Applications of Nanophotonics: Absorption Engineering and Optomechanical Circuits

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Abstract: Using nanofabrication technologies, it is possible to pattern materials on the scale of the wavelength of light, dramatically altering its propagation. Research in nano- and microphotonics involves both the basic science of light propagation in nanostructured materials and the application of this knowledge to engineering problems.

In the first part of the talk, I will discuss how nano- and microscale patterning can be used to efficiently absorb light within small volumes. Such techniques will ultimately lead to cheaper, more efficient solar cells. I will present the results of our electromagnetic calculations on nanowire arrays. We find that optimized nanowire structures have higher broadband absorption than an unpatterned film of the same thickness, even though the volume of absorptive material is lower. I will also show that aperiodic nanowire structures can absorb > 100% more light across the solar spectrum than their periodic counterparts.

In the second part of the talk, I will discuss how the force of light can be used to move parts of photonic integrated circuit. Photonic integrated circuits use nanofabricated devices to control the flow of light on a chip, much like electrical circuits control the flow of electrons. I will look at the force of light on movable waveguides, or photonic wires. Given proper designs, we predict that light forces can be used to trigger motion that feeds back to the light signal, changing polarization, limiting power flow, or giving rise to nonlinear propagation characteristics. These features are expected to contribute new functionalities in on-chip optical signal processing.

Friday, April 22, 2011
1:30 p.m.
Bryan Hall, room 305
(With light refreshments)

Host: Dr. Jung-Tsung Shen

Bio: Michelle Povinelli is Assistant Professor and WiSE Gabilan Chair in the Ming Hsieh Department of Electrical Engineering at the University of Southern California. She is the recipient of an NSF CAREER Award, Army Research Office Young Investigator Award, Presidential Early Career Award for Scientists and Engineers (PECASE), and a TR35 Award for innovators under age 35 from MIT’s Technology Review magazine. She received a BA from the University of Chicago, an MPhil from the University of Cambridge, and a PhD from MIT, all in Physics. She was a postdoctoral researcher in Electrical Engineering at Stanford University, where she won a L’Oréal For Women in Science Postdoctoral Fellowship. She has co-authored over thirty-five refereed journal articles, three book chapters, and three US Patents.