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Multipolar plasmonic resonances in silver nanowire antennas imaged with a sub-nanometer electron probe

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Science Lecture Theatre S1, Building 25

Abstract

We detect short range surface plasmon-polariton (SR-SPP) resonances setup in individual silver nanoantenna structures at high spatial resolution with a scanning, a sub-nanometer electron probe. Both even and odd multipolar resonant modes are resolved up to 6th order, and we measure their spatial distribution in relation to the nanoantenna structure at energies down to 0.55 eV. Fabry-Perot type SR-SPP reflection phase shifts are calculated from direct measurements of anti-node spacings in high resolution plasmonic field maps. We observe resonant SR-SPP anti-node bunching at nanoantenna terminals in high order resonant modes, and anti-node shifts in non-homogeneous local environments. Finally, we achieve good agreement of our experimental SR-SPP maps with numerical calculations of photon excited near fields, using a novel integrated photon excitation geometry.

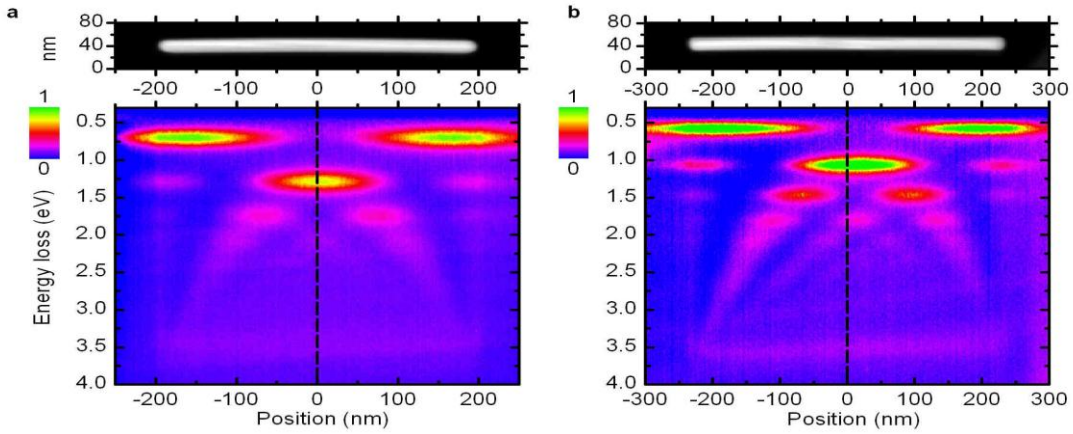

Figure1. The variation of plasmon enhanced field with electron energy loss across a individual nanoantennas of radius 15nm (a) and 13nm (b). Plasmon field amplitude measurements with respect to a nanoantenna structure are accessible with the simultaneous acquisition of the ADF signal (top). Multiple resonance modes at discrete electron energy losses are imaged in one dimension along the length of the nanoantenna (bottom). High order resonance modes are resolved in both nanoantennas. The surface plasmon is also detected at 3.55 for both nanoantennas

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