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Experimental Quantum Simulations of Nuclear and High Energy Phenomena

Tuesday, January 13, 2026 2:30 PM (45 minutes)

I will present recent experiments that simulate several phenomena in nuclear and high-energy physics. This includes of meson scattering [1], string-breaking [2], bubble nucleation across a quantum phase transition [3], and the programming of HaPPY codes related to AdS/CFT holographic duality. These simulations exploit the platform of trapped atomic ions, featuring qubits (spins) with essentially infinite idle coherence times and the highest purity quantum gate operations. Such atomic clock qubits are controlled with laser beams, allowing densely-connected and reconfigurable universal gate sets. In the future, such simulations will rely on scaling to much larger systems, involving concrete architectural paths, from shuttling ions between QPU cores to modular photonic interconnects between multiple QPUs. More broadly, I will summarize the state-of-the-art in ion trap quantum computers in both academic and industrial settings, for both scientific and commercial applications.

[1] E. R. Bennewitz, et al., Quantum 9, 1773 (2025).
[2] A. De, et al., arXiv:2410.13815 (2024).
[3] D. Luo, et al., arXiv:2505.09607 (2025).

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