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Measurement of High Magnetic Fields in Laser Produced Plasmas

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Many high intensity laser applications can generate large magnetic fields up to the level of 100's of Tesla. In particular, the application of circularly polarized [1] or orbital angular mode (OAM) laser beams [2] can be used to generate such large fields using the inverse Faraday Effect (IFE). These fields can play an important role in the generation and guiding of electrons in laser plasma interaction process. Traditional techniques such as the Faraday rotation of the polarization of a probe beam can be applied to measure fields in the 10's to 100's of Tesla range [3]. An alternative technique is to observe the Zeeman splitting of emission lines where the spin orbital angular momentum shifts the energy levels of a set of initially degenerate emission lines [4, 5]. We are interested in exploring techniques for generating fields on the order of 100's of Tesla and are currently investigating techniques for measuring magnetic fields in plasmas. Emissions lines are being explored as potential candidates for Zeeman splitting measurements of magnetic fields. Faraday rotation is also being investigated as an alternative technique. Hybrid Particle in Cell (Hybrid-PIC) code calculations of high intensity interactions will be carried out to predict the expected levels of magnetic field which would be generated under various interaction conditions. Progress on characterization of these measurement techniques and modeling of the magnetic field generation process will be presented.

References:

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