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Collisionless shock formation, spontaneous electromagnetic fluctuations, and streaming instabilities ANTOINE BRET, Universidad Castilla la Mancha, ANNE STOCKEM, Instituto Superior Tecnico, FREDERICO FIUZA, Lawrence Livermore National Laboratory, CHARLES RUYER, LAURENT GREMILLET, CEA, DAM, RAMESH NARAYAN, Harvard-Smithsonian CfA, LUIS SILVA, Instituto Superior Tecnico — Collisionless shocks are ubiquitous in astrophysics and in the lab. Recent numerical simulations and experiments have shown how they can arise from the encounter of two collisionless plasma shells. When the shells interpenetrate, the overlapping region turns unstable, triggering the shock formation. As a first step towards a microscopic understanding of the process, we analyze here in detail the initial instability phase. On the one hand, 2D relativistic Particle-In-Cell simulations are performed where two symmetric initially cold pair plasmas collide. On the other hand, the instabilities at work are analyzed, as well as the field at saturation and the seed field which gets amplified. For mildly relativistic motions and onward, Weibel modes govern the linear phase. We derive an expression for the duration of the linear phase in good agreement with the simulations. This saturation time constitutes indeed a lower-bound for the shock formation time. PHYSICS OF PLASMAS 20, 042102 (2013)

Antoine Bret
Universidad Castilla la Mancha

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