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Rydberg blockade in three-atom systems DANIEL BARREDO, SYLVAIN RAVETS, HENNING LABUHN, LUCAS BEGUIN, ALINE VERNIER, RADU CHICIREANU, FLORENCE NOGRETTE, THIERRY LAHAYE, ANTOINE BROWAEYS, Laboratoire Charles Fabry, Institut d'Optique, CNRS, Univ Paris Sud, 2 avenue Augustin Fresnel, 91127 Palaiseau cedex, France, OPTIQUE QUANTIQUE TEAM — The control of individual neutral atoms in arrays of optical tweezers is a promising avenue for quantum science and technology [1,2]. Here we demonstrate unprecedented control over a system of three Rydberg atoms arranged in linear and triangular configurations. The interaction between Rydberg atoms results in the observation of an almost perfect van der Waals blockade [3]. When the single-atom Rabi frequency for excitation to the Rydberg state is comparable to the interaction energy, we directly observe the anisotropy of the interaction between nD–states. Using the independently measured two-body interaction energy shifts we fully reproduce the dynamics of the three-atom system with a model based on a master equation without any adjustable parameter. Combined with our ability to trap single atoms in arbitrary patterns of 2D arrays of up to 100 traps separated by a few microns, these results are very promising for a scalable implementation of quantum simulation of frustrated quantum magnetism with Rydberg atoms.

[1] E. Urban *et at.*, *Nat. Phys.* **5** 110 (2009).
[2] A. Gaetan *et at.*, *Nat. Phys.* **5** 115 (2009).
[3] L. Beguin, A. Vernier, R. Chicireanu, T. Lahaye, and A. Browaeys, *Phys. Rev. Lett.* **110** 263201 (2013).

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