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Engineering Rydberg Wavepackets Using a Chirped Half-Cycle Pulse Train[1] JEFFREY MESTAYER, WEI ZHAO, JIM LANCASTER, F. BARRY DUNNING, Department of Physics and Astronomy, Rice University, SHUHEI YOSHIDA, Vienna University of Technology, CARLOS REINHOLD, Oak Ridge National Laboratory, JOACHIM BURGDORFER, Vienna University of Technology — A protocol for driving Rydberg atoms to a narrow band of targeted final n states with the aid of a chirped train of half-cycle pulses (HCPs) is described. A localized wavepacket can be generated and maintained by a periodic driving force. The dynamics of such a wavepacket can be manipulated almost as easily and as freely as the dynamics of a single classical particle. This is demonstrated experimentally by exciting potassium atoms to the lowest-lying quasi-one-dimensional (quasi 1-D) states in the n = 350 Stark manifold and transporting them to a narrow range (Δn$\sim \pm 20$) of higher-n states centered on values of n of up to n $\sim$ 670. The protocol is remarkably efficient, with over 90% of the parent atoms surviving the HCP sequence in strongly-polarized quasi-1D states.

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