**Strong photon-photon interactions, magnetic polarons, and strings with cold atoms and van der Waals materials**

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We will in this talk discuss two interesting problems that can be explored in cold atomic gases as well as in van der Waals materials. First, we show how two polaritons, which are coherent superpositions of light and matter, can interact with a strength orders of magnitude larger than the underlying interaction between their matter constituents. The effect opens up a way to realise strong photon-photon interactions. Second, we explore magnetic polarons formed by holes hopping in an anti-ferromagnetic background in a lattice. We develop a non-perturbative theory both for the equilibrium and the non-equilibrium properties and find excellent agreement with experimental results, which is remarkable for a strongly interacting non-equilibrium many-body problem. We end by discussing magnetic polarons in other lattice geometries.