High-Resolution Diagnostics for Laser-Plasma Interactions with Overdense Plasmas

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Relativistic plasmas generated by high-power laser pulses are a potential candidate for future compact particle accelerators. Underdense plasmas have been successfully used to realize compact, laser wakefield accelerators for electrons. The interaction of high-intensity lasers with overdense plasma has led to equally impressive results concerning the acceleration of ions.

However, the physics underlying such interactions are quite complex (and strongly depend on the actual experimental conditions) and in many cases our understanding still heavily relies on the comparison of experimental results with numerical simulations. An experimental approach to gain further insight into the interaction is therefore highly desirable [1].

This presentation will show how the application of ultra-short, broad band probe pulses, synchronized to the high-intensity laser pulses of JETI [2] and POLARIS [3] at FSU Jena and Helmholtz-Institute Jena, can give a detailed insight into various aspects of the interaction. This will be the generation of the plasma through various ionization processes during the rising edge of the laser pulse at a very early stage of the interaction [4]. At later times, the interaction of the main pulse with the laser and the subsequent expansion of the plasma can also be visualized giving high-resolution information of the actual ion acceleration process [5].

References

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