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Polarization singularities at the nanoscale

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We measure the electric field above a photonic crystal waveguide (PhCW) with a polarization- and phase-sensitive near-field microscope. For the first time, we reconstruct the full in-plane polarization state of the light with sub-wavelength resolution. We find locations where the polarization state of the light is ill-defined. These locations are so-called polarization singularities. We identify two polarization singularities within a unit cell of the PhCW and study the topology of the surrounding electric field.

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Background free CARS imaging with local phase detection

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In biological samples the resonant CARS signal is often overwhelmed by the non-resonant background signal of water and other constituents. We show that heterodyne CARS, based on a controlled and stable phase-preserving chain, can be used to simultaneously measure amplitude and phase information of Raman active molecular vibration modes. The detection of the phase allows for rejection of the non-resonant background from the image. Furthermore a new technique (double pump CARS) is developed to correct for phase changes by in- homogeneities (refractive index changes) in the sample and the phase curvature over the field of view. We demonstrate our setup for background free images by combining the heterodyne CARS with double-pump CARS techniques on a point-by-point basis.