A novel technique for measuring the microwave transitions and the indirect spin-orbit splittings in the high angular momentum Rydberg states of barium\(^1\) JIRAKAN NUNKAEW, Department of Physics and Materials Science, Faculty of Science, Chiang Mai University, EVAN KIM, THOMAS GALLAGHER, Department of Physics, University of Virginia — We use a novel detection technique, selective laser excitation to the autoionizing states, to observe the microwave transitions of Ba from 6sng to 6snh, 6sni and 6snk for \(n= 15, 16, 17\) and 18. We extract the dipole and quadrupole polarizabilities of Ba\(^+\) from the measured intervals between the 6snh – 6sni and 6sni – 6snk states of Ba using the non-adiabatic core polarization model. The values we determine for the dipole and quadrupole polarizabilities are \(\alpha_d = 129.03(57) \ a_0^3\) and \(\alpha_q = 1790(76) \ a_0^5\), respectively. The energies of the 6s\(\ell n\), \(\ell \geq 5\) states are split by the indirect spin-orbit coupling of the Ba core to the Rydberg electron, producing the \(K\) splittings. From the \(K\) splittings we extract the ionic dipole and quadrupole matrix elements, \(< 6s|\ell p >= 4.10(9) \ a_0\) and \(< 6s|\ell^2 5d >= 9.64(15) \ a_0^2\), respectively.

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