

# Design and fabrication of plasma accelerator for space micro-debris simulation and preliminary experiment

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A simulation facility for hypervelocity impact of space micro-debris is designed and fabricated. Just after the assembly of the facility, some preliminary debugging experiments have conducted. A plasma accelerator is the core component of the facility which composed of a coaxial discharge electrode, an electromagnetic compressing coil and a nozzle. The coaxial electrode is discharged synchronously by pulse injected gas from a delicate fabricated electromagnetic valve and pulse voltage from a capacitance bank. The time periods for the pulse gas valve to turn on and to feed gas are 400 and 900 microseconds respectively. As to the capacitance bank, the maximum capacity is  $512\mu\text{F}$ , and can be charged as high as 30kV. Therefore the maximum energy storage for the capacitance and discharge is 230KJ. A custom designed control circuit ignites the pulse valve and discharge switch in turn. Then a block of plasma is produced and accelerated into the electromagnetic coil where the plasma is compressed denser. Eventually a plasma flow with high pressure and temperature is sprayed out the nozzle, which pushes a cluster of micro-particles attached closely to the nozzle exit to hypervelocity. During the preliminary debugging experiment,  $128\mu\text{F}$  capacitance is charged to 15kV, and 400kA discharge current is generated, then glass spheres with  $100\mu\text{m}$  diameter is accelerated to 4.3km/s. Now the debug for the facility is still in progress, in the near future it can accelerate micro-particles to higher velocity.