Higgsing SCFTs

-- Decay and Fission of Magnetic Quivers

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Superconformal Field Theories (SCFTs) with eight supercharges in space-time dimensions $d = 3, 4, 5, 6$

Higgsing SCFTs along the Higgs branch

Give VEV to scalars that parameterize the Higgs branch

4d $\mathcal{N} = 2$ example:

$SU(3)$ gauge theory
$N_f = 6$ Flavors

$SU(2)$ gauge theory
$N_f = 4$ Flavors

Trivial

Most SCFTs don't have known Lagrangian description → Higgsing is HARD!

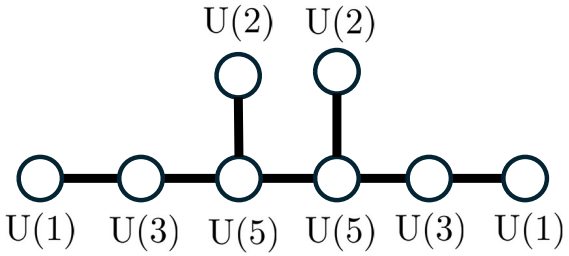
Example: 5d $\mathcal{N}=1$ Low-energy: $SU(5)_1$, $N_f=4$, $N_{\rm AS}=2$

Superconformal fixed point: No known Lagrangian,
Higgs branch enhanced by massless instanton operators

To study Higgs branch: Magnetic Quiver

Definition: An auxillary combinatorial object that encodes the Higgs branch of $d=3,4,5,6$ SCFT with eight supercharges

[Akhond,Arias-Tamargo, Bhardwaj, Bourget, Bullimore, Carta, Closset, Dwivedi, Eckhard, Fazzi, Ferlito, Ferarri, Giacomelli, Giri, Gledhill, Grimminger, Guhesh, Hanany, Hayashi, Kalveks, Kim, Lawrie, Li, Liu, Mansi, Mekareeya, Miketa,Nawata, Pasquarella, Pini, Sacchi, Schäfer-Nameki, Sperling, Van Beest, Wang, Wang, Yagi, Zafrir, Zajac, Zhong '18- '24]

