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1.2 A High-Throughput, Pulse-Front-Tilt–Compensated Streaked Spectrometer for Picosecond Optical Thomson Scattering from Electron Plasma Waves

Monday, 16 April 2018 09:15 (30)

A novel optical spectrometer was built that enables measurements of Thomson scattering from electron plasma waves with 2-ps time resolution. Pulse-front tilt introduced from a diffraction grating scales with aperture diameter and can limit the achievable time resolution of a streaked spectrometer. The spectrometer presented in this work uses an echelon optic to break the aperture into series of temporally delayed segments that compensate for the large-scale optical path length asymmetry introduced by the grating. By decoupling the relationship between pulse-front tilt and aperture size, an optimized spectrometer design can be matched to the time resolution of the streak camera at an arbitrarily large throughput. The as-built streaked spectrometer operates with an effective aperture of f/3.3 with 1-nm spectral resolution covering a range of 460 nm to 590 nm and records spectra with 2-ps time resolution. The system has been implemented to study plasma heating rates of underdense plasmas by observing Thomson scattering from electron plasma waves. This material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DE-NA0001944.

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