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Confinement and symmetries in 1D Ising models on a Rydberg atom simulator

The one-dimensional Ising model, despite its simplicity, exhibits remarkable and exotic physical phenomena, including confinement physics and an emergent E8 symmetry at the critical point. Confinement effects on the non-equilibrium dynamics of quasi-particles have been explored in quantum simulators utilizing both trapped ions and superconducting qubits, while E8 symmetry has been observed in scattering experiments on CoNb_2O_6 . In this work, we present the first quantum simulations of the E8 symmetry using a Rydberg atom platform. Additionally, we emphasize the versatility of this platform, particularly the flexibility of atomic registers, by investigating the quasi-one-dimensional Ising ladder. This extended model exhibits confinement dynamics with both inter- and intra-chain mesons. We demonstrate that this phenomena is experimentally accessible on Rydberg platforms and present preliminary results supporting these findings.

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Short summary

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