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Photon correlations through Raman virtual processes¹ REINALDO DE MELO E SOUZA, Univ Fed Rio de Janeiro, ANDRE SARAIVA, BELITA KOILLER, UFRJ — In Raman inelastic scattering phonons are either absorbed or created, in what is respectively called an anti-Stokes (aS) or a Stokes (S) process. While these two processes are generally uncorrelated, it is possible that the same phonon generated by S is subsequently absorbed by aS. This two photon process is referred to as SaS. In a standard Raman process, conservation of energy forbids virtual phonons to play a role. However, in a SaS process these virtual phonons may be relevant as long as their lifetimes exceed the interval between the two scatterings. We derive the effective photon-photon interaction mediated by the phonon field. The effective hamiltonian is analogue to the one present in BCS superconductivity. The difference lies in the nature of the particles involved – since photons are bosons, there is no Fermi sea instability and no pair condensation. Still it is possible to obtain an attractive photon-photon interaction. Finally, we propose an experiment to detect the correlated photons emerging from a semiconductor. We pinpoint the material properties that might enhance this effect and discuss the possible technological applications of this idea as a correlated photon source.

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