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Towards the generation of collisionless electron-positron shocks in the laboratory: Ultrafast thermalisation of laser-driven relativistic plasma jets MICKAEL GRECH, Laboratoire d'Utilisation des Lasers Intenses, MATHIEU LOBET, CEA/DAM Ile de France, France, CHARLES RUYER, CEA/DAM Ile-de-France, EMMANUEL D'HUMIÈRES, CELIA, Université Bordeaux 1, MARTIN LEMOINE, Institut d'Astrophysique de Paris, France, ARNAUD DEBAYLE, LAURENT GREMILLET, CEA/DAM Ile de France, France — Weibel-mediated collisionless shocks between high-velocity, counter-streaming (electron-ion or electron-positron) plasma flows have been extensively investigated over the past years to gain understanding of various extreme astrophysical scenarii. Here, we examine a concept of colliding pair plasmas that exploits the extreme electromagnetic fields envisioned on compressed LMJ-class laser projects. We present the first self-consistent numerical study, using QED-PIC simulations, of the creation (through the multi-photon Breit-Wheeler process) and subsequent interaction of two counter-streaming, relativistic pair flows driven from laser-irradiated thin Al foils. Fast-growing Weibel instabilities are found to induce ultra-fast thermalisation of the pair jets through the buildup of a MT magnetostatic barrier. The associated gamma-ray generation, its effect on electron-positron thermalisation, as well as the subsequent shock formation are analysed in detail.

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