MP 17: Quanteninformation II

Zeit: Donnerstag 15:00–15:50 Raum: ZHG 003

MP 17.1 Do 15:00 ZHG 003

Mathematical Quantum Systems Theory for Engineers: Theory and Applications with a Focus on Fermions — •Thomas Schulte-Herbrüggen[1], Robert Zeier[1], Zoltan Zimboras[2], and Michael Keyl[2] — [1]TU-Munich, Dept. Chem. — [2]ISI Torino, Italy

The dynamic properties of closed (or open) quantum systems is presented in a unified way via dynamic system Lie algebras (or Lie wedges).

For the quantum engineer, these algebras (or cones) encapsulate all directions a quantum system can be steered along. This is of central importance in quantum simulation and implementation of quantum information processing. We give a number of examples including systems of spins, bosons, and in particular fermions building on [1].

Applications to controllability, reachability, and observability are given. Relations to generalising notions in the mathematical field of C-numerical ranges are pointed out, which go beyond [2, 3].

References:

[1] R. Zeier and T. Schulte-Herbrüggen, J. Math. Phys. 52 (2011) 113510 [doi:10.1063/1.3657939]

[2] T. Schulte-Herbrüggen, S. Glaser, G. Dirr, and U. Helmke, Rev. Math. Phys. 22 (2010) 597–667 [doi:10.1142/S0129055X10004053]

[3] T. Schulte-Herbrüggen et al., Lin. Multilin. Alg. 56 (2008) 3–26 [doi:10.1080/03081080701544114]

MP 17.2 Do 15:25 ZHG 003

Undecidability as a genuine quantum property — Jens Eisert[1], Markus P. Müller[2], and •Christian Gogolin[1] — [1]Dahlem Center for Complex Quantum Systems, Freie Universität Berlin, 14195 Berlin, Germany — [2]Perimeter Institute for Theoretical Physics, 31 Caroline Street North, Waterloo, ON N2L 2Y5, Canada

A famous result by Alan Turing dating back to 1936 is that a general algorithm solving the halting problem on a Turing machine for all possible inputs and programs cannot exist - the halting problem is undecidable. In this talk it will be shown that surprisingly simple problems in quantum mechanics can be undecidable in this sense, even if the corresponding classical problem is decidable. Undecidability appears here as a genuine quantum property. This gives a new twist to quantum complexity theory, which has up to now mostly been concerned with quantitative separations between quantum and classical physics in terms of hardness.