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Scattering theory in the ultrastrong coupling regime JUAN JOSE GARCIA-RIPOLL, CSIC - Madrid, TAO SHI, YUE CHANG, Max-Planck Institute for Quantum Optics — The ultrastrong coupling regime is the one which the light-matter interaction strength is comparable to the energy of the photons and atoms (or qubits) involved. A recent experiment using flux qubits[1] has demonstrated this regime for superconducting circuits and propagating microwave photons, with coupling strengths that go well into the localization phase. In this talk I will present a theoretical framework that can be used to describe the scattering of photons by a two-level system using a combination of the polaron ansatz[2] and S-matrix formalism[3]. This results in quantiative estimates of resonances and lineshapes and can be used to estimate the coupling strength of a dressed artificial atom interacting with a one-dimensional bosonic field. This theoretical approach allows also exploring the potential of the ultrastrong coupling regime for engineering nonlinearities, photon-photon interactions and photon-mediated spin-models.

[1]P. Forn-Daz et al, Nature Physics (to appear)
[2]G. Daz-Camacho et al, Phys. Rev. A 93, 043843 (2016)
[3]T. Shi, D.E. Chang, I. Cirac, Phys. Rev. A 92, 053834 (2015)

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