Physics Colloquium

Michigan Technological University

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Room 139 Fisher Hall

Coherent Light Generation from Metallic Nanostructures

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Abstract: Unlike traditional optical elements, metal nanoparticles and nanostructures can localize and transfer electromagnetic energy at sub-wavelength scales. Collective electron oscillations known as surface plasmons that can be either *propagating* or *localized* can interact with light in small metallic structures such as nanohole arrays or metal nanoparticles, enabling new sources of photons controlled using engineered nanostructures. I present a new design for a plasmonic nanolaser based on gold bowtie nanostructures. The local field enhancement due to the near-field interactions in the gold dimers gives rise to a strong optical nonlinearity. Z-scan transmission measurements show that the effective third-order susceptibility is found to be extremely high (Im $x^{(3)} = 10^{-4}$ esu). Furthermore, the bowtie resonators can show lasing at room temperature when an organic gain material is incorporated in the structure. Time-resolved pump-probe measurements confirm that the laser oscillation originates from the ultrafast resonant energy transfer between the photoexcited dye molecules and gap plasmons. Translating these achievements toward new nanoscale photon sources such as semiconductor nanolasers and single photon emitters will enable exploration of quantum phenomena at the interface between light and matter at the nanoscale.

Biography: Jae Yong Suh received his Ph.D. in Physics from Vanderbilt University with Prof. Richard F. Haglund Jr. in 2007. Following his Ph.D., he worked in LG as a research scientist. He is currently a postdoctoral fellow at Northwestern University. His research interests include nanoscale photonics, quantum optics and plasmonics, including optical characterization, nanofabrication, and ultrafast spectroscopy. His current work focuses on single photon sources using semiconductor and metallic nanocavities.

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