Orbit determination for asteroid satellites

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The process of determining an orbit for an asteroid satellite proceeds in several stages. The discovery and confirmation observations usually span only a few days, during which the asteroid system moves not much in the sky. The initial problem is therefore quite similar to the problem of determining orbits for binary stars. Once an initial orbit—actually, a pair of candidate orbits, owing to the ambiguity in the location of the ascending node on the plane of the sky—has been established, further work proceeds by an iterative linearized least-squares fit. The rapid growth of the partial derivatives with time, combined with a small region of linearity, means that additional data must be added with care. A gradual expansion of the data arc is particularly important when orbits must be numerically integrated. Results are presented for seven binary asteroids, and the particular difficulties of fitting the four-body system of (134340) Pluto are discussed.