Appunti di Fisica '09

1 aprile ore 15.30, aula A
Dip. di Fisica della Materia e Ingegneria Elettronica

Semiconductor Quantum Optics: Entanglement and noise in interacting polariton systems

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The field of quantum optics has witnessed relevant developments and has raised a lot of interest in the last decades. Atom-cavity systems have been used to investigate quantum dynamical processes for open quantum systems in strong coupling and to explore quantum behaviours that have no classical counterparts. On the other hand, the rapid development in the field of quantum information requires monolithic, compact sources of nonclassical photon states enabling efficient coupling into optical fibres and possibly electrical injection. Scalable solid-state devices will make use of local electronic states to store quantum correlations. Polaritons, as hybrid states of electronic excitations and light, are the most promising solution for generation and control of quantum correlations over longer range. In particular, Coulomb-driven parametric processes acting on the electronic part of the polariton state can generate polariton pairs ideally in an entangled state.

In order to address entanglement in quantum systems, the preferred experimental situation is the few-particle regime in which the emitted particles can be detected individually. Even at very low temperatures, in a real system, environment always act as an uncontrollable and unavoidable continuous perturbation producing decoherence and noise. Indeed experiments show an incoherent time-dependent background (i.e.

noise) in competition with parametric phenomena (supposed to create non-classical correlations). As a consequence, noise represents a fundamental limitation, as it tends to lower the degree of non-classical correlations or even completely wash it out.