HUMBOLDT-UNIVERSITÄT ZU BERLIN
INSTITUT FÜR PHYSIK

Optics and Photonics Seminar

Monday, July 01, 2024, 1 p.m.
IRIS – R. 2.049, Zum Großen Windkanal 2, 12489 Berlin

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Nonlinear Optics in Diamond Microcavities

The centrosymmetric nature of the diamond lattice prohibits second-order optical nonlinear processes, which limits pristine diamond to the study of third-order nonlinear interactions. However, introducing crystal defects can break the crystal symmetry, thus allowing for nonlinear second-order processes. In this work, we demonstrate cavity-enhanced second-harmonic generation from a diamond microdisk cavity, which we attribute to the presence of NV centres. We further show strong photoinduced suppression of the second-harmonic generated signal by off-resonant optical excitation of the NV centres. This quenching effect can be explained by nonlinear charge-state conversion from the negative to the neutral charge-state mediated by a strong IR cavity field. From this, we infer that the neutral charge-state possesses a comparatively smaller second-order nonlinearity compared to the negative charge-state.

If time allows, I will present an alternative platform for realising tuneable nonlinear optics based on a diamond membrane embedded in an open, fully-tuneable Faby-Perot microcavity. The resonance frequency of such a hybrid cavity platform depends on the exact combination of diamond thickness and airgap thickness. By exploiting a slight thickness gradient of the diamond membrane, we harness the nonlinear mode dispersion and demonstrate ~THz continuous tuning of double-resonant Raman scattering [1].

[1] S. Flågan, P. Maletinsky, R. J. Warburton, D. Riedel., Optica 9, 1197-1209 (2022).