Seminar über Ultrafast Science and Technology

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Titel: THz metamaterial based accelerator diagnostics

We propose so-called THz meta-atoms for applications in advanced accelerators. Specifically, we discuss THz streaking and a THz driven undulator. In meta-atoms the electromagnetic near-field is defined by geometry and extends over a wavelength. Thus, THz radiation with wavelengths of about 100 microns is well matched to typical electron bunch sizes. Moreover, today's THz sources provide field strengths up to hundreds of MV/m, which can be considerably higher when the source is combined with structures featuring high electric field enhancements. After discussing properties and possibilities of different THz meta-atoms, we present two examples in more detail. First, electron streaking with a split ring resonator loaded by a single cycle THz pulse. Simulations * and recent experiments show that such devices achieve femtosecond to sub-femtosecond temporal resolution. Second, we propose a THz driven undulator composed of a linear chain of meta-atoms. Its alternating electric field forces electron bunches on an oscillatory trajectory and causes them to radiate. The emission is narrowband and tunable; a kinetic energy of 100 MeV results in about 1 keV photon energy.

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