Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Plasma Astrophysics in the Laboratory with Accelerator Beams[1]

P. MUGGLI, USC, S. MARTINS, L. SILVA, GoLP/Inst. de Plasmas e Fusão Nuclear, Instituto Superior Técnico, Lisbon, Portugal — An ultra-relativistic electron/positron or "fireball" beam interacting with a laboratory plasma is subject to the current filamentation instability (CFI). In the near future, ultra-short (<100fs), ultra-relativistic (25GeV) electron and positron bunches will become available at the SLAC FACET facility. These bunches are accelerated one half period apart and overlapped in space and time near the final focal point. With an equal number of particles, these two bunches form a neutral, field- and charge-free beam that we call a relativistic fireball beam. The interaction of this beam with laboratory plasma is rather different from that of either the electron or positron bunch alone. No large wakefields are generated. Instead the beam is subject to the CFI, which results in transverse filamentation, accompanied by strong plasma density modulation, generation of large magnetic fields, and generation of radiation that can be detected. This situation is similar to that of space relativistic plasmas, e.g. from supernovae, interacting with the interstellar medium. The CFI generates the magnetic field, and the charged particles emit radiation as in gamma ray bursts afterglow. Detecting the CFI and measuring it characteristics will validate astrophysical models. CFI may also play an important role in the propagation of hot electrons in plasmas for example in the fast igniter concept of ICF. We describe the CFI and the experiment to detect it.

[1]Work supported by US DoE, by Fundacao Calouste Gulbenkian, and by Fundacao para a Ciencia e Tecnologia

Patric Muggli
University of Southern California

Date submitted: 19 Jul 2010 Electronic form version 1.4