INDIAN INSTITUTE OF SCIENCE
BANGALORE

Cordially invites you to the

INSTITUTE COLLOQUIUM
(Chemical Sciences)

By

Professor S. Umapathy

Department of Inorganic and Physical Chemistry,

On

Light and life : From Physics to Medicine

Date : Wednesday, 27th February 2013
Venue : Faculty Hall, Main Building
Time : 4-00 p.m

Professor P. Balaram, Director
will preside

ALL ARE WELCOME

Tea: 5-00 p.m

ABSTRACT

Lasers have become an essential light source in spectroscopic applications due to their inherent coherence and high intensity. These properties enable both outstanding time (fs) and spatial (nm) resolutions required to study the structure of materials at the nanoscopic to microscopic level and also to examine their dynamics in femtosecond to seconds time scale. In this talk, I shall present various applications of laser spectroscopy, particularly vibrational spectroscopy, in the context of problems in physics, chemistry, biology and medicine.

Understanding ultrafast lattice structure relaxations and the phonon dynamics in the excitonic states and also probing mode-specific structural dynamics were not accessible at femtosecond time resolutions due to the inherent band width restrictions associated with femtosecond laser pulses. However, in recent times, use of the third order non-linear susceptibility response of a system using stimulated Raman scattering processes leads to the observation of evolution of vibrational structures and dynamics in femtosecond time scales. I shall discuss examples of energy migration and coherent oscillation of coupled vibrational modes, which provide information on early time response of a system after excitation.

In the case of biology and medicine, I shall present results of both infrared and Raman microscopic approaches for studying tissues, cell-drug interactions, and for lab-on-chip applications. We also demonstrate an objective classification of grade IV glioblastoma brain cancer tissues using infrared microscopy. Our study on effect of drugs on various cancer cell lines resulted in identification of propionylation, which may be an indication of cancer cell death. Further, we demonstrate the utility in combining surface enhanced Raman with lab-on-chip to study extremely low concentration of biofluids.

Finally, I shall discuss the development of a new form of Raman spectroscopy, called the Diffuse Wave Raman Spectroscopy (DWRS), and discuss some of its potential uses. DWRS can provide chemical structural information of materials deeply buried under surfaces, which can be used for non-invasive detection of hidden objects.