Nonlinear refraction and absorption: Mechanisms, Characterization and Applications

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Abstract

Our understanding of nonlinear optical materials characterization has progressed sufficiently over the years to allow a reliable and complete picture of the underlying physical processes leading to the nonlinear optical properties of a material. This is largely thanks to the development of reliable and complimentary methods for characterization of nonlinear optical properties. I will provide an overview of the field, and describe our latest techniques in nonlinear refraction and absorption characterization which allow measurements dilute solutions and of thin films (dual-arm Z-scan) and time resolved refraction measurements with a sensitivity that allows even gasses to be measured (nonlinear beam deflection). The fundamental mechanisms that give rise to the process will be introduced. Additionally, I will describe how nonlinear refraction and absorption can be strongly enhanced when two very different wavelengths interact in a material. In addition to the obvious applications of this effect, I will show how this could be applied to such diverse applications as infrared detection and tunable mid-IR sources.

Biography:

David J. Hagan received his PhD degree in Physics at Heriot-Watt University, Edinburgh, Scotland in 1985. After a brief spell as research scientist at the University of North Texas, he moved to UCF in 1987 as a founding member of the CREOL faculty. He is currently Professor of Optics and Physics and also serves as Associate Dean for Academic Programs. He is currently Editor-in-Chief of the OSA journal, Optical Materials Express. His current research interests include nonlinear optical materials, especially semiconductors and organics, applications of extremely nondegenerate nonlinear optics, and techniques for nonlinear optical characterization and spectroscopy. Dr. Hagan is a Fellow of OSA.