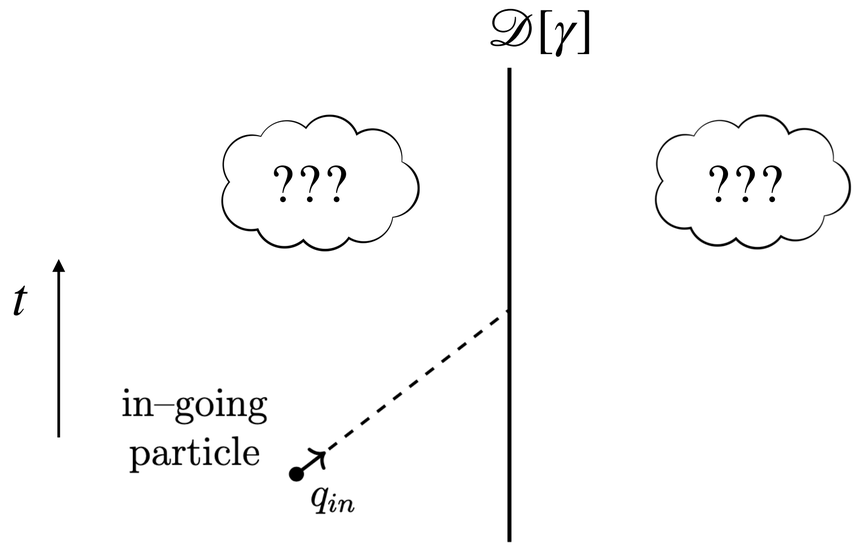
Scattering off Defects

and transmitting what I have understood

with A. Antinucci, C. Copetti, G. Rizi.
Based on 2605.13961

Setup

The setup I would like to study is the scattering of a particle off a localized defect



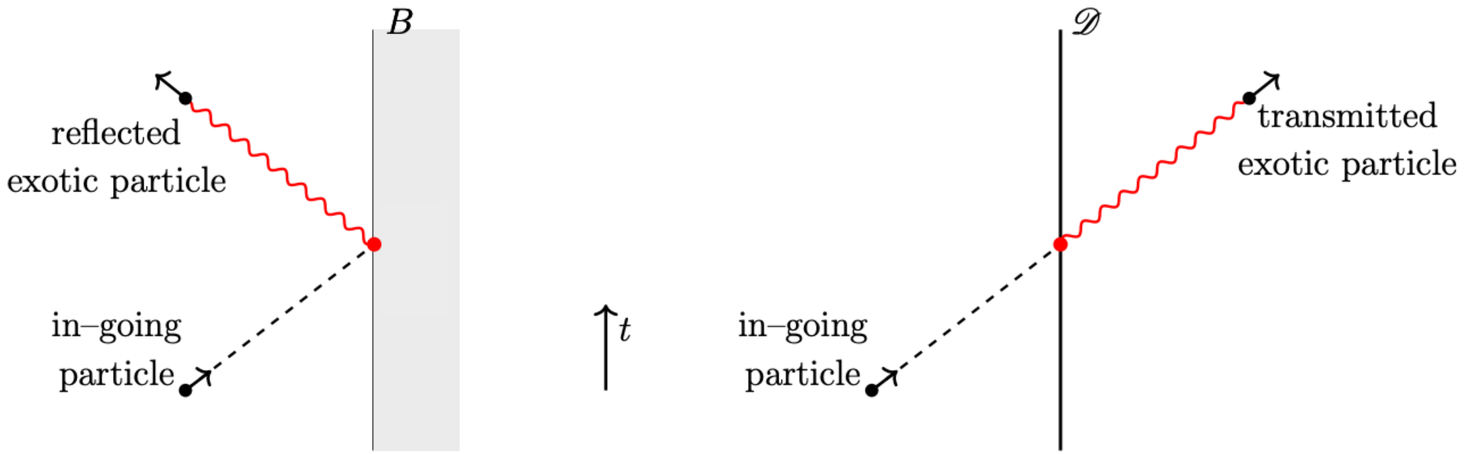
I will consider $(1+1)$d systems, where more interesting physics can be explored easily.

