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Spin-orbit coupling in the kagome lattice with flux and time-reversal symmetry

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We present our work [1] about the topological properties of a spin-orbit coupled tight-binding model with flux on the kagome lattice. It seems experimentally possible to realize the model we investigated, using ultracold atomic gases. The kagome lattice can be realized experimentally by superimposing two optical triangular lattices with different wavelengths [2]. The experimental realization of periodically oscillating on-site energies, i.e., superlattices, is also well established [3]. The results of Ref. [4] seem adaptable to our model for the implementation of the flux and the spin-orbit coupling.
The model we present is time-reversal invariant and realizes a Z2 topological insulator as a result of artificial gauge fields. We develop topological arguments to describe this system showing three inequivalent sites in a unit cell and a flat band in its energy spectrum in addition to the topological dispersive energy bands. We show the stability of the topological phase towards spin-flip processes and different types of on-site potentials. In particular, we also address the situation where on-site energies may differ inside a unit cell. Moreover, a staggered potential on the lattice may realize topological phases for the half-filled situation. Another interesting result is the occurrence of a topological phase for large on-site energies. To describe topological properties of the system we use a numerical approach based on the twisted boundary conditions and we develop a mathematical approach, related to smooth fields.

[1] I. Titvinidze *et al*, Phys. Rev. B 103, 195105 (2021).
[2] G.-B. Jo *et al.*, Phys. Rev. Lett. 108, 045305 (2012).
[3] F. Gerbier and J. Dalibard, New J. Phys. 12, 033007 (2010).
[4] N. Goldman, *et al.*, Phys. Rev. Lett. 105, 255302 (2010).

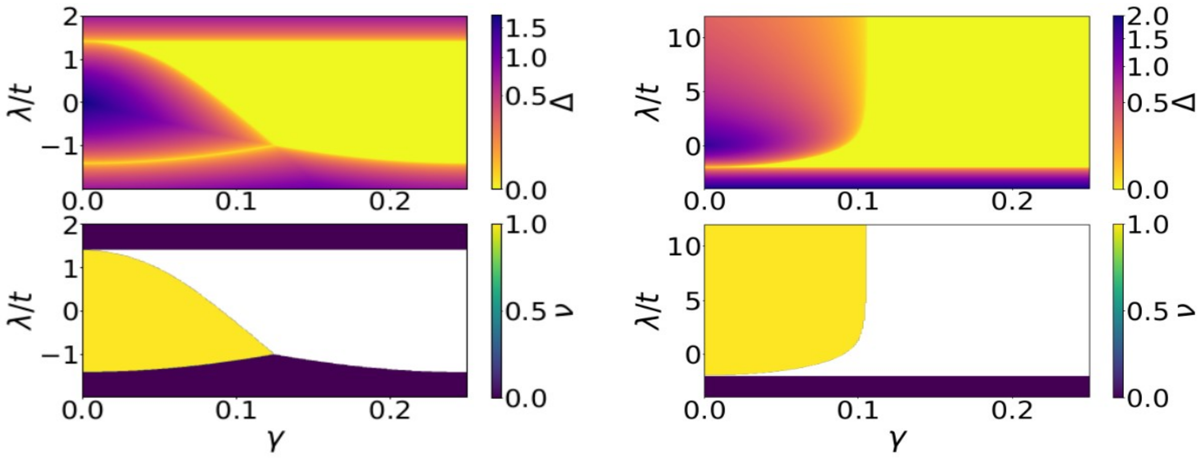

Figure 1 : Z2 topological phases as a function of the strength of the spin-orbit coupling (x-axis) and of the chemical potential (y-axis). Right and left panels are associated to two different settings of the chemical potentials.