **2. The SOFA Board**

In order to be authoritative and maintain IAU standards, SOFA has a Board of experts that produces and validates the material. There have been some changes to the Board over the last triennium. Catherine Hohenkerk has stepped down as chair and Toni Wilmot was elected as her replacement. The Board thank Catherine Hohenkerk for her leadership over the past years and acknowledge the contribution that she has made and is still making to SOFA and the wider astronomical community. Nicole Capitaine of Paris Observatory, Jeffrey Percival of the University of Wisconsin and Zinovy Malkin of Pulkovo Observatory, St Petersburg have also stepped down from the Board. We thank those who have stepped down for their years of service.

#### **3. Software and Website**

The latest release of SOFA, release 19, was made available on 11th October 2023. There have been two major releases during the triennium, releases 18 and 19, and the current software consists of 192 astronomy routines with 3 routines added during this triennium.

As with previous releases, improvements have been made to the documentation within the code and the cookbooks. A new cookbook on miscellaneous topics has been added to the collection; topics include ecliptic and galactic coordinates, Hipparcos/FK5 and FK4/FK5 transformations, geodesy and solar-system ephemerides. We thank all our users for sending in their reports and suggestions.

There are three recognized implementations of SOFA software by third parties. The first is the JAVA version by Dr Paul Harrison of Jodrell Bank Centre, University of Manchester. The second is the Essential Routines for Fundamental Astronomy (ERFA) produced by the AstroPy group which is a library that copies the ANSI C version of SOFA but is not IAU badged and so can be changed by anyone. The third is the World Wide Astronomy (WWA) version by Attila Abrudán which is a set of C# algorithms and procedures. These versions are listed on the SOFA website.

The website statistics are currently still unavailable so there is limited information to measure the use of SOFA. There are currently (end of March 2024) 1049 registered users. Registered users are not necessarily individual users and visitors to the website do not necessarily use SOFA. For release 19 of the SOFA software there have been 1685 downloads of the ANSI C version and 672 downloads of the Fortran version. For release 18 of the SOFA software there have been 19776 downloads of the ANSI C version and 3515 downloads of the Fortran version. The SOFA website provides a means to download the SOFA libraries in Fortran and ANSI C, as well as to view or download any of the documentation including the five cookbooks, and any individual routine may be viewed and downloaded. We do ask that users acknowledge their use of SOFA.

#### 4. Closing Remarks

The SOFA software continues to provide the astronomical community with a set of well-tested, independent standard routines that support IAU resolutions. This gives users the tools for easily implementing and learning about fundamental astronomy algorithms and procedures such as time scales, Earth rotation and precession and nutation for use in research, applications and importantly in testing their particular implementations. This IAU service should continue.

I acknowledge and thank all the Board members and their host institutions for their work, in particular Patrick Wallace, who provides draft code for the Board to review, Catherine Hohenkerk and web-master, Steven Bell. The Board also thanks the United Kingdom Hydrographic Office (UKHO) for hosting the SOFA website ([www.iausofa.org](http://www.iausofa.org)).

Toni Wilmot  
*Chair of SOFA Board*