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Controlling the Collective Rabi Oscillation of N Rydberg Atoms with Ancillary Atoms WOOJUN LEE, HYOSUB KIM, KYUNGTAE KIM, JAE-WOOK AHN, Korea Advanced Institute of Science and Technology — Dipole blockade among atoms excited to Rydberg states, called Rydberg blockade, has been intensively studied as a promising implementation of an atom-atom coupling in quantum computing and quantum simulation [1, 2]. When the Rydberg blockade happens among N atoms, there occurs collective excitation of the atom with $\sqrt{N}$ times enhanced Rabi frequency compared to single atom excitation. Here we demonstrate the configurational effects on the N-atom (Rb 87) collective Rabi oscillation, by adjusting the position of ancilla atoms with atomic dynamic holographic optical tweezers [3, 4]. The characteristics including the frequency shift and amplitude of the collective oscillation and their polarization dependence for various configurations will be presented. [1] Gatan, Alpha, et al. Nature Physics 5.2 (2009): 115-118. [2] Wilk, Tatjana, et al. Physical Review Letters 104.1 (2010): 010502. [3] Lee, Woojun, et al. Optics express 24.9 (2016): 9816-9825. [4] Kim, Hyosub, et al. Nature Communications 7 (2016).

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