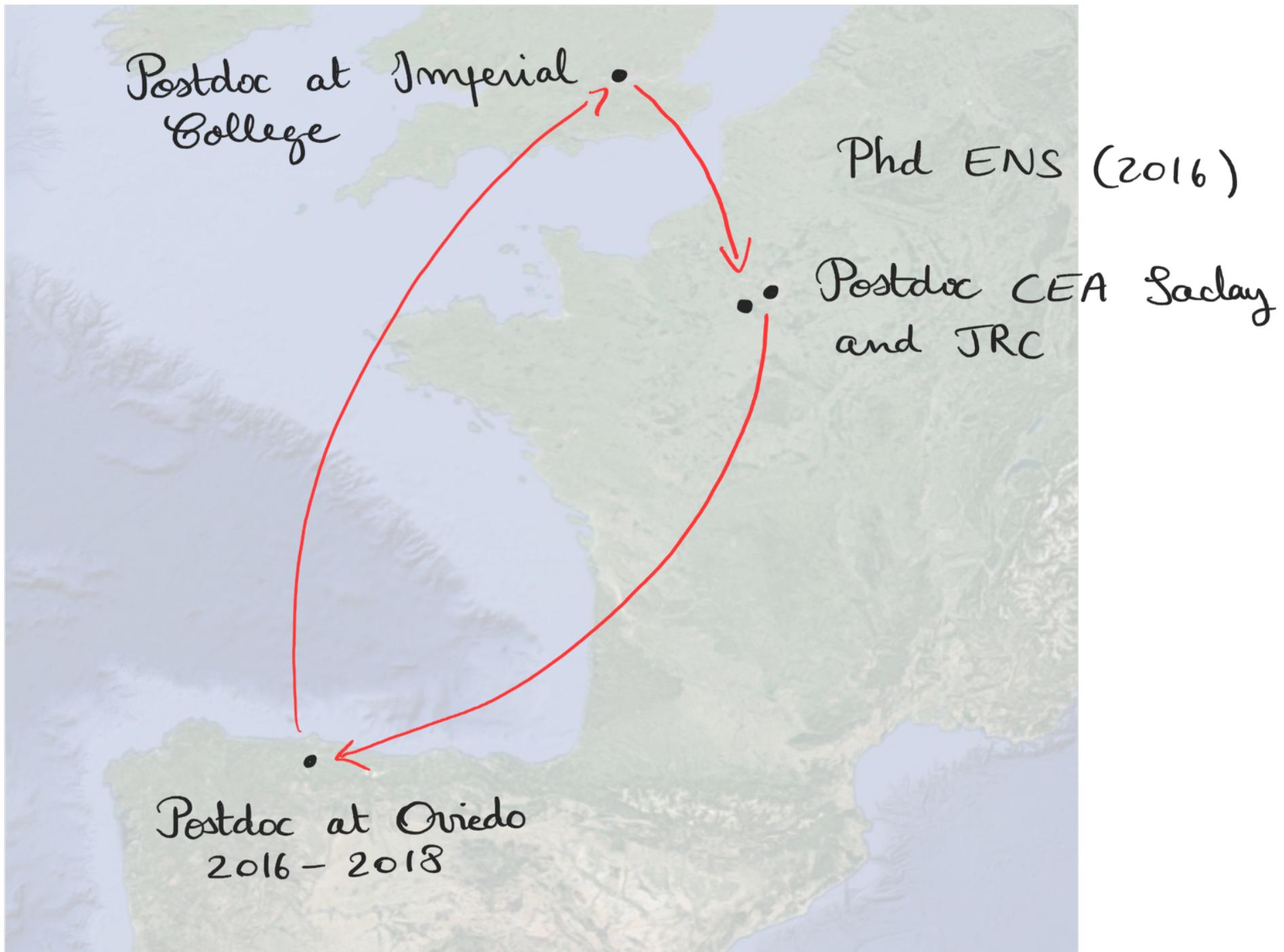


What is a Magnetic Quiver?

