Dr. Peter Nordlander, Rice University

Quantum Plasmonics and Hot Electron Induced Processes

Abstract: Plasmon resonances with their dramatically enhanced cross sections for light harvesting have found numerous applications in a variety of applications such as single particle spectroscopies, chemical and biosensing, subwavelength waveguiding and optical devices. Recently it has been demonstrated that quantum mechanical effects can have a pronounced influence on the physical properties of plasmons. One relatively recent discovery is that plasmons can serve as efficient generators of hot electrons and holes that can be harvested in applications. The physical mechanism for plasmon-induced hot carrier generation is plasmon decay. Plasmons can decay either radiatively or non-radiatively with a branching ratio that can be controlled by tuning the radiance of the plasmon mode. Non-radiative plasmon decay is a quantum mechanical process in which one plasmon quantum is transferred to the conduction electrons of the nanostructure by excitation of an electron below the Fermi level into a state above the Fermi level but below the vacuum level. In my talk I will discuss several aspects of the emerging field of quantum plasmonics such as charge transfer plasmons, molecular plasmons, hot carrier generation, decay and fluorescence, hot carrier applications such as photodetection, photocatalysis, and phase changing of nearby media.

Bio: Professor Peter Nordlander obtained his PhD degree in Theoretical Physics at Chalmers University of Technology in Gothenburg in Sweden in1985. After postdoctoral positions at IBM Thomas J. Watson Research Center at Yorktown Heights (USA) and AT&T Bell Laboratories at Murray Hill (USA) and at Rutgers University, he joined the faculty at Rice University in 1989 and is currently Wiess Chair and Professor of Physics and Astronomy and Professor of Electrical and Computer Engineering and Professor of Materials Science and Nanoengineering. He has been a Visiting Professor at University of Paris, at the Institute of Physics at the Chinese Academy of Sciences, and is presently a visiting professor in the Department of Physics at Peking University and at Wuhan University. His research background is in theoretical condensed matter and nano physics. His current research is focused on the theoretical and computational modeling of Plasmonics and Nanophotonics phenomena. He is an associate editor of ACS Nano. He is a fellow of APS, AAAS, SPIE, and OSA and is the recipient of the 1999 Charles Duncan Award for Outstanding Academic Achievement (Rice), the 2013 Willis E. Lamb Award for Laser Science and Quantum Optics, the 2014 Frank Isakson Prize for Optical Effects in Solids, and the 2015 R. W. Wood Prize for Optics. He has published more than 250 refereed articles, given more than 300 invited presentations at international conferences and workshops, has been cited more than 20000 times with a Web of Science h-index in the 80s, and is a Thomson-Reuters Highly Cited Researcher.