Freie Universität Berlin

Colloquium
Dahlem Center for Complex Quantum Systems

Observation of entaglement between a solid-state spin and a propagating optical photon

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Abstract:

Entanglement plays a central role in the burgeoning field of quantum information processing. A possible route towards a scalable architecture is provided by the concept of distributed quantum computation, based on small-scale few-qubit quantum processor nodes interconnected by single photon pulses. Generation of quantum correlated spin-photon pairs is a key step in such an approach. In this talk, we report the observation of quantum entanglement between a semiconductor quantum dot spin and the color of a propagating optical photon. The demonstration of entanglement relies on the use of fast single-photon detection which allows us to project the photon into a superposition of its two frequency components. Our results extend the previous demonstrations of single-spin photon entanglement in trapped ions, neutral atoms and nitrogen vacancy centers to the domain of artificial atoms in semiconductor nano-structures that allow for on-chip integration of electronic and photonic elements.