Adding defects to the $4d$ $\mathcal{N} = 2$ superconformal bootstrap

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CERN

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together with L. Bianchi and M. Meineri

Outline

1. **The bootstrap program**
   - Adding defects
   - Universality in defect CFT
2. **Defects in $4d$ $\mathcal{N} = 2$ SCFTs**
3. **Summary & Outlook**

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Set of local operators and *all* their correlation functions

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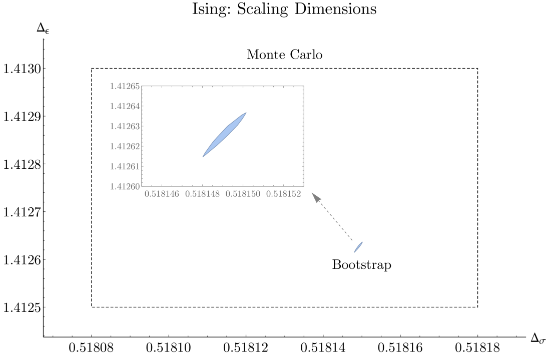
$\Leftrightarrow$ Crossing equations for *all* four-point functions

$3d$ Ising Model

[Poland Simmons-Duffin Kos, Simmons-Duffin, Poland Simmons-Duffin Kos Vichi]



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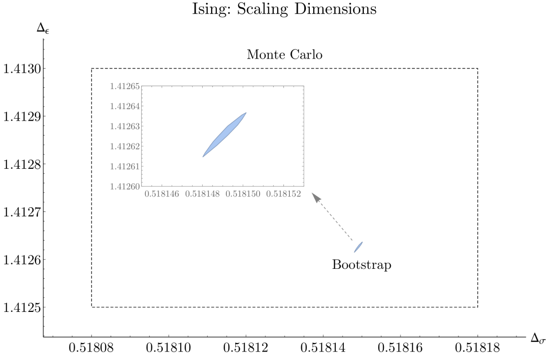

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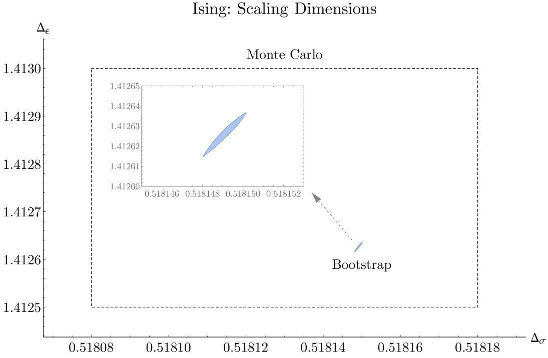

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- and in bootstrapping specific CFTs [see Pufu's talk]

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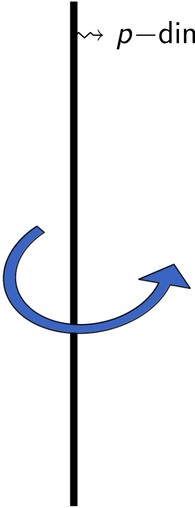
- $\rightarrow$ Break as little symmetry as possible
- $\rightarrow$ Preserve full conformal algebra on defect

Defects in conformal field theories

$d-$ dimensions



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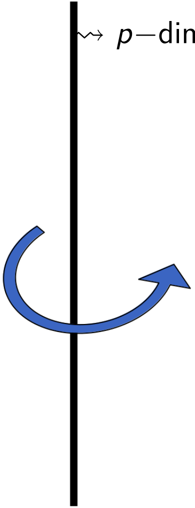

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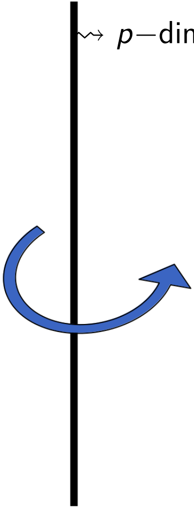

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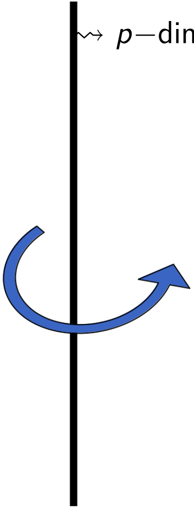

