Abstract Submitted
for the DPP07 Meeting of
The American Physical Society

Radiative cooling in relativistic collisionless shocks. Can simulations and experiments probe relevant GRB physics?[1] MIKHAIL MEDVEDEV, University of Kansas, ANATOLY SPITKOVSKY, Princeton University — We address the question of whether PIC simulations and laboratory laser-plasma experiments can (or will be able to, in a near future) model realistic gamma-ray burst (GRB) shocks. For this, we compare the radiative cooling time, $t_{\rm cool}$, of relativistic electrons in the shock magnetic fields to the microscopic dynamical time of collisionless relativistic shocks, ω_{pp}^{-1}. We have obtained that for $t_{\rm cool}\omega_{pp}^{-1} \lesssim$ few hundred, the electrons cool efficiently at or near the shock jump and are capable of emitting away a large fraction of the shock energy. Such shocks are well-resolved in the existing 2D PIC simulations, therefore the microscopic structure can be studied in details, whereas the spectral power of the emitted radiation can also be directly obtained from simulations and compared with observational data. The conditions in the GRB shocks are almost identical to those in laser-produced plasmas; thus, such GRB-like plasmas can be created and studied in laboratory experiments using the presently available Petawatt-scale laser facilities.

[1]Supported by DoE grants DE-FG02-04ER54790 and DE-FG02-07ER54940 and by NASA grant NNX07AJ50G.

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Date submitted: 20 Jul 2007 Electronic form version 1.4