Thermal phase and many-body parametric resonances in driven interacting one-dimensional systems

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In the context of non-equilibrium physics the stability of periodically-driven many-body systems is the subject of several recent studies. As an example, we consider a periodically-driven sine-Gordon model. By performing a high-frequency expansion, we show the emergence of a sharp "parametric resonance", separating the absorbing from the non-absorbing regimes. This transition survives in the thermodynamic limit and leads to a non-analytic behavior of the physical observables. We then investigate the mode-resolved energy absorption of the slowly driven sine-Gordon model in the presence of a modulated tunnel coupling, obtained by quantizing the Hamiltonian for a chain of driven pendula. For weak driving amplitude, we find an exponentially fast energy absorption in the main resonant mode on short timescale. At later times, the highly excited main resonance provides effective resonant driving terms for its higher harmonics through the nonlinearities in the Hamiltonian. These results could be probed in systems of tunnel coupled parallel one-dimensional quasicondensates.

[1] I. Lovas *et al.*, *Many-body parametric resonances in the driven sine-Gordon model*, Physical Review B **106**, 075426 (2022).

[2] R. Citro *et al.*, *Dynamical stability of a many-body Kapitza pendulum*, Annals of Physics **360**, 694 (2015).