Quantum photonics with semiconductor nanostructures

Exploiting the quantum properties of the light has the potential of enabling many new applications in the fields of quantum metrology and quantum information technology, such as quantum sensing, imaging beyond the diffraction limit, quantum repeaters as well as photonic quantum computing. Many of these applications require the generation of on demand indistinguishable single photons or entangled photon states. Resonantly excited single semiconductor quantum dots are perfectly suited to fulfill these requirements.

In my talk, I will discuss super-resolving phase measurements based on two-photon N00N states generated by quantum dot (QD) single-photon sources making use of the Hong-Ou-Mandel effect on a beam splitter. We achieve, in post-selection, a quantum enhanced improvement of the precision in phase uncertainty, higher prescribed by the standard quantum limit.

In the second part, I will report on the approach of storing quantum light in a cesium (Cs)-vapor by slowing down single photons. We present variable delays up to 16 ns for photons of resonantly excited quantum dots. Eventually, we compare the single-photon emission and two-photon interference of delayed and un-delayed photons.

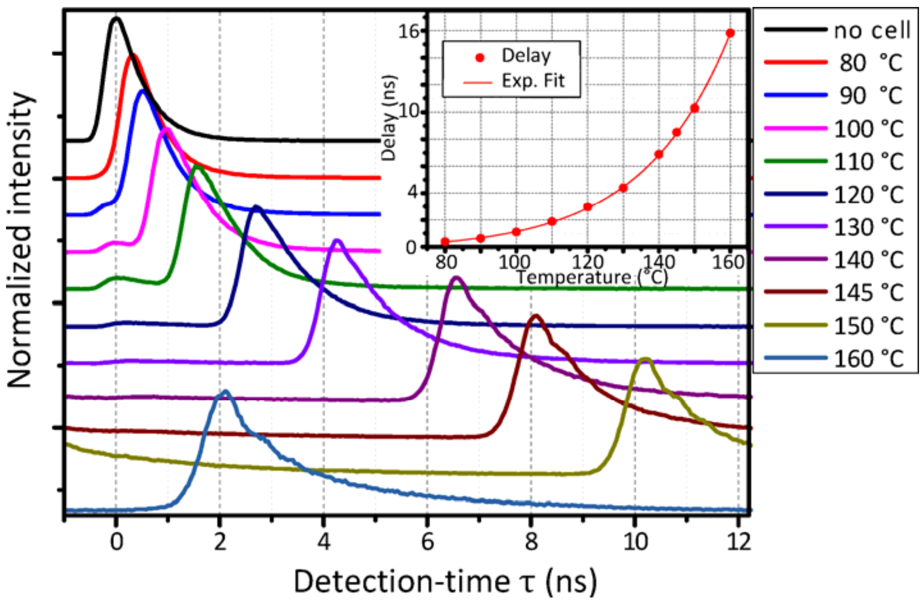

Fig.: Photon delay as a function of Cs-vapor temperature.