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Entangled Photon Spectroscopy with Organic Materials

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The use of entangled light for the purposes of spectroscopy as well as for applications in sensing, quantum microscopy, and quantum lithography will be discussed. The Entangled Two Photon Absorption (ETPA) cross-section of a set of nonlinear optical materials, with known, and large, classical two-photon absorption (TPA) cross-sections, but of differing geometry, donor-acceptor strength, and charge-transfer character, will be presented in this talk. Materials with classical TPA cross-sections attributed to virtual transitions involving an intermediate state are found to have measurable, and large, ETPA cross-sections. However, it is also found that the materials whose (large) classical TPA cross-section is attributed to a dipole transition, without involvement of an intermediate state, are nearly transparent to entangled photons. From these results, it will be shown that entangled photons are highly sensitive to the intermediate states of a nonlinear optical organic molecules and macromolecular materials. These results have great impact in the development of materials for entangled photon sensing applications.