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Measuring Energy Scaling of Laser Driven Magnetic Fields[1]

JACKSON WILLIAMS, CLEMENT GOYON, DEREK MARISCAL, BRAD POLLOCK, SIDDHARTH PATANKAR, JOHN MOODY, Lawrence Livermore Natl Lab

— Laser-driven magnetic fields are of interest in particle confinement, fast ignition, and ICF platforms as an alternative to pulsed power systems to achieve many times higher fields. A comprehensive model describing the mechanism responsible for creating and maintaining magnetic fields from laser-driven coils has not yet been established. Understanding the scaling of key experimental parameters such as spatial and temporal uniformity and duration are necessary to implement coil targets in practical applications yet these measurements prove difficult due to the highly transient nature of the fields. We report on direct voltage measurements of laser-driven coil targets in which the laser energy spans more than four orders of magnitude. Results suggest that at low energies, laser-driven coils can be modeled as an electric circuit; however, at higher energies plasma effects dominate and a simple circuit treatment is insufficient to describe all observed phenomenon. The favorable scaling with laser power and pulse duration, observed in the present study and others at kilojoule energies, has positive implications for sustained, large magnetic fields for applications on the NIF.

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Jackson Williams
Lawrence Livermore Natl Lab

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