

EXCITATION OF ULTRACOLD MOLECULES TO “TRILOBITE-LIKE” LONG-RANGE MOLECULAR RYDBERG STATES

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A class of long-range Rydberg molecules, sometimes called “trilobite states”, occurs when a ground-state atom is embedded in the electronic cloud of a Rydberg atom.^a The bond between the Rydberg atom and the ground-state atom originates from the low-energy scattering of the Rydberg electron from the ground-state atom. We produce trilobite-like states of ultracold Rb₂ at low principal quantum numbers and at internuclear separations less than 40 bohr. We populate these states through single-photon ultraviolet transitions starting from molecules in high-lying vibrational levels of the lowest triplet state. This demonstrates that long-range Rydberg molecules can also be excited through bound-bound transitions, in addition to previous studies that used free-bound transitions. We also discuss the advantages of a bound-bound pathway.

^aC. H. Greene, A. S. Dickinson, and H. R. Sadeghpour, Phys. Rev. Lett. **85**, 2458 (2000).