Physics Colloquium

Application of Proton Deflectometry for the Determination of Current and Magnetic Field Configuration in Pulsed Power Driven Z-Pinch Plasma Loads

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Abstract:
Measuring magnetic fields in z-pinch plasma systems is challenging. Typical laser-probing diagnostics are limited by the critical density and large density gradients, while electrical diagnostics have limited spatial resolution. The first demonstration of proton deflectometry of z-pinch plasma systems at the mega-ampere scale will be shown. A high-energy proton beam is directed through a pulsed-power-driven plasma system and its spatial profile is measured in order to examine configuration of magnetic fields, and infer the currents that support them. The experiments were performed at the Nevada Terawatt Facility using the 10J 0.3ps Leopard laser, coupled to the 1.6MA Zebra pulsed-power driver. Numerical simulations were used to estimate the field and current configurations from the experimental results. Quantitative data from wire array experiments, such as plasma density and temperature, assisted in constraining of numerical simulations of the z-pinch plasma systems performed by the 3D resistive MHD code, Gorgon. Protons were injected and tracked through the simulated z-pinch system using either the 3D hybrid PIC Large Scale Plasma code, or Gorgon’s proton-probing post-processor and the results were then compared against the experimental data.

Thursday, January 30th, 2014
12:00 Noon - 1:00 pm
Leifson Physics Building, Room LP 118