S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

11th December, 2024 **4.00 PM** **ONLINE / BOSON**

SPEAKER
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TITLE OF THE TALK

Quantum photonics with fiber-based nanophotonic platforms

ABSTRACT

An optical fiber with a sub-wavelength diameter has opened promising new avenues in nanophotonics and quantum optics [1]. The key point is that the optical field can be tightly confined in the transverse direction, enabling the possibility of efficiently manipulating quantum emitters/photons. Recently, optical nanofibers (ONFs), optical nanofiber tips (ONFT), and optical nanocapillary fibers (NCFs) are proven to be promising candidates for efficiently manipulating photons/emitters.

In this presentation, we show the fabrication of the ONFT/ONF using chemical etching/gas-flame technique. Regarding ONFT, the observed optical transmissions are more than 30%, and tip diameters are less than 500 nm [2]. The channeling of fluorescence photons from quantum dots into guided ONFT modes is demonstrated, with good agreement with simulation results [3]. Regarding ONF, we design the pulling parameters in a four-step process to achieve the desired diameter. The measured diameters range from 480 to 530 nm, showing good correspondence with the designed diameters [4]. Additionally, we demonstrate the in-situ fiber charecterization using scattering loss analysis [5].

We report numerically the efficient channeling of single photons from a single quantum emitter into guided modes of NCFs. The NCF is formed of a liquid core optical nanofiber with inner and outer diameters. We optimize the inner and outer diameters of the NCF filled with water medium by placing a single dipole source (SDS) inside. The maximum channeling efficiency of 52% is found when the radially polarized SDS is placed at the center of the NCF filled with the water medium [6]. Further, we numerically report highly efficient coupling of single photons using a pair of nanostructures [7]. The present platforms may open new possibilities in quantum networks.

References

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HOST FACULTY

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