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The effects of light-shift and temporal evolution on collective Rydberg excitations NITHIWADEE THAICHAROEN, ANDREW SCHWARZKOPF, DAVID ANDERSON, GEORG RAITHEL, University of Michigan — Optical dipole traps are widely used to trap and manipulate cold ground-state and Rydberg atoms. Here, we present a first study of the effects of dipole-trap-induced light shifts on the spatial pair-correlation function of Rydberg excitations generated in clouds of cold ^{85}Rb atoms. We use ion imaging techniques to obtain the Rydberg pair-correlation functions. We measure and interpret the effects of excitation-laser detuning and dipole-trap-induced light shifts on the Rydberg excitation blockade. We also observe an enhancement of the probability of exciting two Rydberg atoms at a particular separation, which we explain as direct two-photon excitation of Rydberg-atom pairs. In a second experiment, we investigate the evolution of collective Rydberg excitations by adding a time delay between the excitation pulse and the read-out sequence. The observed time dependence of the pair-correlation signal reflects the van-der-Waals forces between the Rydberg atoms.

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