Flux Lattices and Topological Flat Bands in Dipolar Spin Systems

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Topological flat bands provide a fascinating route to the realization of fractional topological insulators and anomalous quantum hall states. Here, we provide the first microscopic description of a physical system, which naturally realizes such bands. In particular, we consider a generic two-dimensional lattice system of tilted, interacting dipoles and demonstrate that such a system harbors single-particle bands with non-trivial topology as well as a quenched kinetic energy relative to the interaction scale. Moreover, we demonstrate that such systems naturally enable uniform arbitrary π/N (for all $N \in \mathbb{Z}$) flux per plaquette, allowing for the realization of a high-field fractional quantum Hall regime where the flux quanta per lattice cell is large. We propose an experimental realization with polar molecules in optical lattices.

References