# – Higgs Branch RG-flows –
# Decay and Fission of Magnetic Quivers

**Marcus Sperling**

33rd Nordic Network Meeting on *Strings, Fields and Branes*

— October 30, 2024 —


# Motivation

**Supersymmetric / superconformal theories** expanded QFT landscape

- higher dim. QFTs
- non-Lagrangian
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Over the years: vast landscape of **theories w/ 8 SUSY**

How to explore?

- Ideally: all local operators & correlation functions $\longrightarrow$ too hard!
- Instead: **simple, robust (and computable) quantities**

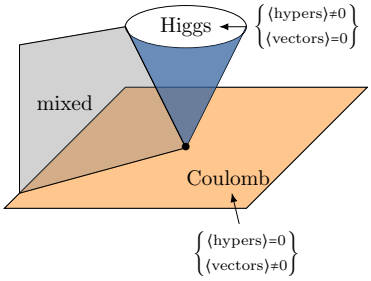
  e.g. symmetries, **vacua**, partition functions, ...

# Problem

Despite extensive research on d=4,5,6 theories w/ 8 SUSY,

**Higgs branches $\mathcal{H}$** not systematically understood

$\longrightarrow$ issue: $\mathcal{H}$ often **beyond hyper-Kähler quotient**



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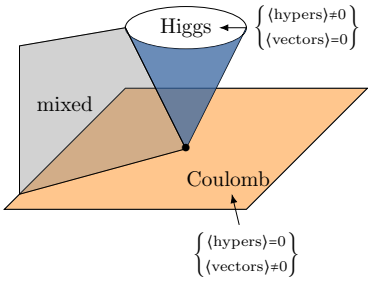

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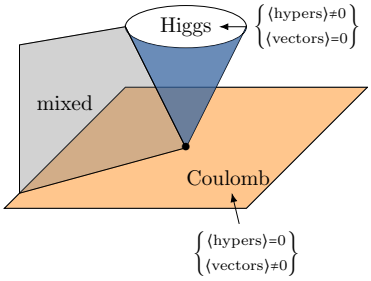

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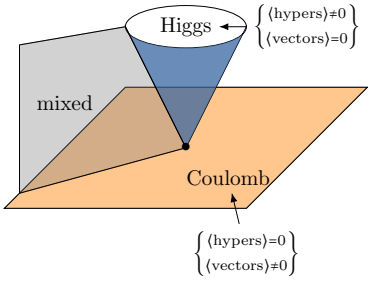

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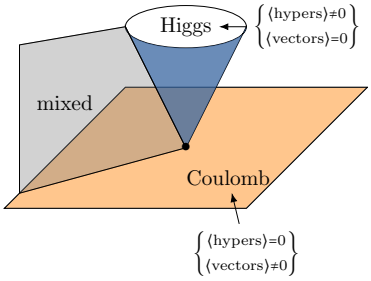


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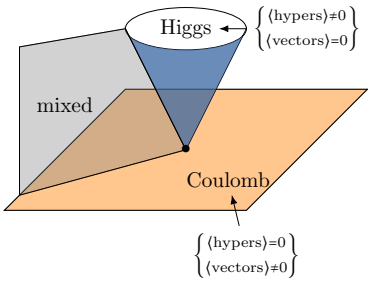


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**Q:** How to approach "**quantum Higgs branches**"? $\rightarrow$ **A:** **Magnetic quivers**!

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| M5 | × | → | M9 |
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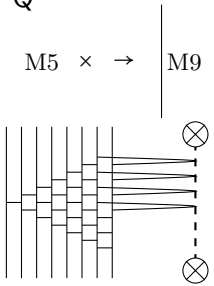


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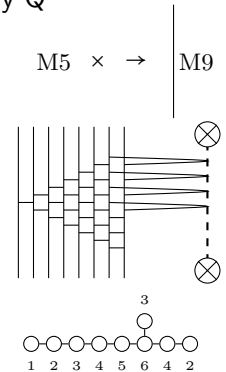


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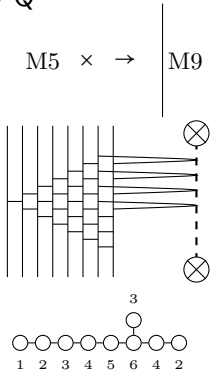


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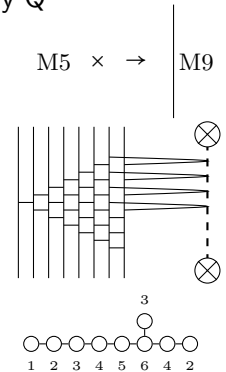


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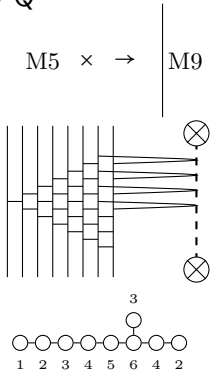


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Comp. data?

