Tunable Gauge Potentials in Periodically Driven Optical Lattices

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The emulation of gauge fields for ultracold atoms has emerged to a promising field of research in the past years. Recently it has been experimentally demonstrated that periodic driving of a one-dimensional optical lattice can generate fully tunable gauge potentials for neutral atoms. The direct extension of this versatile method to higher dimensional lattice geometries with non-parallel bonds mimics the effect of gauge-invariant staggered magnetic fields.
Here, we report on our latest results obtained in a system of ultracold bosonic atoms on a triangular optical lattice under the influence of a strong staggered field. The field - which induces an Ising symmetry at the maximum flux value of π - is used to control the Z2 symmetry breaking in analogy to a transversal homogeneous magnetic field in the Ising-spin model. We observe a thermally driven Ising-type phase transition from an ordered, ferromagnetic to an unordered, paramagnetic state.