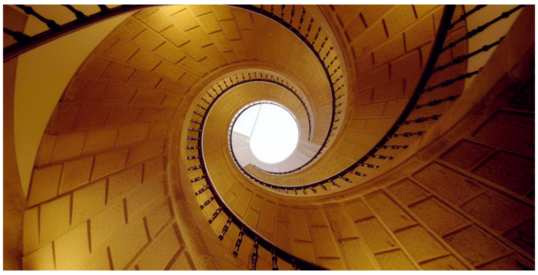

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Benchmarking the Role of Particle Statistics in Quantum Reser- voir Computing

Quantum reservoir computing is a neuro-inspired machine learning approach harnessing the rich dynamics of quantum systems to solve temporal tasks. It has gathered attention for its suitability for NISQ devices, for easy and fast trainability, and for potential quantum advantage. Although several types of systems have been proposed as quantum reservoirs, differences arising from particle statistics have not been established yet. In this work, we assess and compare the ability of bosons, fermions, and qubits to store information from past inputs by measuring linear and nonlinear memory capacity. While, in general, the performance of the system improves with the Hilbert space size, we show that also the information spreading capability is a key factor. For the simplest reservoir Hamiltonian choice, and for each boson limited to at most one excitation, fermions provide the best reservoir due to their intrinsic nonlocal properties. On the other hand, a tailored input injection strategy allows the exploitation of the abundance of degrees of freedom of the Hilbert space for bosonic quantum reservoir computing and enhances the computational power compared to both qubits and fermions.

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