TWO PHOTON EXCITATION OF MOLECULAR IODINE. AN ADVANCED LASER TECHNIQUE FOR THE UNDERGRADUATE PHYSICAL CHEMISTRY LAB

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The iodine molecule is routinely studied in the undergraduate physical chemistry lab and provides practical experiments for topics such as chemical kinetics, phase equilibrium, and electronic molecular structure. In an effort to improve and modernize the physical chemistry lab, many of these experiments now incorporate the use of lasers; for instance, a laser can quite easily be used as the light source for iodine emission and fluorescence quenching experiments. To introduce the use of multiple-laser techniques, and to further the study of iodine in the undergraduate teaching lab, we have developed a double resonance method for accessing the ion-pair states of iodine using a relatively inexpensive nitrogen-pumped dye laser. Iodine is pumped to the B state with the dye laser, followed by excitation to the E and f states with a small portion of the nitrogen beam reflected off the parent beam by a quartz window. The strongest emission to the B state occurs from the f state, and progressions of up to 30 vibrational bands are observed. By varying the energy of the dye laser, we are able to pump vibrational levels of the f state from v=0 up to at least v=17. Analysis of our spectra is complicated by the presence of hot bands and by the relatively large bandwidth of our laser. Even so, we are able to adequately assign most spectral bands and their intensities with the aid of Franck-Condon calculations.