- Dimensions
- Symmetries
- Operator spectrum
- Stratification

# Magnetic quiver have been used in ...

6d $\mathcal{N} = (1, 0)$ SCFTs

- Type II **Cabrera, Hanany, MS '19; MS, Zhong '21; Hanany, MS '22**; Bourget, Gimminger '22; Fazzi Giacomelli, Giri '23; ...
- F-theory inspired Lawrie, Mansi '23; Bao, Zhang '24

6d LSTs

- Type II based Del Zotto, Fazzi, Giri '23; Lawrie, Mansi '23; **Mansi, MS '23**, ...

5d $\mathcal{N} = 1$ SCFTs

- 5-branes Cabrera, Hanany '18; **Bourget, Grimminger, Hanany, MS, Zhong '20**; Akhond, Carta, Dwivedi, Hayashi, Kim, Yagi '20 & '22; Akhond, Carta '21; ...
- M-theory on (toric) CY3 Beest, Bourget, Eckhard, Schäfer-Nameki '20 , Closset, Schäfer-Nameki, Wang '20; ...

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

- Class $\mathcal{S}$ Benini,Tachikawa, Xie '15
- Argyres Dougles **Bourget, Gimminger, Hanany, MS, Zhong '20**; Giacomelli, Mekareeya, Mininno ' 21; ....

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- Type II base

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**Magnetic Quivers** = **novel access** to quantum Higgs branch ✓

→ geometry, duality checks, classifications, ...

but missing **connection to RG-flows** ✗

# Decay & Fission of magnetic quivers

Higgs branch RG-flow $T \to T'$ and Q = mag. quiver of $T$

**Q:** Magnetic quiver of $T'$?

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Higgs branch RG-flow $T \to T'$ and Q = mag. quiver of $T$ ⇔ Coulomb branch RG-flows of Q as 3d $\mathcal{N} = 4$ theory

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**Answer:** encode Q into "shape"-matrix $A$ and "rank"-vector $K$

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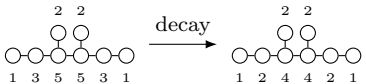

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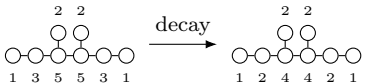
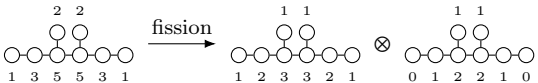



- **Fission**: shape remains, rank vector splits



# Higgs branch RG-flows via Decay & Fission

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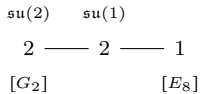

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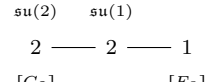


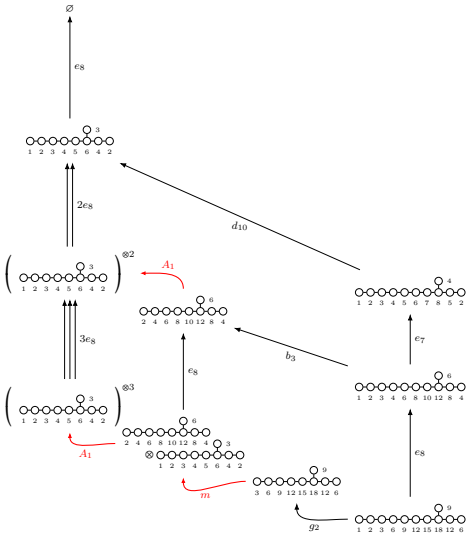

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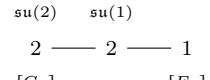


