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Weibel magnetic field amplification and saturation in expanding plasmas KEVIN SCHOEFFLER, NUNO LOUREIRO, LUIS SILVA, RICARDO FONSECA[1], GoLP/Instituto de Plasmas e Fusao Nuclear, Instituto Superior Tecnico, Universidade de Lisboa, Lisbon, Portugal — Recent laser-solid interaction experiments have been used to generate high energy density plasmas with megagauss magnetic fields. These intense magnetic fields are generated by the Biermann battery mechanism via perpendicular temperature and density gradients, and via temperature anisotropy instabilities such as the Weibel instability. Performing particle-in-cell simulations of similar expanding plasmas, we find that in some laser systems as well as in astrophysical shocks the Weibel instability may play the dominant role [Schoeffler et al. Phys. Rev. Lett. 112, 175001 (2014)]. Particularly in systems where the Biermann Battery is expected to generate only small fields with plasma $\beta \sim L/d_i$ (with system size large compared to ion inertial length), while the Weibel may reach fields close to $\beta \sim 1$. Although the Weibel instability is a popular topic regarding these systems, the mechanism for saturation is not clearly understood. We investigate this saturation, as well as uncover a striking confirmation of gyrokinetic predictions of turbulence (from the Biermann field) with a sub-ρ_e (electron gyroradius) $-4/3$ power law for electric field energy and $-16/3$ for magnetic fields [Schekochihin et al. Astrophys. J. Suppl. Ser. 182, 310 (2009)].

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