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Optical dichroism in electron energy-loss spectroscopy

Vortex electron beams (VEBs) are a class of chiral free electron states carrying orbital angular momentum (OAM). Right-handed and left-handed VEBs, acting as probes, can interact differently with chiral objects, yielding measurably different results in electron energy-loss spectroscopy (EELS) experiments. This nontrivial behavior is usually referred to as dichroism. We present a theoretical analysis of localized surface plasmon excitation on a prototype of a chiral plasmonic nanoantenna. We propose an experiment, in which the EEL spectrum is resolved in pre-interaction and post-interaction OAM. We treated this problem both analytically and numerically and showed the conditions necessary for the emergence of dichroism, as well as the possibility of optimizing the experimental parameters for maximization of the dichroism.

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