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INTERSTELLAR FLIGHT VIA THE EXTRACTION OF ORBITAL ENERGY FROM ASTEROIDS USING LORENTZ-FORCE-ACTUATED RICOCHET MANEUVERS OF PELLET STREAMS

Abstract

The advantage of pellet streams (as compared to beamed energy) as a means to drive interstellar flight has been previously articulated by Singer (1980), Nordley (1993), and Landis (2004), but the method for accelerating the macroscopic pellets remains to be specified. Using conventional accelerator technology, the accelerator length required to accelerate a 1 g pellet to 0.1 c would likely be on the order of 10^5 km long, with the entire structure required to be a complex accelerator. The idea of using the magnetosphere of planets (e.g., Jupiter) as a means to effect Lorentz-actuated flybys of charged chipsats ("sprites") was suggested by Peck (2006), effectively as a means to turn the solar system into a giant macroparticle accelerator. Unfortunately, only Jupiter possesses the sufficiently powerful magnetosphere in our solar system to turn charged macroscopic objects at 0.1 c, so it is likely necessary that an artificial magnetosphere will need to be constructed. Here, it is proposed to attach loops of superconducting cable ($\sim 10^3$ km) to two asteroids (one prograde, the other retrograde), so that a stream of smart pellets can be "bounced" back and forth between the two asteroids as they approach each other. Every Lorentz-actuated flyby of each asteroid would boost the pellets velocity by $\sim$100 km/s as viewed from the inertial (solar system) reference frame. Over a period of months, the pellet stream can approach several percent of lightspeed. If the pellets are sufficiently smart with active feedback control of their charge via field emission emitters, the superconducting loop could be a "dumb object." This technique, in effect, is a means to convert the kinetic and potential orbital energy of solar system bodies into the kinetic energy of a stream of pellets, in principle, up to velocities of 0.1 c. A preliminary survey of asteroids in the JPL database has identified a retrograde asteroid (343158) 2009 HC_{82} with several prospective prograde asteroid partners. Magsails (Andrews and Zubrin, 1988), launched from Earth, could rendezvous with and attach to each asteroid and then be reconfigured to become the superconducting loops that redirect the pellet streams. Ancillary benefits would be an infrastructure capable of repositioning potentially hazardous asteroids and the creation of an artificial magnetosphere to protect Mars.