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Microwave/RESIS technique for measurement of heavy ion properties¹ STEPHEN LUNDEEN, JULIE KEELE, SHANNON WOODS, CHRIS SMITH, Colorado State University, CHARLES FEHRENBACH, Kansas State University — The subtle but distinctive patterns of binding energies of high-L Rydberg electrons bound to heavy positive ions reveal the ion properties, such as polarizabilities and permanent moments, that control the long-range interactions between ion and the Rydberg electron. A specialized experimental technique, Resonant Excitation Stark Ionization Spectroscopy (RESIS), facilitates study of these fine structure patterns in a wide variety of Rydberg systems. The simplest RESIS measurements use a Doppler-tuned CO₂ laser to selectively detect individual high-L Rydberg states in a fast Rydberg beam by resonant excitation to a much higher level, followed by Stark ionization and collection of the resulting ion. Much more precise studies use the selective RESIS excitation to detect direct microwave transitions between Rydberg levels of the same n. Recent microwave/RESIS studies of this type have determined many properties of the ions Th⁴⁺[1], Th³⁺[2], and Ni⁺[3]. Details of this method will be described, with particular attention to studies of multiply-charged Rydberg ions.

[1] Chris S. Smith et. al., DAMOP 2012

[2] Julie A. Keele, et. al., DAMOP 2012

[3] Shannon L. Woods, et. al. DAMOP 2012

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