Abstract Submitted
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Modeling of Capillary Discharge Plasmas for Electron Beam Transport and Acceleration[1] NATHAN COOK, JOHAN CARLSSON, PAUL MOELLER, RadiaSoft LLC, PETROS TZEFERACOS, Department of Astronomy Astrophysics, University of Chicago — Next generation accelerators demand sophisticated beam sources to produce ultra-low emittances at large accelerating gradients. Furthermore, the transport of these beams between accelerating stages requires similarly capable beamline optics. Capillary discharge plasmas may address each of these challenges. As sources, capillaries have been shown to increase the energy and quality of laser wakefield accelerators, and as active plasma lenses they provide orders-of-magnitude increases in peak magnetic field. Capillaries are sensitive to energy deposition, heat transfer, ionization dynamics, and magnetic field penetration; therefore, advances in capillary design requires careful modeling. We present simulations of capillary discharge plasmas using FLASH, a publicly-available multi-physics code developed at the University of Chicago. We report on the implementation of a 2D, cylindrically symmetric capillary model for capturing plasma density and temperature evolution with realistic conductivities and magnetic fields. We then illustrate the use of laser energy deposition to model channel formation for the guiding of intense laser pulses. Lastly, we present simulations of active capillary plasmas with varying fill species and comparisons to experiment.

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