CO.CO.MAT
CONTROL OF QUANTUM CORRELATIONS IN TAILORED MATTER
SFB/TR 21 – STUTTGART, ULM, TÜBINGEN

Kolloquium

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Quantum Phase Transitions with Photons and Polaritons

The experimental observation of quantum phenomena in strongly correlated many particle systems is difficult because of the short length- and timescales involved. Obtaining at the same time detailed control of individual constituents appears even more challenging and thus to date inhibits employing such systems as quantum computing devices. Substantial progress to overcome these problems has been achieved with cold atoms in optical lattices, where a detailed control of collective properties is feasible but it is very difficult to address and hence control or measure individual sites. Here we show, that polaritons, combined atom and photon excitations, in an array of cavities such as a photonic crystal or coupled toroidal micro-cavities, can form a strongly interacting many body system and permits the demonstration of quantum phase transitions, while individual particles can be controlled and measured. All building blocks of the proposed setting have already been experimentally realised individually, thus demonstrating the potential of this device as a quantum simulator.

Based on M.J. Hartmann, F.G.S.L. Brandao and M.B. Plenio
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