Contribution ID: **25** Type: **not specified**

Reduced Quantum Dynamics from Observables

Friday, 31 May 2019 10:00 (15 minutes)

When they can be defined, reduced density matrices provide a powerful tool for determining the entanglement structure, approximate dynamics, and potential classical behavior of a portion of a quantum system. It is straightforward to generate a reduced density matrix by tracing out a portion of the full density matrix of a (pure or mixed) quantum state of the full system, but many natural reductions cannot be arrived at by this method. We investigate reductions which are specified by a discrete set of observables which do not span the full algebra of observables on the Hilbert space. Such a set need not be mutually commuting or even a subalgebra. For example, the set might represent a discrete set of measurements which could be classically implemented by an experimenter. We provide an algorithm for passing from a full state and a set of observables to a reduced density matrix which preserves the expectation values of observables in the set. Formally, we embed the space spanned by the observables in the set into the space of linear operators on a different, auxilliary Hilbert space in such a way that the projection of the original state onto the space is itself a bona fide reduced density matrix. This embedding is nontrivial and the methods we use to accomplish it are novel. One special case of the reduction procedure yields an explicit construction of the block decomposition of a Hilbert space with respect to a von Neumann algebra. Another special case classifies collective observables into irreducible representations of the permutation group. We adapt the methods of the decoherence program to investigate under what circumstances coarse-grained states can be described as classical. Our results have relevance for quantum error correction, bulk reconstruction in holography, and quantum gravity.

Primary authors: SINGH, Ashmeet (California Institute of Technology); Dr POLLACK, Jason (University of British Columbia); KABERNIK, Oleg (University of British Columbia)

Presenter: Dr POLLACK, Jason (University of British Columbia)

Session Classification: Talks