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Collective Instabilities and Beam-Plasma Interactions for an Intense Ion Beam Propagating Through Background Plasma[1] RONALD DAVIDSON, MIKHAIL DORF, IGOR KAGANOVICH, HONG QIN, EDWARD STARTSEV, PPPL — This paper presents a survey of the present theoretical understanding based on advanced analytical and numerical studies of collective interactions and instabilities for intense one-component ion beams, and for intense ion beams propagating through background plasma. The topics include: discussion of the condition for quiescent beam propagation over long distances; the electrostatic Harris instability and the transverse electromagnetic Weibel instability in highly anisotropic, one-component ion beams; and the dipole-mode, electron-ion two-stream instability (electron cloud instability) driven by an unwanted component of background electrons. For an intense ion beam propagating through a charge-neutralizing background plasma, the topics include: the electrostatic electron-ion two-stream instability; the multispecies electromagnetic Weibel instability; and the effects of a velocity tilt on reducing two-stream instability growth rates. Operating regimes are identified where the possible deleterious effects of collective processes on beam quality are minimized.

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Edward Startsev
PPPL

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