Antoine Bourget

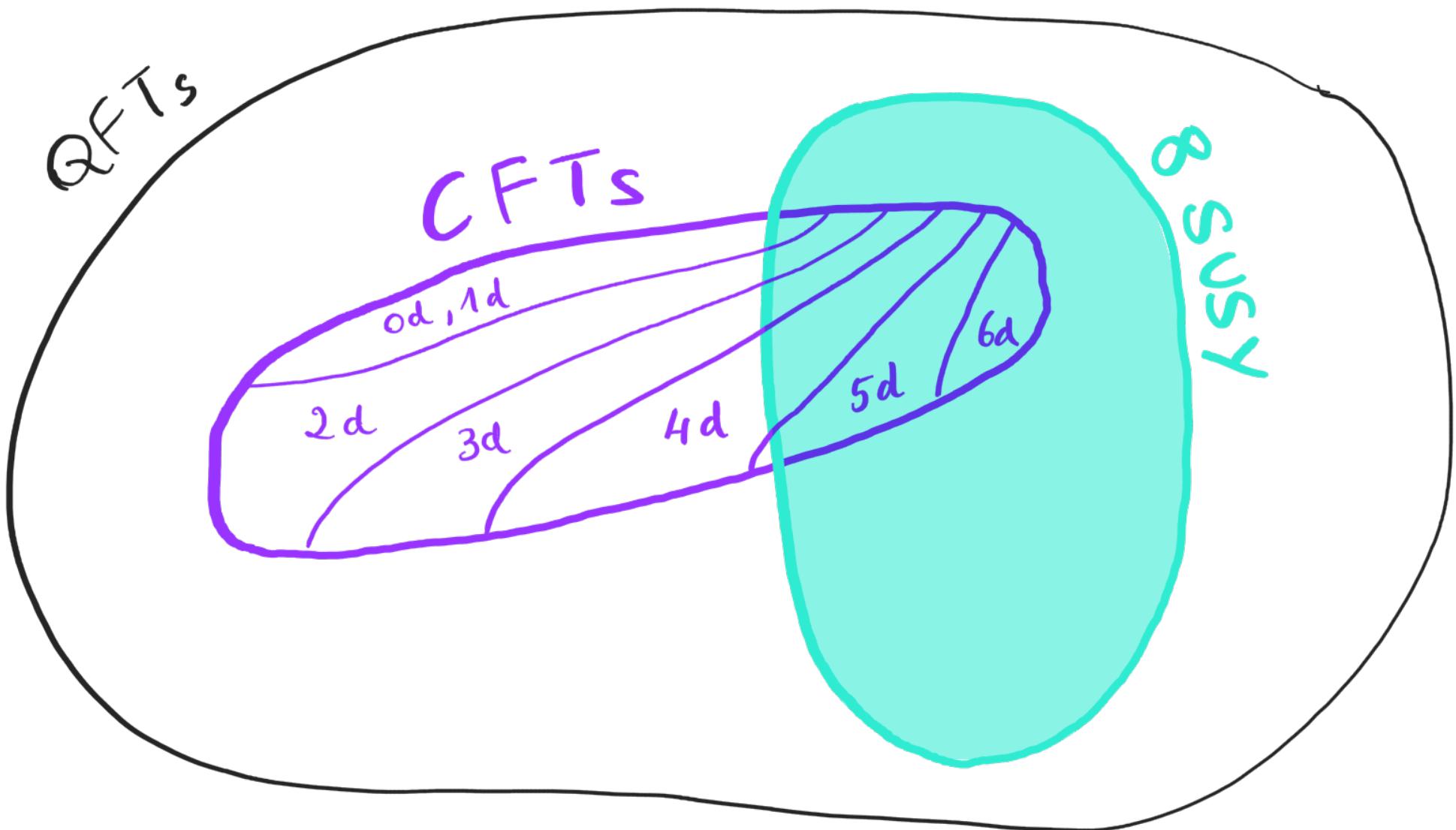
Imperial College London
IPHT, CEA Saclay
JRC, ENS Paris

SHORT PRESENTATION



MAIN QUESTION :

Explore and Chart the landscape of QFTs .

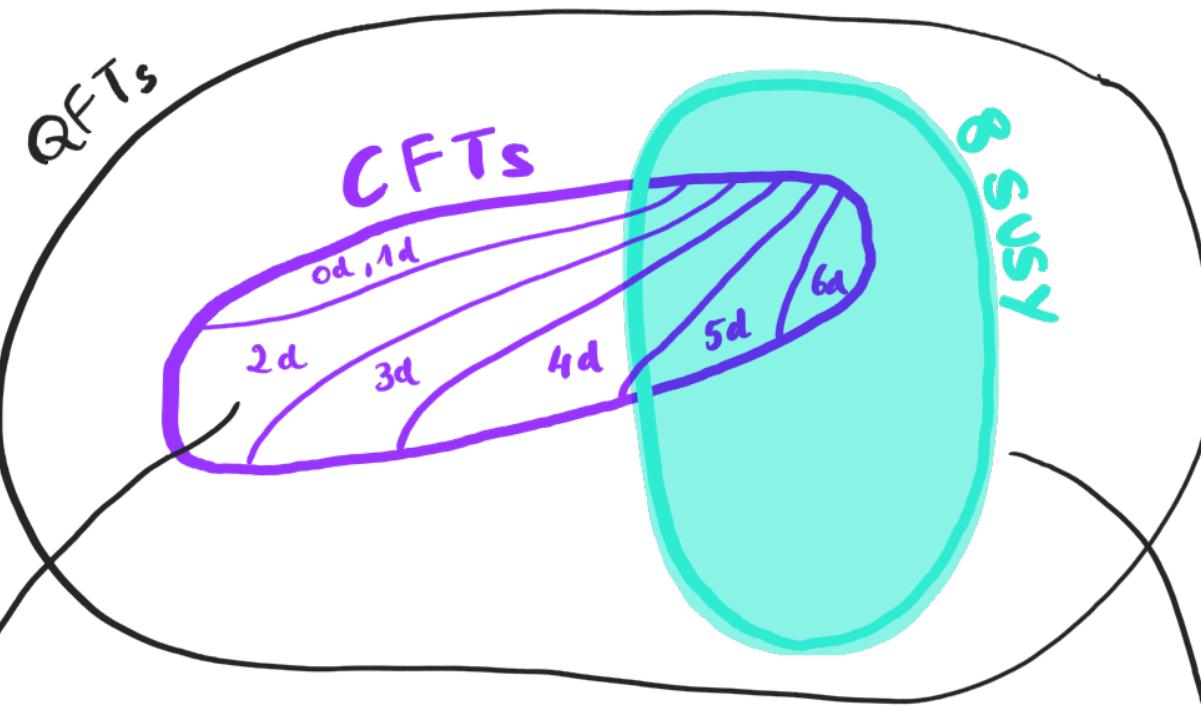


Very hard ! \rightsquigarrow Simplify the problem : find invariants

Example :



