Quantum chaos in many-particle systems

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Abstract:

The semiclassical trace formula connecting traces of quantum evolution operator with periodic orbits of the underlying classical system is the central pillar of the quantum chaos theory. At first sight its applicability seems to be restricted to systems with a small number N of particles. Indeed, the density of energy levels grows exponentially with N and resolving the individual levels becomes neither numerically nor experimentally feasible for a large N.

I will discuss a way to circumvent this problem in a model of kicked spin chains with local interactions. The main tool is an intriguing identity between traces of the unitary evolution operators for time T and traces of (in general) non-unitary matrices whose dimensions depend on T rather then on the size of the chain. Provided T is short, one is capable to evaluate these traces for very large spin chains and extract periodic orbit actions of the corresponding classical systems.

If time allows, I will also discuss the mechanism of correlations between periodic orbits in many particle systems and its implications to many-body quantum chaos.

This is work in progress, but the core of the talk will be based on two papers: J. Phys. A: Math. Theor. 49 (2016) 375101 (with M Akila, D Waltner, T Guhr) and Nonlinearity 29 (2016), 325 (with V. Al. Osipov)