Modulating the quantum noise of interacting exciton-polaritons in the spontaneous emission regime with a spectral filter

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Current theoretical proposals and experimental demonstrations of photon blockade and, more in general, of tunable photon statistics, make use of input coherent fields. Within this methodology, either by energy levels repulsion [1], or in some cases with additional quantum interference [2], the physical system acts as a photon filter. In this talk, we will show that a spectrally narrow filter, together with a weak Kerr nonlinearity, can be used to reduce the quantum noise of the photoluminescence of a strongly-confined exciton-polariton system working below laser threshold. By scanning the filter across the lower polariton resonance, we predict a dispersive shape of the zero-delay second order correlation function, which is sensitive to the magnitude and the sign of the nonlinearity. Our experimental data shows good agreement with the theoretical predictions. Furthermore, we use the same technique to investigate on the nature of the nonlinearity and find signatures of a Feshbach resonance-type of interaction [3]. This scheme opens new prospects not only for new fundamental studies of the exciton-polariton physics, but also for the generation of scalable and electrically controlled light emitting devices with tunable photon statistics.

[1] A. Reinhard *et al.*, "Strongly correlated photons on a chip", *Nat. Photonics.* 6, 93–96(2012).

[2] T.C.H. Liew and V. Savona, "Single Photons from Coupled Quantum Modes", *Phys. Rev. Lett.* 104, 183601 (2010).

[3] N. Takemura *et al.*, "Polaritonic Feshbach resonance", *Nat. Phys.* 10, 500-504 (2014).