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Transferring Rydberg wavepackets between islands across the chaotic sea. SHUHEI YOSHIDA, Vienna University of Technology, C. REINHOLD, Oak Ridge National Laboratory, J. BURGDORFER, Vienna University of Technology, J. MESTAYER, B. WYKER, F.B. DUNNING, Rice University — The classical phase space of periodically driven Rydberg atoms is characterized by a series of stable islands embedded in a chaotic sea. While phase flow between islands that are separated by the chaotic sea is classically forbidden, quantum dynamics allows such transfer by means of "dynamical tunneling". In this work we describe a classical protocol by which a Rydberg wavepacket trapped in a stable period-1 island, whose evolution is synchronized with a periodic sequence of the driving pulses, can be efficiently transferred to a period-2 island such that it evolves with twice the period. This period doubling protocol is analyzed theoretically and demonstrated experimentally. The transfer from a period-1 to a period-2 island is realized using two superposed trains of half-cycle pulses whose relative time delay is varied adiabatically. It is shown that the present protocol provides a tool to manipulate the angle variable of a Rydberg wavepacket while its conjugate principal action is maintained constant. Research supported by the NSF, the Robert A. Welch Foundation, the OBES, U.S. DoE to ORNL, and by the FWF (Austria).

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