

CHAPTER 2 CONVENTIONAL DYNAMICAL REFERENCE FRAME

The planetary and lunar ephemerides recommended for the IERS standards are the JPL Development Ephemeris DE403 and the Lunar Ephemeris LE403 (Standish *et al.*, 1995). The reference frame of these new ephemerides is that of ICRF. The ephemerides have been adjusted to all relevant observational data, including recent observations taken with respect to the IERS frame. It is expected that DE403/LE403 will eventually replace DE200/LE200 (Standish, 1990) as the basis for the international almanacs.

Table 2.1 shows the IAU 1976 values of the planetary masses and the values used in the creation of both DE200/LE200 and of DE403/LE403. Also shown in the table are references for the DE403 set, the current best estimates.

Also associated with the ephemerides is the set of astronomical constants used in the ephemeris creation; these are listed in Table 2.2.

The constants which are provided directly with the ephemerides 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.

Availability of DE403

Sections of DE403 are now available from the anonymous ftp site: “navigator.jpl.nasa.gov” [128.149.23.82]. For a “navio” version (in-house JPL format), the following “navio” and “nioftp” versions are available, covering 1980-2010:

“navigator:/ephem/navio/de403s” and “navigator:/ephem/navio/de403s.ftp”

For other time-spans, contact F A McCreary (faith@viviane.jpl) or E M Standish (ems@smyles.jpl). An outside user is advised to first get and read the file, “navigator:/ephem/export/README”; it should answer most questions about retrieving and using the JPL ephemerides.

Table 2.1. 1976 IAU, DE200 and DE403 planetary mass values, expressed in reciprocal solar masses.

Planet	1976 IAU	DE200	DE403	Reference for DE403 value
Mercury	6023600.	6023600.	6023600.	Anderson <i>et al.</i> , 1987
Venus	408523.5	408523.5	408523.71	Sjogren <i>et al.</i> , 1990
Earth & Moon	328900.5	328900.55	328900.560392...	Williams <i>et al.</i> , 1995
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 <i>et al.</i> , 1992
Neptune	19314.	19314.	19412.24	Jacobson <i>et al.</i> , 1991
Pluto	3000000.	130000000.	135200000.	Tholen and Buie, 1996

Table 2.2. Auxiliary constants from the JPL Planetary and Lunar Ephemerides DE403/LE403.

Scale (km/au)	149597870.691
Scale (secs/au)	499.0047838061...
Speed of light (km/sec)	299792.458
Obliquity of the ecliptic	23°26'21"412
Earth-Moon mass ratio	81.300585
GM_{Ceres}	$4.64 \times 10^{-10} GM_{Sun}$
GM_{Pallas}	$1.05 \times 10^{-10} GM_{Sun}$
GM_{Vesta}	$1.34 \times 10^{-10} GM_{Sun}$
density _{classC}	1.80
density _{classS}	2.40
density _{classM}	5.00

References

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