TECHNISCHE UNIVERSITÄT DRESDEN

Bereich Mathematik und Naturwissenschaften Fachrichtung Physik

PHYSIKALISCHES KOLLOQUIUM

Referent: **apl. Prof. Dr. Maarten Wegewijs**
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Institute for Theory of Statistical Physics

Thema: **Transport through open quantum systems – insights from geometry and quantum-information**

Zeit und Ort: Dienstag, 11.07.2017, 16:40 Uhr
Recknagel-Bau, Hörsaal REC/C213, Haeckelstr. 3

Leiter: Prof. Dr. Carsten Timm

Kurzfassung: I will discuss two recent advances in the description of open quantum systems using density operators focusing on strongly interacting nanostructures.
(1) I will discuss a geometric approach to pumping of various physical quantities in strong nonequilibrium transport situations. In this problem a simple gauge freedom emerges: the possibility of physically recalibrating the meter registering the transported quantity (charge, spin, energy, etc.). Our gauge-invariant formalism leads to a simple expression for the geometric pumping curvature in the weak coupling limit. These suggest a geometric non-equilibrium spectroscopy that complements standard steady-state transport measurements.
(2) I will show how the full perturbative expansion for the time-evolution of an open system can be cast into a form that identifies technical expressions (diagrams, projections, etc.) with physical measurements. This allows us to rigorously implement Kraus' theorem from quantum-information theory on the Keldysh contour of nonequilibrium statistical physics, enabling a novel exchange of ideas and techniques.
An example of practical relevance is that we can give explicit diagrammatic rules for preserving – or improving – the (complete) positivity of the reduced evolution in approximation schemes based on physical principles of measurement. We highlight a nontrivial competition of these rules with the – equally fundamental – constraints imposed by probability normalization. The approach covers any evolution of a system initially not entangled with a reservoir, as we illustrate for the weak-coupling limit – where we recover Gorini-Kossakowski-Sudarshan-Lindblad form – and for explicitly solvable cases with strong coupling for which our more general form is obtained.

Biographie: Maarten Wegewijs obtained his PhD in physics in Delft (2001) and after a postdoc stay in Aachen became a Helmholtz Young Investigator at the Forschungszentrum Jülich (2007-2013), focusing on single-molecule transport. He is presently a researcher at the Forschungszentrum Jülich and apl-Professor at the RWTH Aachen University researching charge, spin and heat transport through nanostructures.