Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

# IRTG-Seminar

## Prof. Francesco Petruccione

University of KwaZulu-Natal, Durban, South Africa

## "Open Quantum Walks"

Open Quantum Walks (OQWs) are discrete time quantum random walks completely driven by dissipation. They were introduced as quantum analogues of classical Markov chains [S. Attal, F. Petruccione, C. Sabot, I. Sinayskiy, J. Stat. Phys. 147 (2012) 832].

OQWs have been shown to be useful for the implementation of quantum algorithms for dissipative quantum computing and quantum state engineering and to model quantum transport in biological systems. The connection between the rich dynamical behavior of OQWs and the corresponding microscopic system-environment models has been established. The microscopic derivation of an OQW as a reduced system [I. Sinayskiy, F. Petruccione, Open Syst. & Inf. Dyn. 20, 1340007 (2013)] allows to explain the dependance of the dynamical behavior of the OQW on the temperature and the coupling to the environment. Recently, a model of open quantum Brownian motion (OQBM) [M. Bauer, D. Bernard, A. Tilloy, Phys. Rev. A 88 (2013) 062340] was introduced as a scaling limit of Open Quantum Walks (OQWs). OQBM is a new type of quantum Brownian motion where the dynamics of the Brownian particle not only depends on the interactions with a thermal environment, but also depends on the state of the internal degrees of freedom of the Brownian particle. It is quite natural to derive both OQWs and OQBM by reduction from a microscopic Hamiltonian for a walker-environment system in a repeated interaction scheme.

**Tuesday, July 25, 2017, 1:00 p.m., HS II,**
**Physics high rise, Hermann-Herder-Str. 3**

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