

## Title

Two promising single photon sources for applications in the quantum network: a few recent developments.

## Date & Time

Wednesday  
11th January 2023  
at 4 PM (IST)

## Speaker

**Dr. Tanmoy Chakraborty**

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## Meeting Link

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## Abstract:

In entanglement distribution-based quantum repeaters, one of the key resources is optically mediated entanglement between distant qubits which can be addressed and controlled individually. In this context, on one hand, atomic defect centers in solids as single photon emitters are suitable candidates as they possess optically active spin qubits that can be controlled with high fidelity. On the other hand, nonlinear optical processes like spontaneous parametric down-conversion (SPDC) have been demonstrated as efficient methods for generating entangled photon pairs. In this presentation, I will talk about quantum control sequences for initializing a quantum register associated with a single nitrogen-vacancy (NV) center, a promising defect center for quantum network applications. I will also present methods for imaging charge states of ensembles of NV centers and their spectroscopic characterizations. Next, I will present the development of an alignment-free, frequency multiplexed photon pair source that is based on fiber-pigtailed, cavity-enhanced spontaneous parametric down-conversion (SPDC) in a nonlinear crystal and is easy to integrate with a practical quantum repeater. We show the characterization of multiple pairs of spectrally-resolved modes, as required for a quantum repeater. We also demonstrate the optical interface of our single photon source with Tm-based quantum memory.

## Biography:

Tanmoy Chakraborty pursued his Ph.D. in IISER-Kolkata. During his Ph.D., he experimentally investigated quantum correlations and magnetic field-induced quantum level crossing in spin  $\frac{1}{2}$  quantum magnets. After finishing his Ph.D. in 2015, Tanmoy joined TU Dortmund (with Prof. Dieter Suter) as a postdoc where his projects dealt with engineering the states of a quantum register associated with a single nitrogen-vacancy (NV) center and performing spectroscopic characterization of NVs to test their quantum sensing efficiencies. He continued working on NV and other defect centers in the diamond during his subsequent postdocs in Stockholm University, Sweden, and Hasselt University, Belgium. Tanmoy joined QuTech - TU Delft, Netherlands in February 2020 as a postdoc (With Prof. Wolfgang Tittel and in a collaborative project with Prof. Ronald Hanson). In QuTech he has been working on the experimental implementation of a frequency multiplexed quantum repeater scheme and a hybrid quantum network scheme.

