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Chaotic Ionization of Bidirectionally Kicked Rydberg Atoms KORANA BURKE, Boston University, KEVIN MITCHELL, UC Merced, SHUZHEN YE, F. BARRY DUNNING, BRENDAN WYKER, Rice University — A highly excited quasi one-dimensional Rydberg atom exposed to periodic alternating external electric ?eld pulses exhibits chaotic behavior. The ionization of this system is governed by a geometric structure of phase space called a homoclinic tangle and its turnstile. We present and explain the results from an experiment designed to probe the structure of the phase space turnstile. We create time-dependent Rydberg wave packets, subject them to alternating applied electric fields (kicks), and measure the survival probability. We show that the survival probability of the electron depends not only on the initial electron energy, but also on the phase space position of the electron with respect to the turnstile–the portion of the electron wave packet inside the turnstile ionizes quickly, after one period of the applied field, while that portion outside the turnstile ionizes after multiple kicking periods. Finally, we use the turnstile geometry to explain the dependence of ionization on the kicking period. This procedure describes a very robust yet simple way to control chaotic ionization of an atomic system.

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