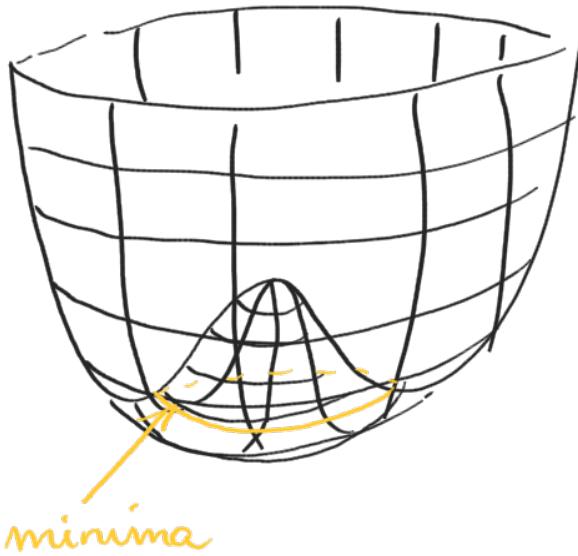
Dimension, genus,
fundamental group, ...



Central
Charge c

Magnetic
Quiver

What is a Magnetic Quiver?



STEP 1 : MODULI SPACE OF VACUA

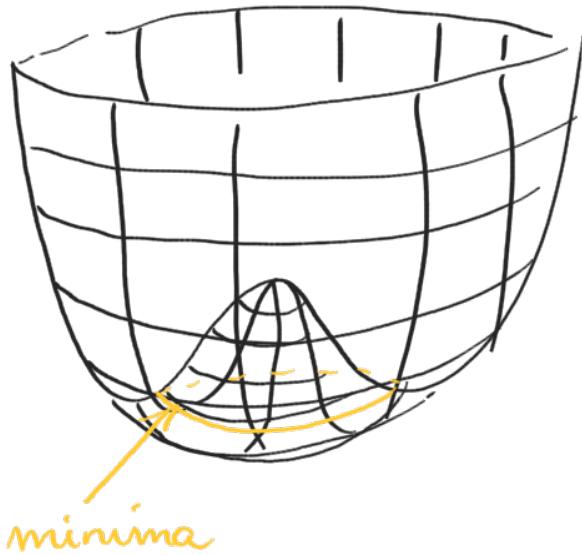
Assumptions : (i) Unbroken Lorentz invariance
(ii) Unbroken 8 supersymmetries .

Only scalar fields can take rev. They typically break the gauge groups \leadsto Higgs mechanism .

- { * Find minimum of potential
- * Impose gauge invariance

Higgs branch (hyperkähler space)

What is a Magnetic Quiver?



STEP 1 : MODULI SPACE OF VACUA

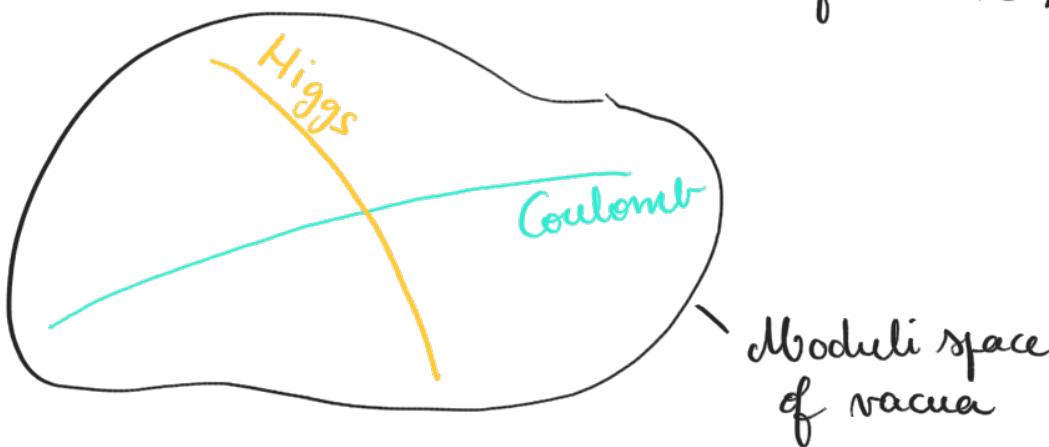
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Higgs branch (hyperkähler space)

Because of susy : gauge group can break to $U(1)^r$ even without "matter" fields \rightarrow Coulomb branch

