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Excitation of ultra-long-range nd Rydberg molecules[1] DAVID ANDERSON, STEPHANIE MILLER, GEORG RAITHEL, University of Michigan — A recently discovered class of ultra-long-range Rydberg molecules has generated a significant amount of theoretical and experimental interest [1,2]. The binding mechanism of these molecules arises from a scattering-induced, attractive interaction between the low-energy electron of a highly-excited Rydberg atom and a nearby neutral perturber [3]. The bond formed between a Rydberg atom and a ground-state atom via this interaction, and the nature of the resulting molecule, is largely dependent on the Rydberg electron wave function. We present here the experimental observation of ultra-long-range $^{87}Rb_2$ Rydberg molecules formed by a $Rb(nd_j)$ Rydberg atom and a $Rb(5s_{1/2})$ ground-state atom, for principal quantum numbers $34 \leq n \leq 40$. The molecular ground states are isolated spectroscopically and their measured binding energies scale as $\sim n^{-6}$, in good agreement with theory [1]. The molecular binding energies are found to be the same for angular momentum $j = 5/2$ and $3/2$ of the nd_j Rydberg state over a selected n range, within the measurement precision. [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] E. Fermi, Il Nuovo Cimento, 11, 1934.

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David Anderson
University of Michigan

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