Close Approach Modeling and the Fate of 29P/Schwassmann-Wachmann 1.

Kevin R. Grazier (JPL), Alan B. Chamberlin (JPL), and William I. Newman (UCLA)

Accurate modeling of close planet/planetesimal approaches has become an increasingly important topic in planetary dynamical simulations (Newman et al., 1997; Levison, 1997; Grazier, 1997; Rauch and Holman, 1998). Using the Newton backwards difference interpolation formula, coupled to our modified Stormer integrator, we present a new, accurate, data-adaptive method for handling planet/planetesimal encounters for dynamical simulations in which planetesimals are treated as massless.

To test this new scheme, we examine the behavoir of two comets which undergo close encounters. In both cases we model the Sun and jovian planets in a mutually-interacting sense, while comets are treated as massless.

In the first test case, we examine the method's performance in modeling the close approach, and temporary capture by Jupiter, of comet 111P/Helin-Roman-Crockett in the year 2075. This scenario has been used previously to test close approach algorithms (Levison and Duncan, 1994).

In the second case, we perform a longer integration of the trajectory of comet 29P/Schwassman-Wachmann 1 (SW1). In a recent study of planetesimal lifetimes in the Jupiter/Saturn zone (Grazier, 1997) we determined that the expected time until first close encounter for this comet ranged from decades to under 1000 years. We find that SW1 does, indeed, encounter Jupiter on short time scales, and we compare its dynamical evolution in our simulations to those reported in similar studies (Emel'yanenko, 1997, 1998; Dones et al. 1996).