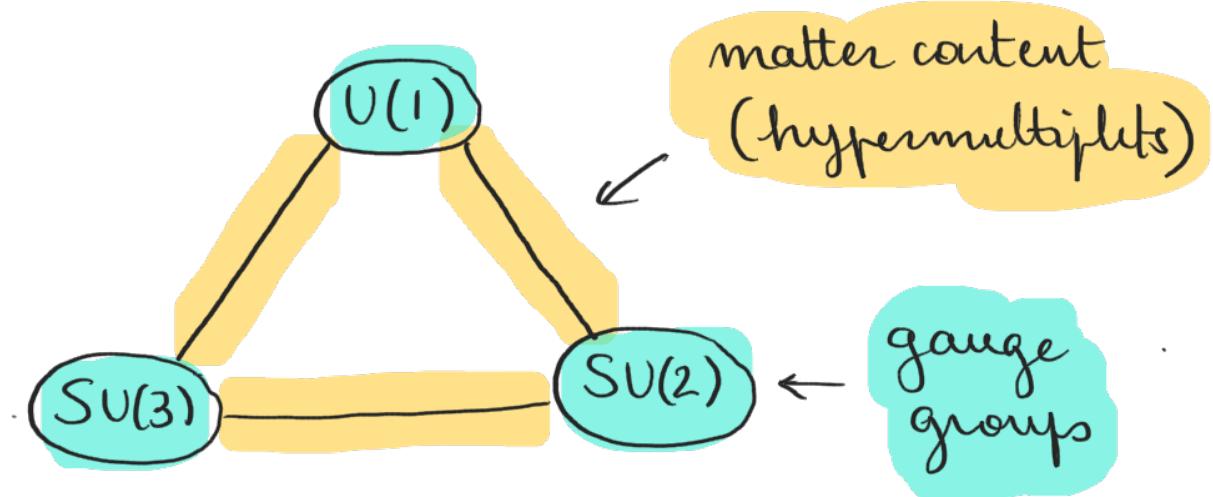


hyperkähler for 3d theories!

What is a Magnetic Quiver?

3d $\mathcal{N}=4$ gauge theory :
(UV complete)

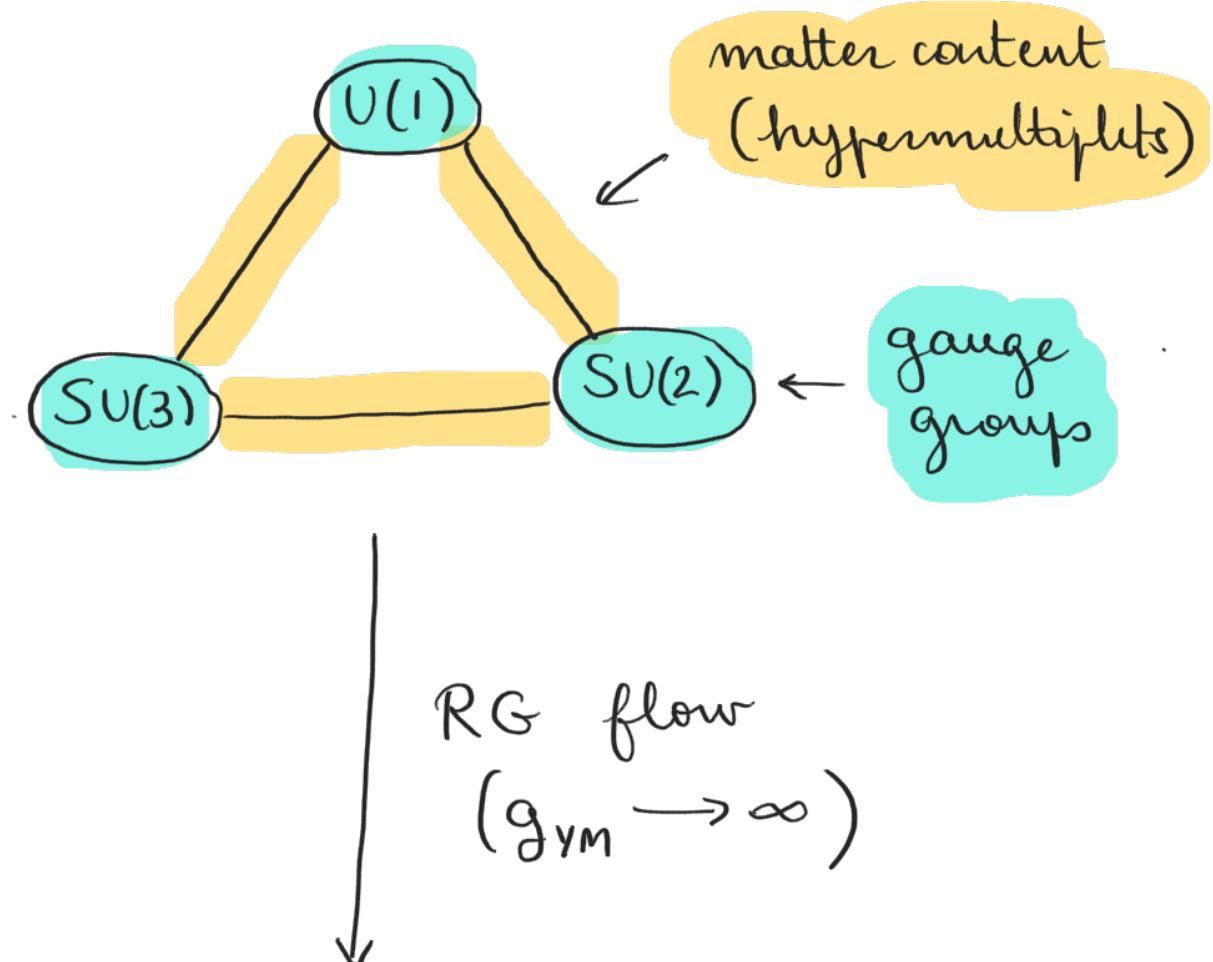
STEP 2 : QUIVER GAUGE THEORY



What is a Magnetic Quiver?

