Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Quantum ratchets, the orbital Josephson effect, and chaos in Bose-Einstein condensates[1] LINCOLN D. CARR, Colorado School of Mines, MARTIN HEIMSOTH, CHARLES E. CREFFIELD, FERNANDO SOLS, Complutense University, Madrid — In a system of ac-driven condensed bosons we study a new type of Josephson effect occurring between states sharing the same region of space and the same internal atom structure. We first develop a technique to calculate the long-time dynamics of a driven interacting many-body system. For resonant frequencies, this dynamics can be shown to derive from an effective time-independent Hamiltonian which is expressed in terms of standard creation and annihilation operators. Within the subspace of resonant states, and if the undriven states are plane waves, a locally repulsive interaction between bosons translates into an effective attraction. We apply the method to study the effect of interactions on the coherent ratchet current of an asymmetrically driven boson system. We find a wealth of dynamical regimes which includes Rabi oscillations, self-trapping and chaotic behavior. In the latter case, a full quantum many-body calculation deviates from the mean-field results by predicting large quantum fluctuations of the relative particle number. Moreover, we find that chaos and entanglement, as defined by a variety of widely used and accepted measures, are overlapping but distinct notions.

[1]Funded by Spanish MINECO, the Ramon y Cajal program (CEC), the Comunidad de Madrid through Grant Microseres, the Heidelberg Center for Quantum Dynamics, and the NSF.

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Date submitted: 15 Nov 2013 Electronic form version 1.4