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# Propositions

accompanying the dissertation

## MANIFESTATIONS OF BROKEN RECIPROCITY

REVEALING TOPOLOGY WITH FLUX

by

**Isidora ARAYA DAY**

1. Probing the topology of third-order topological insulators via quantum transport requires threading at least two independent magnetic fluxes. *This proposition pertains to Chapter 4.*
2. Scattering invariants are the only approach to diagnose the topological phase of disordered samples with average spatial symmetries.
3. The scattering invariant of obstructed atomic insulators is an integral of the reflection matrix over all occupied bands, a manifestation of the pumping cycle of its Wannier centers.
4. Creating a short planar SNS junction with only a minimal number of Andreev bands requires using an ultra-thin Josephson tunnel junction to proximitize a two-dimensional electron gas.
5. A photonic analogue of a narrow superconducting trijunction would realize a light-based circulator free of magnetic materials and time modulations.
6. Developing useful multi-qubit platforms will require analyzing the effects of long range couplings on single qubits, unlike done in the current state-of-the-art.
7. Using perturbation theory to analyze the ground state of strongly interacting systems is key to revealing their topological properties.
8. The combination of electrical transport and circuit quantum electrodynamics techniques in a single device will revolutionize the field of mesoscopic hybrids in the next decade.

These propositions are regarded as opposable and defensible, and have been approved as such by the promoters Dr. A. R. Ahkmerov and Dr. M. Wimmer.