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Spectroscopy of High-L Rydberg States of Nickel KRISTEN VOIGT, STEPHEN LUNDEEN, JULIE KEELE, SHANNON WOODS, Colorado State University — In this study, the fine structure of high-L Rydberg states of nickel is measured. In these high-L Rydberg states, a highly excited "spectator electron" reveals, by the details of its binding energy, certain properties of the Ni+ ion which it "orbits". These special states are created and measured by a technique called RESIS: Resonant Excitation Stark Ionization Spectroscopy. This method involves creating a fast beam of Ni+ ions which travel through a Rb 9F Rydberg target where many of them capture a single electron to form Rydberg states of neutral nickel with population concentrated near n=9. Any unneutralized Ni+ ions are blocked by a high electric potential. The fast Ni Rydberg atoms then pass through a Doppler-tuned CO2 laser which may excite them from n=9 to n=19 or 20, and any atoms so excited are ionized by a strong electric field and collected and counted. As the CO2 laser is tuned across the excitation resonance, the complex fine structure of n=9 L $>$ 5 levels is fully resolved, and analysis of the fine structure pattern determines properties of the Ni+ ion such as its quadrupole moment and polarizabilitiy. Currently, the data of the study is being analyzed to give unprecedented results for these properties of Ni+.

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