3d $\mathcal{N}=4$ gauge theory :
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STEP 2 : QUIVER GAUGE THEORY

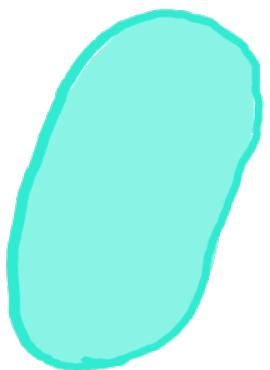


Massless magnetic monopoles
↓

"big" Coulomb branch.

What is a Magnetic Quiver?

$$\mathcal{C} \longrightarrow Q(\mathcal{C})$$



8 susy
theory

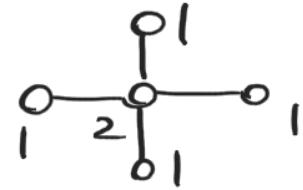
quiver

Higgs
Branch $[\mathcal{C}]$

= Coulomb branch $[\text{IR SCFT} \left(\begin{array}{l} \text{Quiver gauge} \\ \text{theory } Q(\mathcal{C}) \end{array} \right)]$

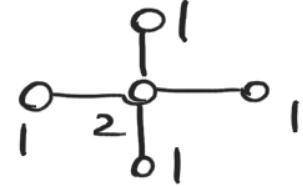
EXAMPLES:

- 4d $\mathcal{N}=2$ $SU(2) + N_f = 4$

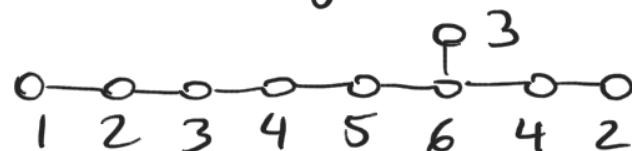


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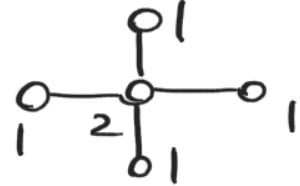


- MN theory E_8 :

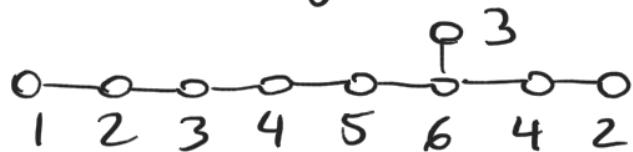


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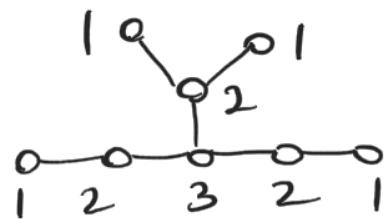
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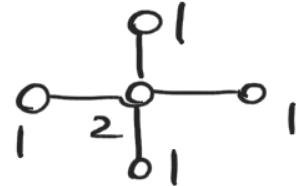


- 5d $\mathcal{N}=1$ SCFT $SU(3) + N_f = 6$

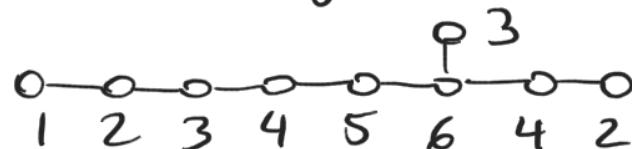


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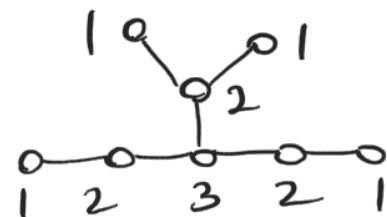
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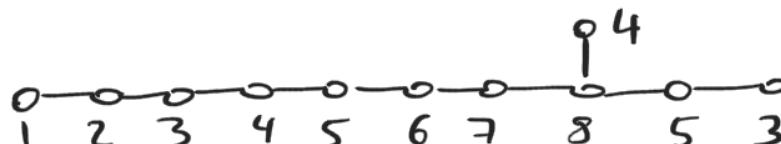
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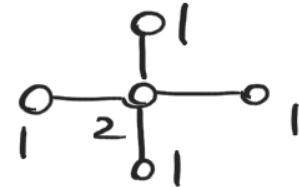


- 6d $\mathcal{N}=(1,0)$ $SU(2) + N_f = 10$

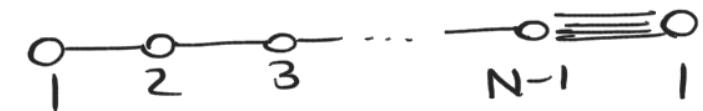


EXAMPLES:

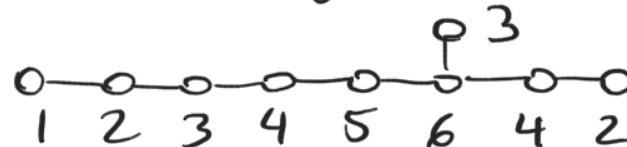
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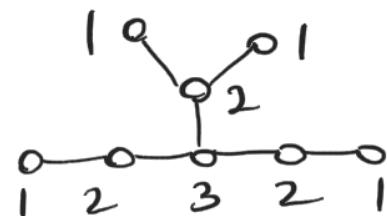
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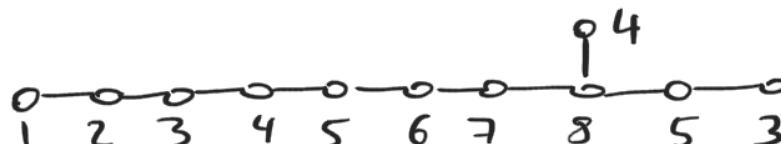
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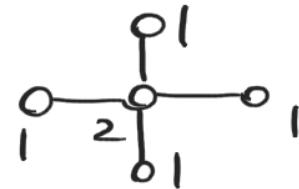


