UNIVERSITÀ DI TRENTO
Dipartimento di Fisica

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Room A221, Povo 1
BEC Seminar: Copying Quantum Channels

Abstract

A famous no-go result in quantum theory is that arbitrary states cannot be copied. Although some form of copying for quantum states can be achieved for a restricted set of states (such as those that lie on the equator of the Bloch sphere), or if we relax the requirement for a deterministic, or error free copying protocol. Unlike states, cloning of unitary quantum gates is possible. Moreover such a protocol is deterministic and with asymptotically vanishing error in the number of input gates.

In this work we ask whether it is possible to clone the most general quantum operations allowed in quantum theory, those that correspond to quantum channels. We consider a specialised version of cloning known as super-replication, whereby one is given access to N copies of the channel and is asked to produce M>N copies of it. We show that for a special class of channels, corresponding to spontaneous emission and/or absorption, super-replication is impossible and we establish both upper and lower bounds on the number M of possible copies that one can in principle produce. Our approach also yields a protocol for losslessly compressing such dynamics into a smaller register which is of relevance in quantum simulation.

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