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High-Resolution Diagnostics for Laser Wakefield Accelerators –a Tool for Detailed Insights into the Interaction

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Relativistic plasmas generated by high-power laser pulses are promising candidates for future compact particle accelerators. In a laser wakefield accelerator for electrons, a driving laser pulse generates a high-amplitude plasma wave forming an electric field structure (the “wakefield”), which can trap and accelerate electrons to several GeV energies over few-centimeter distances only. The properties of the generated electron pulses (energy, duration, lateral dimensions) strongly depend on the parameters and the evolution of the wakefield. Therefore, a complete understanding of the physical phenomena underlying the acceleration process is mandatory to improve the controllability of the electron pulses, which will determine their suitability for future applications. This presentation will discuss transverse optical probing as a diagnostic tool for laser-wakefield electron accelerators and present experimental results on the characterization and evolution of the electron pulses, the plasma wave and the driving laser pulse.

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