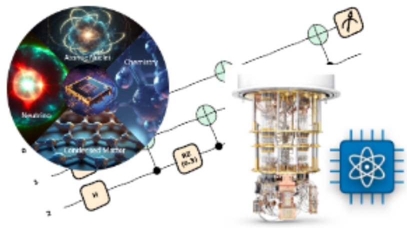

Contribution ID: **59** Type: **Contributed Talk (25 min including questions)**

Measurement of the Lindbladian of quantum computers with randomised Pauli measurements

Thursday, November 20, 2025 2:30 PM (25 minutes)

In the work, we propose a scalable Lindbladian measurement protocol for quantum computers. We will show both numerical and experimental results on systems of 10 and 51 1D chains of trapped ions, subject to XY power law interactions.

A generic characterization protocol for the Lindbladian, i.e. one that does not rely on strong assumptions about its form, is crucial in quantum computing and simulation platforms to certify the generated data.
To overcome the task's complexity, we prepare the qubits in a random Pauli state [1], time-evolve under a Lindbladian (Hamiltonian and additional
dissipation), and measure in a random Pauli basis. We repeat the experiment multiples times, for various random configurations (set of initial states and measurement basis) and evolution times.
Using the randomness of the data [2], we reconstruct the time evolution of Pauli observables, $\langle O\rangle(t) = \mathrm{tr}[\rho O(t)]$, where ρ is a product of Pauli states [1]. We then extract the derivatives at t = 0 via polynomial interpolation.
By choosing particular states ρ, we can isolate a few parameters in the Lindbladian and construct a small linear system of equations to determine them. Following the "Divide and Conquer"algorithmic ideas, we learn the full Lindbladian parts by parts, which makes the protocol scalable with the system size.

Ref:
[1] Efficient and robust estimation of many-qubit Hamiltonians, Daniel Stilck França, 2024
Nature Communications https://doi.org/10.1038/s41467-023-44012-5

[2] Elben, A., Flammia, S.T., Huang, HY. et al. The randomized measurement toolbox. Nat Rev Phys 5, 9–24 (2023). https://doi.org/10.1038/s42254-022-00535-2

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