A Numerical Analysis of the Process of Capture into Resonance

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The problem of capture into resonance, when a nonconservative force is present, has been extensively studied be many authors. Probabilities of capture into resonance have been given an analytical formulation for the case of adiabatic processes. However when adiabaticity is not present, the trapping phenomenon is poorly understood. We here study through several numerical simulations how capture is achieved for nonadiabatic processes. We assume a planar restricted 3-body problem and start the numerical integration of the orbits of several particles subject to Poynting-Robertson drag near the 2:3 (exterior) resonance with the primary (with the Earth's mass and a circular orbit at 1AU). A strong dependence on the initial mean longitudes is observed. Slightly changing the initial semimajor axis, the proportion of captured particles to noncaptured particles varies considerably. A good test for the understanding of the trapping process is the plotting of the eccentricity and the resonant angle (ϕ) for the exact time when $\dot{\phi} = 0$ for the first time and the comparison of the points so obtained which are associated to captured particles to those which are associated to noncaptured particles.