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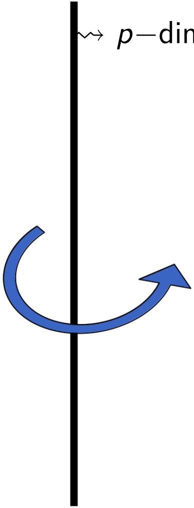

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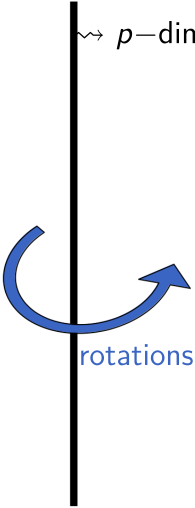

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Breaking of symmetries by defect

- $\rightarrow$ $\exists$ defect operators associated to that breaking

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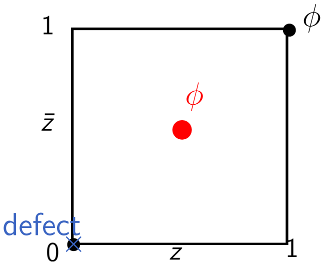

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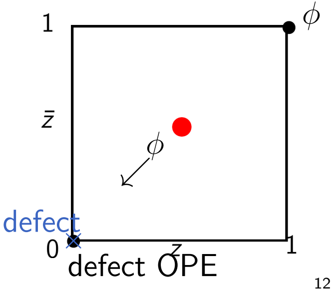

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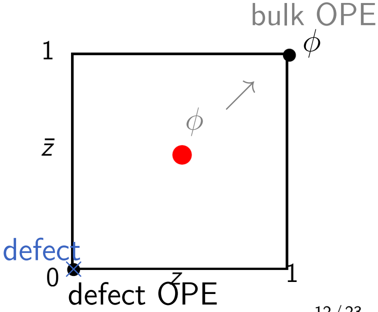

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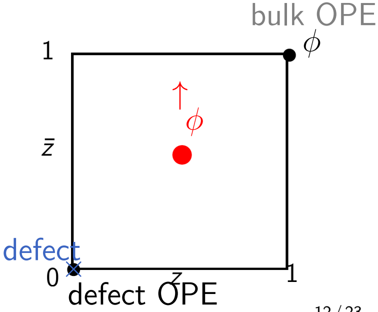

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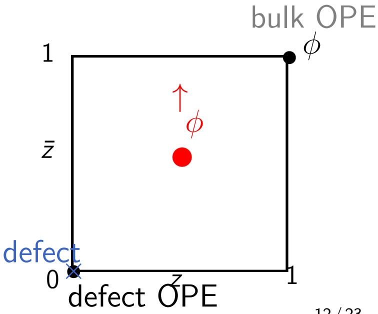

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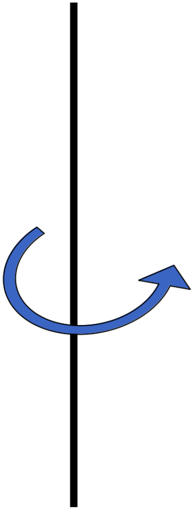

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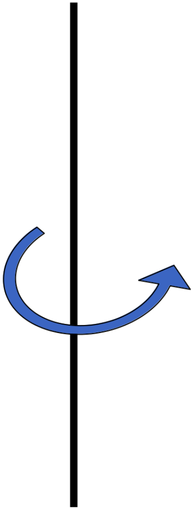

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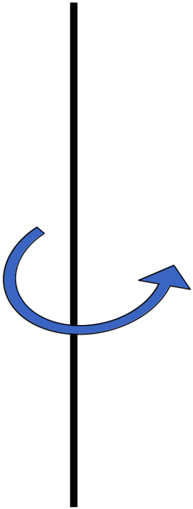

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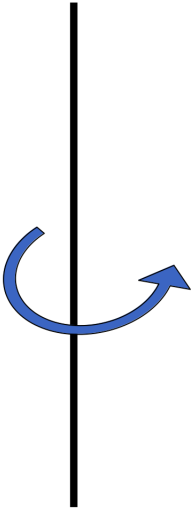

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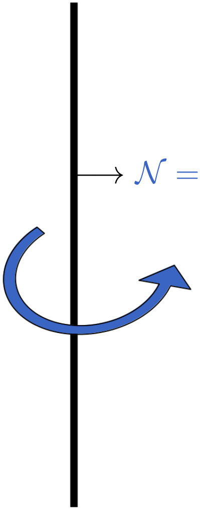

