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High angular momentum density physics of intense laser BAIFEI SHEN, YIN SHI, LINGANG ZHANG, XIAOMEI ZHANG, WENPENG WANG, ZHIZHAN XU, Shanghai Institute of Optics and Fine Mechanics, CAS — Relativistic laser pulse has been used as an important research tool in well known high energy density physics as well as in ultrahigh momentum density which has many important applications like radiation pressure acceleration. But another important character of relativistic laser, orbital angular momentum (OAM) effect was ignored. When a relativistic laser pulse with a 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 an important characteristic, the twisted relativistic light pulse has a strong torque and ultrahigh OAM density. Relativistic light has opened new research fields in high-field physics, including laser acceleration and relativistic high-order harmonics, because it has a high energy density. Now, relativistic twisted light has high angular momentum density, which may result in many new physical phenomena.

[1] Yin Shi, Baifei Shen et al., PRL 112, 235001 (2014).
[2] http://phys.org/news/2014-06-spiral-shaped-fan-laser-driven-plasma.html

Baifei Shen
Shanghai Institute of Optics and Fine Mechanics

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