

The Orbits of the Inner Jovian Satellites

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I have determined new orbits for Amalthea, Thebe, Adrastea, and Metis, the four inner Jovian satellites. These orbits are represented by a precessing ellipse with the semimajor axes, periapsis rates, and ascending node rates computed from analytical expressions derived from secular perturbation theory. The perturbations include the effects of the zonal gravitational harmonics to third order as well as the first order effects of the Sun and the Galilean satellites. In the computations I used the dynamical constants of Campbell and Synnott (1985, *AJ* 90, 364). Based on a comparison with a numerical integration, the precision of the theory is 10 km for Amalthea, 50 km for Thebe, and 4 km for Adrastea and Metis.

I obtained the ellipse elements from a fit of the orbits to Earth-based astrometric observations, Voyager imaging data, and Galileo imaging data. The Earth-based observation set for Amalthea spans the period 1900 to 1995 and includes a large number of the observations discussed by van Woerkom (1950, *Astron. Paper Am. Ephem.* 12) and Sudbury (1969, *Icarus* 10, 116). Among the other Earth-based observations are the near-infrared data of Nicholson (1991, *Icarus* 93, 331; 1997, personal comm.), CCD data from Pascu (1994, personal comm.), and the CCD data of Martins and Veiga (1995, personal comm.). The Voyager data set contains the images used by Synnott in his original determination of the orbits of Thebe, Adrastea, and Metis (1984, *Icarus* 58, 178) as well as all the Amalthea navigation images acquired by Voyager. The Galileo data set, provided by the Galileo Imaging Science Team, comprises images made during the first four orbits of the Galileo spacecraft. The one-sigma uncertainties associated with the satellite orbits are 600 km for Amalthea, 2000 km for Thebe and Adrastea, and 1000" for Metis.

Ephemerides for the satellites are available electronically from the JPL Horizons on-line solar system data and ephemeris computation service via telnet to ssd.jpl.nasa.gov on port 6775.

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