Formation of Heavy Rydberg $K^+ - SF_6^-$ Ion-Pair States in $K(np)$-$SF_6$ Collisions

M. CANNON, Y. LIU, F.B. DUNNING, Rice University — At low $n$ ($n \approx 10 - 15$), electron transfer in collisions between $K(np)$ Rydberg atoms and $SF_6$ can lead to formation of bound $K^+ - SF_6^-$ ion pairs that orbit at relatively large separations, frequently referred to as heavy-Rydberg ion-pair states because of their similarities to atomic Rydberg states. The production of such ion pairs is examined through measurements at different values of $n$ and with different Rydberg atom velocities. The lifetimes of the ion pairs are measured by observing the time development of the $SF_6^-$ signal, part of which results from dissociation of bound ion pairs through the transfer of internal energy from the $SF_6^-$ ions into translational energy of the ion pair. The data point to bound ion-pair lifetimes of $\sim 1 - 2 \mu s$, which are many times larger than their orbital periods of $\sim 30 - 150$ ps. This work is being extended to other attaching molecules to further examine the properties of heavy Rydberg systems.

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