Spectroscopy of high-L Rydberg levels of Fr-like U and Th Ions

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CHARLES W. FEHRENBACK, Kansas State University — High-L Rydberg levels of Fr-like U$^{5+}$ and Th$^{3+}$ have been studied using the Resonant Excitation Stark Ionization Spectroscopy (RESIS) technique. Beams of Rn-like U$^{6+}$ and Th$^{4+}$, obtained from a 14 GHz permanent magnet ECR source at Kansas State University, capture a single electron from a dense Rb Rydberg target, becoming Fr-like ions in very highly excited states, $n \sim 50$. These Rydberg states are selectively excited to much higher levels, using a Doppler-tuned CO$_2$ laser, partially resolving the fine structure of the lower Rydberg level. Analysis of the spectrum with the long-range polarization model can be used to determine the polarizability of the Rn-like ion cores. The technique is analogous to previous studies of Kr$^{3+}$ Rydberg levels [1], but is more challenging because of the presence of background due to auto-ionizing Rydberg levels bound to metastable Rn-like ions.


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