Spectroscopic measurements of Ba+  JOSEPH PIRTLE, RYAN BOWLER, SANGHOON CHONG, Undergrad, MATT DIETRICH, GARY HOWELL, ADAM KLECEWESKI, NATHAN KURZ, Grad, VIKI MIRGON, PHIL NELSEN, JOANNA SALACKA, Undergrad, GANG SHU, LI WANG, Grad, BORIS BLINOV, PI — Our goal is to measure the atomic structure of Ba\(^+\) to a new degree of accuracy. We confine and laser-cool a single barium ion in an RF quadrupole. We intend on measuring the branching ratios for the 6P\(_{3/2}\) - 5D\(_{5/2}\)and the 6P\(_{3/2}\) - 5D\(_{3/2}\)decays in Ba\(^+\). The measurement is achieved by first exiting the ion to the 6P\(_{3/2}\) state with a short duration of a 455 nm shelving laser. We then allow the ion to decay, which will result in one of three states: 5D\(_{5/2}\), 5D\(_{3/2}\), and 6S\(_{1/2}\). Next we use a 650 nm laser to re-pump the ion out of the 5D\(_{3/2}\) into the 6P\(_{1/2}\) and another 493 nm to transition from 6S\(_{1/2}\) to 6P\(_{1/2}\). If the ion fluoresces in this 6S\(_{1/2}\) - 6P\(_{1/2}\) - 5D\(_{3/2}\) cycle then we know the original decay out of 6P\(_{3/2}\) was into either 5D\(_{3/2}\) or 6S\(_{1/2}\). By incrementally increasing the duration of the 455 nm excitation the probability of decay into the 6S\(_{1/2}\) is exponentially decreased. With enough data points we can extrapolate the saturation between the probabilities of fluorescent and non-fluorescent cycles. The branching ratio between the decays into the 5D\(_{5/2}\) and 5D\(_{3/2}\) states is the ratio of these probabilities in this limit. Our future experiments include the precision RF spectroscopy of the 5D\(_{5/2}\) state in \(^{137}\)Ba\(^+\) and the measurement of the 5D\(_{5/2}\) state lifetime.