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Low-energy states in a chain of inductively coupled Josephson junctions HENDRIK MEIER, RICHARD T. BRIERLEY, ANGELA KOU, STEVEN M. GIRVIN, LEONID I. GLAZMAN, Yale University — We investigate a long chain of inductively coupled Josephson junctions penetrated by an external magnetic field. In the limit of infinite junction capacitances, we determine the classical ground state and find that the competition between Josephson and inductive forces leads to a rich phase phase diagram as a function of magnetic flux per plaquette ϕ_e and the ratio $\ell^2 = E_J/E_L$ of Josephson (E_J) and inductive (E_L) energies. At large ℓ, kinks in the superconducting phase set in as a function of ϕ_e similarly to vortices in type-II superconductors. Upon further increasing ϕ_e, the interplay between kink-kink interaction and pinning on the lattice leads to a Frenkel-Kontorova-type (devil's) staircase of phases distinguished by different rational kink densities. At ϕ_e equal to half a flux quantum, the system bears similarity to a classical Ising antiferromagnet, possibly with a long-ranged exchange. Inclusion of a finite junction capacitances is similar to placing the Ising chain in a transverse magnetic field (the quantum Ising model). Using this similarity, we investigate the quantum dynamics of a chain of fluxonium qubits.

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