SPECTROSCOPY OF LiCa AND RbSr MOLECULES ON HELIUM NANODROPLETS

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We report on the investigation of mixed alkali metal (Ak) - alkaline earth metal (Ake) molecules on the surface of helium nanodroplets (He_N). These molecules have recently attracted considerable attention as candidates for the formation of ultracold molecules with a magnetic and an electronic dipole moment[a]. In our experiments, LiCa and RbSr molecules are formed in a sequential pick-up process in their $X^2\Sigma^+$ ground state and cool down rapidly to the droplet temperature of 0.38 K[b]. Excitation spectra of LiCa and RbSr were recorded by using resonance enhanced multi-photon ionization time-of-flight (REMPI-TOF) spectroscopy and laser induced fluorescence (LIF) spectroscopy. On the helium droplet, vibronic transitions in Ak-Ake molecules are broadened and show a characteristic asymmetric peak form, which is caused by the interaction between the molecule and the superfluid He_N environment. For the lower electronic transitions in LiCa and RbSr progressions of vibrational bands excited from the $X^2\Sigma^+$ ($\nu'' = 0$) state are observed. The LiCa spectra can be compared to molecular beam experiments[c], which enables the assignment of three band systems near 15260 cm^{-1}, 19300 cm^{-1} and 22120 cm^{-1} as $^2\Sigma^+$, $^2\Pi_\Omega$ and $^2\Pi$ band, respectively. In the RbSr excitation spectrum we observe a vibrationally resolved band system near 14020 cm^{-1}.
Upon electronic excitation, a fraction of the molecules desorb from the droplet surface and dispersed fluorescence spectra allow to study the $X^2\Sigma^+$ ground state and excited states of free Ak-Ake molecules.

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[b] C. Callegari and W. E. Ernst, Helium Droplets as Nanocryostats for Molecular Spectroscopy - from the Vacuum Ultraviolet to the Microwave Regime, in: Handbook of High-Resolution Spectroscopy, eds. M. Quack and F. Merkt, John Wiley & Sons, Chichester, (2011)

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