Applied Physics & OSA

Optics Seminar

Trapping Light in Optical Microcavities via Dynamic Tuning

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Abstract: The ability to slow down, stop, and trap light pulses on chip is intriguing both as a matter of fundamental interest and for potential applications in all-optical information processing. We present recent theoretical results on the use of dynamic tuning of coupled microcavity systems for stopping and storing light pulses. In multiple-resonator systems, previous work has shown that dynamic tuning of the microcavity resonance frequencies via refractive-index tuning can be used to delay pulses without dispersion and eliminate the bandwidth-delay product constraints found in static systems. We describe our work using the alternative mechanism of loss modulation for light stopping [1]. We demonstrate via numerical simulations that increasing the loss of selected resonators traps light in a zero group velocity mode concentrated in the low-loss portions of the delay line. The large dynamic range achievable for loss modulation should increase the light-stopping bandwidth relative to index-tuning schemes.

Second, we explore pulse trapping in few-microcavity systems that are more amenable to microfabrication. We use coupled-mode theory to design a method for determining the optimal tuning profile in time. The results show that pulses can be captured almost completely, with arbitrarily small reflected power. Current technology should allow for capture of pulses with 100ps widths, with storage times limited only by the cavity loss rate.

[1] S. Sandhu, M. L. Povinelli, and S. Fan, Optics Letters 32, 3333 (2007).
[2] C. Otey, M. L. Povinelli, and S. Fan, in press.

Brief Biography: **Michelle Povinelli** joined the faculty of the University of Southern California as an assistant professor of Electrical Engineering in Fall 2008. Her research focuses on computational modeling and design of nanophotonic devices including photonic crystals and microresonators. Prior to joining USC, she was a postdoctoral researcher in Electrical Engineering at Stanford University. She received a PhD from MIT in 2004, an M. Phil. from the University of Cambridge in 1998, and a BA with Honors from the University of Chicago in 1997, all in Physics. She was awarded several graduate fellowships for her doctoral work, including the Lucent Technologies GRPW Fellowship, the NSF Graduate Fellowship, the MIT Karl Taylor Compton Fellowship, and the Churchill Fellowship. In 2006, she was selected as one of five national recipients of the L'Oréal For Women in Science Postdoctoral Fellowship grant. She has co-authored over twenty refereed journal articles and two book chapters and holds two US Patents.

December 2nd 2008.
4:00pm-5:00pm.
Watson 104

Refreshments will be available in the Watson Lobby at 3:45pm