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FEW-CYCLE LASER BASED ELECTRON EMISSION FROM FIELD EMISSION TIPS:
A CLOSE LOOK AT THE PHYSICS BEHIND VARIOUS EMISSION PROCESSES
AND APPLICATIONS

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Field emission tips are known to be the brightest electron sources. Recently, advanced emitters such as single atom tips and carbon nanotubes have been developed. In parallel, the output of pulsed laser oscillators has reached durations down to only a few optical cycles; also, direct control of the laser electric field is now possible. Investigations of (coherent) electron dynamics in solids with the help of femtosecond laser pulses has revealed a whole lot of fascinating results. Here, we describe our efforts to gain knowledge about the details of few-cycle laser based electron emission from field emission tips. In energy-resolved measurements we observe emission regimes of different nature such as multiphoton emission, photo-assisted field emission, and above-threshold photoemission. We discuss recent results in detail. We will also present applications in quantum optics experiments as well as novel tools of photonics and microwave based electronic motion control.

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