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Isotopic effects in Rb_2 molecules formed by Rydberg- and ground-state atoms[1] JAMIE MACLENNAN, YUN-JHIH CHEN[2], GEORG RAITHEL, University of Michigan - Ann Arbor — The scattering interaction of a Rydberg electron with a ground-state atom can form bound molecular states. Measurement of these binding energies may help refine calculations of electron-atom scattering phase shifts. We report spectroscopic measurements of the molecular binding energies of $Rb(24D_J + 5S_{1/2})$. Dense samples of cold atoms are prepared in a high-intensity optical lattice formed in an in-vacuum near-concentric optical cavity. The molecules are excited via a two-step laser excitation, and analyzed via counting of ions generated by photoionization and molecular decay. We observe molecular states with binding energies up to 430 MHz, with sub-percent relative uncertainty. We show and discuss binding-energy variance by isotope and hyperfine level of the ground-state atom, and by the J-value of the Rydberg level. Isotopic hyperfine-coupling effects on the molecular vibrational energy arise from the different I-values and the different masses of the Rb isotopes.

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