

# SEMINAR NOTICE

Department of Electrical and Systems Engineering

## Manipulating Light at Single Wavelength or Deep Sub-wavelength Scales Open New Device and Material Possibilities

*Jung-Tsung Shen, Faculty Candidate*  
Ginzton Lab  
Stanford University

**Abstract:** The capability of manipulating light using deep sub-wavelength structures opens up new device and material possibilities. In this talk, I will describe our recent research in this aspect and give two examples enabled by such capability. The first example is the strongly correlated photon transport in nano-phonic waveguides. Photons normally do not directly interact with each other, yet many practical considerations, such as quantum communication and information processing, and other novel optoelectronics devices require the use of entangled photons. I will describe how to deterministically generate and manipulate strong photon-photon interactions via a two-level system. Such strong interactions have profound consequences on the photon transport properties. A deep understanding of the mechanism also provides a key to achieve low power optical switching at single-photon level. It also represents the most fundamental form of nonlinear optics. Moreover, the configuration is well-suited for on-chip all solid-state implementations.

In the second part of my talk, I will describe how to design novel metamaterials by exploiting the electromagnetic states at subwavelength scales. In particular, I will discuss the mechanisms and properties of a special class of metamaterials -- broadband, ultra-high refractive index metamaterials. Such artificial structures will be useful in many applications such as subwavelength lithography and imaging, broadband slow-light, and sensitive interferometer.

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10:00 a.m.

Bryan Hall, Room 305

Host: R. Martin Arthur

**Short Bio:** Dr. Jung-Tsung Shen is currently a research associate in physical science at Ginzton Lab at Stanford University, working on photon transport in nano-photonics, metamaterials, plasmonics, and thermal and energy transport in nano-structures. He obtained his PhD degree in physics in 2003 from MIT where he worked on theoretical and computational investigation on electron-hole plasma, laser gain profile, and metamaterials. He was also a graduate scholar at Bell Labs from year 1998 - 2000.