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Quantifying the Impact of State Mixing on the Rydberg Excitation Blockade[1] MILO EDER, TOMOHISA YODA, ANDREW LESAK, ABIGAIL PLONE, AARON REINHARD, Kenyon College — The Rydberg excitation blockade has been at the heart of an impressive array of recent achievements in quantum information and simulation. However, state-mixing interactions may compromise the effectiveness of the blockade under otherwise favorable conditions. When ultracold atoms are excited to Rydberg states near Forster resonance, up to ∼50% of atoms can be found in dipole coupled product states within tens of ns after excitation. There has been disagreement in the literature regarding the mechanism by which this mixing occurs. 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 number of additional Rydberg excitations added by each mixing event, as well as the extent to which state-mixing "breaks" the blockade.

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