CHROMOPHORE DESIGN FOR THIRD-ORDER NONLINEAR OPTICS, Seth R. Marder, Center for Organic Photonics and Electronics and School of Chemistry and Biochemistry, Georgia Institute of Technology, 911 Atlantic Dr., Atlanta, GA 30332-0400 USA

In this presentation we will review recent advances in the design, synthesis, characterization and application of molecules with large real and imaginary third-order optical nonlinearities, focusing on how variation in chemical structure relates to the observed nonlinearities.

Molecules with large two-photon absorption cross-sections are in great demand for variety of applications including, two-photon excited fluorescence microscopy, optical pulse suppression, three-dimensional optical data storage, and two-photon induced biological caging studies. These applications utilize two key features of two-photon absorption, namely, the ability to create excited states using photons of half the nominal excitation energy, which can provide improved penetration in absorbing or scattering media, and the quadratic dependence of the process which allows for excitation of chromophores with a high degree of spatial selectivity in three dimensions using a tightly focused laser beam.

Materials with large real third-order optical nonlinearities that also exhibit low linear and nonlinear loss mechanisms are of interest for a variety of all optical signal processing applications. However most molecules and polymers with large real third-order optical nonlinearities tends to have large two-photon cross sections. We have been examining cyanine molecules, to better understand both their two-photon cross sections and their third-order susceptibilities and have found that it is possible to identify systems at particular wavelengths with negligible two-photon cross sections but large third-order susceptibilities. Such molecules could have utility for all optical signal-processing applications.