Photon-spin quantum interface using electron spins in gate-defined quantum dots

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We study the quantum interface (Poincaré interface) based on quantum state conversion using electron spins in gate-defined quantum dots (QDs) for long distance quantum communication [1]. The technical challenges towards this goal for photons and electron spin in the gate-defined QDs are the quantum state conversion from single photons to single electron spins and the entanglement conversion from photon pairs to electron spin pairs. It has been demonstrated that angular momentum of single photons can be converted to single electron spins in gate-defined double QDs [2].

In this talk, we present the quantum state conversion in a gate-defined QD and the coincidence measurement between single photo-electron detection in a QD and single photon detection using an entangled photon source [3]. Moreover the recent progresses on the enhancement of the coupling between photons and electron spins in QDs will be discussed.

References

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