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Control and Manipulation of Atomic Wavepackets By Dynamical Stabilization[1] W. ZHAO, J.J. MESTAYER, J.C. LANCASTER, F.B. DUNNING, Department of Physics and Astronomy, Rice University, C.O. REINHOLD, Oak Ridge National Laboratory, S. YOSHIDA, J. BURGDORFER, Vienna University of Technology — For a quasi-one-dimensional (quasi-1D) atom subject to a train of kicks directed toward the origin, i.e., the "nucleus", the classical phase space contains large stable islands embedded in a chaotic sea. Atoms whose initial phase points lie within a stable island remain trapped through dynamical stabilization leading to creation of a non-dispersive wavepacket that undergoes strong transient phase-space localization. The positions of the stable islands depend on the frequency and strength of the kicks. Thus, once a wavepacket is localized, it can be steered toward different regions of phase space by "chirping" the frequency and/or amplitude of the HCPs. Strong transient phase space localization can also be obtained in quasi-1D atoms by application of a single HCP. We demonstrate that this transient localization can be maintained for extended periods by taking advantage of dynamical stabilization if, at the time of initial optimal localization, the wavepacket is placed at the center of a stable island associated with a subsequently-applied HCP train. This technique allows a larger fraction of the initial atoms to be trapped within an island.

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