A wireless solenoïd generated from laser-plasma interaction

R.Nuter[1], P. Korneev[2], I. Thiele[3] and V.T. Tikhonchuk[1]

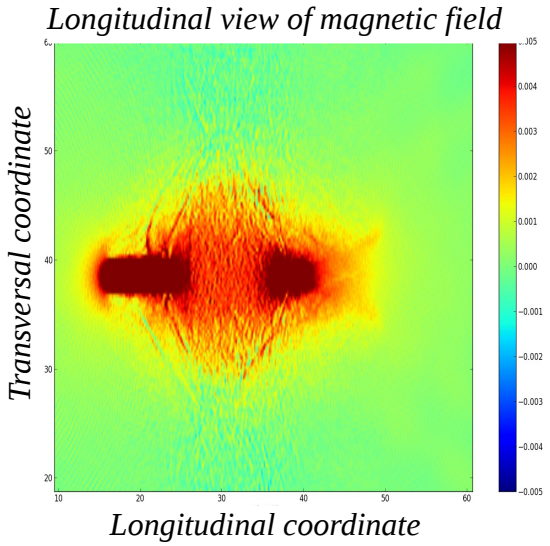
[1] *Université Bordeaux, CNRS, CEA, UMR 5107, 33405 Talence, FRANCE*

[2] *National Research Nuclear University 'MEPHi' Moscow, 115409 RUSSIA*

[3] *Chalmers University of Technology, Departement of Physics, SE-41296 Göteborg, SWEDEN*

Generating a quasi-static magnetic field from the laser-plasma interaction gives rise to many theoretical[1-4] and experimental studies[5-6]. Two approaches are considered : one consists in designing the target in such way that the interaction with laser generates an azimutal current [7], another one consists in transfering angular momentum from the laser to the electrons by considering adapted laser polarization or structured laser spatial shape.

Here we will present a numerical study in which a strongly focused radially polarized laser beam carrying an orbital angular momentum transfers angular rotation to the plasma electron in such way that a static magnetic field is generated. The numerical simulations performed with the 3D Particle In Cell code OCEAN show that the generated quasi-static magnetic field can be controlled with the laser characteristics : pulse duration, angular momentum and focal spot.



1- V.I. Berezhiani *et al.*, Physical Review E, 55:995 (1997)
2- R. Hertel, J. of magnetism and magnetic materials, 303 : L1 (2006)
3-N. Naseri *et al*, Physics of plasmas, 17:083109 (2010)
4- S. Ali *et al*, Physical Review Letters, 105:035001 (2010)
5-Z. Najmundin *et al.*, Physical Review Letters, 87:215004 (2001)
6- J.Deschamps *et al.*, Physical Review Letters, 25:1330 (1970)
7- Ph. Korneev *et al.*, New Journal of physics, 19:033023 (2017)