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All-optical induced twist without angular momentum via local pump depletion

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Angular momentum transfer in nonlinear laser-plasma interactions, accompanied by strong axial magnetic field generation (Tesla to kilo-Tesla) [1-2], can significantly influence the dynamics during laser-driven particle acceleration. Axial magnetic field generation is typically identified in systems using lasers with angular momentum, such as circularly polarized lasers [1] and lasers with orbital angular momentum [2]. We demonstrate a novel mechanism for angular momentum transfer with a laser that lacks this characteristic. The mechanism is based on the conservation of canonical momentum during the laser depletion of an ultra-intense, azimuthally polarized laser pulse in underdense plasma. During this process, a strong axial magnetic field (˜2 kT) is generated within a nonlinear wakefield in the bubble regime. Our findings are supported by analytical considerations and three-dimensional particle-in-cell simulations with OSIRIS [3].

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Available for oral presentation in a session

Yes

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