The SOFA Astronomy Library

- **Precession, nutation and polar motion**
  - 60 routines, 16 canonical
  - Frame bias components (IAU 2006)
  - Precession angles \( \xi, \eta \) (IAU 1976, 2000, 2006)
  - Precession angles including frame bias (IAU 2006)
  - All ephemerides based precession angles (IAU 2006)
  - Fukushima-Williams precession angles, including frame bias \( \xi, \eta \) (IAU 2006)
  - Mean obliquity \( e \) (IAU 1980)
  - Nutation angles \( \varphi, \psi \), \( \varphi \) (IAU 1980, 2000)
  - CSP Y and SCL Locator \( s \) and \( q \) (IAU 2000, 2006, 2006/2000A)
  - Equation of the origins
  - Matrices for frame bias (IAU 2001)
  - Precession (IAU 1976, 2000, 2006)
  - Polar motion
  - Vector, matrix & utility routines – VML (Support Library)

- **Vector, matrix routines**
  - 37 routines
  - Vector algebra: plus, minus, dot (scalar) & cross (vector) products, modulus, normalization, scalar times vector
  - Products of two matrices & transpose of a matrix, a matrix & vector & conversions between matrices & rotation vectors

- **Spherical / cartesian conversions**
  - 6 routines
  - Conversions between the coordinate systems

- **Operations on angles**
  - 12 routines
  - Conversions between vectors & position angle and separation
  - Conversions between radians and \( \frac{\theta}{\pi} \) (degrees) and \( \frac{\theta}{\pi} \) (arcminutes), radians and (hours) \( \frac{\theta}{\pi} \) (arcseconds), and days and h m s
  - Normalize radians between 0 and 2\( \pi \) and -\( \pi \) to \( \pi \)

The SOFA Software

- A Service for All
- http://www.iausofa.org
- sofa@ukho.gov.uk

IAU SOFA Software

- IAU Division I, Commission 19 via the IAU SOFA Board

What standards?
- Canonical routines adopt IAU standards:
  - IAU 2000A, IAU 2000
  - IAU 1980 & IAU 1976

Documentation?
- The Manual: ASCII & pdf from the comments
- Cook Books:
  - SOFA Tools for Earth Attitude
  - SOFA Time Scale & Calendar Tools

What tools provided?
- makefile to build library
- Validation programs:
  - t_sofa.f Fortran 77
  - t_sofa.c ANSI C

What is available?
- Single download of the library:
  - UNIX tarball (UNIX line-terminators)
  - Windows tarball (DOS line-terminators)

What is provided?
- 15 routines, 8 routines, 2 routines, canonical
- 7 routines, 16 routines, 37 routines

What terms?
- Anyone may use SOFA, free of charge
- If you change any of the code you must say so & not claim that it is SOFA
- Please acknowledge use
- © SOFA Software belongs to the IAU SOFA Board

Who provides it?
- IAU Division I, Commission 19 via the IAU SOFA Board

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