Deep Space Travel with Fusion

- Interstellar flight is not feasible with current rocket technology, which produce too low exhaust speeds and require enormous amounts of propellant.
- The Z-pinch configuration could fulfill the requirements of both high thrust and high propellant utilization efficiency for operation into deep space.

Z-Pinch Plasma Thruster Schematic [1]

- The Z-pinch thruster would be lighter and smaller than other fusion approaches, which require complex applied magnetic fields.

What is a Z-Pinch?

- A Z-pinch is a configuration that magnetically confines high-temperature and high-density plasma to attain the conditions necessary for fusion.
- The Z-pinch is advantageous for achieving fusion as it does not require an applied magnetic field, and is a simple, linear configuration.

Measuring Thrust on ZaP-HD

- As the plasma is made up of moving charges with a current in the ‘Z’ direction, an azimuthal magnetic field radially ‘pinches’ the plasma via the Lorentz force.

Ballistic Pendulum Design

Expected Results

- Once the thrust stand is installed, we can process deflection measurements into values of thrust and specific impulse of ZaP-HD.
- We expect to record more than 1000 newtons of thrust and 7000 seconds of specific impulse as our new configuration is more potent than previously tested ones.

Device Name | Thrust (N) | Specific Impulse (s)
--- | --- | ---
Aerojet Hall Thruster | 0.254 | 2020
Aerojet APS | 0.6 | 2800
VASIMR VX-200 | 6 | 5000
ZaP-HD | 1000 | 7000
Theoretical Z-Pinch Thruster | 3.3 \times 10^5 | 3.5 \times 10^5

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