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Weibel instabilities with relativistic laser pulses

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Weibel and filamentation instabilities are investigated using relativistic ultra intense short laser pulses. Recent theoretical and numerical studies on astrophysical collisionless shocks have revealed that in the presence of ambient magnetic field the Weibel filaments trigger multiple or turbulent magnetic reconnections[1]. The Weibel mediated turbulent reconnection nonthermally accelerates charged particles by the same manner as the first order Fermi acceleration [2]. Experimental verification in mind, we discuss the possible experimental models on the Weibel instability with intense short laser pulses in the presence of an external magnetic field. Unlike the nanosecond large laser facilities, intense short laser can be operated in high repetition rate. By performing 2D particle-in-cell simulations, we discuss the excitation and saturation of Weibel filaments by changing the external magnetic field. We address the magnetic field amplification and the scaling law relevant to the Weibel instability at planetary and astrophysical shocks[3,4].

References

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