Plasma Physics Seminar

UCLA College | Physical Sciences Physics & Astronomy

Physics & Astronomy Building (PAB) Room 4-330
Friday January 23rd at 12:30 PM
Via Zoom: https://ucla.zoom.us/j/92785449357?pwd=SVBTSko3bTdEUW03dzQwNks1Q2lKZz09

Self-magnetization of Laser-Driven High-Energy-Density Plasmas

Will Fox (UMD)

Laser-heated plasmas are important for fusion, industry, and enable experiments on fundamental phenomena important in plasma astrophysics. I will present recent results on the generation and dynamics of magnetic fields in laser-produced plasmas. Magnetic fields are important for modifying particle and heat transport in plasmas, and for example can mediate the generation of collisionless shocks. Laboratory experiments at OMEGA and OMEGA EP are used to study magnetic field generation by two processes, the Biermann battery effect and Weibel instability. Proton deflectometry is used to measure the magnetic fields, and we introduce a tomographic analysis to obtain 3-D reconstructions of self-generated magnetic fields, revealing the spatial structure and evolution of the Biermann-generated fields. Secondly, recently we developed a particle-in-cell simulation with laser ray tracing, enabling first-principles kinetic simulation of laser-solid interaction. These simulations show how a rapidly-expanding plasma develops temperature anisotropy, which drives the self-generation of filamentary magnetic field structures by Weibel instability. In both cases, the self-generated magnetic fields are sufficient to magnetize the plasma and modify its heat conductivity, highlighting the importance of self-magnetization to laser-driven plasmas.