A theoretical investigation of steady state critical plasma flows in ablative, capillary, high pressure discharges

S Cuperman

Raymond and Beverly Sackler, Faculty of Exact Sciences, School of Physics and Astronomy, Tel Aviv University, Ramat Aviv, Tel Aviv 69978, Israel

D Zoler

Raymond and Beverly Sackler, Faculty of Exact Sciences, School of Physics and Astronomy, Tel Aviv University, Ramat Aviv, Tel Aviv 69978, Israel

Received 19-MAR-92

A new method for the consistent study of stationary, critical flows in ablative capillary discharges is presented. This method enables one to determine the correct values of the plasma characteristics (mass density, flow velocity and temperature) at both closed (z=0, say) and open (z=1) ends of the capillary; a subsequent integration of the basic model equations used provides correct solutions at all axial distances along the capillary.

The method is independent of the complexity of the model equations used and holds for any kind of critical (fluid) flow, in the presence of various types of external energy inflow. For demonstration, we here considered the familiar, relatively simpler, non-ideal hydrodynamic equations obtained by averaging two-dimensional equations over the capillary cross-section; these quasi one-dimensional equations describe (correctly) the essential 2D features of the ablative capillary discharge, namely, the radial outwards radiative transfer of energy and the radial inwards ablative mass flow.

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