Colloquium

Bosonic error-correction codes with trapped ions

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Host: Julian Léonard

Abstract: The development of useful quantum computers will rely on the ability to suppress errors which occur both naturally and through the erroneous application of gate operations. Error-correction typically comes with significant resource overheads, which motivates the search for implementations which can naturally provide error correction in a compact manner. One approach is to use bosonic degrees of freedom to encode information redundantly, allowing to perform feedback which suppresses errors. I will describe two sets of experiments in which we perform operations and bosonic error correction using mechanical oscillations of a single trapped ion. In the first, we demonstrate the entanglement and subsequent error-correction of logical qubits encoded using superposed displaced squeezed states forming periodic structures in phase space. This “GKP” encoding is particularly well suited to diffusive errors in the oscillator phase space. Then, using a novel non-linear regime of control, I will show how we realize non-linear reservoir engineering to perform confinement of states into finite-dimensional subspaces which have discrete rotational symmetry, and which protect from dephasing errors. Alongside coverage of the state-of-the-art, I will provide perspectives as to how these approaches could be embedded in larger systems.”

Tuesday, May 19, 2026 11:00am - 12:00pm
Office Bldg West / Ground floor / Heinzel Seminar Room (I21.EG.101)

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