46th PLASMA PHYSICS Conference EPS 2019 Milan, Italy

Orbital angular momentum transfer in two Laguerre-Gaussian beams

When ultraintense ($I > 10^{18\text{-}19}$ W.cm^{-2}) and ultrashort laser pulses interfere in the middle of a tenuous plasma, the electrons are gaining energy in the two waves by a chaotic mechanism, commonly known as stochastic heating. If the waves present in addition an orbital angular momentum (Laguerre Gaussian modes), some of this momentum can be transferred to the electrons.

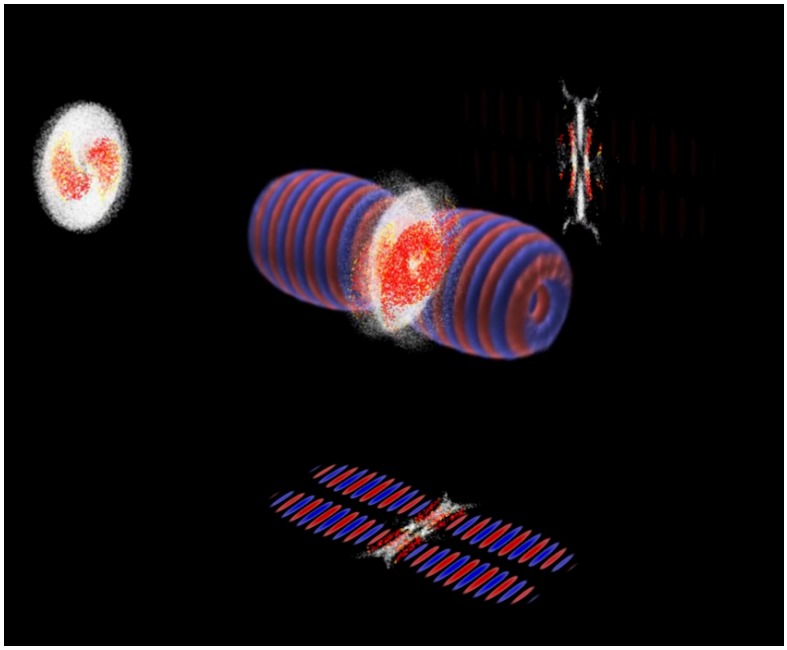

Figure 1: Two Laguerre-Gaussian beams, pictured from blue to red, are travelling inside a plasma cylinder full of electrons, represented initially by white spheres. These become more red, when the particles start gaining energy.

This simulation was performed with a homemade and open source particle pusher code [1], where no collective plasma effects are at play and the fields are imposed analytically. For the rendering, we use VisIt 2.13.3 [2], the open source 3D visualization software developed by Lawrence Livermore National Laboratory.

The 3D rendering of the interaction is displayed Fig. 1, with 2D-slices taken at the middle of the box in each direction. The orbital angular momentum transfer is clearly visible on the left projection, where electrons start rotating in the interference field.

[1] https://github.com/lidyl/particle_pusher

[2] https://visit.llnl.gov/

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