Highlights of Astronomy, Volume 15
XXVIIth IAU General Assembly, August 2009
Ian F. Corbett, ed.

doi:10.1017/S1743921310008823

Implementation of the IAU 2000 definition of UT1 in astronomy

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Abstract. We recall the concepts and nomenclature associated with the IAU 2000 definition of UT1 as function of the Earth rotation angle (ERA). We comment on the complications that arise when UT1 is regarded as both an angle and a time scale. We review the IAU 2006 expressions for the position of the celestial intermediate origin (CIO) and the equation of the origins, and the associated CIO and equinox based procedures for the celestial-to-terrestrial transformation.

Keywords. astrometry, reference systems, time, Earth

According to the IAU 2000/2006 resolutions, the concepts, nomenclature and numerical expressions associated with the IAU 2000 definition of UT1 as function of the Earth rotation angle (ERA) have replaced the pre-2003 concepts, nomenclature and numerical expressions associated with Greenwich sidereal time (GST).

ERA is the angle measured along the equator of the Celestial Intermediate Pole (CIP) between the Terrestrial Intermediate Origin (TIO) and the Celestial Intermediate Origin (CIO), and increases as the Earth rotates. Due to the kinematical definition of the CIO, its position as function of time depends only on the CIP motion, while the position of the equinox depends on both the equator and ecliptic motions. UT1 is defined by its conventionally adopted linear relation to the ERA. The equation of the origins (i.e. the distance from the CIO to the equinox along the CIP equator), EO, is the link between the CIO based and equinox based expressions. The ERA based expression for GST (=ERA−EO) allows a clear distinction between UT1 regarded as a time determined by the rotation of the Earth and Terrestrial time (TT), which were merged in the pre-2003 GST expression.

The IAU 2006 expressions for the precession quantities and GST have been provided by Capitaine *et al.* (2003a), while the IAU 2000/2006 expressions for locating the CIP (i.e X, Y) and the CIO (i.e the s quantity) can be found in Capitaine & Wallace (2006). The largest change in the IAU 2006 expression for s w.r.t. the IAU 2000 one (see Capitaine *et al.* 2003b) is below 3 μas, while the corresponding change in the EO (and hence GST) is more than 5 mas. The associated CIO and equinox based precession-nutation procedures provided in Wallace & Capitaine (2006) have been the basis for the SOFA (Standards Of Fundamental Astronomy) and IERS implementations (IERS, 2009).

References

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