Speaker: **Sebastian Ludwig DIEHL (University of Cologne, Germany)**

Title **Fermion quantum criticality far from equilibrium**

Driving a quantum system out of equilibrium while preserving its subtle quantum mechanical correlations on large scales presents a major challenge, both fundamentally and for technological applications. At its core, this challenge is pinpointed by the question of how quantum effects can persist at asymptotic scales, analogous to quantum critical points in equilibrium. We construct such a scenario using fermions as building blocks. These fermions undergo an absorbing-to-absorbing state transition between two topologically distinct and quantum-correlated dark states. Starting from a microscopic, interacting Lindbladian, we derive an effective Lindblad-Keldysh field theory in which critical fermions couple to bosonic hydrodynamic fluctuations. A key feature of this field theory is an emergent symmetry that protects the purity of the system's state. We quantitatively characterize the critical point using a leading-order expansion around the upper critical dimension, thereby establishing the first non-equilibrium universality class of fermions. The symmetry protection mechanism, which exhibits parallels to the problem of directed percolation, suggests a pathway toward a broader class of robust, universal quantum phenomena in fermionic systems.