Formation of Cold Homo- and Heteronuclear Alkali Molecules on Helium Nanodroplets

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Superfluid Helium nanodroplets are doped with combinations of different alkali atoms (Li, Na, Rb, Cs). The atoms form molecules on the surface of the droplets which thermalize at the droplet temperature ($T < 0.4$ K) [1]. Different detection schemes (photoionization, laser-induced fluorescence and laser- induced beam depletion) are employed to reveal detailed information on the binding and the internal states of the molecules. Besides the formation of heteronuclear alkali dimers (LiCs, NaCs) we observe CsHe* exciplexes at excitation frequencies close to the cesium *D1* and *D2* transitions. Characteristic features in the cesium excitation spectrum are identified as Cs_3 trimer states.

Excitation spectra of the heteronuclear alkali dimers in the frequency range of a tunable Ti:Sa-laser are recorded. The observed vibrational progressions are identified in terms of transitions within the triplet ground-state manifold. Analysis of the spectra yields constraints to *ab initio* potential curves from literature. Laser-induced desorption of the heteronuclear dimers is observed which opens perspectives to create a beam of free, cold heteronuclear molecules for precision spectroscopy or to provide a source for deceleration and trapping of polar molecules.

[1] F. Stienkemeier, W.E. Ernst, J. Higgins, and G. Scoles, Phys.Rev.Lett. **74**, 3592 (1995)