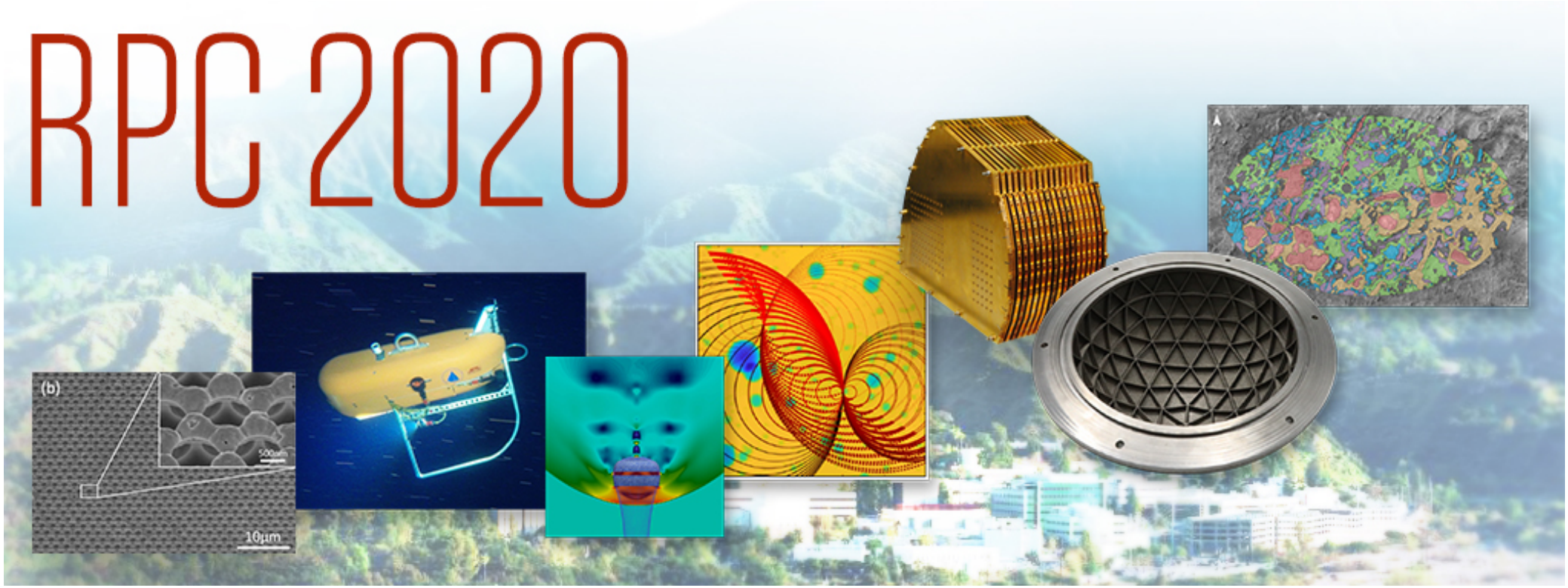

Virtual Research Presentation Conference

Cathode Oscillation Modes in High-Powered Cathodes for Electric Propulsion

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Program: Spontaneous Concept

Assigned Presentation #

Jet Propulsion Laboratory
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Tutorial Introduction

Abstract

Hollow cathodes used in electric propulsion have modes and behaviors that generate oscillations and energetic ions.

These ions can sputter the cathode surfaces and other thruster electrodes and limit the life of the thruster.

These oscillations can get worse at higher current, impacting high power electric thruster life.

This work was intended to measure the time dependent ion energy fluxes near the cathode and correlate them to oscillation behaviors of the cathode discharge to help identify the mechanism for the ion heating/acceleration.

Problem Description

a) NASA is developing higher power electric thrusters (above 5 kW) to support advanced deep space and manned/cargo missions.

b) JPL has built new high current hollow cathode and run them in high power Hall thrusters at GRC at up to 250 A. We don't have models of energetic ion generation at these high currents to support life time assessment.

c) NASA Is developing a 12.5 kW Hall thruster for the PPE mission, and understanding it's life is critical. As NASA goes to higher power for cargo and manned missions to Mars, this will become more critical. Experiments to guide and benchmark models of thruster and cathode life are very important to future missions.

Methodology

a) Prof. Lemmer from U.W. Michigan was coming to JPL to measure ion energies at high-frequency (up to 100 kHz) in high current hollow cathode discharges. This frequency corresponds to the oscillation modes most often observed in high current (>50 A) hollow cathodes used in Hall thrusters.

b) A novel high speed retarding potential analyzer developed at W.Michigan University was to be brought to JPL to make these measurements. JPL's contribution was the test set up with the cathode and to provided a high speed, high impedance amplifier to interface their diagnostic with our data acquisition system.

Results

a) None. Work was stopped before Prof. Lemmer's visit by COVID.

b) We costed transferred the travel money to her university and bought the amplifier, but no work was done due to COVID.

c) Next steps - none

Publications and References

none