Yale Institute for Nanoscience and Quantum Engineering

Friday- October 17, 2014

12:00 to 1:00 p.m.

BECTON SEMINAR ROOM

Light lunch will be served at 11:45 a.m.

Yaron Bromberg

Department of Applied Physics, Yale University

"Classical Key Distribution in Multimode Fibers Using Optical Reciprocity"

In modern society, there is an ever growing demand for improving the security levels of communication networks. Most of the internet security nowadays is based on powerful algorithms that distribute keys between remote users. These algorithms, however, are often vulnerable to implementation flaws. Quantum key distribution is an alternative approach, which takes advantage of the fundamental laws of quantum mechanics to guarantee unconditional security. However, it is technically challenging to implement and difficult to integrate with telecommunication networks. We have recently developed a new key distribution method, which relies on classical light and a multimode optical fiber. It is based on the strong mode mixing in the fiber to encrypt the key and optical reciprocity to decrypt it. In the talk I will explain the basic concepts of our method, and present its implementation using telecommunication compatible components.

Xiaosong Ma

Department of Electrical Engineering, Yale University

"Quantum Silicon Photonics"

The advantages of single photons at the optical frequency make them not only the workhorse of testing the foundations of quantum physics against the classical interpretation of nature, but also suitable for various tasks in quantum information processing. In order to realize these tasks, one needs a scalable platform for building up multiple quantum logic gates with complex quantum optical circuitries. Silicon and other CMOS compatible material are the ideal candidates due to their chip-scale footprint, well-established fabrication techniques and compatibility to exotic material (superconductors for instance) enabling measurement-induced nonlinear interaction between photons. In my talk, I will cover our recent endeavors in quantum sensing as well as quantum logic operations with silicon photonic platform. I will first present our demonstration of on-chip interaction-free measurements via the quantum Zeno effect. By taking the inherent advantages of the lithographically written waveguides, we employ wave-particle duality of single photons and the quantum Zeno effect to sense the presence of absorbers even if the photons and the absorbers haven't interacted. Second, I will present the results of on-chip quantum interference realized with SiN waveguides, which is the key building block of linear optical quantum computation. At last, I will discuss the opportunities and challenges for improving the scalability of photonic quantum systems.

HOST: Paul Fleury