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On kinetic instabilities in collisionless ultra-relativistic streaming cold electron-proton plasma GREGORY VERESHCHAGIN, ICRANet, V.M. CHECHETKIN, V.F. DYACHENKO, S.L. GINZBURG, N.N. FIMIN, Keldysh Institute of Applied Mathematics, RAS, REMO RUFFINI, IVAN SIUTSOU, ICRANet — We consider cold collisionless electron-proton plasma, moving in the vacuum with large bulk Lorentz factor. In order to describe such a system numerical integration of Vlasov-Maxwell equations is performed by a 3-dimensional Eulerian code. The plasma is shown to experience kinetic instabilities, leading to generation of stochastic electro-magnetic fields. The motion of electrons and protons randomizes in these stochastic fields, leading to a thermal-like spread in the distribution function of electrons and protons. Both electrons and protons, and the electromagnetic field reach equipartition on a timescale L/c, where L is the characteristic size in the problem, c is the speed of light. We discuss particle distributions in coordinate and momentum space, as well as the structure of electromagnetic fields. Consequences of the considered phenomenon for astrophysical sources are quite general and include, in particular, gamma-ray bursts.

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