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Enhanced proton acceleration in an applied longitudinal magnetic field[1] TOMA TONCIAN, ALEXEY AREFIEV, CHEDS, Univ. of Texas, Austin, GENNADY FIKSEL, Univ. of Michigan, Ann Arbor — Using two-dimensional particle-in-cell simulations, we examine how an externally applied strong magnetic impacts proton acceleration in laser-irradiated solid-density targets. We find that a kT-level external magnetic field can sufficiently inhibit transverse transport of hot electrons in a flat laser-irradiated target. While the electron heating by the laser remains mostly unaffected, the reduced electron transport during proton acceleration leads to an enhancement of maximum proton energies and the overall number of energetic protons. The resulting proton beam is much better collimated compared to a beam generated without applying a kT-level magnetic field. A factor of three enhancement of the laser energy conversion efficiency into multi-MeV protons is another effect of the magnetic field. The required kT magnetic fields are becoming feasible due to a significant progress that has been made in generating magnetic fields with laser-driven coils using ns-long laser pulses. The predicted improved characteristics of laser-driven proton beams would be critical for a number of applications.

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