Physics Colloquium

Michigan Technological University

Tuesday, November 6, 2007
11:00 am
Room 139, Fisher Hall
(Note: This is a different day and time)

Entanglement Source for Quantum Communication and Computing

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Abstract:
Superposition and entanglement are the foundations for quantum information processing. One of the great challenges of quantum information science is to develop tools to prepare and manipulate the quantum state of a physical system. This quantum state engineering demands understanding of what constitutes truly quantum mechanical behavior. One way to explore this question is to study the differences and similarities between measurements made on classical wave and quantum systems. In a well-designed classical system, optical electromagnetic field interferences may reproduce quantum features such as negative-valued of Wigner functions and violations of Bell's inequalities. I will discuss such a classical wave system and its possible application in biomedical imaging. Then, I will talk about my current research in developing and characterizing degenerate and non-degenerate photon-pairs generated through four-photon scattering process in a dispersion-shifted fiber. The goal is to develop a high purity polarization-entangled photon-pair source and low-noise high-speed single photon counting system in telecom-band for practical quantum communication. The Raman scattering process is suppressed by cooling the fiber with liquid nitrogen at 77K. This suppression removes noise photons in photon-pair generation and hence improves the visibility of two-photon interference to 98%. I will discuss fiber based entanglement generation schemes for quantum information applications such as controlled NOT gate and entanglement distribution over a distance of 100 km in a WDM network environment. Finally, generation of photon-pairs in a nanoscale silicon waveguide is also presented.

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