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Modeling Laser-Plasma Interactions in a Magnetized Plasma[1]

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— We consider how laser-plasma interactions, namely stimulated Raman and Brillouin scattering, develop in the presence of a background magnetic field. Externally-launched waves in magnetized plasma have been studied in magnetic fusion devices for several decades, with relatively little work on their parametric decay. The topic has received scant attention in the laser-plasma and high-energy-density fields, but is becoming timely. The MagLIF pulsed-power scheme relies on an imposed axial field and laser-preheat [S. Slutz et al., Phys. Rev. Lett. 2012]. Imposing a field on a hohlraum to reduce hotspot losses has also been proposed [L. J. Perkins et al., Phys. Plasmas 2013]. We consider how the field affects the linear light waves in a plasma, e.g. by decoupling the left- and right- circular polarizations (Faraday rotation). Parametric instability growth rates are presented, as functions of plasma conditions, field strength, and geometry. The scattered-light spectrum, which is routinely measured, is also found.

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