LIGHT FAN DRIVEN BY RELATIVISTIC LASER PULSE

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When a relativistic laser pulse with high photon density interacts with a specially tailored thin foil target, a strong torque is exerted on the resulting spiral-shaped foil plasma, or "light fan". Because of its structure, the latter can gain significant orbital angular momentum (OAM), and the opposite OAM is imparted to the reflected light, creating a twisted relativistic light pulse. Such an interaction scenario is demonstrated by particle-in-cell simulation as well as analytical modeling, and should be easily verifiable in the laboratory. As important characters, twisted relativistic light pulse has strong torque and ultra-high OAM density.

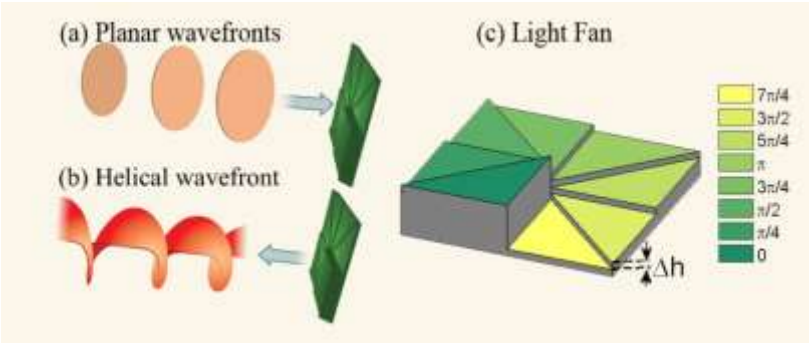

Fig. (a) the normal incident laser pulse has planar wavefronts. (b) the reflected laser pulse gets a helical wavefront. (c) The foil used in the simulation has eight parts, with the same step height $\Delta h = \lambda/16$ to mimic a $h = \lambda/2$ spiral phase plate. The colors represent different phase changes when a plane wave incidents normally and the foil acts as a perfect reflection mirror. The maximum thickness of the foil is set as 0.8 μm to ensure that laser pulse is not transmitted.