replacing MAR17-2016-005768.

Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Spontaneous dipole-dipole interactions in many-body, driven, dissipative Rydberg systems JAMES MASLEK, THOMAS BOULIER, ERIC MAGNAN, CARLOS BRACAMONTES, JEREMY YOUNG, ALEXEY GORSHKOV, STEVE ROLSTON, TREY PORTO, Univ of Maryland-College Park — We observe unexpected dipole-dipole interactions leading to the violation of a forbidden transition to the 18s manifold of ultra-cold ^{87}Rb atoms in a 3D optical lattice, as well as an increase in the linewidth of the allowed two photon rydberg transition. At increasing two photon Rabi frequency, a new resonance appears 10 MHz detuned from the main rydberg transition. Due to the selection rules of the circularly-polarized 2-photon excitation, the $|F = 1, m_F = -1 >$ state, which lies roughly 10 MHz away, should be inaccessible, and is not present at rabi frequencies less than 60kHz. We interpret this as a mixing of both the accessible and forbidden 18s states, which comes from the dipole-dipole interaction between these states and the populations of nearby p states, which are induced from blackbody decay from the. $|18s, F = 2, m_F = -2 >$ state. These p states are created faster than the timescales of the experiment, making their effect instant. We observe that the pumping rates of these resonances tend to the same value as the rabi frequency gets large enough, showing a complete mixing of the states. This phenomenon occurs due to the finite lifetimes of rydberg atoms and occurs in highly excited many-body systems. It is relevant for a wide array of proposals, including rydberg dressing

James Maslek
Univ of Maryland-College Park

Date submitted: 11 Nov 2016 Electronic form version 1.4