Prethermalization and wave condensation in a nonlinear disordered Floquet system

Prosenjit Haldar[a], Sen Mu[b], Bertrand Georgeot[a], Jiangbin Gong[b], Christian Miniatura[c], Gabriel Lemarié[a]

a *Laboratoire de Physique Théorique · IRSAMC Université Toulouse III, France*
b Department of Physics, National University of Singapore
c *Laboratoire de Physique de Nice, Université Côte D'Azur, CNRS, France*

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Periodically-driven quantum systems make it possible to reach stationary states with new emerging properties. However, this process is notoriously difficult in the presence of interactions because continuous energy exchanges generally boil the system to an infinite temperature featureless state. Here, we describe how to reach nontrivial states in a periodically-kicked Gross-Pitaevskii disordered system. One ingredient is crucial: both disorder and kick strengths should be weak enough to induce sufficiently narrow and well-separated Floquet bands. In this case, inter-band heating processes are strongly suppressed and the system can reach an exponentially long-lived prethermal plateau described by the Rayleigh-Jeans distribution. Saliently, the system can even undergo a wave condensation process when its initial state has a sufficiently low total quasi-energy. These predictions could be tested in nonlinear optical experiments or with ultracold atoms.