Combining insights from coherent and incoherent Thomson scattering in propulsion plasmas

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Plasma thrusters rely on the acceleration of charged particles to produce thrust. These technologies encompass a range of devices, including magnetoplasmadynamic, arcjet, gridded ion and Hall thrusters. Gridded ion and Hall thrusters have been successfully applied to primary propulsion in space missions such as NASA's 1998 Deep Space-1 asteroid flyby and ESA's 2003 Earth-moon flight. Hall thrusters are today widely used on telecommunications satellite platforms for stationkeeping and orbit-topping maneuvers.

The crossed electric and magnetic field geometry of Hall thrusters is at the origin of highly-complex physics, including the driving of different plasma waves and anomalous particle transport. Today, predictive codes for thruster operation remain beyond reach, due chiefly to a poor understanding of such physics. Advanced plasma diagnostics, however, offer a path forward for improving our understanding.

This talk focuses on new insights which may be gained through the use of unique coherent and incoherent Thomson scattering diagnostics, specifically developed to meet the challenges posed by propulsion plasma environments. Combined measurements from these diagnostics can answer longstanding questions regarding plasma waves and the role they play in the physics of propulsion plasmas, and potentially advance the development of relevant theory and codes.