

# **New (polarized) light on plasmonic photonic crystals**

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Plasmonic photonic crystal structures consisting of a highly organized square array (lattice parameter 210 nm) of half-spheroids (30/50 nm radii) of Au on uv-transparent glass, reveal a surprisingly rich optical response when studied by an optical near infrared-visible-ultraviolet spectroscopic technique allowing to measure the complete polarization response in terms of the so-called Mueller-Jones matrices (Mueller-Stokes formalism) as recently reported by Brakstad, Kildemo, Ghadyani and Simonsen (2015, Phys. Rev. B. (submitted)). By full azimuthal rotation of the sample, we observe all the Rayleigh/Wood lines corresponding to grazing diffracted waves, and we explain how the measurements nearly map out the first, second and third Brillouin zones. Strong resonances are observed for co-polarization, at high symmetry points, and the general symmetry for co-polarization is 45 degrees. On the other hand, the scarcely studied polarization-conversion has 90 degrees symmetry. We also observe an oscillation in the Localized Surface Plasmon Resonance (LSPR) upon azimuthal rotation of the sample, and a pattern of cross-polarization surrounding the LSPR. The samples were favorably produced by Focused Ion Beam milling using the NTNU Nanolab facilities.