



On Possibility of Direct Asteroid Deflection by Electric Solar Wind Sail

Sini Merikallio and Pekka Janhunen

Finnish Meteorological Institute, Space Research, Helsinki, Finland (Sini.Merikallio@fmi.fi, 358 9 19294694)

The Electric Solar Wind Sail (E-sail) is a new propulsion method for interplanetary travel which was invented in 2006 and is currently under development. The E-sail uses charged tethers to extract momentum from the solar wind particles to obtain propulsive thrust. According to current estimates, the E-sail is 2-3 orders of magnitude better than traditional propulsion methods (chemical rockets and ion engines) in terms of produced lifetime-integrated impulse per propulsion system mass. Here we analyze the problem of using the E-sail for directly deflecting an Earth-threatening asteroid. The problem then culminates into how to attach the E-sail device to the asteroid. We assess a number of alternative attachment strategies and arrive at a recommendation of using the gravity tractor method because of its workability for a wide variety of asteroid types. We also consider possible techniques to scale up the E-sail force beyond the baseline one Newton level to deal with more imminent or larger asteroid or cometary threats. As a baseline case we consider a 3 million ton asteroid which can be deflected with a baseline 1 N E-sail in 5-10 years. Once developed, the E-sail would appear to provide a safe and reasonably low-cost way of deflecting dangerous asteroids and other heavenly bodies in cases where the collision threat becomes known several years in advance.