Ultrafast photoemission control in nanoplasmonic near-fields

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Photoelectrons were shown to be sensitive tools for ultrahigh-sensitivity near-field probing on the nanoscale [1,2]. We have shown that using this technique, plasmonic field enhancement can be experimentally measured with unprecedented surface sensitivity with the help of photoemitted and rescattering electrons. It was demonstrated that the cutoff region of these photoelectron spectra is made up of electrons emitted from plasmonic hot spots of the nanoparticles [1].

If we use femtosecond pulses made with ~1.5 eV photonenergy for such a measurement, the photoelectron generation is highly nonlinear and it can serve as a basis for time-resolved probing of near-fields in a spatially highly selective manner. By filtering for a certain kinetic energy range of photoemitted electrons, we can limit the measurement for rescattering electrons resulting in a sub-nm surface sensitivity [2] and selectivity for plasmonic hot spots. I will present first results of our femtosecond time-resolved measurments [3]. In addition, I will also how rescattering can be switched off by using few-cycle pulses for plasmon generation.

References

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