Abstract

When a molecular transition and a resonant optical cavity mode strongly interact by photon exchange, new hybrid light-matter states called as polaritonic states are generated. Generation of polaritonic states modifies the physical and chemical properties of the coupled system. It has already been shown that strong coupling affects the ground state electronic configuration as well as its vibrational envelope. In the current project, we studied the effect of vibrational strong coupling (VSC) on controlling the vibrational ladder in the electronic excited state. Benzoylacetone and coumarin are chosen as model systems for present study. Cooperative VSC effect was incorporated by selective overlapping of solvent vibrational frequency with the carbonyl stretching modes of benzoylacetone and coumarin molecules. Here, we have shown that VSC can affect the vibrational ladder of an excited electronic state through cooperative interactions. The fundamental change in the vibrational frequency and also the reshuffling of the vibrational wavefunction in the excited state modify the F-C transition and hence could affect the transition dipole moment of the system. Cavity tuning experiments clearly shows fluctuation behavior in the electronic absorption spectrum, thus proving the existence of vacuum field.