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Many-body physics of Cesium Rydberg molecules in high principal quantum number states* JIN YANG, University of Oklahoma, SETH RITTENHOUSE, The United States Naval Academy, HOSSEIN SADEGHPOUR, ITAMP, Harvard-Smithsonian Center for Astrophysics, Harvard University, JAMES SHAFFER, University of Oklahoma — We present our recent results on many-body and few-body physics of Cesium Rydberg molecules. When a Rydberg electron is highly excited, it has a large chance to interact with more than one ground state atom in a high density ultracold gas ($>10^{12}$ cm^{-3}) which leads to the formation of Rydberg molecule oligomers. Typically, interaction of each ground state atom with the Rydberg electron is independent, due to the large space between ground state perturbers. As a consequence, the binding energies of Rydberg molecule oligomers are multiples of the binding energy of the Rydberg molecule dimer (nS). However, when the spherical symmetry of the Rydberg electron wavefunction is broken (nD), correlations between the different ground state atoms can be significant. As we go to higher n states, different oligomer signals merge together, resulting in a spectral tail attached to the Rydberg line. In this work, we investigated the buildup of these ultralong-range Rydberg oligomers in a Cs gas where p-wave scattering is strong.
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