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Quantum simulation of magnetic kinks with dipolar lattice gases
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— We propose an effective Ising spin chain constructed with dipolar quantum gases confined in a one-dimensional optical superlattice. Mapping the motional degrees of freedom of a single particle in the lattice onto a pseudo-spin results in effective transverse and longitudinal magnetic fields. This effective Ising spin chain exhibits a quantum phase transition from a paramagnetic to a single-kink phase as the dipolar interaction increases. Particularly in the single-kink phase, a magnetic kink arises in the effective spin chain and behaves as a quasi-particle in a pinning potential exerted by the longitudinal magnetic field. Being realizable with current experimental techniques, this effective Ising chain presents a unique platform for emulating the quantum phase transition as well as the magnetic kink effects in the Ising-spin chain and enriches the toolbox for quantum emulation of spin models by ultracold quantum gases.

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