Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

A plasma solenoid driven by a OAM laser beam RACHEL NUTER, CELIA, Université de Bordeaux, CNRS, CEA, France, PHILIPP KORNEEV, EGGOR DMITRIEV, National Research Nuclear University 'MEPhI', Russian Federation, ILLIA THIELE, Chalmers University of Technology, Departement of Physics, Sweden, VLADIMIR TIKHONCHUK, CELIA, Université de Bordeaux, CNRS, CEA, France — The generation of a quasi-static long time standing magnetic field in the laser plasma interaction is a subject of many theoretical and experimental studies. In most of the studies, the magnetization of the plasma originates from the inverse faraday effect, where the spin angular momentum of a laser beam is transfered to the electrons due to dissipation processes such as collisions, ionization or radiation friction. Here, we present a novel setup in which he laser to electron angular momentum transfer does not require any dissipative process, but takes place within a purely optical process. It is based on the irradiation of a low density electron plasma with a strongly focused polarized laser beam carrying an orbital angular momentum. Three dimensional Particle In Cell (PIC) simulations show an irreversibly transfer of angular momentum from the laser to the electrons, and the generation of a quasi-static axial magnetic field over long time. These numerical results are confirmed with theoretical analysis. The PIC simulations coupled to the analytical theory show that the B field amplitude and direction may be tuned by controlling the laser beam characteristics such as for example the orbital angular momentum and/or the pulse duration.

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Date submitted: 25 Jun 2019 Electronic form version 1.4