Contribution ID: **88** Type: **Invited talk**

Effects of Beam-Plasma Instabilities on Neutralized Propagation of Intense Ion Beams in Background Plasma*

Thursday, 16 August 2012 10:25 (20 minutes)

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In ion-beam-driven high energy density physics and heavy ion fusion applications, the intense ion beam pulse propagates through a background plasma before it is focused onto the target [1]. The streaming of the ion beam relative to the background plasma can cause the development of fast electrostatic collective instabilities [2]. These instabilities produces fluctuating electrostatic fields that cause a significant drag on the background plasma electrons and can accelerate electrons up to the average ion beam velocity. Consequently, the dominant electron current can reverse the beam self-magnetic field. As a result, the magnetic self-field force reverses sign and leads to a transverse defocusing of the beam instead of a pinching effect in the absence of instability [3]. In addition, the ponderomotive force of the unstable wave pushes background electrons transversely away from the unstable region inside the beam, which creates an ambipolar electric field, which also leads to ion beam transverse defocusing.

Because the instability is resonant it is strongly affected and thus can be effectively mitigated and controlled by the longitudinal focusing of the ion beam [4]. In this paper the conditions for the formation of nonlinearly generated de-focusing self-electric and self-magnetic fields are studied in detail using the particle-in-cell code LSP [5]. The scalings of the average de-focusing forces on the beam ions due to these effects are identified and compared with proposed theoretical model. These scalings can be used in the development of realistic ion beam compression scenarios in present and next-generation ion-beam-driven high energy density physics and heavy ion fusion experiments.

- Research supported by the U.S. Department of Energy.

[1] A. Friedman et. all., Physics of Plasmas 17, 056704 (2010).
[2] R. C. Davidson, M. Dorf, I. Kaganovich, H. Qin, E.A. Startsev, S. M. Lund, Nuclear Instruments and Methods in Physics Research A606, 11 (2009).
[3] R. N. Sudan, Physical Review Letters 37, 1613 (1976).
[4] E. A. Startsev, R. C. Davidson and M. Dorf, Nuclear Instruments and Methods in Physics Research A 606, 42 (2009).
[5] D. R. Welch, D. V. Rose, B. V. Oliver, R. E. Clark, Nuclear Instruments and Methods in Physics Research A464, 134 (2001).

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