More generically, I will also consider interfaces and boundaries.

Setup

Recent studies argued that outgoing states can be created by non-local/non-genuine/twist/ monodromy operators. They are local operators living at the end of a topological line.

[van Beest, Boyle Smith, Delmastro, Komargodski, Tong] [Loladze, Okui, Tong] [Ueda, Lootens, Haegeman, Fendley, Verstraete],...



In this talk I will present a kinematical mechanism which allows for this exotic scattering, only based on the realization of symmetries in a defect QFT.

Symmetries & Defects

First, bulk symmetries are in one-to-one correspondence with topological line operators

[Gaiotto, Kapustin, Seiberg, Willet]

In the presence of a defect, three scenarios can happen:

Symmetry breaking defects

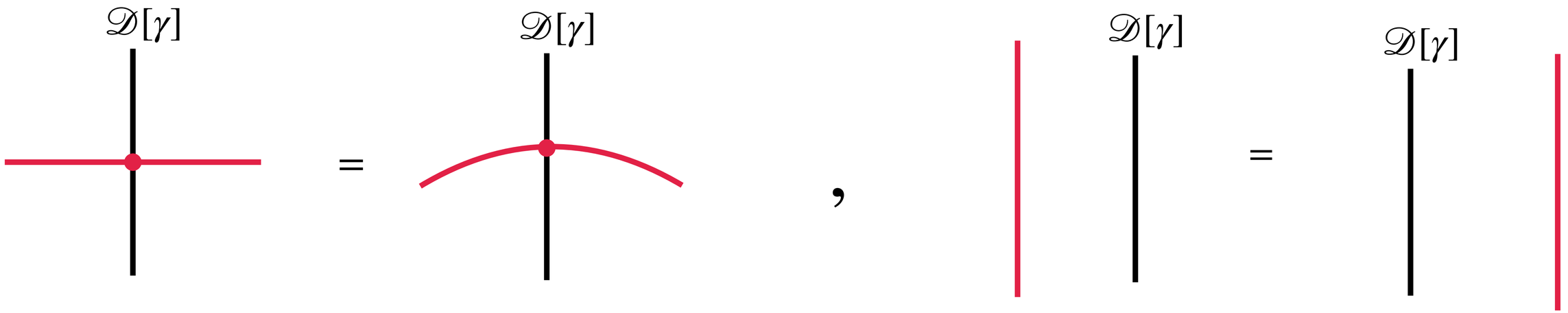
The charge is not anymore conserved

Symmetries & Defects

First, bulk symmetries are in one-to-one correspondence with topological line operators

In the presence of a defect, three scenarios can happen:

Symmetry preserving defects



The charge is still conserved in the presence of $\mathscr{D}$

Symmetries & Defects

First, bulk symmetries are in one-to-one correspondence with topological line operators

In the presence of a defect, three scenarios can happen:

Symmetry reflecting defects

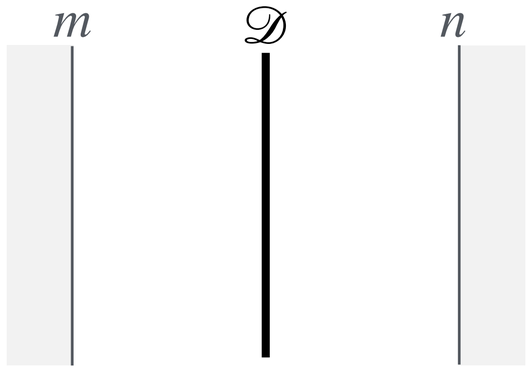
[Antinucci, Copetti, GG, Rizi]

