THE DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING SPEAKER SERIES

PRESENTS

Principles and Biomedical Applications of Plasmon Enhanced Luminescence Upconversion

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Monday, February 5, 9:55 am

Room W122, Engineering Building 2

LECTURE ABSTRACT

Storing a significant fraction of energy in electron gas, surface plasmon offers a highly effective mechanism for strong localization of light and local field enhancement. Naturally there has been extensive research worldwide for their applications in various fields of photonics and optics. One of the latest emerging frontiers in plasmonics research is the study of plasmonic enhancement of nonlinear optical processes. Among them, luminescence upconversion has attracted much interest. In contrast to the nonlinear susceptibility based frequency conversion processes, luminescence upconversion is efficient even when excited by incoherent light with low intensity. This prompted much interest for potential applications in solar energy conversion and bioimaging.

In this talk, I will start with an introduction to surface plasmon and frequency upconversion processes and then present the electrodynamic principles governing the luminescence upconversion process in a plasmonic nanostructure. I will then present our spectroscopic studies on the plasmon enhanced luminescence upconversion, which allowed us to quantitatively determine the contributions by all processes involved in the luminescence upconversion. Finally, I will present a new therapeutic approach for bladder cancer based on plasmon-upconversion nanoclusters. Biological tissue is highly transparent to the near-infrared light. By using plasmon-upconversion nanoclusters excited by near-infrared light, one can detect cancer cells via upconversion luminescence and also selectively ablate cells with minimal damage to surrounding tissue. It is also possible to perform photothermal and photodynamic dual therapy. For this, we developed techniques of synthesizing plasmon-upconversion nanoclusters and bioconjugation with antibody to epidermal growth factor receptor for cancer targeting. I will show the latest results from our *in vitro* and *in vivo* experiments, which clearly show the potential of this approach.

SPEAKER BIOSKETCH

Dr. Wounjhang (Won) Park received his Ph.D. from Georgia Institute of Technology. He then worked as Post-Doctoral Fellow and Research Scientist II at the Georgia Tech Research Institute until he joined the faculty of University of Colorado Boulder where he is currently N. Rex Sheppard Professor of Electrical, Computer and Energy Engineering, Materials Science and Engineering Program and University of Colorado Cancer Center. Dr. Park's research interest is mainly in the light-matter interaction in nanostructures. Current research focuses on the thermal radiation engineering for energy harvesting, plasmonic nanostructures for cancer detection and therapy and mid-infrared photonic devices. Dr. Park has published over 100 peer-reviewed technical articles and 4 invited book chapters and holds 5 U.S. patents. He is the recipient of Ruth L. Kirschstein NRSA Senior Fellowship in Cancer Nanotechnology from the National Institute of Health, the Provost's Faculty Achievement Award from the University of Colorado Boulder and Changbai Scholar Award from the Chinese government.