universität ulm

Physikalisches Kolloquium — Physics Colloquium

Einladung — **Invitation**

Monday, 09 December 2024

Lecture Hall N24/H13, at 16:15
Coffee and cookies will be served in front of the lecture hall from 16:00

Designing quantum technologies based on collective light matter effects

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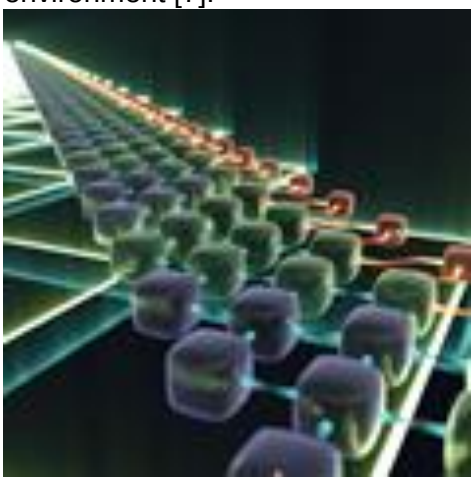
https://qtt.eps.hw.ac.uk/

Nonclassical correlations can fundamentally alter the way in which ensembles of quantum emitters interact with their surrounding electromagnetic environment [1]. Such effects are not only at the heart of a coherent light matter interface, as is required for distributed quantum information processing, sensing, and communication, but also manifest in networks of interacting molecular optical dipoles, where they play an important role in photosynthetic and artificial light harvesting.
In this presentation, I will give an overview of our recent theoretical work on utilizing bio-inspired collective quantum optical effects [2] and verifying and characterizing cooperative photon emission in condensed-matter systems [3]. These effects could, for instance, enable quantum-enhanced photocells [2, 4], facilitate the charging of Dicke quantum batteries through the super-absorption of light [5], and allow for efficient long-range (exciton) energy transport [6].
I will also provide a brief summary of our methodological advances, which allow simulating the dynamics of quantum nano-structures that are strongly coupled to more than one non-additive environment [7].



References

[1] Gross and Haroche, *Physics Reports* 93 301 (1982).
[2] Brown and Gauger, *J. Phys. Chem. Lett.* 10, 15, 4323–4329 (2019), Werren, Brown and Gauger, *PRX Energy* 2, 013002 (2023), Burgess *et al*, arXiv:2410.08940.
[3] Koong et al, *Science Advances* 8 abm8171 (2022); Wiercinski, Cygorek and Gauger, *Phys. Rev. Research* 6, 033231 (2024).
[4] Tomasi *et al*, *J. Phys. Chem. Lett.* 12, 26, 6143–6151 (2021); Rouse *et al*, *J. Phys. Chem. Lett.* 15, 254 (2024)
[5] Quach *et al*, *Science Advances* 8, eabk3160 (2022).
[6] Scott, Pollock and Gauger, *PRX Quantum* 3, 020354 (2022); Coates, Lovett, and Gauger, *Phys. Chem. Chem. Phys.* 10103 (2023).
[7] Cygorek *et al*, *Nature Physics* 18, 662 (2022); Cygorek *et al*, *Phys. Rev. X* 14, 011010 (2024).

Host: Prof. Dr. Martin Plenio, Institute of Theoretical Physics

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