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Navigating in Phase Space WEI ZHAO, JEFF MESTAYER, JIM LANCASTER, F. BARRY DUNNING, Department of Physics and Astronomy, Rice University, CARLOS REINHOLD, Oak Ridge National Laboratory, SHUHEI YOSHIDA, JOACHIM BURGDORFER, Vienna University of Technology — A Rydberg atom subject to a periodic train of unidirectional electric field pulses, termed half-cycle pulses (HCPs), of duration much less than the classical electron orbital period, is a "kicked" quantum system whose classical counterpart displays "soft" chaos, i.e., a mixture of regular and chaotic dynamics. Poincaré surfaces of section for the kicked atom contain a number of stable islands enclosed by KAM tori that are embedded in a chaotic sea. We show how different dynamical behaviors are observed if an initial state that is transiently localized in phase space is placed in different regions of large islands immediately before the train. If the initial state is localized at the center of the island little evolution of the excited-state distribution is observed during the HCP train. In contrast, placing the initial state in an outer region leads to periodic changes in this distribution that are associated with motion on the KAM tori. This work points to the feasibility of manipulating atomic states by navigating in phase space. Research supported by NSF, DoE, the R. A. Welch Foundation, and the FWF (Austria).

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