Emergent Functionality in Quantum Plasmonics

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Abstract

We propose a highly efficient down-conversion scheme capable of photon pair generation on the single-photon level. Ultrastrong coupling of a tip-enhanced gap-plasmon and a fast dephasing semiconductor quantum dot exciton, a configuration realizable with current technology, allow for an increase in pair-generation efficiency of four orders of magnitude compared to the current state-of the-art. Beyond offering a new route towards single-photon nonlinearities in integrated optical circuits, the proposed scheme to enable usually forbidden optical transitions via dephasing is rather universal and can be employed in many other coupled quantum systems.