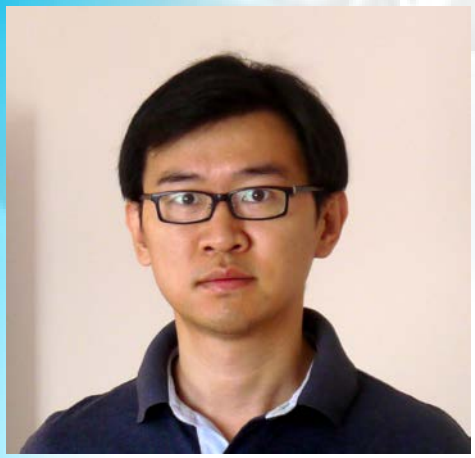
Physics Colloquium

Michigan Technological University

Thursday, December 12, 2013
at 4:00 pm
Room 139 Fisher Hall



Lasers and "Anti-lasers" in Complex Photonic Media

Li Ge

College of Staten Island
One Senior College of
City University of New York

Abstract: Despite being open systems described by a non-hermitian wave equation, lasers have traditionally been treated as closed cavities, with the coupling to the continuum included phenomenologically or perturbatively. This approach is ill-suited to treating modern complex microlasers, and particularly very low-Q systems, such as random lasers. We have developed a unified approach, Steady-state Ab initio Laser Theory (SALT) [1,2], which treats the openness of the cavity exactly and the nonlinear modal interactions to infinite order. Solutions of the SALT equations are in excellent agreement with brute force time integration of the semiclassical Maxwell-Bloch laser equations, but are orders of magnitude faster. SALT has been applied to photonic crystal slab lasers, microdisk lasers, and random lasers, leading to the observation of new lasing modes and behaviors.

Applying the time-reversal operator to the laser equations uncovers a new effect, coherent perfect absorption, in which a lossy cavity completely absorbs the incoming radiation corresponding to the complex conjugate of the original laser emission [3]. This effect, which is a generalization of critical coupling to a cavity, has recently been demonstrated experimentally.

Biography: Dr. Li Ge is an assistant professor at the College of Staten Island, one senior college of the City University of New York (CUNY). He received his PhD in Physics from Yale University in 2010. His thesis focused on laser physics in complex and disordered media, including wave-chaotic lasers and random lasers. He did his postdoctoral in the Department of Electrical Engineering at Princeton University, with expanded interest in other branches of non-hermitian systems, including parity-time symmetric optics and cavity optomechanics. He was the co-discoverer of coherent perfect absorbers, commonly known as "anti-lasers" and featured in media such as BBC News, New York Times, Scientific American, and Nature.

MichiganTech