Intra-jet hydrodynamics in two weakly collisional counterstreaming jets

D.D. Ryutov[1], N.L. Kugland[1], H.-S. Park[1], C. Plechaty[1], B.A. Remington[1], and J.S. Ross[1]

[1]Lawrence Livermore National Laboratory

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Abstract

Counterstreaming laser-generated plasma jets can serve as a test-bed for the studies of a variety of astrophysical phenomena, including collisionless shock waves. In the latter problem, the jets parameters have to be chosen in such a way as to make the collisions between the particles of one jet with the particles of the other jet very rare. This can be achieved by making the jet velocities high and the Coulomb cross-sections correspondingly low. On the other hand, the intra-jet collisions for high-Mach-number jets can still be very frequent, as they are determined by the much lower thermal velocities of the particles of each jet. This paper describes some peculiar properties of intra-jet hydrodynamics in such a setting: the steepening of smooth perturbations and shock formation affected by the presence of the stiff opposite flow; the stretching of the shock fronts by the shear flow; the shear-flow enhancement of the seed magnetic field created by the Biermann battery effect. Potential applications to astrophysical colliding plasmas are discussed.

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