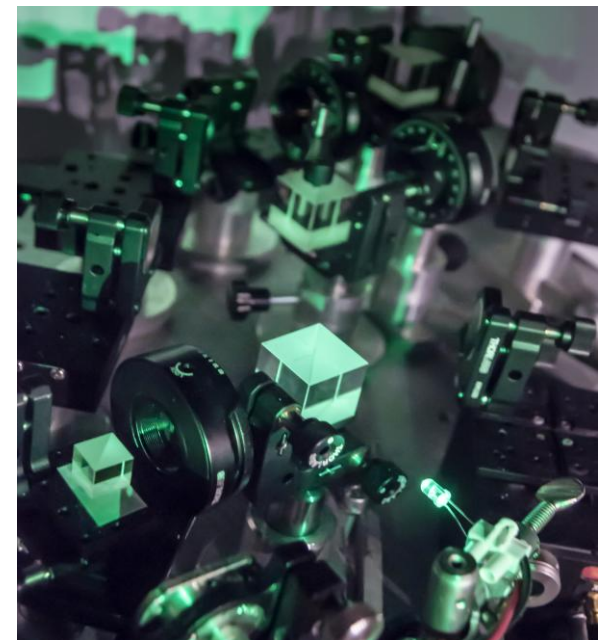# Q@TN Colloquium

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University of Cambridge

Zero-error communication under discrete-time Markovian dynamics

September 26, 2025 – h 14:30

Aula A205 – Povo 1 – Via Sommarive n. 5

Abstract:

Consider a quantum memory modelled by an open quantum system with (discrete-time) Markovian dynamics. Our task is to store information in it in such a way that it can be retrieved perfectly, even after the system is left to evolve for an arbitrarily long time. We show that this is impossible for classical (resp. quantum) information precisely when the dynamics is mixing (resp. asymptotically entanglement breaking). Furthermore, we provide tight universal upper bounds on the minimum time after which any such dynamics 'scrambles' the encoded information beyond the point of perfect retrieval. On the other hand, for dynamics that are not of these kinds, we show that information must be encoded inside the peripheral space associated with the dynamics in order for it to be perfectly recoverable at any time in the future. This allows us to derive explicit formulas for the maximum amount of information that can be stored perfectly in the quantum memory. The case of small but non-zero probability of error in retrieving the encoded information is also considered. This is based on joint work with Satvik Singh.

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