SYQE 2: Quantum Correlations Beyond Entanglement II

Time: Tuesday 16:30–18:30   Location: Kinosaal

Invited Talk   SYQE 2.1   Tue 16:30   Kinosaal
The arrow of time and correlations in quantum physics —
•Vlatko Vedral — University of Oxford — National University of
Singapore

We discuss the arrow of time in terms of the increase of correlations
between the system and its environment. Here we show that the ex-
istence of the arrow of time, based on deleting correlations, requires a
strict absence of initial correlation between the system and the environ-
ment. We discuss our work in relation to other approaches addressing
the same problem of entropy increase and emphasize similarities and
differences. In particular, we comment on the link between initial cor-
relations between the system and the environment and the resulting
non complete positivity of the reduced state evolution.

Invited Talk   SYQE 2.2   Tue 17:00   Kinosaal
Quantum correlations on indefinite causal structures —
•Caslav Brukner — Faculty of Physics, University of Vienna, Austria
— Institute for Quantum Optics and Quantum Infromation, Austrian
Academy of Sciences, Austria

In quantum physics it is standardly assumed that the background time
or definite causal structure exists such that every operation is either in
the future, in the past or space-like separated from any other operation.
I will present a framework that assumes that operations in local labo-
ratories are described by quantum theory (i.e. are completely-positive
maps), but where no reference is made to any causal relations between
the operations in the laboratories. Remarkably, the framework allows
for correlations that are not causally ordered (i.e. one cannot say that
one operations is before or after the other), as demonstrated by the
violation of "causal inequality". I will show that the violation of the
inequality is upper bounded by a bound (analogous to the "Tsirelson's
bound") that is lower than what is algebraically possible and discuss
interferometric experiments involving "superpositions of quantum cir-
cuits with definite causal structures".

Invited Talk   SYQE 2.3   Tue 17:30   Kinosaal

**Zero-error classical channel capacity and simulation cost as-
sisted by quantum non-signalling correlations** — •Andreas
Winter — Universitat Autonoma de Barcelona

We describe quantum non-signalling correlations as two-input and two-
output completely positive and trace preserving maps with linear con-
straints determining non-signalling. We then study the one-shot zero-
error classical capacity of a quantum channel assisted by quantum non-
signalling correlations, and the reverse problem of simulation. Both
lead to simple semidefinite programmings (SDPs) whose solutions can
be given in terms of the conditional min-entropies and depend only
on the Kraus operator space of the channel. In particular, we show
that the asymptotic zero-error classical simulation cost is precisely the
conditional min-entropy of the Choi-Jamiolkowski matrix of the given
channel. The asymptotic zero-error classical capacity is given by the
regularization of a sequence of SDPs, and generally has no simple form.
Interestingly, for the class of classical-quantum channels, we show that
the asymptotic capacity is reduced to the solution of a rather simple
SDP, which coincides with a quantum version of the fractional packing
number suggested by Aram Harrow. This further gives an operational
interpretation of the celebrated Lovasz number of a classical graph
as the zero-error classical capacity of the graph assisted by quantum
non-signalling correlations.

Invited Talk   SYQE 2.4   Tue 18:00   Kinosaal
The quantum marginal problem — •Matthias Christandl —
ETH Zurich

Given a set of local density matrices, are they compatible? That is,
could they arise from a joint global state? This question is known as
the quantum marginal problem and is of importance in many aspects
of quantum theory ranging from quantum chemistry (here known as
the N-representability problem) to quantum information theory. In
this talk, I will give an overview over recent progress on this problem
and highlight some unexpected relations of this problem to the repre-
sentation theory of the symmetric group and of Lie groups as well as
the P versus NP conjecture of computational complexity.