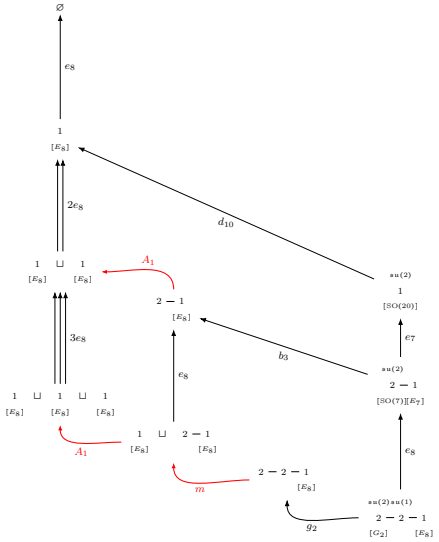

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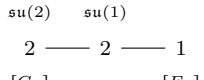
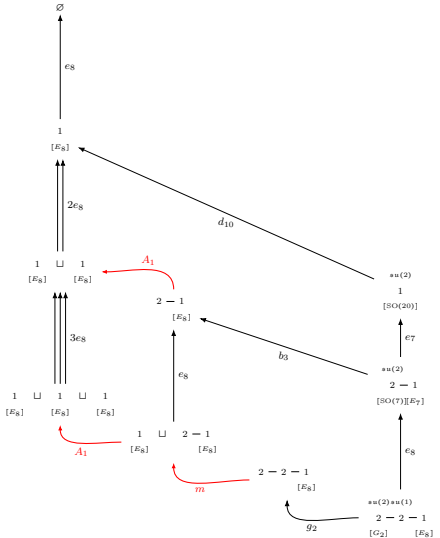



Distinct Higgsing types

- **Decay** – a.k.a. nilpotent Higgsing
- **Fission** into products



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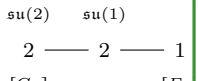


6d $\mathcal{N} = (1, 0)$ Higgs branch RG-flows more than just "nilpotent Higgsing"

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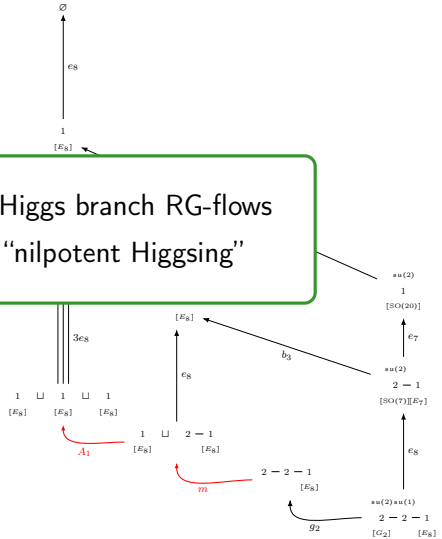

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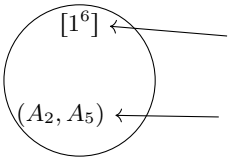
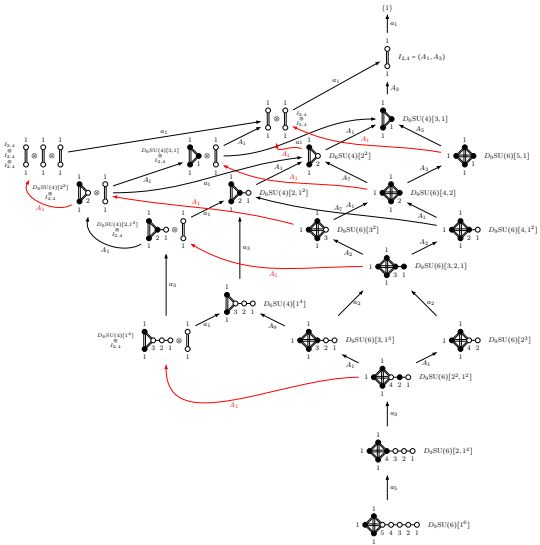



Two types of Higgsing

- Partial closure of **regular puncture**
- Higgsings from **irregular puncture**

  → contains fissions



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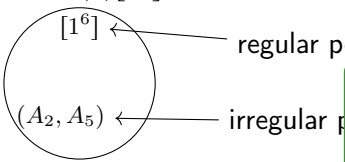
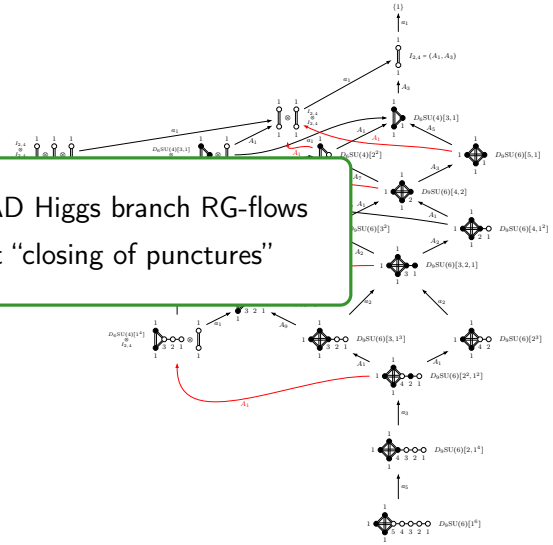



4d class $\mathcal{S}$ / AD Higgs branch RG-flows
more than just "closing of punctures"

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- **Magnetic quivers** = window into geometry, symmetries, ...
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