Development of an Achromatic Quadriwave Lateral Shearing Interferometer (AQLSI) to Measure Density Gradients in Relativistic Laser-Plasma Experiments.

The understanding of nonlinear, relativistic laser-plasma interactions highly relies on accurate measurements of the plasma’s electron density with a high spatial and temporal resolution. Due to the ultra-broadband nature of the femtosecond sources used to image such interactions, interferometry using standard wave-division concepts e.g., Michelson and Mach-Zehnder, suffers from poor fringe contrast, ultimately reducing the field of view and sensitivity of the measurements. Using an achromatic quadriwave lateral shearing interferometer, detailed phase maps of a several-mm$^2$ scale area of the laser-plasma interaction can be recorded and analyzed.

Figure 1: from D. Ullmann’s Master’s Thesis, 2015

Expected tasks:

- Design and finalization of a modified Shack-Hartmann phase mask in cooperation with a local manufacturer,
- implementation of AQLSI in a laser wakefield acceleration experiment to record data
- programming of a phase retrieval algorithm and Abel inversion analysis to convert the raw data into a map of the electron plasma’s density distribution,
- work will require a well-rounded mix of laboratory and programming skills.

This topic is expected to be investigated within a Master’s Thesis. If you are interested please contact

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