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Nonlinear effects of beam-plasma instabilities on neutralized propagation of intense ion beams in background plasma[1] EDWARD STARTSEV, IGOR KAGANOVICH, RONALD DAVIDSON, Princeton Plasma Physics Laboratory — In ion-beam-driven high energy density physics and heavy ion fusion applications, the intense ion beam pulse must propagate through background plasma before it is focused onto the target. The streaming of the ion beam relative to background plasma can cause the development of fast electrostatic collective instabilities. The nonlinear stage of these instabilities can affect the degree to which the ion beam can be focused onto the target. Simultaneously, the development of the instabilities is also affected by the ion beam focusing. In this paper we examine numerically three effects of instabilities on the beam focusing: heating of the beam ions, heating of the neutralizing background electrons inside the beam, and the nonlinear effect of the instabilities on the dynamical evolution of the electron return current. The scalings of the average de-focusing forces on the beam ions due to these effects are identified, and confirmed by comparison with numerical simulations. These scalings can be used in the development of realistic ion beam compression scenarios in present and next-generation ion-beam-driven experiments.

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