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Università di Pisa

Seminar Series on Quantum Computing

Dynamic Cooling of Qubits on Contemporary Quantum Computers

Lindsay Bassman Oftelie

NEST – CNR Pisa

Abstract:

Quantum computers require qubits to be initialized in a pure (i.e., cold) state for successful computation. Dynamic cooling offers a route to effectively lower qubit temperatures beyond what is possible with direct, physical cooling techniques. It works by cooling a subset of qubits, at the expense of heating others, by applying certain logic gates to the entire system. While it was initially dismissed as impractical for the high-temperature NMR-based quantum computers available at the time of its inception, we show how dynamic cooling is substantially more effective and efficient on the low-temperature quantum computers available today. In this talk, we will examine how optimal dynamic cooling scales with total system size, in terms of the minimal achievable final temperature, the work cost, and the complexity of the associated quantum circuits. We will observe the effect of hardware noise on cooling and we will propose a sub-optimal dynamic cooling scheme with fixed (low) complexity to improve the feasibility of implementation on noisy quantum hardware.

Venue: **Sala Polifunzionale, Ed. C, Polo Fibonacci (Dip. Informatica)**
Time: **Monday, 22/04/2024, 14:00**

Piano Nazionale di Ripresa e Resilienza (PNRR)
MISSIONE 4 COMPONENTE 2, INVESTIMENTO N. 1.4
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