Time resolved photoion/electron imaging spectroscopy of rubidium atoms attached to Helium nanodroplets

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This contribution will focus on the dynamics of rubidium (Rb) atoms attached to helium nanodroplets following upon excitation of the dopant to intermediately lying electronic states, i.e. the 6PΣ and 6PΠ states in the pseudodiatomic model approach. This excitation, the first step in our femtosecond pump probe experiment, triggers the desorption of the Rb atom from the droplet surface. By subsequently ionizing the dopant and detecting the fragment ion masses, we observe $Rb^+He_{n=0,1,2}$ ions at long and heavy cluster ions at short delay times, inferring submersion of the Rb^+ ion into the droplet. This effect is caused by the attractive ion-droplet interaction and occurs on a timescale $t \leq 2\,\mathrm{ps}$ for all regarded excitation wavelengths.
To gain more insight into the involved dynamics, velocity map ion and electron images have been recorded for different pump probe delays. Rb^+ and $RbHe^+$ photofragments show an increasing kinetic energy and anisotropy leveling out at $t \leq 10\,\mathrm{ps}$. Vice versa, photoelectron images show a decreasing energy asymptotically reaching the corresponding atomic transition. Additionally, relaxation into lower electronic states has been observed. The experimental results will be compared to a semiclassical model particularly focusing on the $RbHe^+$ formation dynamics involving associative photoionization.

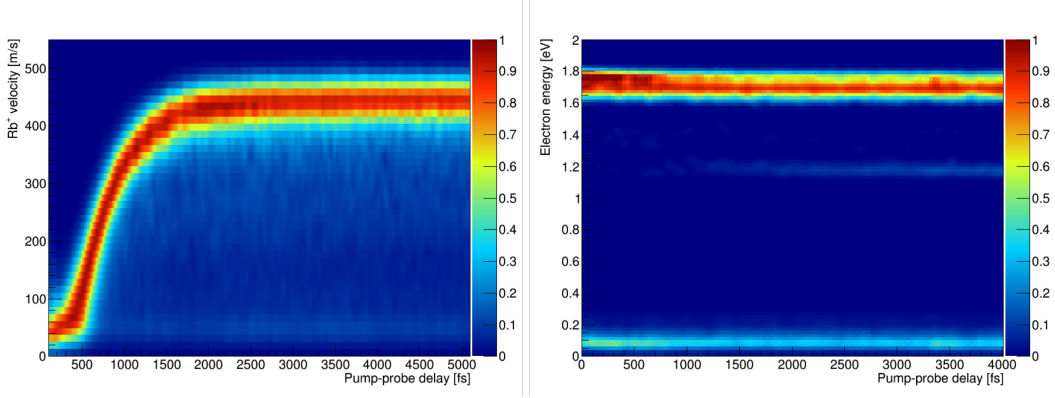

Figure 1: Left: Speed distribution of desorbing Rb^+ ions at different pump probe delays for laser excitation to the pseudodiatomic 6PΣ state. Right: Electron kinetic energy at different pump probe delays for laser excitation to the pseudodiatomic 6PΠ state.