MOLECULAR VS. CHARGE TRANSFER TRANSITIONS IN 3,4,9,10-PERYLENE-TETRACARBOXYLIC DIANHYDRIDE (PTCDA) ATTACHED TO HELIUM NANODROPLETS

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Laser-induced fluorescence of 3,4,9,10-perylene-tetracarboxylic dianhydride (PTCDA) molecules inside superfluid helium nanodroplets is applied to study electronic properties at temperatures below 1 K. Perylene derivatives such as (PTCDA) are of current interest because of their electronic conductance properties as organic semiconductors. Furthermore, PTCDA serves as a model system for exciton formation in organic thin films. Spectra of single molecules in comparison with PTCDA dimers as well as larger PTCDA complexes are presented. The method of doping helium droplets with large organic molecules offers the possibility to simplify spectra in the cold, weakly perturbing environment, suitable to test existing theories on charge transfer processes. The monomer spectrum of PTCDA inside helium droplets is compared to Raman spectra of PTCDA films on Ag(110). Absorptions of different dimer structures as well as larger complexes of PTCDA molecules can be distinguished. The spectra allow, for the first time, to separate sharp molecular transitions (monomer and dimer) from broad charge transfer excitations.