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EFFECTS OF ENHANCED GRAPHENE REFLECTION ON PERFORMANCE OF SUN-LAUNCHED STARWISP PROBES

Abstract

Graphene, a carbon molecular monolayer, has an essentially zero reflectivity to visible light and a fractional visible-light absorption of 0.023. Recently published theoretical work discusses possibly feasible methods of altering graphene optical properties. This paper considers the effects of increasing graphene reflectivity of sunlight on the performance of a "Starwisp"-type interstellar probe with the photon sail unfurled at the 0.1-AU perihelion of and initially parabolic solar orbit. It is assumed that the sail is oriented normal to Sunlight during the acceleration process. In concurrence with laser-launched Starwisp-type probes under consideration by Project Starshot, the scientific payload of the probe is one-tenth the mass of the sail. Since beam stability is not an issue for Sun-launched thin-film probes, the payload is assumed to deposited on the anti-Sun face of the sail. Final interstellar cruise velocity, peak acceleration and perihelion temperature are examined as functions of sail reflectivity to sunlight. It is shown that even small increases in reflectivity significantly increases interstellar cruise velocity.