ELECTRONIC SPECTRA OF TRIPLET KRb MOLECULES ON HELIUM NANODROPLETS.

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A beam of cold (0.4 K) superfluid helium droplets, each consisting of several thousand He atoms, is used for production and spectroscopic investigation of cold KRb molecules in their lowest triplet state. The droplets pass through two pickup cells containing K and Rb vapor at low pressure, and capture one or more atoms. The atoms remain on the surface of the droplet, where they move freely and form bound complexes. Because the binding energy is dissipated into the He droplet, weakly bound molecules are preferentially formed: in our case high-spin dimers, both homo- (K_2, Rb_2) and heteronuclear (KRb).

The measured electronic absorption spectra are only weakly perturbed by the droplets and can normally be assigned from the simulated spectra of the free species. Because the presence of the droplet does not quench the fluorescence from the excited molecules, emission spectra are also easily measured; in most cases emission occurs from free molecules which have come to separate from the droplet upon excitation.

We have investigated the $^3\Pi \leftarrow {}^3\Sigma^+$ electronic absorption spectrum of KRb at $\approx$13700 cm^{-1}, as well as its dispersed emission spectra. The absorption spectrum only shows two unstructured peaks separated by $\approx$100 cm^{-1}; unlike the case of Rb_2, presented in the companion talk, simulations with gas-phase potentials fail to reproduce the bluer of the two peaks, a fact which was already observed for the corresponding transition in K_2.[a,b] In that case the bluer peak was tentatively assigned to simultaneous collective excitations of the droplet (phonons). We will present and weigh the arguments in favor of each interpretation (spin-orbit splitting, similar to Rb_2, or phonon excitations, similar to K_2).

Emission spectra are sharp, indicating emission from the gas phase after separation from the droplet. A moderate amount of blue-shifted emission (i.e., at higher energy than the excitation) is observed, indicating the occurrence of some triplet-to-singlet conversion in the excited state. Atomic fluorescence is also observed, indicating the presence of a dissociative channel.

[a] J. Higgins, C. Callegari, J. Reho, F. Stienkemeier, W. E. Ernst, M. Gutowski, and G. Scoles *J. Phys. Chem. A* **102,** 4952 (1998).
[b] J. H. Reho, J. P. Higgins, and K. K. Lehmann *Faraday Discuss.* **118,** 33 (2001).