# MP 2: Quanteninformation

Zeit: Dienstag 14:00–15:40 Raum: HS 8

MP 2.1 Di 14:00 HS 8

**The Magic Power of Combining Coherent Control with Switchable Markovian Noise Amplitudes** — •Thomas Schulte-Herbrüggen[1] and Ville Bergholm[2] — [1]Dept. Chem., TU-München — [2]Institute for Scientific Interchange Foundation

Adding bang-bang switchable noise on a single qubit (out of a total of $n$) on top of unitary control seems magic: For amplitude-damping noise (non-unital) this simple add-on suffices for acting transitively on the set of *all* density operators. So one can transform *any initial state* into *any desired target state*. For bit-flip noise (unital), the add-on allows for reaching any target state *majorised* by the initial state [1].

In the Lie-semigroup framework of Markovian open systems, we also show that for *state transfer* our Markovian open-loop scheme [1] is as powerful as measurement-based closed-loop control schemes designed to embrace non-Markovian evolution [2].

We have extended our open-loop optimal control algorithm (dynamo) by incoherent control so that these unprecedented reachable sets can systematically be exploited in experiments [1]. As illustrated for an ion trap experimental setting, open-loop control with noise switching can thus simplify the more complicated measurement-based closed-loop feedback schemes [2,3,4] requiring a resettable ancilla qubit.

[1] V. Bergholm and T. Schulte-Herbrüggen, arXiv/1206.4945 (2012)
[2] S. Lloyd and L. Viola, Phys. Rev. A **65**, 010101 (2001)
[3] J. Barreiro et al., Nature **470**, 486 (2011)
[4] P. Schindler et al., arXiv/1212.2418 (2012)

MP 2.2 Di 14:25 HS 8

**The geometry of tensor network states** — •Tobias Osborne[1], Jutho Haegeman[2], Michaël Mariën[3], and Frank Verstraete[2] — [1]Institute of Theoretical Physics, Leibniz Universität Hannover, Germany — [2]Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Austria — [3]Faculty of Physics and Astronomy, University of Ghent, Belgium

We study the geometric properties of the manifold of states described as tensor network states (TNS). Due to parameter redundancies TNS often have the mathematical structure of a (principal) fiber bundle. The total space or bundle space corresponds to the parameter space, i.e., the space of tensors associated to every physical site. The base manifold is embedded in Hilbert space and can be given the structure of a Kähler manifold by inducing the Hilbert space metric. Our main interest is in the states living in the tangent space to the base manifold, which have recently been shown to be interesting in relation to variational methods for time dependence and elementary excitations.

MP 2.3 Di 14:50 HS 8

**On the Differential Geometry of Fixpoint Engineering in Markovian Open Quantum Systems** — •Corey O'Meara[1], Gunther Dirr[2], and Thomas Schulte-Herbrüggen[1] — [1]Dept. Chem., TU-München — [2]Inst. Math., University of Würzburg

In quantum memories and practical quantum control, recent focus has been on steering the open quantum system into desired fixed points.

Here we give a complete account of Lie semigroups (of controlled Markovian quantum systems) and their fixpoint sets in terms of their Lindbladian generators in the corresponding Lie wedge. For $n$-qubit systems, we parameterise *all* Lindblad generators sharing a desired fixed point. We also give a constructive overview how to make this fixed point unique. Building upon our classification thus facilitates to choose the simplest Markovian experimental implementation to arrive at any desired fixed point.

MP 2.4 Di 15:15 HS 8

**Lie-theoretic results in (unitary) Quantum Control Theory** — •Zoltán Zimborás[1,2], Robert Zeier[3], Michael Keyl[2], and Thomas Schulte-Herbrüggen[3] — [1]Department of Theoretical Physics, University of the Basque Country UPV/EHU, Bilbao, Spain — [2]Institute for Scientific Interchange Foundation, Torino, Italy — [3]Department of Chemistry, Technical University of Munich (TUM), Garching, Germany

We shortly review the Lie-theoretic framework of quantum control theory. In particular, conditions for full controllability and pure state reachability both in the presence and in the absence of symmetries are discussed. Finally, we mention concrete applications concerning translation-invariant and fermionic systems.

[1] Zoltán Zimborás, Robert Zeier, Michael Keyl, Thomas Schulte-Herbrüggen, *A Dynamic Systems Approach to Fermions and Their Relation to Spins*, arXiv:1211.2226