CO.CO.MAT

David Hunger
(Universität München)

Enhancement of light-matter interactions with tuneable optical microcavities

Spatio-temporal confinement of light can dramatically enhance light-matter interactions. To achieve this capability on an accessible platform, we have developed microscopic Fabry-Perot cavities based on laser-machined optical fibers. The approach provides wavelength-scale mode volumes and quality factors exceeding ten million, combined with full tuneability and open access to the cavity field. We employ such cavities to realize efficient and narrow-band single-photon sources by means of Purcell enhancement of fluorescence emission. We study color centers in diamond such as the Nitrogen-Vacancy center and explore different regimes of the cavity enhancement, aiming at applications in quantum cryptography, all-optical quantum computation, and efficient spin-state readout. In the context of sensitive microscopy, we investigate microcavities for imaging and spectroscopy applications. Scanning cavity microscopy provides spatially and spectrally resolved maps of various optical properties of a sample with ultra-high sensitivity. We demonstrate the technique by quantitative imaging of the extinction cross-section of gold nanoparticles and measurements of the birefringence and extinction contrast of gold nanorods. Finally, we show that the Purcell effect can be used for cavity-enhanced Raman spectroscopy and hyperspectral imaging. Simultaneous enhancement of absorptive, dispersive, and scattering signals promises intriguing potential for optical studies of nanomaterials, molecules and biological nanosystems.

27. November 2015, 15:30 Uhr

Universität Stuttgart, NWZII, Raum 2.136
Pfaffenwaldring 57, 70569 Stuttgart