Interaction of a Laser-Produced Plasma with an Azimuthal External Magnetic Field

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The investigation of the interaction which occurs between a plasma and an externally applied magnetic field is an important topic with a large range of application. Applications range from the closure of magnetically insulated transmission lines, to astrophysical systems such as a supernova collapsing to a pulsar, the magnetic field of which interacts with the ejecta forming magnetic Rayleigh-Taylor filaments, or the interaction which occurs between the solar wind and the Earth's magnetic field, where plasma from the solar wind is observed to penetrate into the magnetosphere.

To investigate how a plasma interacts with an externally applied magnetic field, experiments were performed at the Nevada Terawatt Facility. In experiment, a high-intensity laser (E ~ 10 J, $\tau = 0.5$ ns, $I \sim 2 \times 10^{14}$ W/cm^2) was employed to generate a plasma by ablating a polyethylene target (CH_2), and a pulsed power device was employed to produce a external magnetic field by passing a current (0.6 MA, 200 ns) through a straight cylindrical electrode. The surface of the target was placed 1 cm from the surface of the electrode and the laser-produced plasma expanded in the direction of the magnetic field gradient. As the plasma expands into the magnetic field, it appears to collimate and become jet-like. All progress will be presented.

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