IMPRS Seminar 01 March 2023
4:30 pm at MPI-PKS (hybrid)

Classical and quantum transport in 4D symplectic maps

Speaker: Jonas Stöber, TU Dresden

Abstract: Partial transport barriers in the chaotic sea of Hamiltonian systems restrict classical chaotic transport, as they only allow for a small flux between phase-space regions. In two-dimensional (2D) symplectic maps, the most restrictive partial barriers are based on a cantorus, the remnants of a broken one-dimensional (1D) torus forming a Cantor set. Quantum mechanically for 2d symplectic maps one has a universal transition from impeded to unimpeded transport. The scaling parameter is the ratio of flux to the Planck cell of size h, so quantum transport is suppressed if h is much bigger than the flux while mimicking classical transport if it is much smaller. Whether a transition exists in higher-dimensional systems and how it scales is still an open question and will be answered in this talk.

In a four-dimensional (4D) symplectic map, the cantorus is generalized to a normally hyperbolic invariant manifold (NHIM) with the structure of a cantorus. Using the general flux formula, we consider higher-order periodic NHIMs to approximate the global flux across a partial barrier. One naively expects that the scaling parameter of the universal transition is the same, but now with a Planck cell h squared. We show that due to classical diffusive transport along resonance channels, the quantized system exhibits dynamical localization and the localization length modifies the scaling parameter.