Mach Effect Gravitational Assist Drive

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Abstract

We first review in broad terms what a MEGA drive is and how it works. At the core is a stack of lead-zirconate-titanate (PZT) 19 mm diameter by 2 mm thick plates. Silver electrodes are deposited on the flat surfaces of the plates. PZT is a ferroelectric material with a dielectric constant typically of more than 1000 that, because of the asymmetry of the crystalline structure of the material, can be polarized by the application of electric fields. If mechanical stresses are applied to polarized PZT, generally, an electric field is induced in the material and electric charge appears on the surfaces of the material. The inverse of this process is to apply an electric field to the material (by charging adjacent electrodes) and produce a mechanical deformation of the material. The resulting piezoelectric strain is a linear function of the applied electric field. "Poled" PZT has many electromechanical applications, audio transducers and micro-linear actuators being typical uses.

A PZT stack of 8 plates (4 pairs of plates, typically about 17 mm long when the electrodes and an accelerometer are included) The piezoelectric stack is compressed by two end masses; an aluminum mass of 28.2mm diameter and about 3 mm thick and a cylindrical brass mass of the same diameter and 16mm long. The brass mass is at the supported end and is attached to the aluminum mass by six 2 -56 stainless steel socket head cap screws (torqued to 4.0 inch pounds) as shown in Fig. 1. These screws have heat shrink around them for electrical insulation. The device is placed inside a sealed Faraday cage which is mounted on the end of a balance beam able to twist in the horizontal direction. The deflection of the beam is measured with a Philtec optical sensor. The stack is subjected to 200-300 Volts using 30-40 KHz frequency sine waves. The PZT is also electrostrictive, which allows a force to push against the stack.

Figure 1. A MEGA device photograph. Taken by Charles Platt.

The MEGA drives operates by producing a small fluctuation in the PZT mass, which is undergoing energy fluctuations. This is used to produce a steady thrust which we measure during the experiment. We push on the PZT (whose mass is fluctuating) when it is more massive and pull back when it is less massive, this produces a steady linear acceleration, which is detectable in the laboratory. This steady force could be used to produce a propulsive force on a massive object without having to expel propellant from the object. This would be highly desirable from a space rocket point of view, which then would not have to carry a massive payload of expendable fuel. The mass fluctuation formula was derived by JFW many years ago and is in a recent book [1], it has also been re-derived for HF [2] using the advanced wave gravitational theory of Hoyle and Narlikar.

Tests of Mach effect thrusters (METs), or as they have recently been renamed, Mach effect gravity assist (MEGA) drives, in three labs other than ours at CSUF, have produced thrust signatures like those we have obtained over the past several years. These tests, Nembo Buldrini at FOTEC (Austria), George Hathaway in Toronto, and Martin Tajmar at Dresden Technical University, have all been conducted by experts with world class facilities at their disposal. These results have been shared at a recent workshop in Estes Park, Colorado, in September 2016 [2]. The proceedings is freely available online at the Space Studies Institute website. This paper will review the theory and give a simple model of the device. It will further show the latest experimental results and explain recent systematic testing being done in the laboratory since January 2017.

Keywords: Propellant-less propulsion, space-drive

References:

[1] J. F. Woodward, "Making Starships and Stargates, The science of Interstellar Transport and Absurdly Benign Wormholes", Springer Press, New York, December 2013.

[2] H. Fearn and L. L. Williams editors, "Proceedings of the Estes Park Advanced Propulsion Workshop", Estes Park CO , September 19-22 (2016). Free download is available at the Space Studies Institute (SSI.org) http://www.ssi.org

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