



# Indian Institute of Technology Kanpur

Student Chapter of

## The Optical Society (OSA)



### Invited Lecture

**Title :** Nonlinear spectroscopy: absorption and refraction

**Speaker:** Professor Eric Van Stryland

*Affiliation: The College of Optics and Photonics, University of Central Florida, Orlando, Florida, USA*

**Date :** 5 Dec, 2016, Monday – 3:00 PM

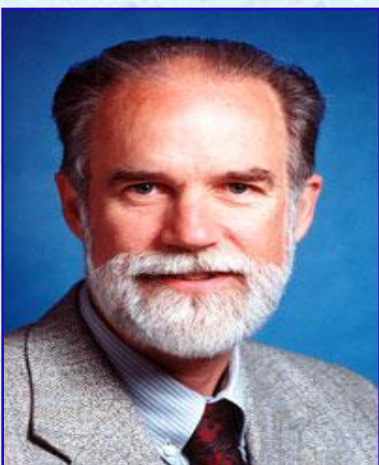
**Venue:** Lecture Hall Complex, L-8

*Sponsor:* OSA Visiting Lecturer grant

### Abstract:

At high optical irradiance of short pulse lasers, the absorption and refraction of materials changes temporarily. We have been developing nonlinear spectroscopic tools for measuring these changes of nonlinear absorption (NLA) and nonlinear refraction (NLR). The tools include Z-scan that separately yields the sign and magnitude of both NLA and NLR, pump-probe for the dynamics of NLA, and our newly developed Beam-Deflection technique that gives the dynamics of NLR. This last technique is so sensitive that it can measure the nonlinear refraction of air ( $\lambda/20,000$  induced phase change). I will also discuss the interesting and intuitive relations between NLR and NLA determined by causality (nonlinear Kramers-Kronig relations). This leads to a discussion of nondegenerate nonlinearities, e.g. 2-photon absorption (2PA) with two different energy photons. We find orders of magnitude enhancement of 2PA for photon energy ratios of  $\sim 10$ . We then utilize these nonlinearities for devices including gated IR detection with uncooled wide-gap semiconductors for 3D LIDAR and the possibility of a 2-photon laser.

### About the Speaker:



*Eric Van Stryland received his Physics PhD working at the Optical Sciences Center, University of Arizona, in 1976 and joined the University of North Texas. He then joined at the start of CREOL in 1987, became director in 1999, and its first Dean in 2004, for The College of Optics and Photonics. He is past President of OSA and Fellow of OSA (R.W. Wood Prize winner), SPIE, IEEE, APS and a past Board member of LIA. He graduated 37 Ph.D.s, published >300 papers primarily in the field of nonlinear optics (e.g. Z-scan >4000 citations, nonlinear Kramers-Kronig, cascaded second-order nonlinearities), and is Pegasus Professor and Trustee Chair.*