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

Quantum Simulation of Chaos

Speaker: Prof. Peter Schlagheck, Université de Liège, Belgium

Abstract: State-of-the-art platforms for quantum simulations, using photons, trapped ions, ultracold atoms, or superconducting qubits, share the common feature that they are very complex and involve many degrees of freedom. Quite unsurprisingly, pioneering studies with such quantum simulation platforms were therefore focused on obtaining a better understanding of the generic properties of complex quantum many-body systems and their relation with the notions of integrability or chaos. I will address these quantum signatures of chaos in the specific context of ultracold bosonic atoms confined within optical lattices, theoretically described by Bose-Hubbard systems which feature a well-defined classical counterpart. I will specifically focus on deviations from the quantum-classical correspondence in this context, owing to many-body quantum interference effects. Those deviations

can be rather subtle, if induced by the presence of discrete symmetries or time-reversal invariance, or rather important, as exemplified by scars, i.e., eigenstates that are strongly localized in phase space and thereby defy thermalisation despite global chaos.