The charge is conserved independently on the two half spaces

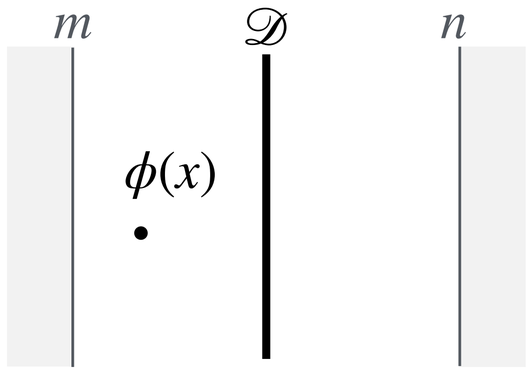
Symmetries & Defects

The defect Hilbert space of symmetry reflecting defects has states created by both local and twist operators.

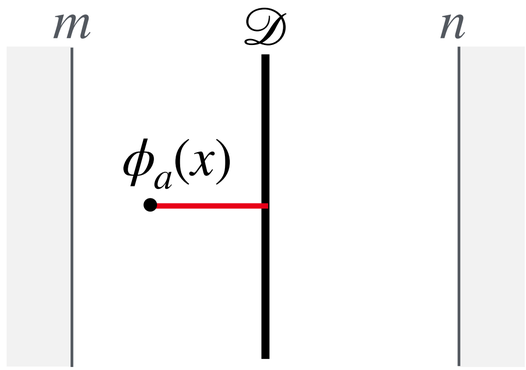
$\mathbb{H}^{\mathscr{D}}_{m,n}$:



$\Longrightarrow$



And

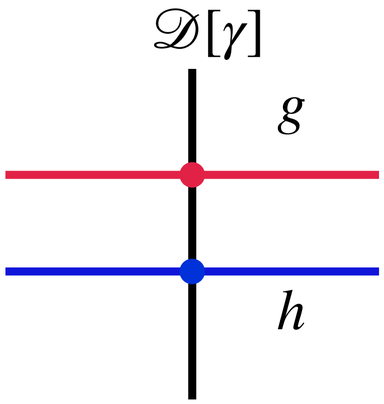


$\in \mathbb{H}^{\mathscr{D}}_{m,n}$

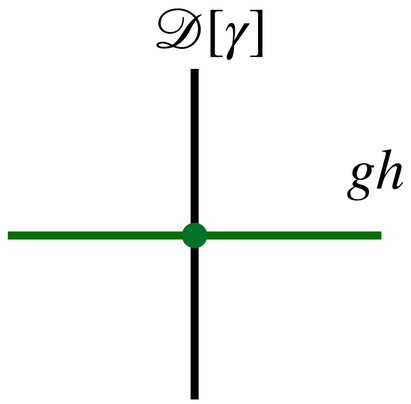
From Defect Anomaly to Scattering

Symmetries (when preserved) can have localized 't Hooft anomalies on the defect world-volume.

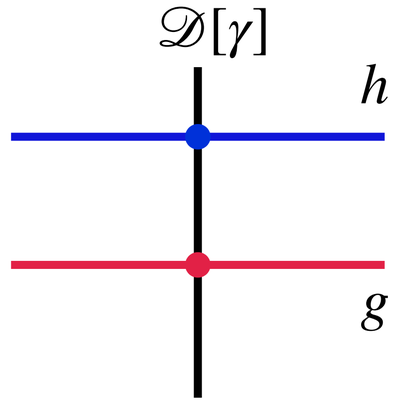
[Aharony, Cuomo, Komargodski, Mezei, Raviv-Moshe],[Antinucci, Copetti, GG, Rizi],...

