Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Limits on the compression of magnetic islands in strongly radiative magnetic reconnection KEVIN SCHOEFFLER, THOMAS GRISMAYER, Instituto Superior Tecnico, DMITRI UZDENSKY, University of Colorado Boulder, RICARDO FONSECA, LUIS SILVA, Instituto Superior Tecnico — The evolution of magnetic islands generated in a reconnecting relativistic pair plasma is investigated using 2D and 3D particle-in-cell simulations in strong magnetic fields. For sufficiently strong fields (and a weak guide field), radiation cooling leads to compression of the magnetic islands, which amplifies fields and plasma density [1]. The quantum electrodynamic (QED) module [2] of the OSIRIS framework allows us to model the radiation as either classical radiation reaction or the QED emission of discrete photons according to non-linear Compton scattering, as well as single photon decay into pairs (non-linear Breit-Wheeler). These QED effects are important for the field strengths close to the critical (Schwinger) field occurring in magnetar magnetospheres, where gamma-ray flares occur. We show that the measured increases in density n and magnetic fields B due to compression are limited by power-laws in n-B space. In 3D, the magnetic flux ropes become kink-unstable, which effectively limits the compression of density. However, increasing upstream plasma magnetization leads to stronger magnetic compression, which in turn leads to increased pair production. [1] K. Schoeffler et al., ApJ, 870, 1 (2019) [2] T. Grismayer et al., Phys. Plasmas 23, 056706 (2016)

Kevin Schoeffler
Instituto Superior Tecnico

Date submitted: 02 Jul 2019 Electronic form version 1.4