3 Conventional Dynamical Realization of the ICRS (1 June 2004)

The planetary and lunar ephemerides recommended for the IERS standards are the JPL Development Ephemeris DE405 and the Lunar Ephemeris LE405, available on a CD from the publisher, Willmann-Bell. See also the website $<^1>$; click on the button, "Where to Obtain Ephemerides."

Note that the time scale for DE405/LE405 is not Barycentric Coordinate Time (TCB) but rather, a coordinate time, T_{eph}, which is related to TCB by an offset and a scale. The ephemerides based upon the coordinate time T_{eph} are automatically adjusted in the creation process so that the rate of T_{eph} has no overall difference from the rate of Terrestrial Time (TT) (see Standish, 1998), therefore also no overall difference from the rate of Barycentric Dynamical Time (TDB). For this reason space coordinates obtained from the ephemerides are consistent with TDB.

The reference frame of DE405 is that of the International Celestial Reference Frame (ICRF). DE405 was adjusted to all relevant observational data, including, especially, VLBI observations of spacecraft in orbit around Venus and Mars, taken with respect to the ICRF. These highly accurate observations serve to orient the ephemerides; observations with respect to other frames (*e.g.*, FK5) were referenced to the ICRF using the most recent transformations then available.

It is expected that DE405/LE405 will eventually replace DE200/LE200 (Standish, 1990) as the basis for the international almanacs. Table 3.1 shows the IAU 1976 values of the planetary masses and the values used in the creations of both DE200/LE200 and of DE405/LE405. Also shown in the table are references for the DE405 set, the current best estimates.

Table 3.1   1976 IAU, DE200 and DE405 planetary mass values, expressed in reciprocal solar masses.

Planet	1976 IAU	DE200	DE405	Reference for DE405 value
Mercury	6023600.	6023600.	6023600.	Anderson *et al.*, 1987
Venus	408523.5	408523.5	408523.71	Sjogren *et al.*, 1990
Earth & Moon	328900.5	328900.55	328900.561400	Standish, 1997
Mars	3098710.	3098710.	3098708.	Null, 1969
Jupiter	1047.355	1047.350	1047.3486	Campbell and Synott, 1985
Saturn	3498.5	3498.0	3497.898	Campbell and Anderson, 1989
Uranus	22869.	22960.	22902.98	Jacobson *et al.*, 1992
Neptune	19314.	19314.	19412.24	Jacobson *et al.*, 1991
Pluto	3000000.	130000000.	135200000.	Tholen and Buie, 1997

Also associated with the ephemerides is the set of astronomical constants used in the ephemeris creation; these are listed in Table 3.2. They are provided directly with the ephemerides and should be considered to be an integral part of them; they will sometimes differ from a more standard set, but the differences are necessary for the optimal fitting of the data.

Table 3.2   Auxiliary constants from the JPL Planetary and Lunar Ephemerides DE405/LE405.

Scale (km/au)	149597870.691	GM_{Ceres}	$4.7 \times 10^{-10} GM_{Sun}$
Scale (s/au)	499.0047838061	GM_{Pallas}	$1.0 \times 10^{-10} GM_{Sun}$
Speed of light (km/s)	299792.458	GM_{Vesta}	$1.3 \times 10^{-10} GM_{Sun}$
Obliquity of the ecliptic	$23°26'21.409''$	density$_{classC}$	1.8
Earth-Moon mass ratio	81.30056	density$_{classS}$	2.4
		density$_{classM}$	5.0

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[1] http://ssd.jpl.nasa.gov/iau-comm4

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