Evolution of Laser Produced Aluminum Plasma in the Presence of a Transverse Magnetic Field

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Surface erosion of plasma-facing components is a very important problem in fusion reactors. In order to make fusion reactors economically viable the lifetime of plasma-facing components must be extended. My research entails using magnetic field interactions with plasma in order to determine how the plasma moves through the field, and if it can be stopped by using a certain orientation of magnetic field. A magnetic field should be able to alter the path of evolving plasma due to the interaction of the magnetic field with the charged particles in the plasma. The optimal orientation for slowing the evolution of the plasma is hypothesized to be perpendicular to the magnetic field. Also it is anticipated that the higher the magnetic field the greater the stopping of the plasma. This experiment consisted of designing a magnetic trap and creating laser produced plasma with and without a magnetic field. Intensified CCD was used to image the plasma plume expansion with and without a transverse magnetic field. An aluminum target was used to generate the plasma using laser pulse energies of 50 mJ, 100 mJ, and 150 mJ. It was found that with no magnetic field the plume expanded freely, with larger velocities for higher laser pulse energy. With magnetic field the plasma was confined and this confinement was more pronounced at higher energies. This experiment can be extended by gathering spectroscopic data in order to determine the temperature and the levels of ionization inside the plasmas at different laser energies and magnetic orientations.