Beitrag ID: **47** Typ: **Talk**

Experimentally modulated laser plasma instabilities by using low coherence lasers

Donnerstag, 29. Januar 2026 17:30 (20 Minuten)

In the interaction of ns laser pulses with plasma, a large amount of highly energetic electrons stems from laser plasma instabilities (LPIs). These describe the scattering of a large percentage of laser photons on ion acoustic or electron plasma waves, with unbound electrons being accelerated in the resulting fields of the latter.
By adjusting the incident laser light, LPIs can be modulated to fit the intended application. Increasing the spectral bandwidth is a newly studied approach to do so without adjusting its overall temporal and spatial profile. From theoretical studies, an appreciable effect is expected for a FWHM of $\Delta\lambda/\lambda\approx 1\%$, with lower coherence length denying LPI the time to fully develop [1,2]. But due to the complexity of realistic laser systems and plasmas, such as the interaction between different types of LPI [3], careful experimental studies are required to fully resolve all effects in play. So far, the number of studies is limited due to the small number of laser systems equipped with the necessary broadband capabilities. The PHELIX laser is one of them, newly capable of providing tunable bandwidths up to about 0.5%.
We present a study of LPI with 2-ns laser pulses at a central wavelength of 527 nm, including comparison of different types of LPI under monochromatic and broad-bandwidth laser conditions at PHELIX [4]. With the latter, two plasmon decay and stimulated Brillouin scattering were reduced in back- and side-scatter directions, but side stimulated Raman scattering was strongly increased. In conjunction, the number and temperature of "hot"electrons and of the x-ray photons they produce was increased. This is in agreement with experiments performed at the other operational high-bandwidth laser facility [5]. Going forward, this discrepancy between expected and observed modulation of LPI should be investigated by more detailed analysis of on-shot plasma conditions and of the focal region of the laser pulse.

Autor: Herr KANSTEIN, Christoph (TU Darmstadt, GSI (Plasmaphysics/PHELIX))

Co-Autoren: Prof. WASSER, Florian (Focused Energy GmbH); Prof. BAGNOUD, Vincent (GSI Helmholtzzentrum für Schwerionenforschung)

Vortragende(r): Herr KANSTEIN, Christoph (TU Darmstadt, GSI (Plasmaphysics/PHELIX))

Sitzung Einordnung: Session 10 - Inertial Confinement Fusion 3