Colloquium

Dual-Species Atom Array Quantum Processors and Quantum Networks

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Reconfigurable arrays of neutral atoms have emerged as a leading platform for quantum science. Their excellent coherence properties combined with programmable Rydberg interactions have led to intriguing observations such as quantum phase transitions, the discovery of quantum many-body scars, and novel quantum computing architectures. Here, I am introducing a dual-species Rydberg array that naturally lends itself for measurement-based protocols [1] such as quantum error correction, long-range entangled state preparation, and measurement-altered many-body dynamics. Furthermore, Rydberg interactions between the two species then lead to novel regimes, including greatly enhanced resonant dipole interactions, that we use to demonstrate a two-qubit gate and quantum non-demolition readout [2]. I will present our current experiments on implementing quantum cellular automata in a dual-species array. Cellular automata are famous for producing complex behavior as well as universal computation based on simple initial states and update rules. Here we investigate this paradigm by implementing an update rule based on dual species Rydberg blockade and periodic driving. [1] Singh, Bradley, Anand, Ramesh, White, Bernien, Science 380, 1265 (2023).[2] Anand, Bradley, White, Ramesh, Singh, Bernien, Nature Physics 20, 1744 (2024).

Tuesday, June 2, 2026 11:00am - 12:00pm
Office Bldg West / Ground floor / Heinzel Seminar Room (I21.EG.101)

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