MP 1: Quanten- Information, Komplexität

Zeit: Montag 17:15–18:35 Raum: M010

MP 1.1 Mo 17:15 M010

Tensor norms of operator systems and Tsirelson's problem — •Volkher Scholz and Reinhard F. Werner — Technical University of Braunschweig

We discuss some possible ambiguities in the definition of "correlations produced by quantum systems", which were noted by Acin [M. Navascues, S. Pironio and A. Acin, *Bounding the set of quantum correlations*, Phys. Rev. Lett 98, 010401 (2007)] and formulated in a sharp way by Tsirelson [B.S. Tsirelson, *Bell inequalities and operator algebras*, Problem 33 on the Braunschweig list, http://www.imaph.tu-bs.de/qi/problems/33.html]. The issue is the notion of "subsystem", or the kind of independence postulated between two observers Alice and Bob. If we just assume that all of Alice's observables commute with all of Bob's, we might get some larger set of correlations than if we assume in addition that these commuting observables act on different tensor factors in a tensor product decomposition of the underlying Hilbert space.

Tsirelson showed already that if the ambient Hilbert space is finite dimensional, this distinction is irrelevant. The problem of Tsirelson is to decide the question in case of arbitrary Hilbert spaces and observable algebras. We show here that the problem is equivalent to the question whether all quantum correlations can be approximated by correlations between finite dimensional systems. Although we do not offer a solution, we do link the problem to issues well-known in the theory of C*-algebras, von Neumann algebras and operator systems.

MP 1.2 Mo 17:35 M010

The algebra of Grassmann canonical anti-commutation relations and its application to fermionic systems — •Dirk-Michael Schlingemann, Michael Keyl, and Lorenzo Campos Venuti — ISI Foundation Torino, Quantum information group

The basic constituents of the matter that surrounds us in daily life are fermions. Therefore it is needless to say that theoretical investigation of fermion systems play an essential role in almost all areas of quantum physics. A particular class of states of fermion systems are quasi-free states. On one hand, this class of states can be treated analytically even for very large systems, on the other hand, these states are complex enough to describe ground states of interacting spin chain systems.

We present an approach to non-commutative phase space which allows to analyze quasi-free states on the CAR algebra in analogy to quasi-free states on the CCR algebra. The used mathematical tools are based on the Grassmann algebra of canonical anti-commutation relations (GAR algebra) which is given by the twisted tensor product of a Grassmann and a CAR algebra.

As a new application, the corresponding theory provides an elegant tool for calculating the fidelity of two quasi-free fermionic states which is needed for the study of entanglement distillation within fermionic systems.

MP 1.3 Mo 17:55 M010

Invariant states of Clifford Quantum Cellular Automata — •Zoltán Zimborás[1], Johannes Gütschow[2], Sonja Uphoff[2], and Reinhard Werner[2] — [1]Institut für Theoretische Physik, Universität des Saarlandes, Campus 1, 66041 Saarbrücken, Germany — [2]Institut für Mathematische Physik, Technische Universität Braunschweig, Mendelssohnstrasse 3, 38106 Braunschweig, Germany

Clifford Quantum Cellular Automata (CQCA) are a special kind of Quantum Cellular Automata for which the so-called Clifford condition ("products of Pauli matrices are mapped to products of Pauli matrices") is satisfied. In this talk we show how one can construct different (product, stabilizer, finitely correlated, quasifree) states that are invariant with respect to a given CQCA action. The possible convergence of non-invariant states to invariant ones under a CQCA action is also discussed. The similarities and differences between CQCA time-evolutions and time-evolutions generated by Hamiltonians (and the differences in the structure of invariant states) are shown by examples. Finally, applications in quantum information theory are outlined.

MP 1.4 Mo 18:15 M010

Outliers of exponentiated power-law variates could determine entire subjective histories — •Lutz Polley — Institut für Physik, Universität Oldenburg, 26111 Oldenburg

In the many-worlds view of an observer's physical evolution, I argue that the dimension of a cognitive Hilbert space, at the ends of decoherent branches, should be distributed like a power-law variate exponentiated. Order statistics of extreme and next-to-extreme values then implies that most of the dimension is located in a single branch.