Sonderforschungsbereich 631

Festkörperbasierte Quanteninformationsverarbeitung

TECHNISCHE UNIVERSITÄT MÜNCHEN

SEMINARANKÜNDIGUNG

Dienstag, 29. April 2008

17:15 Uhr

WSI, Seminarraum S 101

"Entangled photons from quantum dot-devices: environment watching biexciton decay"

We theoretically investigate the production of polarization-entangled photons through the biexciton cascade decay in a single semiconductor quantum dot. A biexciton decays radiatively through two intermediate exciton states. If these are degenerate, the two decay paths differ in polarization but are indistinguishable otherwise leading to polarization-entangled photons. This ideal performance is usually spoiled by the electron-hole exchange interaction splitting the intermediate exciton states by a small amount and attaching a which-path information to the photon frequencies. We discuss strategies to accomplish a high degree of entanglement, despite the exciton finestructure splitting. One must either energetically align the two exciton states or erases the which-path information by post-selecting photons within the correct frequency or time range. We show how spectral filtering and time shifts at a single photon level affect the quantum information encoded in the photon wavepacket. Here the solid state environment plays a crucial role in the effective measurement of the intermediate exciton states. Our results suggest that protocols for solid-state based quantum cryptography are more strict than previously thought.

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