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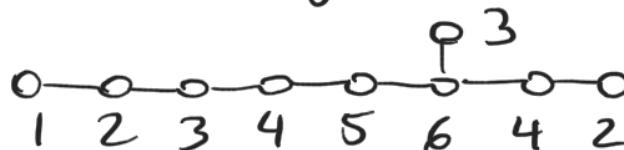


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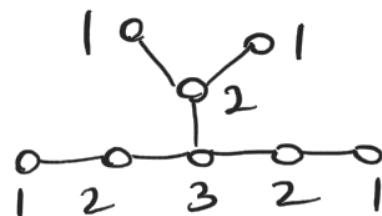
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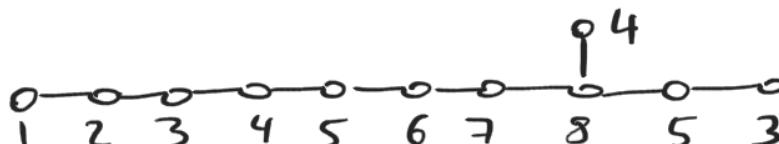
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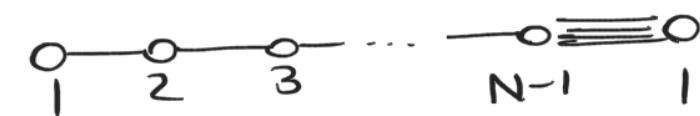
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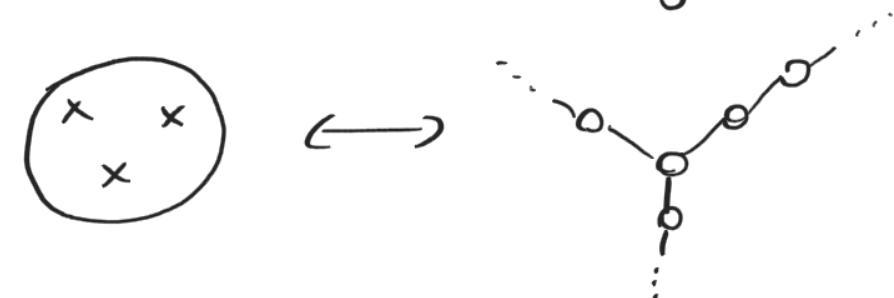
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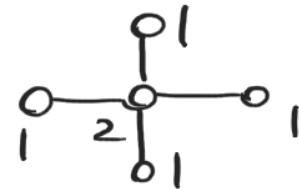


- "Class S" 4d theory

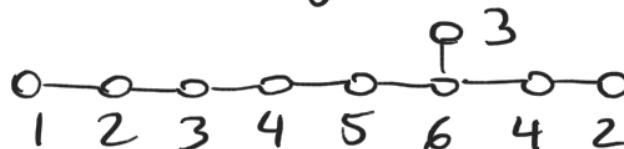


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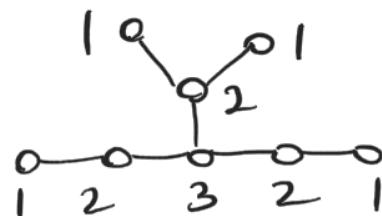
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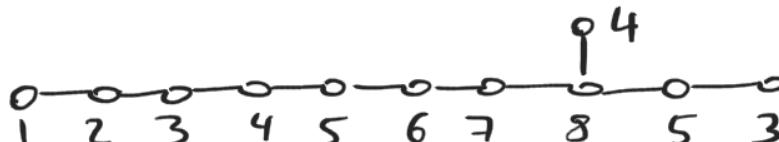
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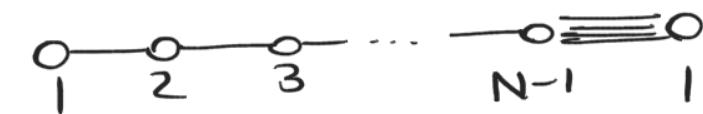
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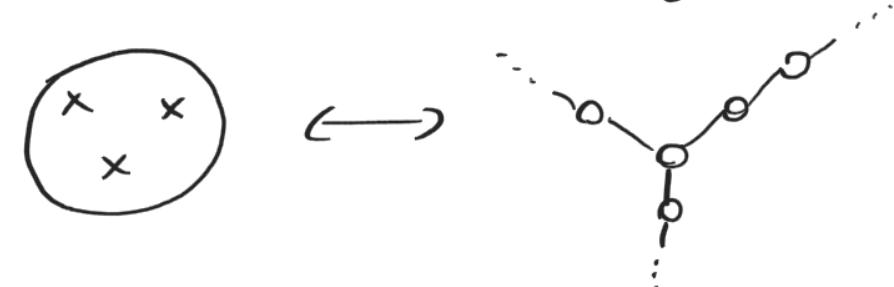
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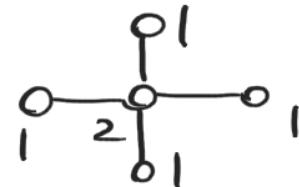
- $\mathcal{N}=2$ "S-fold" theories

