Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Influence of plasma instabilities on interpenetrating plasma clouds as a test for electromagnetic dark matter self-interactions N. SHUKLA, GoLP/IPFN, IST, Lisbon, Portugal, B. FELDSTEIN, Oxford U., J. MARDON, Stanford U., K. SCHOEFFLER, J. VIEIRA, L. SILVA, GoLP/IPFN, IST, Lisbon, Portugal — Dark matter (DM) could be charged under its own "dark electromagnetism" (DEM), behaving like a cold collisionless plasma of self-interacting DM particles. Under this hypothesis, DM could exhibit plasma-like instabilities [1] with observational consequences. We investigate this via PIC simulations [2], exploring the instabilities driven by the interpenetration of two e-e+ plasma clouds that mimic the "dark plasma." We show that the clouds slow down mostly due to Weibel generated magnetic fields, which deflect the particle trajectories, such that particles acquire transverse momentum, thus leading to an isotropic velocity distribution. This process causes the flow velocity to decrease approximately by 1/2 in a time interval $\Delta\mathrm{t} = 1/\sqrt{\alpha}\Delta\mathrm{v}(\mathrm{c}/\mathrm{v})$, where α is the equipartition parameter, v the initial flow speed and c the light speed, comparable with the plasma instability growth time. We show that if the typical DM slab length is much longer than vΔt, DM particles are always expected to slow down by a factor of about 1/2. Comparison with astronomical observations may yield new constraints on DEM.

[1] L. Ackerman et al Phys.Rev. D79 023519 (2009)(2006).
[2] R. A. Fonseca et al., LNCS 2331, 342 (2002).

Jorge Vieira
IST

Date submitted: 24 Jul 2015 Electronic form version 1.4