Halbleiter-Nanophotonik

SFB 787

Einladung

Es spricht: **Dr. Christopher Gies**

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Zeit: **Donnerstag, 11. Juni 2015, 15:00 Uhr**

Ort: **Technische Universität Berlin**
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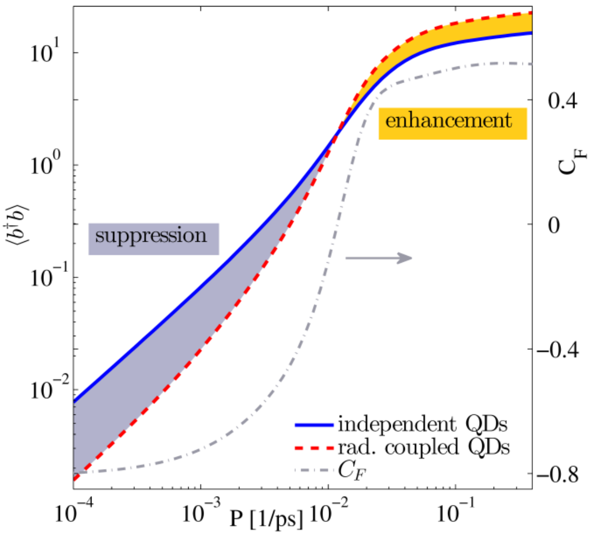
Thema: **„Sub- and Superradiance in Nanolasers"**

Abstract:

Radiative coupling between emitters is the origin of sub- and superradiance. Superradiance is typically understood as an enhanced cooperative emission from a gas of atoms [1]. Common laser theories are based on the assumption of individually radiating emitters and do not consider these coupling effects.

Nanolasers, on the other hand, do not behave like conventional lasers [2], but new properties arise from strong cavity-QED effects and small emitter numbers. For microcavity lasers with 10-200 emitters, we find that radiative coupling can have a strong impact even on the steady-state properties. The relation between the important ⍰-factor and the jump in the input/output characteristics can change by an order of magnitude (the figure shows the i/o curve of a Q=20,000 VCSEL with 100 QD emitters resonant with the mode), and much less emitters may be required to reach the lasing threshold in the presence of radiative coupling.



In collaboration between theory and experiment, signatures of radiative coupling have been identified in a typical quantum-dot micropillar VCSEL under pulsed excitation. The time-resolved autocorrelation function $g^{(2)}$, recorded with streak-camera measurements [3], reveals a giant photon bunching with values far exceeding the thermal limit of 2. The radiative lifetime is strongly accelerated and leads to a superradiant emission pulse. These findings are surprising, since in semiconductor systems, fast scattering and dephasing is expected to destroy the inter-emitter coupling.

I will discuss the origin of these effects on the basis of a microscopic laser theory that allows to switch the radiative QD-QD coupling on and off and thereby to directly monitor its impact.

[1] R.H. Dicke, Phys. Rev. **93**, 99 (1954)

[2] W.W. Chow, F. Jahnke, and C. Gies, *Emission properties of nanolasers during transition to lasing*, Light: Science and Applications **3**, e201 (2014)

[3] J. Wiersig et al., Nature **460**, 245 (2009)

Gäste sind herzlich willkommen!

Prof. Dr. S. Reitzenstein