P-QEO8: Surface plasmon polariton based optical beam profiler

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We demonstrate a novel surface plasmon polariton (SPP) based optical beam profiler with submicroscopic spatial resolution and the potential to be applied directly onto a photodiode. A sharp step of a gold thin film is positioned in the focal region of a light beam, converting light to SPPs. The SPPs emit directed leakage radiation into the glass substrate supporting the thin film. The leakage radiation intensity is proportional to the incident local light intensity at the position of the step, allowing to reconstruct the optical field profile by scanning the thin film edge through the focal region.

P-QEO9: Manipulating optical plasmon polaritons with surface nanostructures

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The present know-how and technology with regard to plasmon effects on the micro- and nanoscale seem sufficiently advanced to allow the development of functional surface plasmon polariton (SPP) based optical devices. Therefore, however, quantitative information describing SPP phenomena is required. In the former study metal nanostructures fabricated by electron-beam lithography on thin metal film performed as mirrors, beam splitters and interferometers was demonstrated by qualitative fluorescence imaging [1]. On the other hand, the qualitative measurement of light/SPP coupling was shown by analyzing of leakage radiation [2]. In the present work, we applied the measurement of leakage radiation to the excitation an propagation of SPPs in silver films with various surface nanostructures, thereby gaining quantitative information about SPP reflection, transmission and scattering. The factors, which influence SPP propagation in complex nanostructures are discussed.

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P-QEO10: Single-atom lasing induced atomic self-trapping

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We study atomic center of mass motion and field dynamics of a single-atom laser consisting of a single incoherently pumped free atom moving in an optical high-Q resonator. For sufficient pumping, the system starts lasing whenever the atom is close to a field antinode. If the field mode eigenfrequency is larger than the atomic transition frequency, the generated laser light attracts the atom to the field antinode and cools its motion. Using quantum Monte Carlo wave function simulations, we investigate this coupled atom-field dynamics including photon recoil and cavity decay. In the regime of strong coupling, the generated field shows strong nonclassical features like photon antibunching, and the atom is spatially confined and cooled to sub-Doppler temperatures.

P-QEO11: Polarisation Sensitive Optical Coherence Tomography for Material Anaysis and Diagnostics

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Optical Coherence Tomography (OCT) is a novel non-invasive technique which permits high-resolution cross-sectional imaging of turbid media. Since the initial use of OCT for imaging transparent and low-scattering tissues in ophthalmology the application fields have been extended to a variety of tissues in bioimaging and great efforts are currently undertaken for further developments of this technique.
In contrast to conventional OCT, in which the magnitude of the backscattered light is imaged, Polarisation Sensitive OCT (PS-OCT) maps the polarisation state of light within the sample. Thus, additional physical parameters (like birefringence) and enhanced structural information, that is difficult to resolve with other imaging techniques, can be obtained. The applications of OCT outside the biomedical sector, especially for material investigation and research, are so far only marginally touched. Some few developments concern e.g. classical OCT imaging of glass fibre composites and detection of subsurface defects in other non-biological materials. We extended classical OCT measurements to PS-OCT for a variety of problems posed in material analysis and diagnostics. In detail, PS-OCT has been used to measure the birefringence and the orientation of the fast optical axis within test structures: mapping of strain fields of samples under uni-axial and non-uniform external stress and the detection of flow patterns, especially in injection-molded plastic parts, could be successfully demonstrated.

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P-QEO12: Photonic crystal contra-directional couplers

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Photonic crystal (PhC) structures offer the possibility to synthesize highly integrable optical devices to process signals in the optical domain and to overcome the electronic bottleneck in current optical networks. Light can be efficiently guided in photonic bandgap structures, and the present paper shows that it is also possible to add/drop frequency channels within the same technology. We present a PhC device composed of two waveguides in a hexagonal pattern of air holes in silicon (refractive index n=3.4). Contra-directional coupling occurs in an extremely short region, about 10 micrometres, and two waveguide modes with opposite slopes satisfy the phase matching condition. The device is an ultra-compact add-drop filter. In