B   IAU Resolutions Adopted at the XXVIth General Assembly (2006)

B.1   IAU 2006 Resolution B1 on Adoption of the P03 Precession Theory and Definition of the Ecliptic

The XXVIth International Astronomical Union General Assembly,
Noting

1. the need for a precession theory consistent with dynamical theory,

2. that, while the precession portion of the IAU 2000A precession-nutation model, recom-mended for use beginning on 1 January 2003 by resolution B1.6 of the XXIVth IAU General Assembly, is based on improved precession rates with respect to the IAU 1976 precession, it is not consistent with dynamical theory, and

3. that resolution B1.6 of the XXIVth General Assembly also encourages the development of new expressions for precession consistent with the IAU 2000A precession-nutation model, and

Recognizing

1. that the gravitational attraction of the planets make a significant contribution to the motion of the Earths equator, making the terms lunisolar precession and planetary precession misleading,

2. the need for a definition of the ecliptic for both astronomical and civil purposes, and

3. that in the past, the ecliptic has been defined both with respect to an observer situated in inertial space (inertial definition) and an observer comoving with the ecliptic (rotating definition),

Accepts

the conclusions of the IAU Division I Working Group on Precession and the Ecliptic published in Hilton et al. (2006, Celest. Mech. 94, 351), and

Recommends

1. that the terms lunisolar precession and planetary precession be replaced by precession of the equator and precession of the ecliptic, respectively,

2. that, beginning on 1 January 2009, the precession component of the IAU 2000A precession-nutation model be replaced by the P03 precession theory, of Capitaine et al. (2003, A&A, 412, 567-586) for the precession of the equator (Eqs. 37) and the precession of the ecliptic (Eqs. 38); the same paper provides the polynomial developments for the P03 primary angles and a number of derived quantities for use in both the equinox based and CIO based paradigms,

3. that the choice of precession parameters be left to the user, and

4. that the ecliptic pole should be explicitly defined by the mean orbital angular momentum vector of the Earth-Moon barycenter in the Barycentric Celestial Reference System (BCRS), and this definition should be explicitly stated to avoid confusion with other, older definitions.

Notes

1. Formulas for constructing the precession matrix using various parameterizations are given in Eqs. 1, 6, 7, 11, 12 and 22 of Hilton et al. (2006). The recommended polynomial developments for the various parameters are given in Table 1 of the same paper, including the P03 expressions set out in expressions (37) to (41) of Capitaine et al. (2003) and Tables 3-5 of Capitaine et al. (2005).

2. The time rate of change in the dynamical form factor in P03 is $dJ_2/dt = -0.3001 \times 10^{-9} century^{-1}$.

B.2   IAU 2006 Resolution B2 on the Supplement to the IAU 2000 Resolutions on reference systems

Recommendation 1. Harmonizing the name of the pole and origin to "intermediate"
The XXVIth International Astronomical Union General Assembly,
Noting

1. the adoption of resolutions IAU B1.1 through B1.9 by the IAU General Assembly of 2000,

2. that the International Earth Rotation and Reference Systems Service (IERS) and the Standards Of Fundamental Astronomy (SOFA) activity have made available the models, procedures, data and software to implement these resolutions operationally, and that the Almanac Offices have begun to implement them beginning with their 2006 editions, and

3. the recommendations of the IAU Working Group on "Nomenclature for Fundamental Astronomy" (IAU Transactions XXVIA, 2005), and

Recognizing

1. that using the designation "intermediate" to refer to both the pole and the origin of the new systems linked to the Celestial Intermediate Pole and the Celestial or Terrestrial Ephemeris origins, defined in Resolutions B1.7 and B1.8, respectively would improve the consistency of the nomenclature, and

2. that the name "Conventional International Origin" with the potentially conflicting acronym CIO is no longer commonly used to refer to the reference pole for measuring polar motion as it was in the past by the International Latitude Service,

Recommends

1. that, the designation "intermediate" be used to describe the moving celestial and terrestrial reference systems defined in the 2000 IAU Resolutions and the various related entities, and

2. that the terminology "Celestial Intermediate Origin" (CIO) and "Terrestrial Intermediate Origin" (Terrestrial Intermediate Origin) be used in place of the previously introduced "Celestial Ephemeris Origin" (Celestial Ephemeris Origin) and "Terrestrial Ephemeris Origin" (Terrestrial Ephemeris Origin), and

3. that authors carefully define acronyms used to designate entities of astronomical reference systems to avoid possible confusion.

