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Collective Focusing of a Plasma-Neutralized Intense Ion Beam Propagating Along a Weak Solenoidal Magnetic Field[1] MIKHAIL A. DORF, IGOR D. KAGANOVICH, EDWARD A. STARTSEV, RONALD C. DAVIDSON, Princeton Plasma Physics Laboratory, Princeton University — Two schemes are considered for focusing intense ion beams utilizing the collective dynamics of plasma electrons. In the first approach, an ion beam propagates through a neutralizing background plasma along a uniform magnetic field. In the second approach, an ion beam passes through a finite size plasma, extracts neutralizing electrons from the plasma, and then enters a magnetic lens. In the both cases, a strong radial electric field is produced due to the collective electron dynamics. This self-electric field provides the enhanced transverse focusing of the ion beam. Detailed analytical and advanced numerical studies using particle-in-cell simulations are performed for both approaches. The radial focusing force acting on beam ions is calculated for an arbitrary ratio between the electron cyclotron and plasma frequencies. Collective focusing effects are shown to be important for the design of heavy ion drivers for high energy density and warm dense matter physics applications.

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