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Complex Dynamics in Systems of Interacting Bosons MORITZ HILLER, MPI for Dynamics and Self-Organization, Goettingen-Germany and Fakultaet fuer Physik, University of Goettingen, JOSHUA BODYFELT, Department of Physics, Wesleyan University, Middletown CT-USA, TSAMPIKOS KOTTOS, Department of Physics, Wesleyan University, Middletown CT-USA and MPI for Dynamics and Self-Organization, Goettingen-Germany , THEO GEISEL, MPI for Dynamics and Self-Organization, Goettingen-Germany and Fakultaet fuer Physik, University of Goettingen — We consider interacting bosons described by a Bose-Hubbard Hamiltonian (BHH) and analyze the evolving energy distribution as an experimentally controllable parameter, the coupling strength k between neighboring sites, is changed. Three driving schemes of k are considered: (a) the sudden limit (LDoS analysis), (b) the one-pulse scheme (wavepacket dynamics), and (c) the time-reversal scheme (fidelity). We find in all cases two distinct regimes: the Linear Response (LRT) regime where we can trust the Fermi-Golden-Rule picture, and what we call the non-perturbative regime where the perturbation k is quantum mechanically large. In the former regime, the evolving distribution can be described by an improved Random Matrix Theory (RMT) which takes into accont the structured energy landscape of the perturbation. Instead, in the latter regime, non-universal features of the underlying classical dynamics dictate the energy spreading thus leading to a clash with the predictions of RMT.

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