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Interacting and Emergent Photons in Quantum Optics and Condensed Matter

Photons, that is, the quanta of light fields, typically interact only weakly. In our research at the interface of quantum optics and condensed matter [1], we explore theoretically the behavior of quantum materials in which quantum light couples strongly and coherently to non-linear matter components. The matter, in turn, can mediate photon-photon interactions. Examples include dense optical media in optical cavities or fractionalized spins in quantum magnets, which couple to emergent gauge fields. In this talk, will describe our work on many-body physics across these areas and try to elucidate the differences and commonalities between the photons of quantum optics versus the emergent photons in strongly correlated condensed matter materials.

[1] <http://www.thp.uni-koeln.de/~strack/>