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Tip-based electron source for femtosecond electron diffraction JAN-PAUL STEIN, MARKUS SCHENK, JOHANNES HOFFROGGE, MICHAEL KRÜGER, PETER BAUM, PETER HOMMELHOFF, Max Planck Institute of Quantum Optics — In today's femtosecond electron diffraction and microscopy experiments, femtosecond UV pulses are employed to trigger photoemission of electrons from a flat metallic surface cathode. Subsequently, the electrons undergo acceleration in an electric field. By careful choice of the laser intensity profile and compression of the electron bunches via rf-cavities and electron optics sub-100 fs electron pulses have been achieved in the state of the art experiment. The aim of this study is to replace the flat cathode by a sharp metal tip with a radius in the one hundred nanometer regime. Due to the tip geometry the electric field at the apex is greatly enhanced so that electrons experience a strong acceleration right after emission. Electrons leaving the tip with different initial kinetic energies therefore develop a significantly lower timing jitter during their propagation, translating into pulse durations on the order of several tens of femtoseconds at the target, as inferred from simulations. Furthermore, the electron beam emittance decreases drastically. We will present results of a detailed analytic and numerical analysis of different setup parameters and discuss the current experimental status.

Jan-Paul Stein
Max Planck Institute of Quantum Optics, Garching

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