Quantitative Rates of Convergence to Non-Equilibrium Steady States for the chain of oscillators

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A long-standing open problem in the study of out-of-equilibrium systems in statistical mechanics is the validity of Fourier's law. In this talk we will present a family of models, the atom chains, introduced for this purpose, i.e. to describe properly heat diffusion. The model we will focus on is the so-called chain of oscillators coupled at its boundaries to heat baths at different temperatures. We will present new results on the exponential convergence to the non-equilibrium steady state in several distances with explicit rates of convergence in terms of the number of particles for 1-dimensional weakly anharmonic homogeneous oscillator chains. We will also present sharp estimates on the spectral gap for harmonic homogeneous, with an impurity, or disordered oscillator chains in all dimensions. Some of the results are in collaboration with Simon Becker [2, 1].

[1] S. Becker, A. Menegaki. *The optimal spectral gap for regular and disordered harmonic networks of oscillators.* Arxiv.org/abs/1909.12241.

[2] A. Menegaki. *Quantitative Rates of Convergence to Non-equilibrium Steady State for a Weakly Anharmonic Chain of Oscillators.* J. Stat. Phys., **181(1)**, 53–94, 2020. doi :10.1007/s10955-020-02565-5.

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