

Topological states in a microscopic model of interacting fermions

RAPID COMMUNICATIONS

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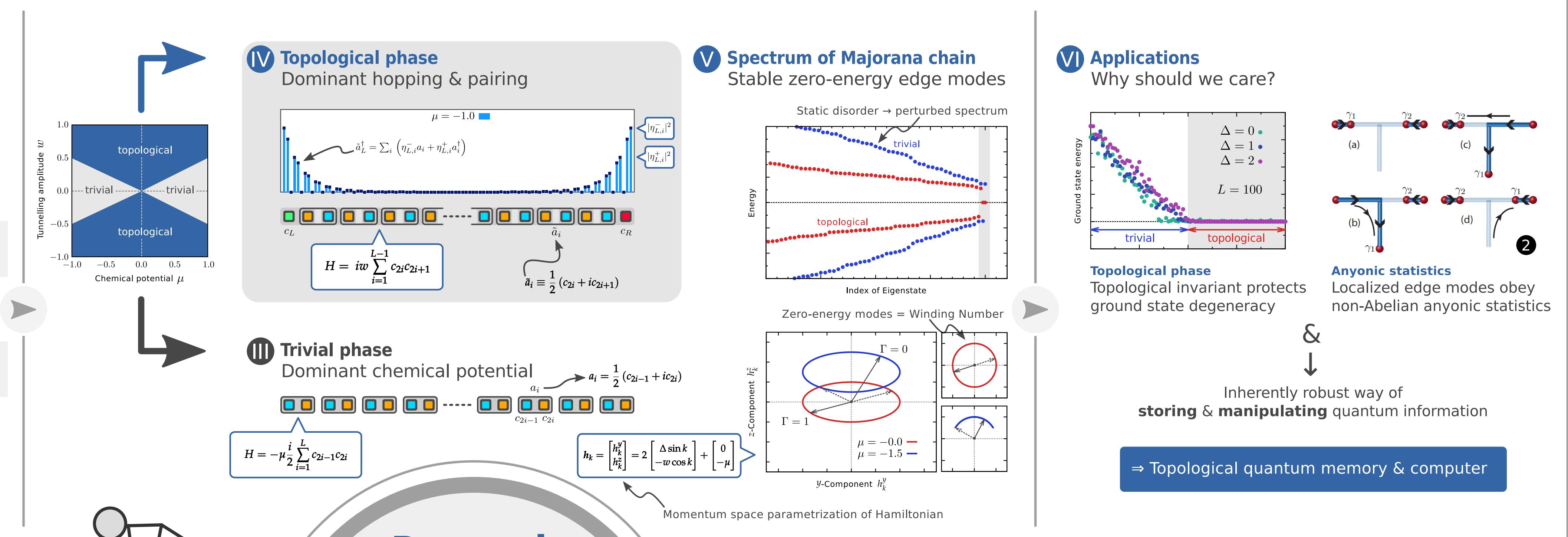
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1 Motivation

The Majorana Chain

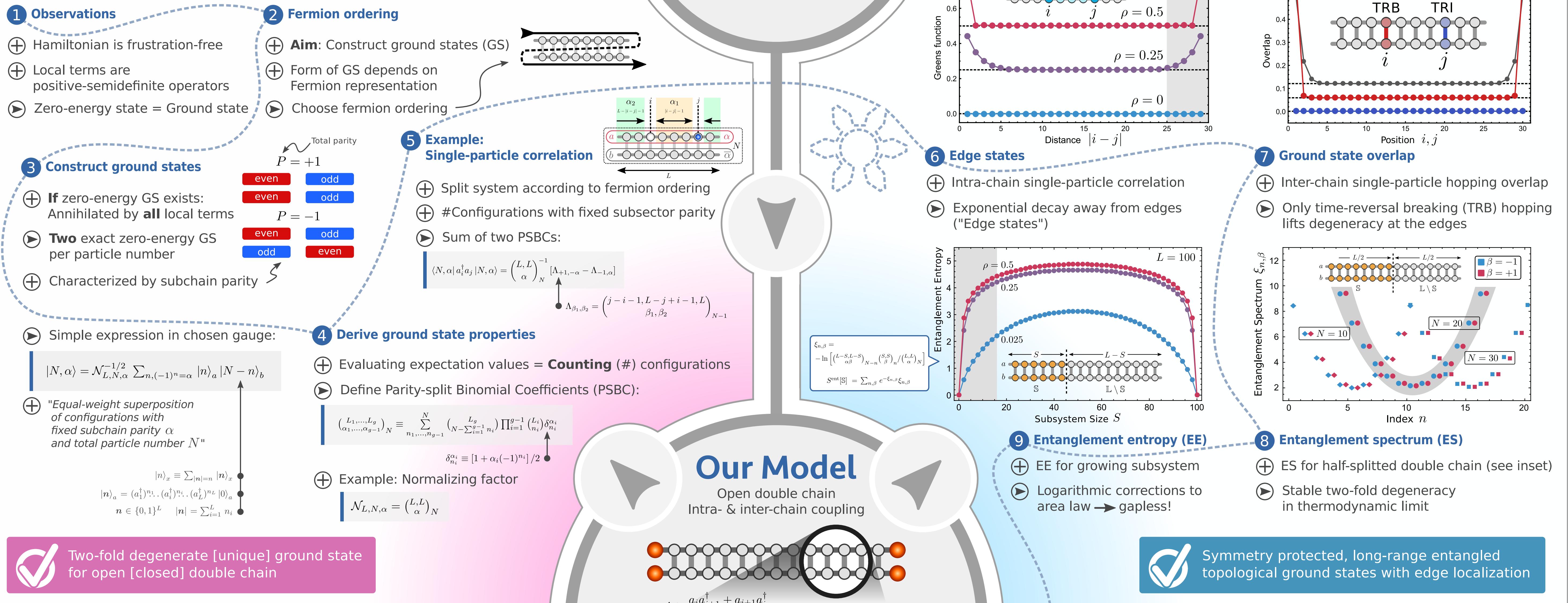
- I Paradigmatic model Open chain of spinless fermions \hookrightarrow "Kitaev Chain" ①
- $$H = -\sum_{i=1}^{L-1} [w a_i^\dagger a_{i+1} - |\Delta| a_i a_{i+1} + \text{h.c.}] - \mu \sum_{i=1}^L \left(a_i^\dagger a_i - \frac{1}{2} \right)$$
- II Introduce Majorana fermions "Real & Imaginary part of fermionic generators"
- $$c_{2i-1} \equiv a_i + a_i^\dagger \quad \text{and} \quad c_{2i} \equiv i(a_i^\dagger - a_i) \quad \text{for } i = 1, \dots, L$$
- \Rightarrow Self-adjoint fermions: $\{c_l, c_m\} = 2\delta_{l,m}$ and $c_l = c_l^\dagger$



