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Towards Quantifying the Impact of State-Mixing on the Rydberg Excitation Blockade[1] MILO EDER, ANDREW LESAK, ABBY PLONE, AARON REINHARD, Kenyon College — The Rydberg excitation blockade, a process in which interactions among highly-excited atoms suppress laser excitation, has been at the heart of an impressive array of recent achievements in quantum information and simulation. It has been shown that state-mixing interactions, which result from couplings among multi-particle Rydberg states near Forster resonance, may compromise the effectiveness of the blockade under otherwise favorable conditions [1]. We present progress on an experiment in which we seek to quantify the negative impact of state-mixing on the blockade. We use state-selective field ionization spectroscopy to measure, on a shot-by-shot basis, the distribution of Rydberg states populated during narrowband laser excitation of ultracold rubidium atoms. Our method allows us to quantify both the "mixing-free" blockade effectiveness, as well as the number of additional Rydberg excitations added by each mixing event. [1] A. Reinhard et al, PRL, 100, 123007 (2008)

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