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“Steering electrons on fastest time scales: attosecond physics at a nanometric metal tip”

Sharp metal tips are employed as field emission sources in countless devices and applications. In almost all of them, the electrons are emitted by a DC electric field. Here we show that intriguing effects show up if the tip is driven with femtosecond laser pulses. We observe strong-field effects, which means that the laser field itself starts to govern the dynamics of the emitted electrons. Moreover, we observe that the laser-emitted electron can be driven back to the parent tip, scatter at it elastically, and gain more energy in the laser field; we also observe electronic matter wave interference. All this is the basis of attosecond physics, namely the steering of electrons within a single cycle of an optical field, for the first time observed at a solid.
If time permits, we also discuss a novel electro-dynamic waveguide for slow electrons and possible applications towards a quantum electron microscope.