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Long-Range Trilobite-like Cs Molecules in a Crossed 1064 nm Dipole Trap JONATHAN TALLANT, University of Oklahoma, DONALD BOOTH, LUIS MARCASSA, BRUNO MARANGONI, JAMES SHAFFER, University of Oklahoma — In the past, our group has observed long-range Rydberg atom- Rydberg atom molecules created within a MOT. The density required to observe such molecules can be relatively low, $\lesssim 10^{10}$ cm^{-3} because the bound states exist at internuclear separations between $\sim 3\mu$m and $\sim 9\mu$m. The increase in density to $\sim 10^{13}$ cm^{-3} in a crossed dipole trap allows for new types of molecule formation which are inefficient in lower density traps, like the MOT. In particular, new bonding mechanisms may arise from the low-energy scattering of a Rydberg atom electron (with negative scattering length) from a ground state atom, so called trilobite and trilobite-like molecules. We present data on the spectroscopic identification of Cs $n^2S_{1/2} + 6^2S_{1/2}$ trilobite-like molecules. Progress on resolving the vibrational structure of both singlet and triplet species will be presented. We acknowledge funding from ARO (W911-NF-08-1-0257), NSF (PHY- 0855324) and NSF (OISE-0756321).

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