Georg H. Endress Research Seminar Announcement

Speaker: Valerii K. Kozin, (University of Basel, Klinovaja Group)

Date: February 7th 2024

Time: 16:15 o'clock

Location: Albert Ludwig's University of Freiburg
HS II, 1. floor, Physics-High-Rise Building

Title: Quantum phase transitions and cat states in cavity-coupled quantum dots

Abstract:

We study double quantum dots coupled to a quasistatic cavity mode with high mode-volume compression allowing for strong light-matter coupling. Besides the cavity-mediated interaction, electrons in different double quantum dots interact with each other via dipole-dipole (Coulomb) interaction. For attractive dipolar interaction, a cavity-induced ferroelectric quantum phase transition emerges leading to ordered dipole moments. Surprisingly, we find that the phase transition can be either continuous or discontinuous, depending on the ratio between the strengths of cavity-mediated and Coulomb interactions. We show that, in the strong coupling regime, both the ground and the first excited states of an array of double quantum dots are squeezed Schrödinger cat states. Such states are actively discussed as high-fidelity qubits for quantum computing, and thus our proposal provides a platform for semiconductor implementation of such qubits. We also calculate gauge-invariant observables such as the net dipole moment, the optical conductivity, and the absorption spectrum beyond the semiclassical approximation.