SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

QUANTUM NANOPHOTONICS--GENERATION OF PHOTONIC BOUND STATES AND MODELING OF PHOTONIC DISSIPATIONS

PhD Preliminary Research Examination

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Abstract: Quantum nanophotonics refers to the study of quantized optical fields at the wavelength or sub-wavelength scale, which plays essential roles in designing photon-based nano-devices for quantum information science. One extra degree of freedom that is entirely beyond the scope of classic nanophotonics is the entanglement characteristic. For example, faithful single-photon sources as the unconditional security requirement in quantum communication protocol can be achieved by the spontaneously emitted entangled light of antibunching statistics from resonance fluorescence of atoms or artificial atoms (e.g., quantum dot, nitrogen-vacancy in diamond, and etc). Another example of particular interest is the photonic bound state, which is a novel entangled state with potential applications in few-photon fluorescence microscopy and quantum computing. However, photons are not charged, and typically have weak interactions, thereby not forming bound states easily. In this talk, we will show that the photonic bound state exists wherein the constituent photons manifest mutually attractive behaviors due to inherent entanglement. Moreover, we demonstrate that such a state can be generated through a coherent scattering process mediated by two-level atoms.

On the other hand, quantum nanophotonic systems are not isolated from ambient environments and the resulting system-environment entanglement may leave substantial effects. For example, due to the dipole-field interactions, photons may escape from the system of interest to the environment, which is referred to as photonic dissipations. Such ubiquitous processes may result in loss of photonic flux, change of transport and entanglement properties. Nonetheless, conventional approaches (e.g., density-matrix approach) typically trace over the system-environment entanglement so that they do not provide complete information for correlated few-photon process. Thus, we develop an entanglement-preserving approach to describe the photonic dissipations due to scattering loss. In particular, our approach confirms that the effects of dissipations can be described by using a damping term in a non-Hermitian Hamiltonian, which is rigorously valid for an arbitrary N-photon correlated transport process.

DATE:	Wednesday, May 2, 2018
TIME:	10:30 a.m.
PLACE:	Green Hall, Room 0120

Thesis advisor:
Dr. Jung-Tsung Shen

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE