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High-Resolution Spectroscopy of Long-Range Molecular States of $^{85}Rb_2$ RYAN CAROLLO, YOANN BRUNEAU, EDWARD EYLER, PHILLIP GOULD, WILLIAM STWALLEY, University of Connecticut — We present analysis of low-n long-range molecular states in $^{85}Rb_2$, and additional high-resolution spectra. Our process excites a photoassociation resonance in the $1\,(0_g^-)$ state which decays to $v'' = 35$ and 36 of the $a\,^3\Sigma_u^+$ state and to the continuum. These bound molecules are excited via a single photon to target states near the $5s{+}7p$ asymptote by a frequency-doubled pulse-ampli?ed CW laser with narrow linewidth, under 200 MHz. The long-range portion of the bonding potential is formed by the scattering interaction of the Rydberg electron of a perturbed $7p$ atom scattering from a nearby ground-state atom, in the same manner as trilobite states. We use time-of-flight to selectively measure molecular ions, which are formed via autoionization. This technique gives a two orders-of-magnitude improvement in linewidth over our previous excitation method, which was done by a broader linewidth conventional pulsed laser as reported in Ref. [1]. This work is supported by the NSF and AFOSR.

[1] M. A. Bellos *et al.*, Phys. Rev. Lett. **111**, 053001 (2013)

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