Recommendation 2. Default orientation of the Barycentric Celestial Reference System (BCRS) and Geocentric Celestial Reference System (GCRS)
The XXVIth International Astronomical Union General Assembly,
Noting

1. the adoption of resolutions IAU B1.1 through B1.9 by the IAU General Assembly of 2000,

2. that the International Earth Rotation and Reference Systems Service (IERS) and the Standards Of Fundamental Astronomy (SOFA) activity have made available the models, procedures, data and software to implement these resolutions operationally, and that the Almanac Offices have begun to implement them beginning with their 2006 editions,

3. that, in particular, the systems of space-time coordinates defined by IAU 2000 Resolution B1.3 for (a) the solar system (called the Barycentric Celestial Reference System, BCRS) and (b) the Earth (called the Geocentric Celestial Reference System, GCRS) have begun to come into use,

4. the recommendations of the IAU Working Group on "Nomenclature for Fundamental Astronomy" (IAU Transactions XXVIA, 2005), and

5. a recommendation from the IAU Working Group on "Relativity in Celestial Mechanics, Astrometry and Metrology",

Recognizing

1. that the BCRS definition does not determine the orientation of the spatial coordinates,

2. that the natural choice of orientation for typical applications is that of the ICRS, and

3. that the GCRS is defined such that its spatial coordinates are kinematically non-rotating with respect to those of the BCRS,

Recommends

that the BCRS definition is completed with the following: "For all practical applications, unless otherwise stated, the BCRS is assumed to be oriented according to the ICRS axes. The orientation of the GCRS is derived from the ICRS-oriented BCRS."

B.3   IAU 2006 Resolution B3 on the Re-definition of Barycentric Dynamical Time, TDB

The XXVIth International Astronomical Union General Assembly,
Noting

1. that IAU Recommendation 5 of Commissions 4, 8 and 31 (1976) introduced, as a replacement for Ephemeris Time (ET), a family of dynamical time scales for barycentric ephemerides and a unique time scale for apparent geocentric ephemerides,

2. that IAU Resolution 5 of Commissions 4, 19 and 31 (1979) designated these time scales as Barycentric Dynamical Time (TDB) and Terrestrial Dynamical Time (TDT) respectively, the latter subsequently renamed Terrestrial Time (TT), in IAU Resolution A4, 1991,

3. that the difference between TDB and TDT was stipulated to comprise only periodic terms, and

4. that Recommendations III and V of IAU Resolution A4 (1991) (i) introduced the coordinate time scale Barycentric Coordinate Time (TCB) to supersede TDB, (ii) recognized that TDB was a linear transformation of TCB, and (iii) acknowledged that, where discontinuity with previous work was deemed to be undesirable, TDB could be used, and

Recognizing

1. that TCB is the coordinate time scale for use in the Barycentric Celestial Reference System,

2. the possibility of multiple realizations of TDB as defined currently,

3. the practical utility of an unambiguously defined coordinate time scale that has a linear relationship with TCB chosen so that at the geocenter the difference between this coordinate time scale and Terrestrial Time (TT) remains small for an extended time span,

4. the desirability for consistency with the Teph time scales used in the Jet Propulsion Laboratory (JPL) solar-system ephemerides and existing TDB implementations such as that of Fairhead & Bretagnon (*A&A* **229**, 240, 1990), and

5. the 2006 recommendations of the IAU Working Group on "Nomenclature for Fundamental Astronomy" (IAU Transactions XXVIB, 2006),

Recommends

that, in situations calling for the use of a coordinate time scale that is linearly related to Barycentric Coordinate Time (TCB) and, at the geocenter, remains close to Terrestrial Time (TT) for an extended time span, TDB be defined as the following linear transformation of TCB:
$TDB = TCB - L_B \times (JD_{TCB} - T_0) \times 86400 + TDB_0$, where $T_0 = 2443144.5003725$,
and $L_B = 1.550519768 \times 10^{-8}$ and $TDB_0 = -6.55 \times 10^{-5}$ s are defining constants.

Notes

1. JD_{TCB} is the TCB Julian date. Its value is $T_0 = 2443144.5003725$ for the event 1977 January 1 00h 00m 00s TAI at the geocenter, and it increases by one for each 86400 s of TCB.

2. The fixed value that this definition assigns to L_B is a current estimate of $L_C + L_G - L_C \times L_G$, where L_G is given in IAU Resolution B1.9 (2000) and L_C has been determined (Irwin & Fukushima, 1999, *A&A* **348**, 642) using the JPL ephemeris DE405. When using the JPL Planetary Ephemeris DE405, the defining L_B value effectively eliminates a linear drift between TDB and TT, evaluated at the geocenter. When realizing TCB using other ephemerides, the difference between TDB and TT, evaluated at the geocenter, may include some linear drift, not expected to exceed 1 ns per year.

3. The difference between TDB and TT, evaluated at the surface of the Earth, remains under 2 ms for several millennia around the present epoch.

4. The independent time argument of the JPL ephemeris DE405, which is called Teph (Standish, *A&A*, **336**, 381, 1998), is for practical purposes the same as TDB defined in this Resolution.

5. The constant term TDB_0 is chosen to provide reasonable consistency with the widely used $TDB - TT$ formula of Fairhead & Bretagnon (1990). n.b. The presence of TDB_0 means that TDB is not synchronized with TT, TCG and TCB at 1977 Jan 1.0 TAI at the geocenter.

6. For solar system ephemerides development the use of TCB is encouraged.