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Collective Interaction Processes in Intense Heavy Ion Beam-Plasma Systems* RONALD DAVIDSON, MIKHAIL DORF, IGOR KAGANOVICH, HONG QIN, ADAM SEFKOW, EDWARD STARTSEV, Princeton Plasma Physics Laboratory, DALE WELCH, DAVID ROSE, Voss Scientific, STEVE LUND, Lawrence Livermore National Laboratory — This paper presents a survey of the present theoretical understanding of collective interactions in intense heavy ion beams for high energy density physics and fusion applications. Emphasis is placed on identifying operating regimes that minimize the deleterious effects of collective instabilities on beam transport and focusing. In the beam transport region, the topics covered include: the electrostatic Harris instability and the transverse electromagnetic Weibel instability driven by strong temperature anisotropy in a nonneutral ion beam; and the electron-ion two-stream (electron cloud) instability driven by an unwanted component of background electrons. In the neutralized drift compression and target chamber regions, the collective interaction processes associated with beam propagating through a dense, charge-neutralizing background plasma are discussed, including the multispecies electromagnetic Weibel instability, and the electrostatic two-stream instability with and without longitudinal velocity tilt in the beam ions. Finally, a class of exact, kinetic, dynamically-compressing (both transversely and longitudinally) beam equilibria are presented for the case of an intense, stable ion beam propagating through a background plasma. * Research supported by the U.S. Department of Energy.

Ronald Davidson
Princeton Plasma Physics Laboratory

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