TECHNISCHE UNIVERSITÄT DARMSTADT

Fachbereich Physik

Institut für Physik
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Prof. Dr. Benno Liebchen

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Physikalisches Kolloquium

Title: **Engineered quantum dynamics in dipole coupled nano arrays of quantum emitters**

Speaker: **Prof. Dr. Helmut Ritsch,**
Institut für Theoretische Physik in Innsbruck, Österreich

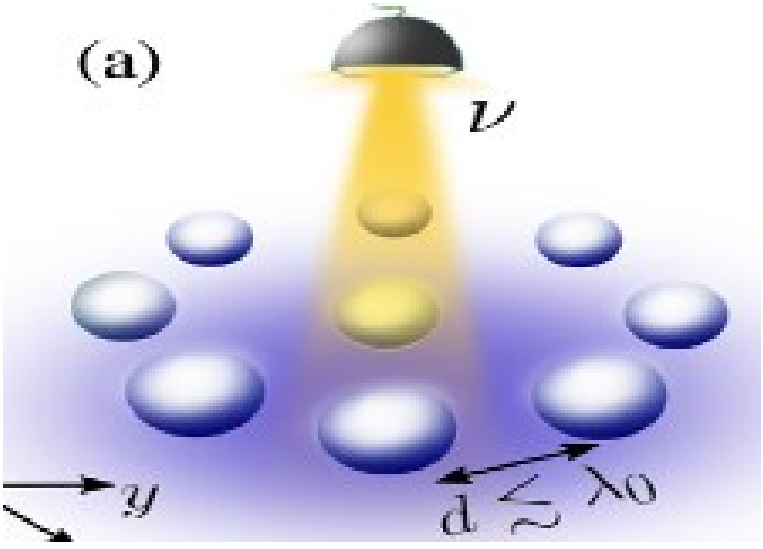
Date & time: **Friday 11.07.2025, 2 pm**

Location: **ZKS-Uhrturmhörsaal, S2|08, R. 171, Hochschulstraße 4**

Host: **Prof. Dr. Claudiu Genes**

Abstract:

An array of closely spaced, dipole coupled quantum emitters exhibits collective energy shifts as well as super- and sub-radiance with characteristic tailorable spatial radiation patterns.



As a striking example we identify a sub-wavelength sized ring of exactly 9 identical dipoles with an extra identical emitter with an extra loss channel at the center as the most efficient configuration to deposit incoming photon energy to center without reemission. For very tiny structures below a tenth of a wavelength a full quantum description exhibits an even larger enhancement than predicted from a classical dipole approximation. Adding gain to such systems allows to design minimalistic classical as well as non-classical light sources.

On the one hand this could be the basis of a new generation of highly efficient and selective nano antennas for single photon detectors for microwaves, infrared and optical frequencies, while on the other hand it could be an important piece towards understanding the surprising efficiency of natural light harvesting molecules.

References:
Holzinger, Raphael, Mariona Moreno-Cardoner, and Helmut Ritsch. "Nanoscale continuous quantum light sources based on driven dipole emitter arrays", Appl. Phys. Lett. 2021
M Fasser, L Ostermann, H Ritsch, C Hotter, Subradiance and superradiant long-range excitation transport among quantum emitter ensembles in a waveguide, Optica Quantum 2 (6), 397-403