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

M. A. BELLOS, R. CAROLLO, J. BANERJEE, E. E. EYLER, P. L. GOULD, W. C. STWALLEY, *Department of Physics, University of Connecticut, Storrs, CT 06269-3046*.

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 Rb_2 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.

[a] C. H. Greene, A. S. Dickinson, and H. R. Sadeghpour, Phys. Rev. Lett. **85**, 2458 (2000).