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Coherent Population Transfer of Ground State Atoms into Rydberg States AARON REINHARD, TARA CUBEL, KEVIN TEO[1], VLADIMIR MALINOVSKY[2], JEFF GUEST[3], BRENTON KNUFFMAN, PAUL BERMAN, GEORG RAITHEL, University of Michigan — Using the STIRAP technique, we have excited laser-cooled rubidium atoms from the $5S_{1/2}$ ground state into the $44D_{5/2}$ Rydberg state with an efficiency of up to $\sim 70\%$. Two consecutive STIRAP sequences are applied to the same atom sample, allowing us to extract the excitation efficiency from the ratio of Rydberg atom counts detected after the two sequences. Experimental results are compared with the results of density-matrix calculations, and good agreement is found. Using STIRAP excitation, we have observed spectral broadening of resonance lines of 60-80MHz when exciting to the higher-lying 84D Rydberg state. Using samples of just a few tens of atoms, we have measured probability distributions for the number of Rydberg atoms excited in a single pulse. For resonant excitation, the distributions exhibit a sub-Poissonian character (Q=0.8-0.9), indicating the presence of a blockade effect due to Van-der-Waals interactions.

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