

Physics 790 Seminar

Line Emission and X-ray Line Polarization of Multiply Ionized Mo Ions

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Abstract:

The dipole radiation emitted by quasi-stationary ions excited by a unidirectional electron beam is both polarized and anisotropic. As a result, polarization of x-ray line emission can be used as a plasma diagnostic for detecting the presence of directional electron beams in various types of plasmas. However, the process of measuring the polarization in such plasmas can prove to be very challenging due to depolarization effects caused by Maxwellian electrons, a small number of non-Maxwellian electrons compared to Maxwellian electrons, and uncertainties due to an unknown electron distribution function. In this presentation, we show a comprehensive experimental and theoretical study of the line emission from multiply ionized Mo ions produced by two different sets of experiments: at LLNL EBIT and the pulsed power generator Zebra at UNR. Mo line emission and polarization measurements were accomplished at EBIT for the first time. In particular, benchmarking experiments at the LLNL EBIT with Mo ions produced at electron beam energies from 2.75 keV up to 15 keV allowed us to break down these very complicated spectra into spectra with only a few ionization stages and to select processes that influence them as well as to measure line polarization. The EBIT data were recorded using the EBIT Calorimeter Spectrometer and a crystal spectrometer with a Ge crystal. X-ray Mo spectra and pinhole images were collected from Z-pinch plasmas produced from various wire loads. Non-LTE modeling, high-precision relativistic atomic and polarization data were used to analyze L-shell Mo spectra.

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