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Direct laser acceleration of electrons in a strong azimuthal magnetic field[1] TAO WANG, TOMA TONCIAN, CHEDS, Univ. of Texas, Austin, DAVID STARK, Los Alamos Nat. Lab., ALEXEY AREFIEV, CHEDS, Univ. of Texas, Austin — 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. At the same time, the quasi-static electric field in this regime is an order of magnitude weaker than the quasi-static magnetic field as a result of ion mobility and the fact that electrons are irradiated by a high intensity laser pulse. We have examined analytically and numerically direct laser acceleration of electrons in such an azimuthal magnetic field. We have considered a general case of a laser beam propagating with a superluminal phase velocity and compared the results to those for a luminal case. Our key finding is that the maximum gamma-factor that can be attained by electrons has a pronounced threshold, with a significant enhancement of the electron energy taking place above the threshold. The threshold is a function of the azimuthal magnetic field and of the initial transverse electron momentum.

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