Thermalization of weakly non-integrable Josephson junction networks

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Statistical mechanics (SM) is, in many ways, considerably more general than either classical or quantum mechanics: as long as one knows how to write a partition function, the statistical formalism can be applied. A cornerstone assumption for such generality is the ergodic hypothesis, which allows us to average over ensembles of similarly prepared systems rather than time. This is definitely not true for integrable systems, in which motion is always confined to lower-dimensional submanifolds and, therefore, thermalization is never achieved. It is then natural to wonder how thermalization is suppressed as a system approaches an integrable limit: Is integrability reached through an universal mechanism? How long does it take? Does it happen isotropically?

In this talk I will expand on results previously published by our group, namely that there appear to be two main pathways towards integrability, each with markedly distinguishable features. While previous investigations were focused on abstract discrete unitary maps, I will present results obtained for one- and two-dimensional networks of hundred(s) of coupled Josephson junctions. Such a generalization from maps to high-dimensional Hamiltonian systems is quite a formidable computational task, some aspects of which I will also briefly expose in the presentation.