$$g_{A_{2,2}}^{(r)} :$$

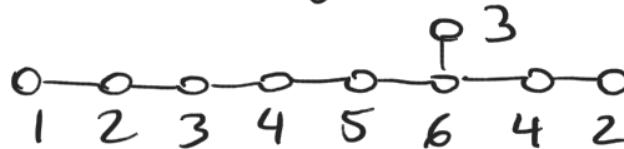


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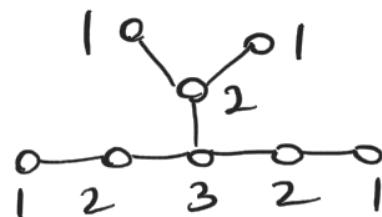
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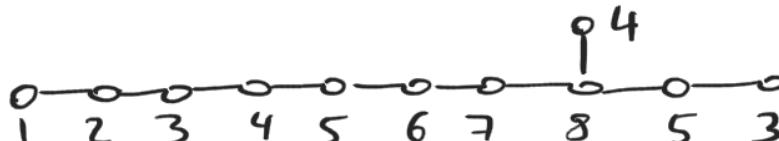
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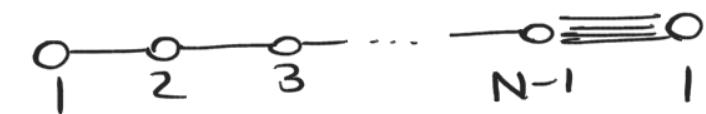
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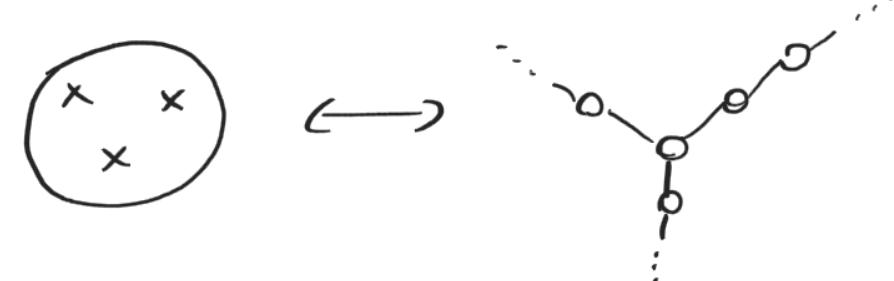
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- $\mathcal{N}=2$ "S-fold" theories



- Argyres-Douglas theories

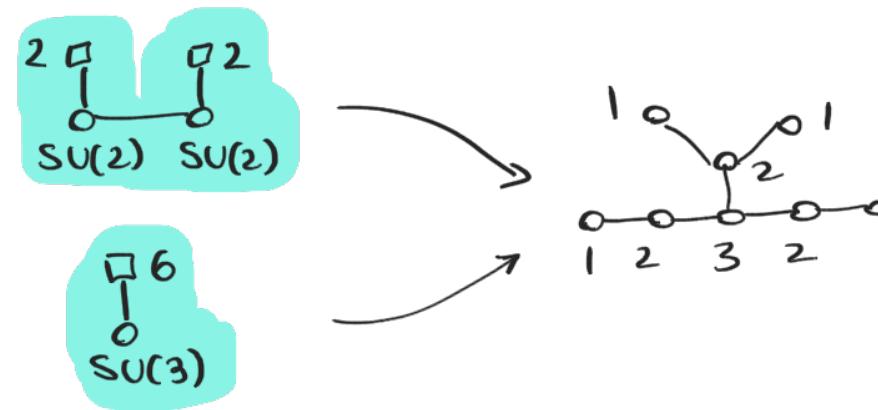


(A_4, A_4)

APPLICATIONS

- Distinguish theories / Conjecture dualities.

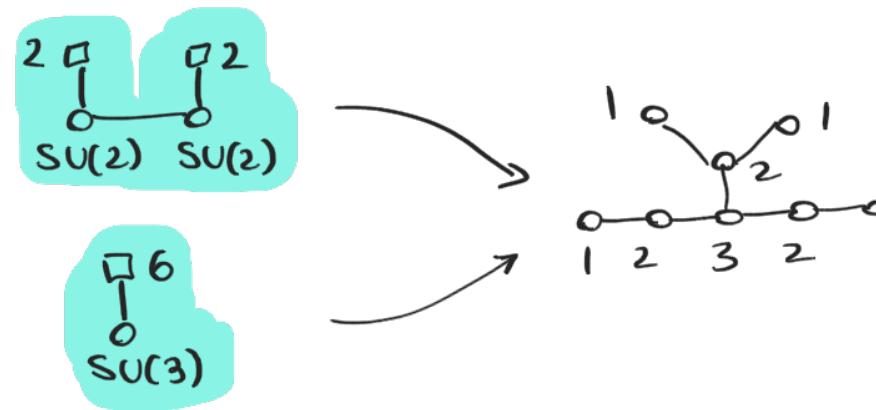
Ex : 5d SCFTs



APPLICATIONS

- Distinguish theories / Conjecture dualities.

