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Computationally efficient description of relativistic electron beam transport in dense plasma OLEG POLOMAROV, IFS, The University of Texas at Austin, TX, 78712, ADAM SEFKOV, IGOR KAGANOVICH, PPPL, Princeton, NJ 08543, GENNADY SHVETS, IFS, The University of Texas at Austin, TX, 78712 — A reduced model of the Weibel instability and electron beam transport in dense plasma is developed. Beam electrons are modeled by macro-particles and the background plasma is represented by electron fluid. Conservation of generalized vorticity and quasineutrality of the plasma-beam system are used to simplify the governing equations. Our approach is motivated by the conditions of the FI scenario, where the beam density is likely to be much smaller than the plasma density and the beam energy is likely to be very high. For this case the growth rate of the Weibel instability is small, making the modeling of it by conventional PICs exceedingly time consuming. The present approach does not require resolving the plasma period and only resolves a plasma collisionless skin depth and is suitable for modeling a long-time behavior of beam-plasma interaction. An efficient code based on this reduced description is developed and benchmarked against the LSP PIC code. The dynamics of low and high current electron beams in dense plasma is simulated. Special emphasis is on peculiarities of its non-linear stages, such as filament formation and merger, saturation and post-saturation field and energy oscillations.
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