Abstract Submitted
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Photoassociation of long-range nD Rydberg molecules[1] DAVID ANDERSON, STEPHANIE MILLER, GEORG RAITHEL, University of Michigan — A recently discovered class of long-range Rydberg molecules has generated a significant amount of theoretical and experimental interest [1,2]. We present on the observation of long-range homonuclear diatomic nD Rydberg molecules photoassociated out of an ultracold gas of ^{87}Rb atoms for $34 \leq n \leq 40$ [3]. We measure the ground-state binding energies of $^{87}\mathrm{Rb}(nD-5S_{1/2})$ molecular states to be larger than those of their $^{87}\mathrm{Rb}(nS-5S_{1/2})$ counterparts, showing the dependence of the molecular bond on the angular momentum of the Rydberg atom. We probe the transition of $^{87}\mathrm{Rb}(nD-5S_{1/2})$ molecules from the molecular-binding-dominant regime at low n [Hund's cases (a)] to a fine-structure-dominant regime at high n [Hund's case (c)]. A Fermi model that includes the fine structure of the nD Rydberg atom and hyperfine structure of the $5S_{1/2}$ pertuber is presented that describes this transition. The resulting molecular potentials and bound states are in good agreement with the experimental data.

[1] C. H. Greene, A. S. Dickinson, and H. R. Sadeghpour, PRL, **85**, 2458-2461 (2000).
[2] V. Bendkowsky et al., Nature, **458**, 1005-1008 (2009).
[3] D. A. Anderson, S. A. Miller, and G. Raithel, arXiv:1401.2477.

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David Anderson
University of Michigan

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