Development of Third-Order Nonlinear Optical Materials.

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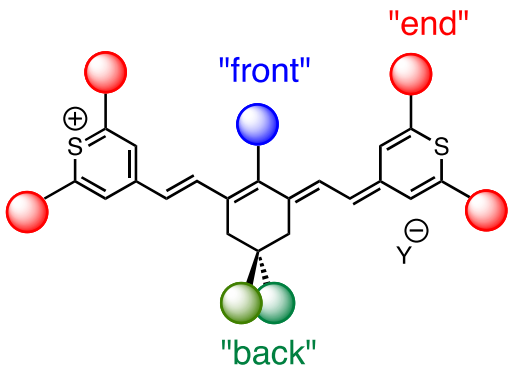
Abstract:

Materials with high number densities of molecules that exhibit large real third-order optical nonlinearities and that also have low linear and nonlinear loss mechanisms may be of utility for a range of all optical signal processing applications. To date, most molecules and polymers that have large real third-order optical nonlinearities tends to have acceptably large two-photon cross sections. Here we will report on our studies of cyanine molecules, to better understand both their two-photon cross sections and their third-order susceptibilities. We have found that it is possible to identify systems at particular wavelengths with very small two-photon cross sections but large third-order susceptibilities. We will discuss recent advances in the design, synthesis, characterization and application of molecules with large real third-order optical nonlinearities, focusing on how variation in chemical structure relates to the observed nonlinearities and how substitution on the molecule as shown below can help to prevent undesirable aggregration.



Schematic showing some of the structural features of polymethine dyes that can be varied to inhibit aggregation