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*"Ultralight Solar Sails for Interstellar Travel"*

Solar sails offer unique promise for interstellar travel because their lack of need for rocket propellant frees them from the velocity limits imposed by the rocket equation. Conventional solar sails made of aluminized plastic films cannot reach velocities relevant for interstellar flight on the power of sunlight alone, however, as their thrust to mass ratio is too low to allow the attainment of high velocities before leaving the solar system. For this reason, alternative concepts have been advanced which involve pushing light sails with very high-powered lasers or other transmitting devices positioned within the solar system. Such schemes, which involve a host of very formidable technical challenges.



In this proposal, an alternative approach is advanced -- that of manufacturing ultralight perforated solar light sails, which operate without plastic backing. Based upon a preliminary analysis of the fundamental physics of such systems, we have found that they can achieve thrust to mass ratios in sunlight at 1 AU on the order of  $10 \text{ m/s}^2$ , and that if solar system departure is initiated at 0.1 AU, that terminal velocities on the order of 1% the speed of light can be achieved with no other source of energy than sunlight. The ability to achieve such high velocities with such a simple and relatively near-term system define it as a technology of extreme interest, enabling routine ultra-high speed interplanetary travel, and offering a first-generation capability for interstellar flights.