SFB/TRR 21 - Colloquium

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Networks of Interacting Photons

Photons are ideal carriers for transmitting information as they propagate with very low loss and long-lived coherence in a wide range of media. Their use in information processing however faces difficulties to realize controlled, strong interactions between individual photons. To make photons a more versatile information carrier, it is therefore important to develop networks where photonic signals may interact with each other at various nodes. Such networks give rise to strongly correlated quantum many-body systems formed by photons which may by studied in novel scenarios and allow for high resolution measurement access.

In this talk, I will present some recent approaches to this physics and discuss perspectives for their experimental implementation. One of these approaches considers an optical nanofiber that is coupled to nearby cold atoms and in this way forms an optically nonlinear waveguide with strong and tuneable photon-photon interactions. A further, experimentally very viable approach studies networks of coupled superconducting circuit resonators that can host a system of strongly interacting microwave photons. A straightforward but very interesting way of operating these systems is in a driven dissipative regime where the inevitable loss of photons is constantly compensated by driving the structures with a coherent input. I will discuss photon-photon correlations for this scenario and finish off with a sketch of the promising perspectives for near future experiments.

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