Electric Space Propulsion: An Exploration into Innovative Propellant Solutions Involving the Testing of an Electromagnetic Drive

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Spaceflight has always been hindered by propellant constraints. The high propellant mass fractions required for chemical systems and the thrust disadvantages of electric systems have slowed space exploration. The recent testing of an experimental space propulsion system, known as the Electromagnetic Drive (EMDrive) has suggested it may be possible to transfer momentum without any propellant – although the results have been far from conclusive. The device is composed of a conductive, conical frustum into which resonating microwaves are supplied. It has been proposed that the microwaves may interact with quantum vacuum fluctuations, producing an acceleration without violating conservation of momentum. This project seeks to further investigate the plausibility of such devices and their potential use in space travel. A non-resonant cavity was first constructed to act as a control which was later extended to accommodate resonance at the microwave frequency of 2450 MHz. Both cavities were tested at this frequency in the upright and inverse orientations, to reduce the effects of thermal interference. Testing was performed on a knife-edge fulcrum equipped with a laser-camera setup to computationally determine the amount of thrust produced. Thermal effects lead to net upwards motion across all tests. Statistical analysis determined there was a significant difference between the background and powered oscillations which averaged to 1.43 millinewtons. The force difference between the resonating and control tests was found to be statistically insignificant, averaging to 215 micronewtons. This finding does not invalidate the possibility of an electromagnetic drive, however alternative methods are to be investigated.