

Abstract Submitted
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Experimental study of deformable mirror on ZEUS (Zettawatt-Equivalent Ultrashort pulse laser System)¹ QIAN QIAN, BIXUE HOU, YONG MA, ANATOLY MAKSIMCHUK, JOHN NEES, KARL KRUSHELNICK, ALEXANDER THOMAS, University of Michigan, Grard Mourou Center of Ultrafast Optical Science, Ann Arbor, Michigan 48109 — The Gérard Mourou Center of Ultrafast Optical Science in the University of Michigan will upgrade its 300 TW Hercules laser to a new 3 PW laser system called ZEUS in the near future. A deformable mirror is an important part in this system. It not only enables focusing of laser beams to diffraction limited spots, but also allows for active feedback to control and fine-tune laser-plasma interactions. In the current Hercules laser, the output beam after the deformable mirror is focused to 1 micron spot size, producing intensity over 10^{22} W/cm². For the upcoming ZEUS laser, the highest laser intensity after the deformable mirror is expected to be on the order of 10^{23} W/cm². This extremely intense laser pulse could greatly exceed the quantum electrodynamic critical field when colliding with a 5 GeV electron beam. ZEUS also allows for a high repetition-rate operation mode, which means we could use the deformable mirror to adaptively control and optimize laser-plasma accelerators. The large amount of data generated from the system allows the application of machine learning. This may offer a new way to understand complex physical processes in nonlinear laser-plasma interactions.

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