Nonlinear Absorption Spectroscopy - and how to detect IR with wide-gap semiconductors

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Abstract: We have been developing nonlinear spectrophotometers to measure nonlinear absorption spectra, e.g. 2-photon absorption, and the dispersion of the nonlinear refractive index in materials from semiconductors to organic dyes. We are close to having an automated system utilizing a white-light continuum, WLC, in conjunction with our Z-scan technique, i.e. “WLC Z-scan”. However, useful additional information on the physical processes can be obtained from pump-probe experiments which can measure frequency nondegenerate nonlinearities. In semiconductors the nondegenerate 2-photon absorption is greatly enhanced wrt its frequency degenerate counterpart. I will go over the reasons for this and demonstrate the results of using a GaN detector to measure fs 5.6 micron pulses by first ‘dressing’ the system with 390nm pulses. The preliminary results show detection as good as or better than obtained using a liquid nitrogen cooled HgCdTe detector.

Biography: Eric Van Stryland received a PhD in Physics in 1976 from the University of Arizona, Optical Sciences Center, where he worked on optical coherent transients and photon counting statistics. He worked in the areas of femtosecond pulse production, multiphoton absorption in solids, and laser induced damage at the Center for Laser Studies at the Univ. of Southern California. He joined the University of North Texas in 1978 helping to form the Center for Applied Quantum Electronics. In 1987 he joined the newly formed CREOL (Center for Research and Education in Optics and Lasers) at the University of Central Florida (UCF). NSF has funded him for the past 29 years. His current research interests are in the characterization of the nonlinear optical properties of materials and their temporal response as well as the applications of these nonlinear materials properties for optical switching, etc. He helped develop the Z-scan and also established the methodology for applying Kramers-Kronig relations to ultrafast nonlinearities and helped develop the field of cascaded second-order effects. He is a fellow of the OSA, a former member of their Board, a senior member of the Laser Institute of America and a former board member, a Fellow of SPIE, and IEEE and a member of the APS, SPIE, and MRS. He also served as a topical editor for Optics Letters. He was elected Vice President of the OSA which led to becoming President in 2006. He graduated 27 Ph.D.’s and published ~300 papers and is on the ISI ‘highly cited’ list. In 2003 he was awarded the highest honor UCF bestows, the Pegasus Award. He was Director of the School of Optics/CREOL from July 1999 to May of 2004. With the elevation of the School to a College, he became its first Dean (retired as Dean 2009). In addition, Governor Bush established the Florida Photonics Center of Excellence (FPCE) in 2003 and he was Director of that Center along with CREOL until he retired in 2009. The Townes Laser Institute is the latest addition to CREOL which began as a second round of the FPCE and was established during his administration.