

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

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Seminar Notice

Org. by

Department of Materials Science

Speaker: Dr. Aveek Chandra, LKB, University of Pierre and Marie Curie, Paris.

Date & Time: Friday, 19 Jan, 12:00 Noon

Venue: C V Raman Hall, IACS

Title: "Coupling 1D Atom Arrays to an Optical Nanofiber: Platform for Waveguide QED experiments".

Abstract:

The coupling of cold atoms to 1D nanoscale waveguides have opened new avenues of research. The waveguide in our case is a nanofiber, which confines light transversally to a subwavelength scale. The guided light exhibits a strong evanescent field allowing enhanced atom-photon interaction in the vicinity of nanofiber. In our experiment, a cold atomic cloud is first interfaced with an optical nanofiber. By using an optical lattice in the evanescent field, the atoms are then trapped in 1D atomic arrays close to the nanofiber. In this platform, we reach high optical depth $OD \sim 100$ and long lifetimes ~ 25 ms by using a dual-color compensated trapping scheme that preserves the internal properties of atoms.

Recently, we have demonstrated the creation of a heralded single collective excitation in the trapped ensemble of atoms using DLCZ protocol. Subsequently, the excitation has been converted into a single photon in the guided mode with high efficiency. Non-classical correlations between photon pairs have been observed in the experiment.

In another experiment, we have explored the collective effects emerging from the spatial ordering of atoms. When the period of the lattice is made close to commensurate with the resonant wavelength, Bragg reflection, as high as 75%, is observed. The reflection shows dependency on orientation of the probe polarization relative to the atomic arrays - a chiral signature in nanoscale waveguide-QED systems. The ability to control photon transport in 1D waveguides coupled to spin systems would enable novel quantum networking capabilities and the study of many-body effects arising from long-range interactions.

All are cordially invited to attend the seminar