Plasmonics - Mapping surface plasmons with fast electrons on metallic nanostructures

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Metallic nanostructures and their extraordinary optical properties have become of great interest in the last 2 decades. Their ability to transform light into areas much smaller than its wavelength and to increase strongly the electric field intensities led to an immense motivation for scientific research and to a multitude of various technological applications [1, 2]. The interesting behavior of such nanoparticles is linked to optical excitations on their surfaces, so called localized surface plasmons (LSPs). Using fast electrons, instead of photons, to analyze LSPs has the advantage of unbeaten high spatial resolution. This enables, in combination with spectroscopical techniques, observation of the electric field distribution of LSPs on the nanometerscale [3, 4].

In this talk I want to give a short introduction in the field of plasmonics and present some recent results, where silver nano-discs were analyzed and a multitude of LSPs could be observed, including a new fundamental plasmonic mode, the so called breathing mode.

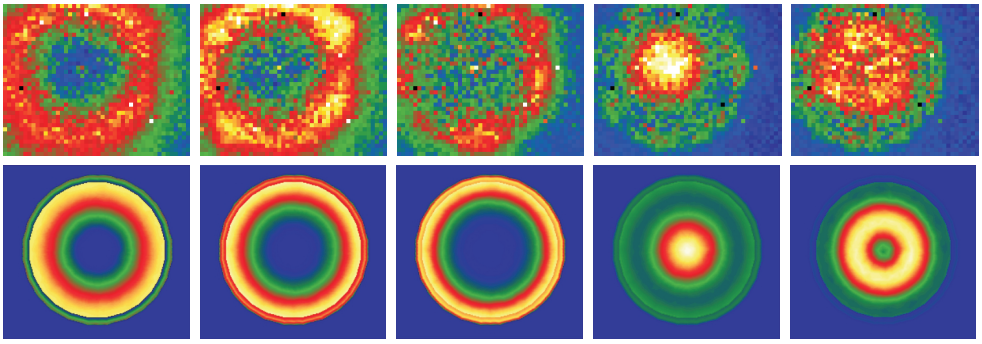

Figure 1. *EEL-maps: Experimental (upper row) and simulated (lower row) electron energy-loss maps of a silver nanodisc (200 nm diameter, 30 nm thickness) on a 30 nm thick silicon nitride membrane, which show the electric field distribution of 5 different localized surface plasmons - dipole, quadrupole, hexapole and breathing mode of first and second order are presented from left to right.*

References

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