
SEMINAR: Continuous operation of a coherent 3,000-qubit system

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15:00 to 16:00

Seminar Room

Arrays of neutral atoms have emerged as a powerful platform for quantum computing. One limitation to achieving deep circuit depths is atom loss occurring during gate operations and collisions with the background molecules in a vacuum. In this talk, I will present a new experimental architecture where this atom loss can be compensated by continuously reloading fresh atoms into the atomic array. Our architecture employs a pair of optical conveyor belts that transport dense atomic reservoirs, initially prepared in a first vacuum chamber, into a second chamber where they are positioned near the quantum processor. Importantly, loading new atoms from the reservoir is non-destructive to the quantum state of the nearby array, enabling deep circuits through mid-circuit atom replacement in future experiments. Demonstrating a reloading rate of 300,000 atoms in tweezers per second, we create over 30,000 initialized qubits per second, which we leverage to assemble and maintain an array of over 3,000 atoms for more than two hours.

At the end of the talk, I will focus on molecular physics emerging from long-range Rydberg interactions. I will summarize studies of so-called Rydberg macrodimers using quantum gas microscopy and briefly discuss new insights into the interaction blockade between pairs of macrodimers, which can be understood through the Rydberg interactions among all four participating Rydberg atoms.

Hosted by: Prof. Dr. Leticia Tarruell