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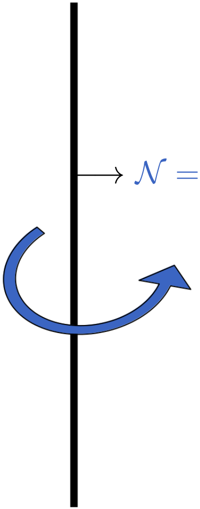

$\longrightarrow$ $\mathcal{N} = (2,2)$ surface

$$su(1,1|1) \oplus su(1,1|1)$$

Defects in $4d\ \mathcal{N}=2$ SCFTs

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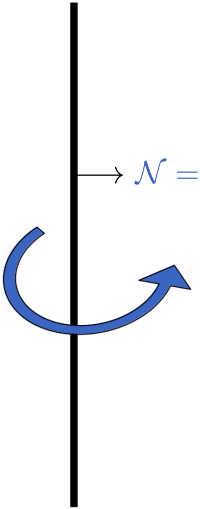

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$$su(2,2|2) \supset \underbrace{so(4,2)}_{conformal} \oplus \underbrace{su(2)_R \oplus u(1)_r}_{R-symmetry}$$

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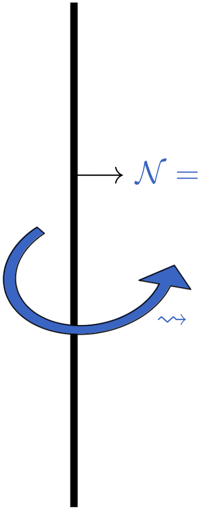

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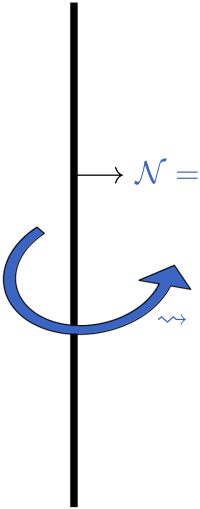

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$\rightsquigarrow$ $u(1)_\perp$ mixes with Cartan of $su(2)_R$

Displacement operator

Breaking of translation invariance

$\rightarrow \ \langle D^i D^j \rangle \propto \delta^{ij} C_D$

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√ $\mathcal{N} = 2$ Half-BPS line and surfaces

⇒ follows from supersymmetry
[Bianchi ML Meineri, Bianchi ML]

Broken symmetries

Displacement supermultiplet

Broken translations $\Rightarrow$

Broken symmetries

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[Billò Gonçalves Lauria Meineri]

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A solvable subsector of $4d$ $\mathcal{N} \geqslant 2$ SCFTs

$4d$ $\mathcal{N} = 2$ SCFTs $\to$ $2d$ chiral algebra

[Beem Lemos Liendo Peelaers Rastelli van Rees] [see Pufu's talk]

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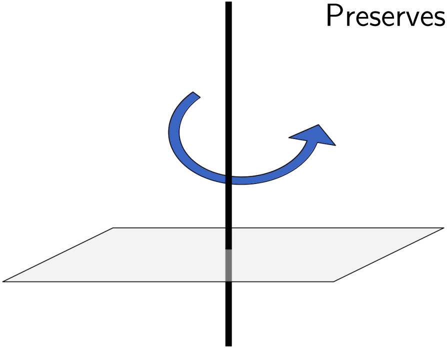
Adding defects

Surfaces preserving $\mathcal{N} = (2, 2)$

[Beem Peelaers Rastelli, Cordova Gaiotto Shao]



Preserves $\mathcal{Q} + \mathcal{S}$ used for chiral algebra

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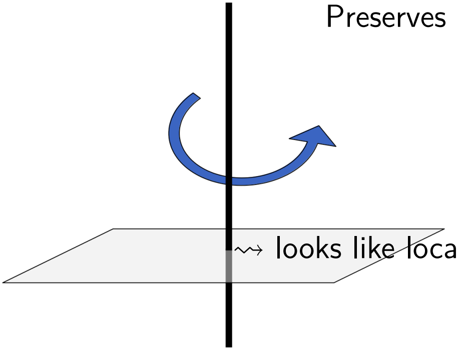

