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Thomson scattering measurements of cylindrical wire array parameters[1]

ADAM HARVEY-THOMPSON, Imperial College, London

Wire-array z-pinch implosions are characterized by a long initial period in which the dense, stationary cores of the wires steadily ablate low-density plasma radially inward, where it can accumulate in an on-axis "precursor" plasma even before the main implosion begins. The plasma ablation stage is important, since up to about half of the initial wire array mass can be ablated during this stage. The ablation stage ends with the rapid implosion of the remaining mass to the array axis, a process subject to instabilities that can break up the imploding plasma and cause substantial amounts of mass to trail the main implosion and arrive only later (or not at all) on the axis. An optical Thomson scattering diagnostic has been developed and used for the first time to measure critical plasma parameters in wire array z-pinches, including 1) a measurement of the flow velocity of plasma ablated from the wires (at multiple radial positions inside the array), 2) the temperature of the precursor plasma accumulating on the array axis, and 3) the parameters of plasma stranded at large radius behind the implosion (trailing mass). These results allow detailed verification of 3-D MHD simulations of wire array z-pinch implosions. The data are also extremely important for designing and interpreting HEDP experiments based on ablation plasma flows, e.g. high Mach number radiatively cooled jets relevant to astrophysics. In collaboration with: S.V. Lebedev, S. Patankar, A. Colaitis, S.N. Bland, G. Burdiak, G.N. Hall, F. Suzuki-Vidal, G. Swadling, P. deGrouchy, L. Pickworth, E. Khoory, L. Suttle, J.P. Chittenden, R.A. Smith, H. Doyle.

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