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Rydberg dressing of fermionic lithium[1] BENJAMIN M SPAR, ELMER GUARDADO-SANCHEZ, WASEEM S. BAKR, Princeton University — Rydberg dressing, the admixing of a Rydberg state into the ground state of an atom, has been proposed as a way to introduce laser-controlled long-range interactions in an ultracold gas. The resulting soft-core interaction potentials have been measured with localized atoms [1,2] and used to simulate spin models in optical lattices [3]. An exciting prospect is the preparation of a Rydberg-dressed quantum gas with a sufficiently long lifetime to observe motional effects. We report on the realization of Rydberg-dressing of lithium-6 atoms in an optical lattice using single photon excitation. We measure the interactions between the dressed atoms and study the lifetime of the gas and its dependence on the geometry of the sample. The experiments are conducted in a quantum gas microscope, which allows the use of small atom numbers to ameliorate the effect of collective loss processes. The light mass of lithium-6 facilitates exiting the frozen gas regime while the fermionic nature of the species opens the door to new avenues in the quantum simulation of Hamiltonians with long-range interactions. [1] Y.-Y. Jau et al, Nat. Phys. 12, 71 (2016) [2] J. Zeiher et al, Nat. Phys. 12, 1095 (2016) [3] J. Zeiher et al, Phys. Rev. X 7, 041063 (2017)

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