LASER EXCITATION SPECTROSCOPY: AN ANALYTICAL TOOL FOR STUDYING ENERGY TRANSFER MECHANISMS IN KXe AND OTHER GAS MIXTURES

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Laser excitation experiments were conducted to study the energy transfer mechanisms in K-Xe mixtures with narrowband dye lasers. Specifically, the K-Xe gas mixture was excited by a tunable dye laser in the vicinity of the K D_2 line such that a population inversion on the K D_1 line was achieved. The second dye laser served as the probe and scanned around the K D_1 transition. Through these experiments, the amplified probe energy is measured and the pump gain profile is obtained as shown in the spectra. The obtained data suggests than an electronic and molecular stimulated Raman scattering (SRS) process occur and compete in KXe in addition to a broad pump absorbance for emission on the K D_1 line. The Raman shift associated with the molecular SRS process of $\sim$59 cm^{-1} is associated with the KXe $B^2\Sigma^+_{1/2}$ and the dissociative $X^2\Sigma^+_{1/2}$ interatomic potentials. Consequently, the $B^2\Sigma^+_{1/2}$ and $X^2\Sigma^+_{1/2}$ interatomic potentials of KXe at large R can be determined by comparing experiment with calculations of the Franck-Condon integrals and quasistatistic line-broadening theory.