



## **NONLINEAR RAMAN MICROSPECTROSCOPY: APPLICATIONS TO BIOMEDICAL IMAGING AND SENSING**

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**ROOM 442 DANA RESEARCH**

**HOST: PROF CHARLES DIMARZIO, ECE/MIE**

### **Abstract:**

Progress in the Life Sciences has always depended on the development of new tools and instruments. Our ability to understand the functions of living systems on a cellular and molecular level is greatly enhanced by imaging techniques capable of providing structural and chemical information *in vivo*. The simplicity, availability, and non-invasiveness of optical methods are attractive features for fundamental physiological studies in small animals, disease diagnosis, image-guided surgery and post-treatment recovery management in patients.

Nonlinear Raman spectroscopy based on coherent anti-Stokes Raman scattering (CARS) is seeing its renaissance these days and sparking a number of new applications in biomedical imaging and sensing. In my presentation I will describe the major physical principles that underlie this increasingly popular nonlinear optical microspectroscopy, outline the major technical innovations that allow this advanced spectroscopic tool to be incorporated in almost any laboratory utilizing short pulsed lasers and discuss its limitations from the standpoint of the signal-to-noise analysis. A careful analysis of those limitations allows designing the most ideal conditions for imaging and bioanalytical spectroscopy.

At the end of my lecture I will describe a recently demonstrated intriguing possibility of combining nonlinear Raman excitation with ultrasound detection, which allows reaching a large penetration depth, while preserving chemical specificity and high spatial resolution.

### **Biography:**

Vladislav Yakovlev received his BS, MS, and Ph.D. in radiophysics/quantum electronics from the Moscow State University, Moscow, Russia. During his short tenure with a biomedical start-up company ("Novatek, Inc" San Diego, California) he was the first to demonstrate the feasibility of corneal eye surgery using ultrashort laser pulses. His current work is primarily focused on developing new instrumentation for biomedical optical imaging and studying protein dynamics both *in vitro* and *in vivo*. He is a recipient of NSF CAREER award (2000), and his work has been supported by the NSF, NIH and DOD.