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**Lattice-Boltzmann Models of Ion Thruster Cathode
3D MHD Flows** JACQUES RICHARD, PRERIT SHAH, Texas A
& M University — The lattice-Boltzmann method (LBM) has been ap-
plied to modeling the flow through ion thruster optics where a linearized
Boltzmann equation for a lattice is coupled to Poisson's equation for
the electrostatics. LBM has also been implemented in modeling three-
dimensional (3D) magneto-hydrodynamics (MHD) wherein the magnetic
field is represented by a separate three-component vector distribution
function corresponding to a vector kinetic equation. Discretization of
the 3D phase space is based on a 19-bit scheme for the fluid model
and on a 7-bit scheme for the magnetic field versus finite differencing
of all of Maxwell equations. Issues that affect ion thruster operation,
like the flow about the cathode assembly that reduce cathode and hence
engine life, are investigated with this model. Historically, the transport
of mass, momentum, energy, sub-atomic particles, etc. and the complex
multi-scale physics involved in ion thrusters had been modeled mostly
using Bird's Direct Simulation Monte Carlo (DSMC). While DSMC has
achieved great success in EP models, their connection to the Boltzmann
equation for the molecular velocity distribution function suggests alter-
nate approaches based more directly on that equation.

Prefer Oral Session
 Prefer Poster Session

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