Ex : 5d SCFTs



- Classify / Constraint the landscape of theories

Ex : classification of rank 1 4d $\mathcal{N}=2$ SCFTs

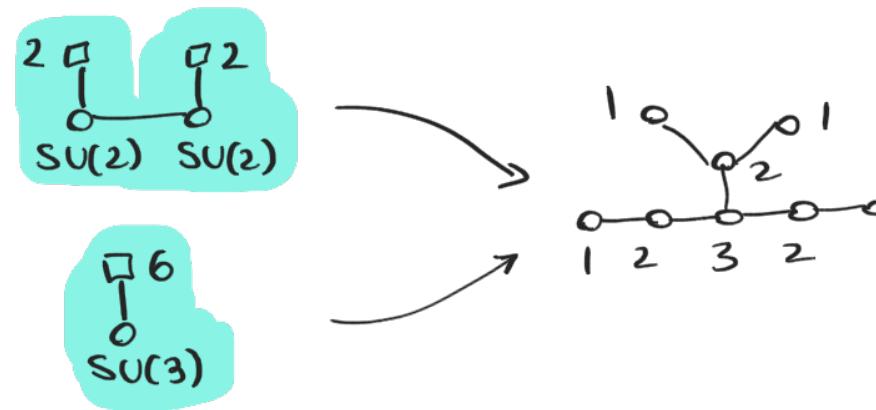
rank 2 4d $\mathcal{N}=2$ SCFTs

:

APPLICATIONS

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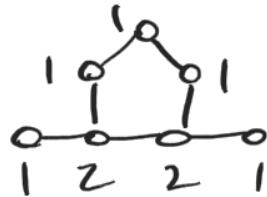
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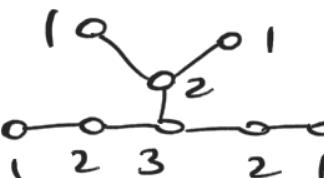
rank 2 4d $\mathcal{N}=2$ SCFTs

:

- Understand how theories are connected



RG flow



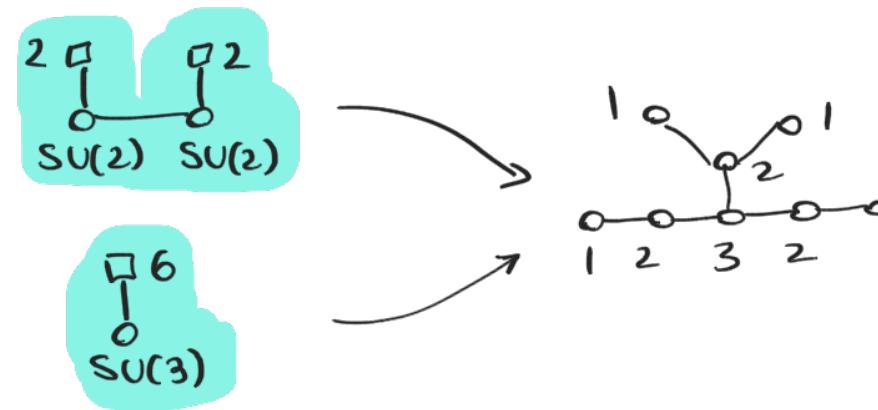
Twisted
Compact.
on S^1



APPLICATIONS

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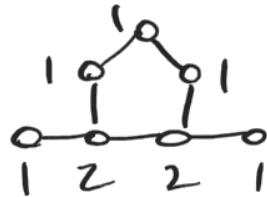
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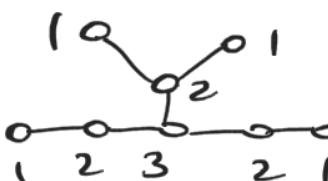
rank 2 4d $\mathcal{N}=2$ SCFTs

:

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RG flow



Twisted
Compact.
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- Study the moduli space of non-Lagrangian theories

Ex : Argyres - Douglas, S-folds, high-dim SCFTs

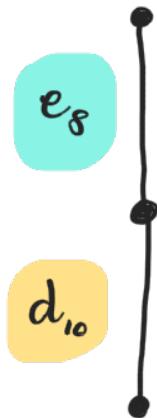
} computation
of chiral ring

- Study geometry of the moduli space \rightsquigarrow draw the phase diagram.

Ex : 6d $d\Gamma = (1, 0)$

$$SU(2) + N_f = 10$$

"Quiver subtraction"



"Small instanton transition"
(tensionless strings)

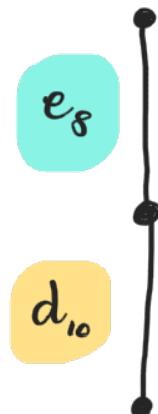
"Higgs mechanism"

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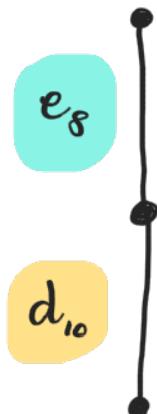
- Discover new
 - \rightarrow physical theories (e.g. VOA construction of 4d $N=2$ from Higgs branch)

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\int physical effects \longleftrightarrow geometry.

- Discover new
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- Rephrase physics question into
 - { combinatorics / graph theory
 - { representation theory

OPEN QUESTIONS

