SPIN-POLARIZED ALKALI CLUSTERS ISOLATED IN HELIUM NANODROPLETS

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Helium Nanodroplet isolation has been applied to form alkali clusters (Li_n, Na_n, K_n, Rb_n, Cs_n, $n \leq 20$). We use a beam of helium droplets (He_N, $N \approx 5000$) and consecutively pick-up several alkali atoms. These recombine on the surface of the droplet to molecules and larger clusters. As already known from the formation of alkali dimers and trimers on helium droplets[a], we find the larger clusters in their electronic ground state exclusively in high spin states, i.e. the valence electrons are totally spin-polarized. Apparently, species having paired spins efficiently desorb from the helium droplet because of their larger recombination energy compared to the very weak binding to the surface of the droplets. We measured the abundance of cluster sizes by means of femtosecond multi-photon ionization. Since sodium and potassium readily form clusters, this process appears to be suppressed for the heavier alkalies. Upon laser excitation the spin-polarization collapses, releasing lots of binding energy followed by fragmentation of the clusters. The degree of fragmentation and first results on the absorption characteristics are presented.

[a] J. Higgins, C. Callegari, J. Reho, F. Stienkemeier, W. E. Ernst, K. K. Lehmann, M. Gutowski, and G. Scoles, SCIENCE **273**, 629 (1996).