# The levin-Wen model with gapped boundary junctions

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Boundary Hamiltonian: $H_A^{LW} = -\sum_p \bar{B}_p^{LW}$

$\bar{B}_p^{LW}$:

## Observables

Mobile charge:

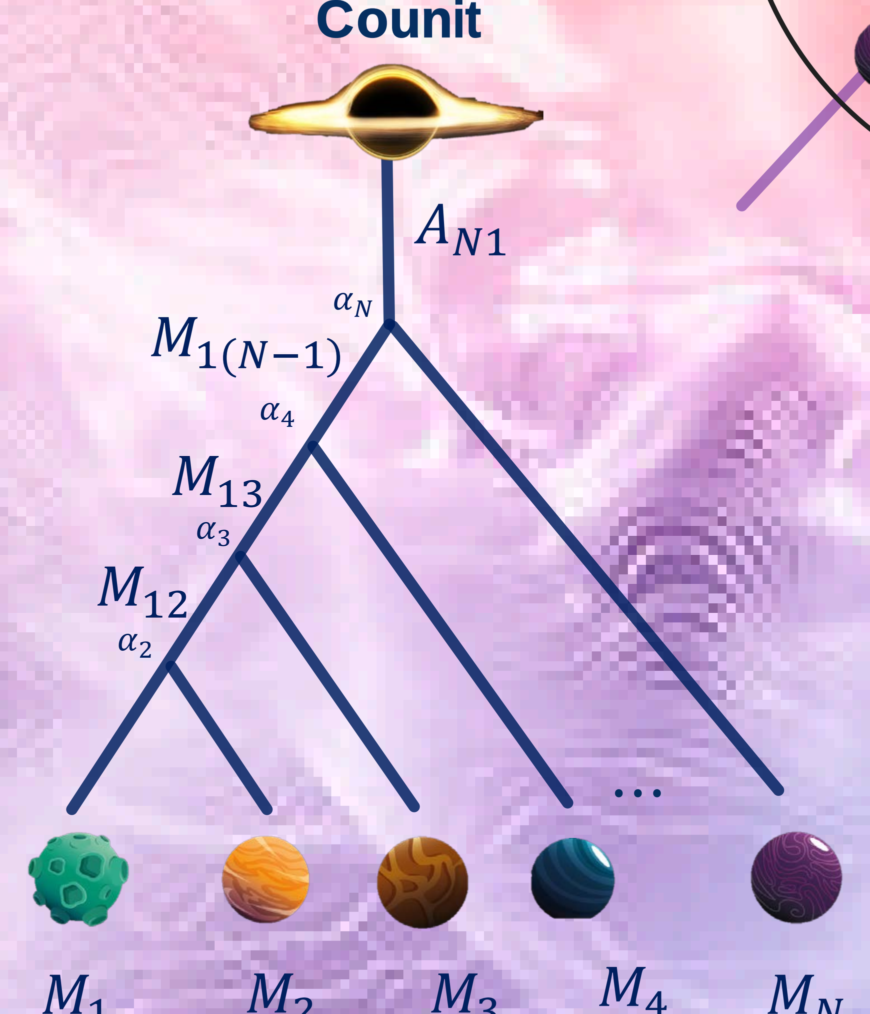
Immobile charge:

Ground-state subspace:

$\mathcal{H}^{GS} = \otimes_{\{M_i\}} \mathcal{H}_{M_1,\dots,M_N}$

Immobile charges $\{M_i\}$ are observables of ground states and characterized by $A_{(i-1)i} - A_{i(i+1)}$ subalgebra bimodules

Ground-state basis:





Levin-Wen model on a disk with N boundary segments characterized by gapped boundary conditions Frobenius algebras $A_1, \dots, A_N \in \mathcal{C}$

Hibert space: spanned by configurations of string types with boundary d.o.f taking value in $A_i$

The total Hamiltonian:

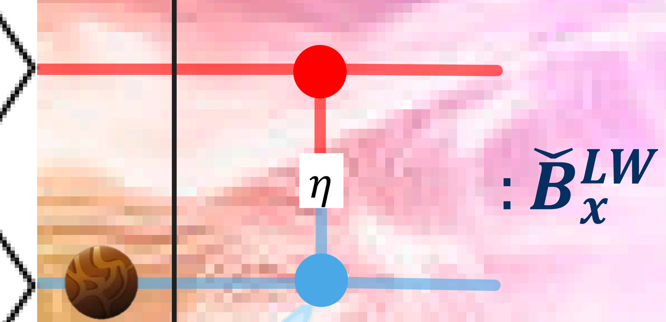
$$H = H_{\mathcal{C}}^{LW} + \sum_{seg\ i} H_{seg\ i}^{LW} + \sum_{junc\ x} H_{junc\ x}^{LW}$$

Bulk Hamiltonian:

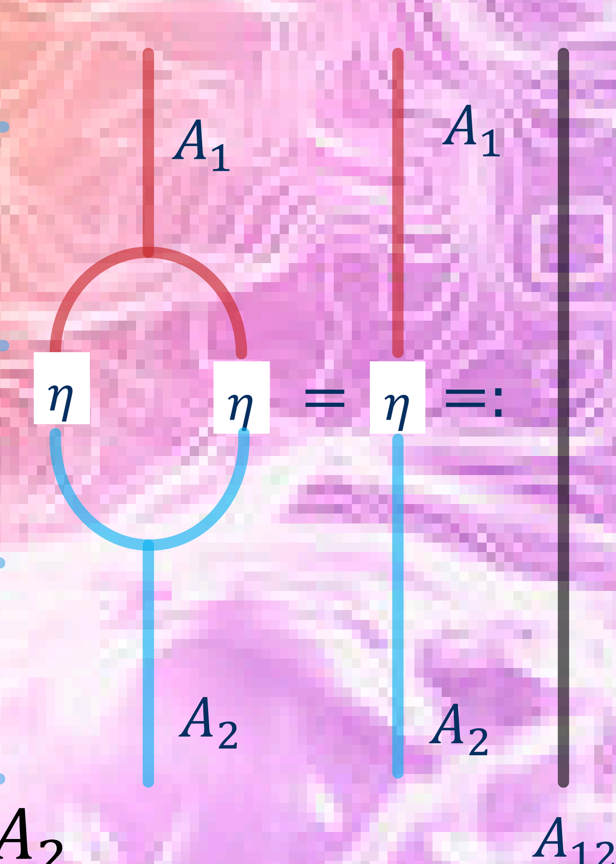
$$H_{\mathcal{C}}^{LW} = -\sum_v A_v^{LW} - \sum_p B_p^{LW}$$

Different colors represent distinct gapped boundary conditions

Boundary junction term: $H_{junc\ x} = -\breve{B}_x^{LW}$




Consistency condition:




Mobile charges are common elements of all Frobenius subalgebras $A_{i(i+1)}$

A gapped boundary junction between $A_1$ and $A_2$ is equivalently characterized by either morphism $\eta: A_1 \longrightarrow A_2$ or common Frobenius subalgebra $A_{12}$