PHOTONICS SEMINAR

Professor Hui Cao

Disordered Photonics

Faculty Host: Professor Jerome Mertz

September 18, 2014

2:00-3:00 p.m.

Room 901

Photonics Center

8 Saint Mary's Street

Refreshments will be served!

Most of the research in the field of photonics has focused on understanding and mitigating the effects of disorder which are often detrimental. For certain applications, however, intentionally introducing disorder can actually improve the device performance, e.g., in photovoltaics optical scattering improves the efficiency of light harvesting. Professor Cao's lab has utilized multiple scattering in a random photonic structure to build a compact on-chip spectrometer. The probe signal diffuses through a scattering medium generating wavelength-dependent speckle patterns which can be used to recover the input spectrum after calibration. Multiple scattering increases the optical pathlength by folding the paths in a confined geometry, enhancing the spectral decorrelation of speckle patterns and thus increasing the spectral resolution. By designing and fabricating the spectrometer on a silicon wafer, Professor Cao efficiently channeled the scattered light to the detectors, minimizing the reflection loss. Her lab has demonstrated the wavelength resolution of 0.75 nm at the center wavelength of 1500 nm in a 25 μm by 50 μm random structure. Furthermore, the phenomenal control afforded by semiconductor nanofabrication technology enables engineering of the disorder to reduce the out-of-plane scattering loss.

Hui Cao is a Professor of Applied Physics at Yale University. She received her B.S. degree (1990) in Physics from Peking University, and her Ph.D. degree (1997) in Applied Physics from Stanford University. Her doctoral research was in the area of semiconductor microcavity quantum electrodynamics. Prior to joining the Yale faculty in 2008, Professor Cao was on the faculty of the Department of Physics and Astronomy at Northwestern University. Her technical interests and activities are in the areas of complex photonic materials and devices, nanophotonics, and biophotonics. She has co-authored one book and nine book-chapters, and has published more than 180 research papers in the area of random lasers, optical microcavities, photonic crystals, and structural coloration. She is the recipient of the NSF Career Award, Packard Fellowship, Sloan Fellowship and Maria Goeppert-Mayer Award. She is also a fellow of the American Physical Society and fellow of the Optical Society of America.

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