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Efficient Rydberg Excitation of He with STIRAP[1] S-H. LEE, K. CHOI, J. KAUFMAN[2], A. VERNALEKEN[3], O. KRITSUN[4], H. METCALF, Physics Stony Brook University, NY 11794-3800 USA — We have used Stimulated Rapid Adiabatic Passage (STIRAP)[5] for highly efficient excitation of Rydberg states, and developed an absolute measure of the efficiency. The metastable 2^3S_1 state (He*) comes from a dc discharge atomic beam source. A blue laser beam (λ = 389 nm) excites He* to the 3^3P_2 state, and a red laser beam (λ=796 nm) then excites the 26^3S_1 state. If this intuitive order of excitations is reversed (STIRAP) the theoretical excitation efficiency $\rightarrow$ 100%. In our experiment, He* atoms cross both blue and red beams whose positions can be shifted to affect the order that the atoms encounter them. We observed a large increase in the Rydberg population as we shift the red beam upstream of the blue one (the counterintuitive order appropriate for STIRAP). We also use 389 nm light to measure the excitation efficiency with blue detuned optical molasses directly downstream of the STIRAP area. It spreads the spatial distribution of remaining He* but Rydberg atoms are unaffected. We present the results of our first measurements.

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