

- **Where and when can a qubit be?**

Patrick Hayden (McGill University)

One of the most important properties of quantum information is that it cannot be copied. That statement, however, is not completely accurate. While the no-cloning theorem of quantum mechanics prevents quantum information from being copied in space, the reversibility of microscopic physics actually requires that the information be copied in time. In spacetime as a whole, therefore, quantum information is widely replicated but in a restricted fashion. In this talk, I will fully characterize which regions of spacetime can all hold the same quantum information. Because quantum information can be delocalized through quantum error correction and teleportation, it need not follow well-defined trajectories. Instead, replication of the information in any configuration of spacetime regions not leading to obvious violations of causality or the no-cloning principle is allowed. This provides a simple and complete description of where and when a qubit can be located in spacetime, revealing a remarkable variety of possibilities.