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Gamma-ray emission enhanced by direct laser acceleration in a laser-driven magnetic field[1] ALEXEY AREFIEV, TAO WANG, TOMA TONCIAN, CHEDS, Univ. of Texas, Austin, DAVID STARK, Los Alamos Nat. Lab. — Recently published particle-in-cell simulations [Phys. Rev. Lett. 116, 185003 (2016)] indicate that a high-intensity laser irradiating an over-critical plasma can induce relativistic transparency and drive a Megatesla magnetic field while propagating into the plasma. We have examined the role of such an azimuthal Megatesla-level magnetic field on electron dynamics in a laser pulse with intensities around 5×10^{22} W/cm^2, within reach for the existing laser facilities. We find that the magnetic field can be utilized in two complementary ways: to enhance direct laser acceleration, generating a GeV-level electron beam in the plasma, and to boost synchrotron emission by the accelerated electrons, producing copious multi-MeV photons in the form of a collimated beam. This regime potentially opens an opportunity for generating dense gamma-ray beams using existing laser facilities, thus fast-tracking a number of eagerly awaited applications.

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