

Effects of spacecraft trajectory errors on Saturn ring geometry from Cassini occultations

C. McGhee (1), R. French (1), N. Rappaport (2), E. Marouf (3)

(1) Astronomy Dept., Wellesley Coll., Mass., USA, (2) Jet Propulsion Laboratory, California, USA, (3) San Jose State Univ., California, USA (cmcghee@wellesley.edu)

A suite of dozens of occultation observations over the course of the Cassini tour should eventually yield extremely precise measurements of the geometry of Saturn's ring system. A series of high-SNR multiwavelength RSS diametric ring occultations between May and September 2005 has been completed, and the first of many planned UVIS and VIMS stellar occultations have already taken place. Collectively, these measurements provide extremely precise measurements of the locations of ring edges, non-circular (and possibly inclined) structure, the direction of the pole of the mean ring plane, the precession rate of Saturn's pole, and the low-order gravitational harmonics of the planet itself. Errors in the reconstructed spacecraft trajectory are among the largest sources of systematic error in determination of the ring plane radius scale, but these can be minimized by solving for corrections to the spacecraft position during an occultation. We decompose corrections to the nominal trajectory into orthogonal components along and perpendicular to the line of sight, and assess the sensitivity of the derived ring plane radius to trajectory errors along each direction, for the RSS diametric occultations and representative UVIS and VIMS occultations. We also examine the prospects for using the rings as a fiducial reference system, enabling systematic trajectory errors to be determined as part of a global solution for the geometry of the ring system. Finally, we estimate the expected accuracy in the pole direction and radial scale from a combination of all occultation measurements throughout the Cassini orbital tour.