Saverio Pascazio

Correlated photon emission by two excited atoms in a waveguide

An excited atom in free space decays towards its ground state through spontaneous emission. Boundary conditions and artificial dimensional reduction drastically modify this picture, providing a test-bed for physically and practically interesting interference effects, and enhancing or inhibiting (sometimes hindering) decay.

We consider the dynamics of a pair of atoms, approximated as two-level quantum emitters, coupled to a linear guided mode, in a quasi-one-dimensional configuration. We focus on the single- and two-excitation sectors. We explore the relaxation towards bound states for resonant values of the interatomic distance, the stability of such states, the generation of entanglement and the existence of plasmonic modes.

We also analyze the evolution of an initial state in which both atoms are excited, which is expected to decay into an asymptotic two-photon state. We estimate the probability that the two photons are emitted in the same or in opposite directions. We find that the ratio R between parallel and antiparallel emission probabilities is maximal when the interatomic distance is an odd multiple of a quarter wavelength of the emitted light. In such a case, R = 3 in the small-coupling regime.