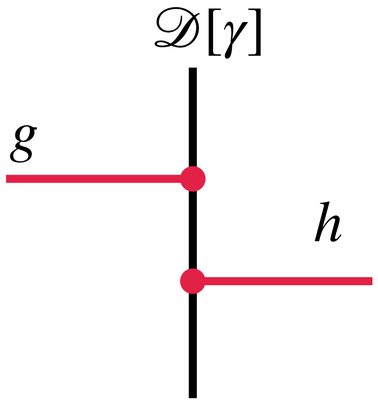


$= \omega(g,h)$



$= \chi(g,h)$





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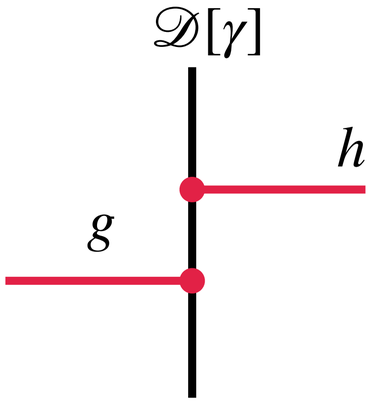
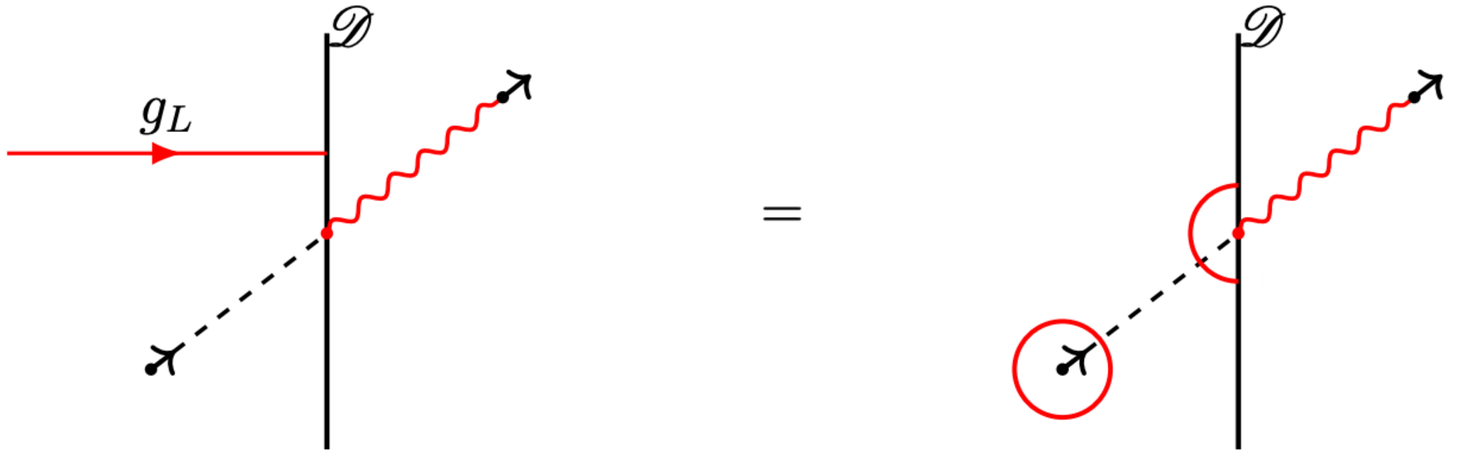


$\Longrightarrow$

χ can be thought as the charge of the topological junctions

From Defect Anomaly to Scattering

Defect anomalies open new scattering channels.



(Similar for boundaries and reflected particles)

Defect anomalies can trap charges on topological junctions, making these scatterings compatible with selection rules.

Generically one needs to take these channels into account to get a unitary amplitude

Examples

In 2605.13961 we studied several examples

- Known models in the literature:
    1. 3450 model
    2. Fermion-rotor system
    3. Ising lattice model with impurity

  } Explained from defect anomalies

- Integrable massive theories with Interfaces/Boundaries:
    1. Ising Field Theory with a family of interfaces
    2. Tricritical Ising + $\Phi_{2,1}$ with weakly symmetric b.c.

  } Explicit reflection and transmission amplitudes (not topological)

For extra details see also

Thank you