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Monoenergetic Proton Radiography of Electromagnetic Fields in Laser-Plasma Interactions and Areal Density in Imploded Capsules[a,b]

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An isotropic, monoenergetic proton backlighter source with matched detector has been utilized on the OMEGA laser system to accurately and sensitively study the following: First, MG fields generated by laser plasma interactions [(1,2)], both in the growth and decay phase, the latter associated with the development of 2-d symmetry breaking instabilities. Second, the reconnection of MG fields of interacting laser generated magnetic bubbles [(3)]. Third, the fields and areal density evolution for cone-in-shell implosions [(4)]. And fourth, the fields and areal density evolution of spherical implosions. Mottled, complex field structures are sometimes observed during the implosions. Because of the precise energy of the 14.7 (3.0) MeV P and 3.5 MeV alpha backlighter particles, a result of the fusion reaction of D and ^{3}He (and DD) in an exploding pusher, a quantitative relationship can be established between particle energy loss and areal density (through stopping power) or between deflections and field strength (via the Lorentz force). Results of these experiments, as well as those currently being planned, such as accurate stopping power measurements in warm dense matter, will be presented.

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1. C. K. Li et al, PRL **97** 2006 ; 2. C. K. Li et al, PRL **99** 2007; 3. C. K. Li et al, PRL **99** 2007; 4. J. R. Rygg , submitted to Science.