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Kinetic Simulations of Laser Parametric Amplification in Magnetized Plasmas[1] QING JIA, YUAN SHI, HONG QIN, NATHANIEL FISCH, Princeton University — Laser pulse compression using magnetized resonance near the upper-hybrid frequency is promising for achieving higher output intensity in regimes previously thought impossible using unmagnetized plasmas. Using one-dimensional particle-in-cell simulations, we verify that, by partially replacing plasma with an external transverse magnetic field of megagauss scale, the output pulse can be intensified by a factor of a few, due to the increased allowable amplification time despite a decreased growth rate. Further improvement is impeded by the generation of an electromagnetic wakefield, to which the amplified pulse loses more energy than it does in the unmagnetized case. This limitation can however be circumvented by the use of a stronger pump. In contrast to unmagnetized compression, the magnetized amplification remains efficient when the pump intensity is well above the wavebreaking threshold, until a higher phase-mixing threshold is exceeded. This surprising resilience to wavebreaking in magnetized plasma is of great benefit for magnetized compression.

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