INFRARED SPECTROSCOPY OF THE $Co^+(H_2O)$ COMPLEX WITH He, Ne, AND Ar TAGGING.

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Cobalt cation-water complexes are generated in a pulsed supersonic expansion by laser vaporization. Complexes are mass-selected in a time-of-flight mass spectrometer and their spectra are measured using infrared laser photodissociation of the rare gas tagged complexes. The spectrum of $Co^+(H_2O)$ was measured with He, Ne, and Ar_3 tags. These spectra reveal that the water remains intact in the metal cation-water complex. The Ar_3 tag is found to cause a small blue shift of the O-H stretches relative to that observed with helium tagging. Rotational structure observed for $Co^+(H_2O)$ and $Co^+(D_2O)$ with helium tagging reveal perturbations to the rotational constants introduced by the motion of the helium in the ground vibrational state. Nuclear spin statistics were found to maintain a room temperature population of states which indicates an antisymmetric ground electronic state. Spin-rotation coupling was observed to vary between isotopologues and differed from values obtained in untagged measurements.