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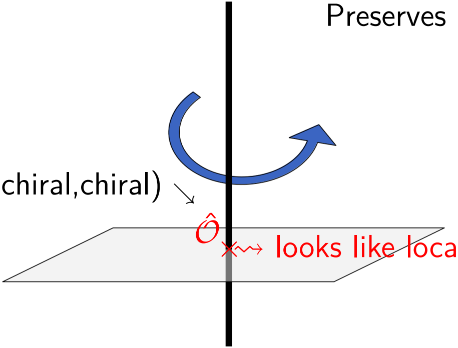

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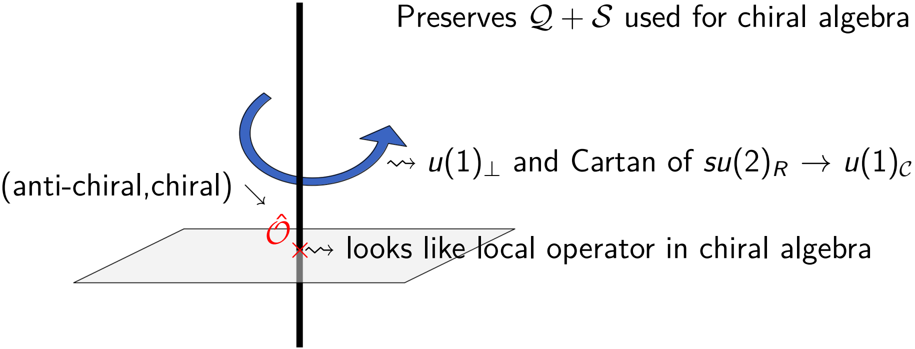

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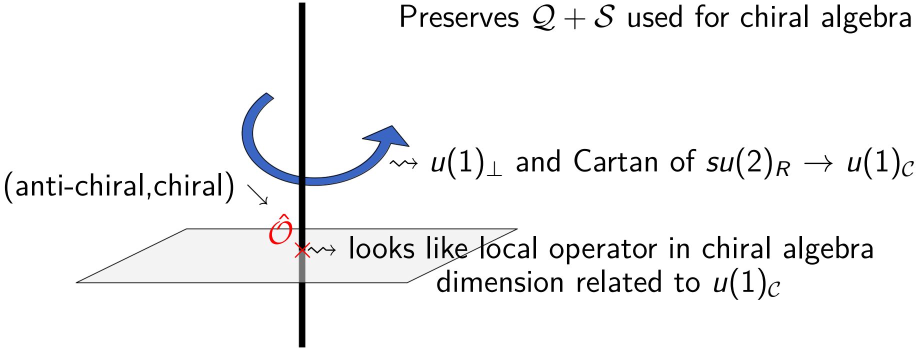

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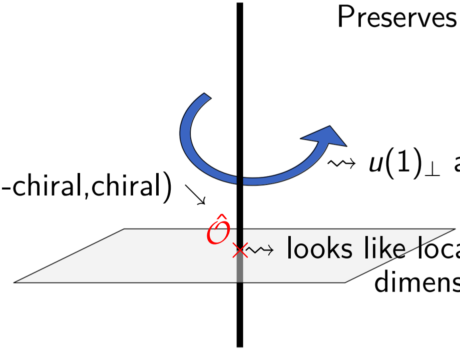

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dimension related to $u(1)_{\mathcal{C}}$

$\to$ Defects give modules of chiral algebra

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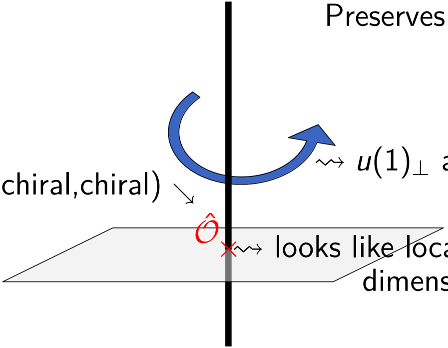

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Chiral algebras with defects

Operators in cohomology

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Chiral algebras with defects

Operators in cohomology

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Chiral algebras with defects

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- → Superprimary of displacement
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- → Defect marginal operators

Outline

Summary & Outlook

Defects in conformal field theories

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- Universality in defect spectrum

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- Defect CFT data from chiral algebras?

Thank you!