

FOR 1809 Seminar Talk

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Seminar Room 211 (PhysChem)

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Insight into Plasmonics
Observing of Surface Plasmon Polaritons in Time-Resolved Photoemission Electron Microscopy

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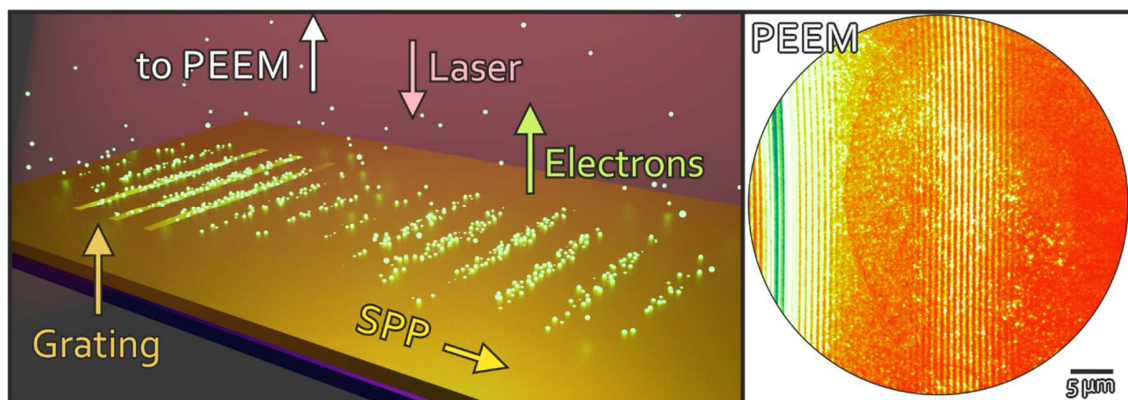
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Insight into Plasmonics – Observing of Surface Plasmon Polaritons in Time-Resolved Photoemission Electron Microscopy

Surface Plasmon Polaritons (SPPs) are propagating electromagnetic modes bound to the dislocation of electrons within a metal at a metal-dielectric interface. Therefore the properties of SPPs differ from those of vacuum light modes. For example, SPPs are not restricted by the Abbe-Rayleigh diffraction limit and can be focused in structures much smaller than their wavelength. As such, SPPs are candidates for information technology applications in the future [1].

Photoemission electron microscopy (PEEM) has been shown to be a very powerful technique of imaging SPPs for almost a decade now [2,3]. Compared to other methods, such as scanning near-field optical microscopy, PEEM has the advantage of obtaining images at video rates. In combination with an ultra-short laser pulses, PEEM can be used for time-resolved measurements in a pump-probe fashion as well. But it was only after the recent development of the so called “normal incidence light geometry” that SPP phase fronts could be visualized directly [4].

In my talk I will shortly explain how the imaging of SPPs in PEEM works and demonstrate how movies of SPP packets, propagating in different directions at the surface, can be recorded with a temporal resolution of a few attoseconds. I will show the reflection, focusing and standing wave formation of SPPs. Furthermore, I will show the latest results in high resolution imaging of short-range SPPs, a hybrid mode in very thin metals surrounded by dielectrics. As a result short-range SPPs exhibit a much smaller wavelength than the exciting laser pulses and its associated “normal” (long-range) SPPs and can be focused even further.



- [1] Ozbay, E.: Plasmonics: Merging Photonics and Electronics at Nanoscale Dimensions, Science 311 pp. 189, 2006
- [2] Meyer zu Heringdorf, F.-J. *et al.*: Femtosecond photoemission microscopy, Surf. Sci. 601 (20), pp. 4700, 2007
- [3] Kubo, A. *et al.*: Femtosecond Microscopy of Surface Plasmon Polariton Wave Packet Evolution at the Silver/Vacuum Interface, Nano Lett. 7 (2), pp. 470, 2007
- [4] Kahl, P. *et al.*: Normal-incidence photoemission electron microscopy for imaging surface plasmon polaritons, Plasmonics 9, pp. 1401, 2014