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Chaotic Energy Hopping in Bidirectionally Kicked Rydberg Atoms KORANA BURKE, Boston University, KEVIN MITCHELL, University of California at Merced, SHUZHEN YE, F. BARRY DUNNING, Rice University — A highly excited (n 306) quasi one-dimensional Rydberg atom exposed to periodic alternating external electric field pulses exhibits chaotic behavior. Time evolution of this system is governed by a geometric structure of phase space called a homoclinic tangle and its turnstile. The turnstile is responsible for organizing chaotic ionization. We present and explain the results from an experiment designed to probe the structure of the phase space turnstile. We create time-independent Rydberg wave packets, subject them to alternating electric field kicks, and measure the ionization fraction. We present the behavior of the ionization fraction as a function of the applied kick strength and show that this behavior is directly connected to the size and shape of the underlying turnstile. For short kicking periods the ionization fraction as a function of the applied kick strength exhibits step-function-like behavior that changes into s-shape behavior for large kicking periods. Next we use the geometric structure of phase space to design a short pulse sequence that quickly and efficiently transfers electronic wave packet from a high energy state to a much lower energy state. Finally, we show how the phase space geometry influences the efficiency of the transport between energy states.

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