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Ion Beam Pulse Propagation through a Neutralizing Background Plasma along a Solenoidal Magnetic Field: Whistler Wave Excitation and Beam Self-focusing[1] MIKHAIL DORF, IGOR KAGANOVICH, EDWARD STARTSEV, RONALD DAVIDSON, Plasma Physics Laboratory, Princeton University, Princeton, New Jersey, 08534, USA — The electromagnetic field perturbations excited by an ion beam propagating through a neutralizing background plasma along a solenoidal magnetic field is studied analytically by solving the Vlasov-Maxwell equations. Analytical predictions are compared with the results of particle-in-cell simulations using the LSP code. It is found that the plasma response to the ion beam pulse is significantly different depending on whether the value of the solenoidal magnetic field is below or above a threshold value corresponding to the resonant excitation of large-amplitude whistler waves. The self-pinching force acting on the beam particles is calculated. It is demonstrated that even a weak solenoidal magnetic field affecting only the plasma electron dynamics can significantly enhance the pinching force in the limit where the beam radius is small compared to the electron skin depth. Therefore, this effect can be used for effective ion beam focusing. Intense resonant whistler wave excitation can be also used for diagnostic and communication purposes.

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