

Time-domain nonlinear refraction - toward tailorable nonlinear optical responses.

David J. Hagan¹ and Eric W. Van Stryland¹

¹ CREOL, The College of Optics and Photonics, University of Central Florida,
4000 Central Florida Blvd., Orlando, FL 32816-2700 USA
E-mail: hagan@creol.ucf.edu

Our ultrafast nonlinear beam deflection technique [1] allows unambiguous separation of slow and fast nonlinearities and allows prediction of nonlinear properties for much longer pulses. It is also highly sensitive, allowing testing of models, e.g. gas phase vs liquid phase to test local field correction factors.[2] Beam deflection basically provides the impulse response function for nonlinear refraction, thus providing information that or the nonlinear response as measured by Z-scan or other methods for arbitrary pulse shapes and durations.[3] We have characterized a large number of common solvents in this way. Many solvents have significant non-instantaneous contributions to NLR, and for these solvents, when used to dissolve molecules with negative (i.e. self-defocusing) nonlinear refraction, we find that the effective nonlinear refraction becomes highly dependent on pulse width, and for certain combinations of pulse width and concentration, the effective n_2 may be exactly zero. The beam deflection method is also used to reveal the extremely large nonlinear absorption and refraction in semiconductors that occurs when two very different wavelengths are used. We have also used these methods in combination with the dual-arm Z-scan method to test a simplified 3-level model for organic materials that predicts nonlinear refraction knowing only the linear and 2-photon absorption spectra.[4]

References

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