LATTICE 21

JULY 26-30 2021, ZOOM/GATHER@MIT

Quantum simulation of quantum mechanics with a theta-term for a 't Hooft anomaly

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Dimensionally reducing gauge theories like QED or Yang-Mills theory on small spatial tori often yields simple quantum mechanical models that retain some of the interesting structure of the parent gauge theory. 2D electrodynamics with massive charge-N matter, for example, leads to the quantum mechanics of a particle on a circle with a Z_N potential and a theta-term. This model, despite being simple to solve, exhibits the 't Hooft anomaly or global inconsistency of the parent theory, and related phenomena of spontaneous symmetry breaking and instanton-anti-instanton interference. We propose a scheme for realizing the real-time quantum simulation of this model on a synthetic dimension. Similar phenomena in more complicated theories are of great interest and may be studied by quantum simulators in the future.

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