2 Exact Ground States

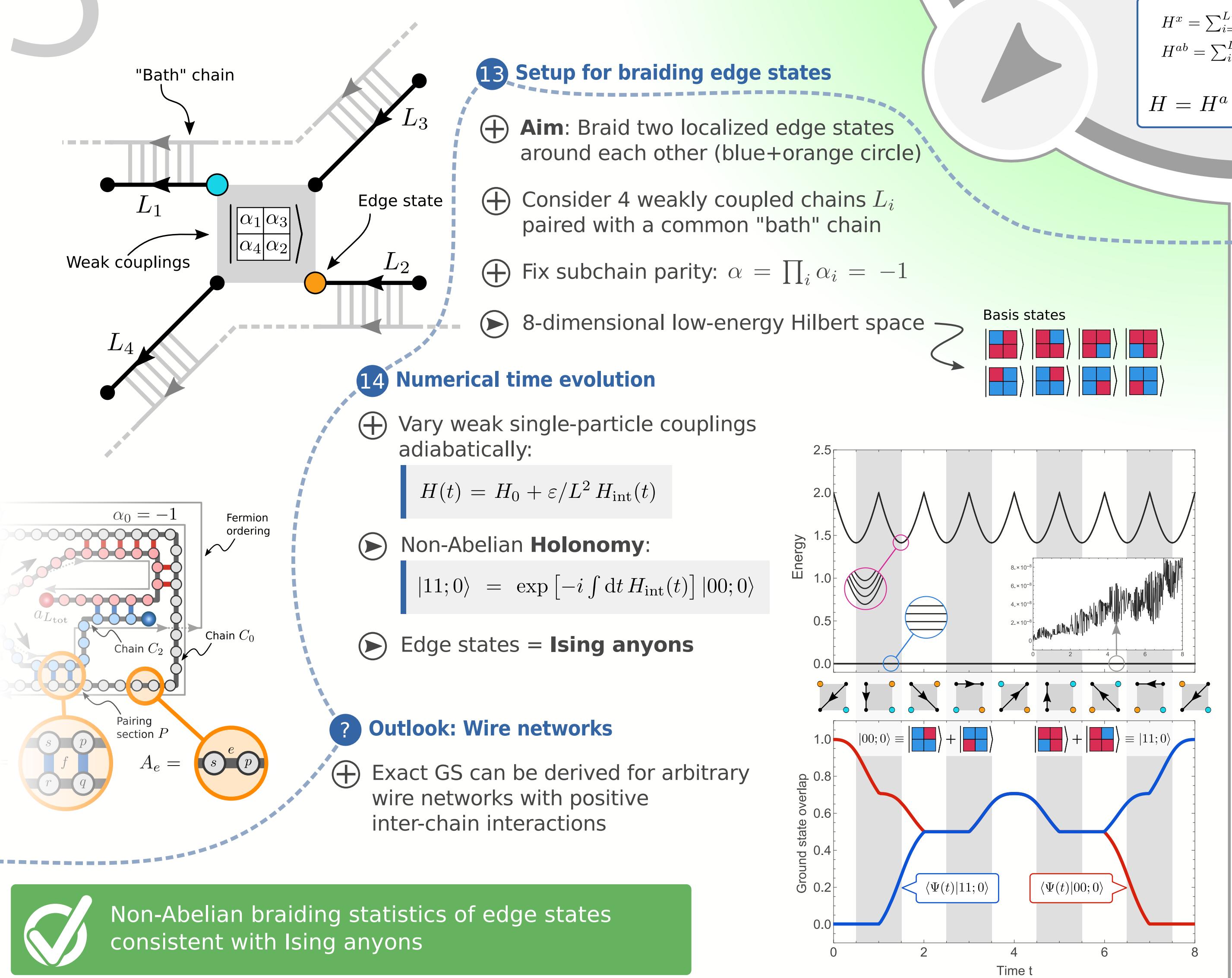
A Combinatorial Analysis

- + Interacting & number-conserving theory
- ▷ Not generically solvable. However ...



5 Braiding Edge States

Non-Abelian Statistics



Excitations

Gapless Goldstone Modes

