

## EE Department Seminars

July 22, 2013, Monday, 13:00

**Yorgo I Stefanopoulos Meeting Lounge**

### **THE NANO-OPTICS OF SURFACE PLASMON POLARITONS, AND THEIR APPLICATIONS IN CLOAKING AND SURFACE-ENHANCED FLUORESCENCE FROM QUANTUM DOTS**

*Professor Christopher C. Davis*

*Department of Electrical and Computer Engineering, University of Maryland, College Park*

In this talk I will describe what surface plasmon polaritons (SPPs) are, how they are excited, and how they can be used to produce both very large, and effectively negative, relative permittivities and group refractive indices. The effectively negative permittivities and refractive indices that can be produced in metal/dielectric composite nanostructures has allowed the first demonstration of 2-D cloaking in the visible part of the spectrum. The general principle and limitations of practical cloaking will also be discussed, and some of the approaches that are being considered for reducing the visibility of 3-D objects. SPPs can also be used to enhance the fluorescence from quantum dots and organic dyes placed on nanostructured surfaces. Experimental studies of the enhancement effect are used to explore the behavior of quantum dots on different substrates and probe the relationship between observed enhancement and geometrical factors of the surface structure. Imaging using standard fluorescence optical microscopy clearly demonstrates the strong dependence of fluorescence enhancement on fundamental parameters for corrugated surface structures. If time permits I will also discuss some interesting optical properties of vertically aligned carbon nanotube arrays.

#### **Short Bio:**

**Christopher C. Davis** is Minta Martin Professor of Engineering and Professor of Electrical and Computer Engineering at the University of Maryland, College Park. He received the B.A. degree (with Honors) in Natural Sciences from the University of Cambridge in 1965, the M.A. degree from the University of Cambridge in 1970, and the Ph.D. degree in Physics from the University of Manchester in 1970. From 1973-1975 he was an Instructor/Research Associate at Cornell University, and from 1982-83 was a Senior Visiting Fellow at the University of Cambridge. He has been a recipient of the following Honors and Awards: University of Maryland Distinguished Scholar-Teacher, 1989-90; Fellow of the Institute of Physics, 1989; AT&T/ASEE Award for Excellence in Engineering Education, 1990; Fellow of the IEEE, 1993; Invention of the Year Award in Information Technology, University of Maryland, 2000. Professor Davis is the author of the widely used text "Lasers and Electro-Optics," soon to be published in its second edition by Cambridge University Press, and co-author with Jack Moore and Mike Coplan of the best-selling text "Building Scientific Apparatus," now in its 4th edition published by Cambridge University Press. He is also author or co-author of 14 chapters in books, co-editor of seven volumes of SPIE Proceedings, author or co-author of 215 refereed journal articles and over 295 conference papers, and is the holder of twelve awarded and several pending patents. He is Conference co-Chair of the SPIE Free Space Laser Communications Conference, and is a frequently invited lecturer both nationally and internationally. He has served as a scientific consultant to several US Government agencies and industry. He is a member of the IEEE Standards Coordinating Committee SCC-34 SC2, which deals with RF exposure from wireless devices. His currently active research includes optical and RF directional wireless, real-time advanced surveillance systems with "event" detection, the optical properties of nanostructures where surface plasmons can be excited, laser interferometry, dielectrometry, fiber sensors and biosensors, optical trace detection, atmospheric turbulence, optical communication systems and devices, and studies of the biological effects of non-ionizing radiation.