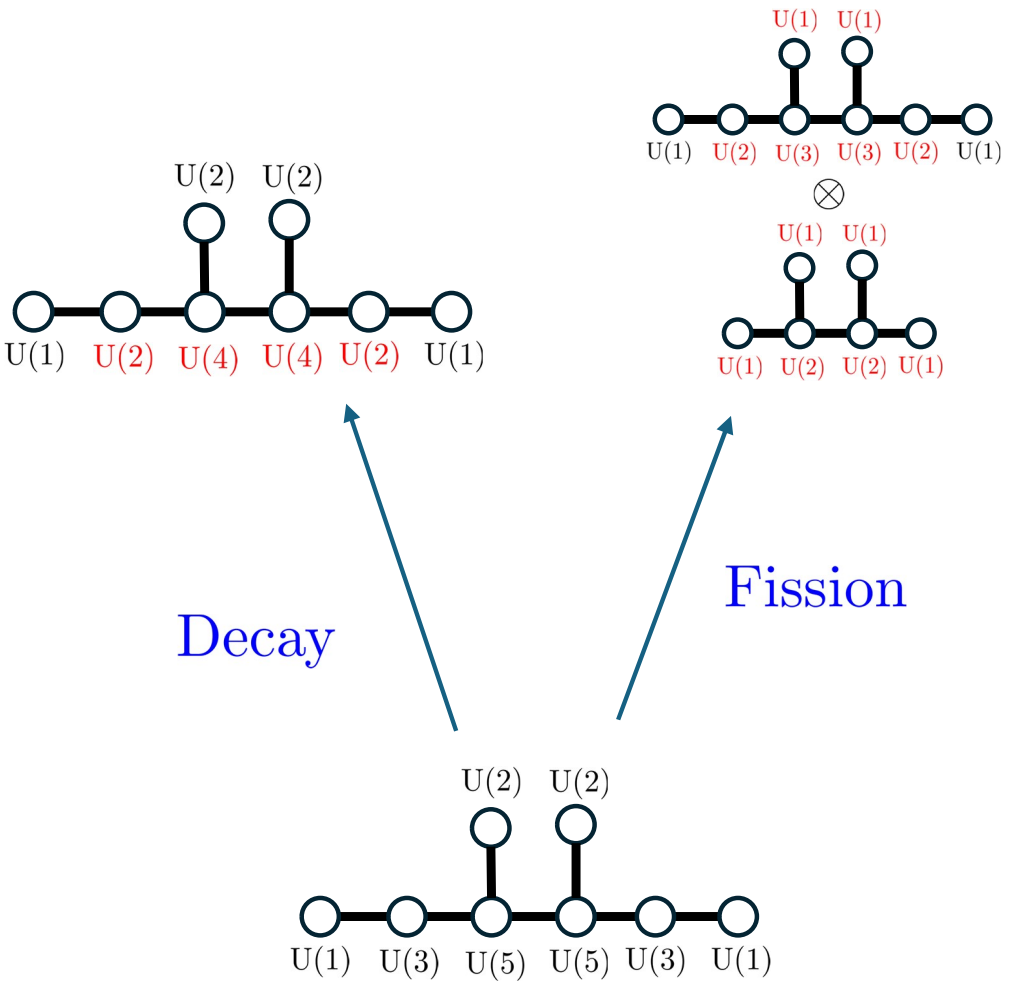


Magnetic Quiver from:
[Van Beest, Bourget, Eckhard, Schäfer-Nameki '20]

To perform Higgsing: Decay and Fission algorithm

A Higgsing algorithm: Decay and Fission of magnetic quivers

Magnetic Quivers



SCFTs

$SU(4)_1^{g\infty}$, $N_f = 4$
$N_{\rm AS} = 2$

$SU(3)_1^{g\infty}$, $N_f = 6$
$N_{\rm AS} = 0$

$\otimes$

$SU(2)_1^{g\infty}$, $N_f = 4$
$N_{\rm AS} = 0$

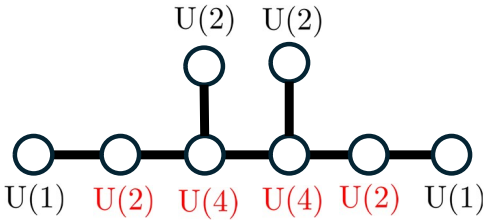
Higgsing

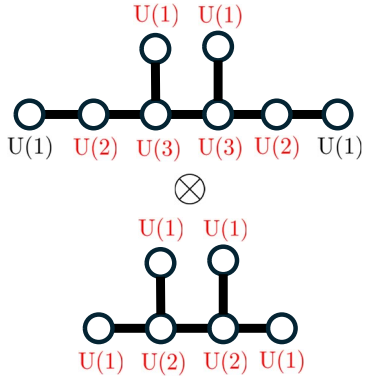
Higgsing

$SU(5)_1^{g\infty}$, $N_f = 4$
$N_{\rm AS} = 2$

A Higgsing algorithm: Decay and Fission of magnetic quivers

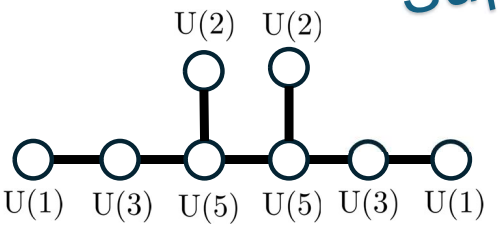
Magnetic Quivers





Decay

Fission



Super efficient code!!!

SCFTs

$SU(3)_1^{g\infty}$, $N_f = 6$
$N_{\rm AS} = 0$

⊗

$SU(4)_1^{g\infty}$, $N_f = 4$
$N_{\rm AS} = 2$

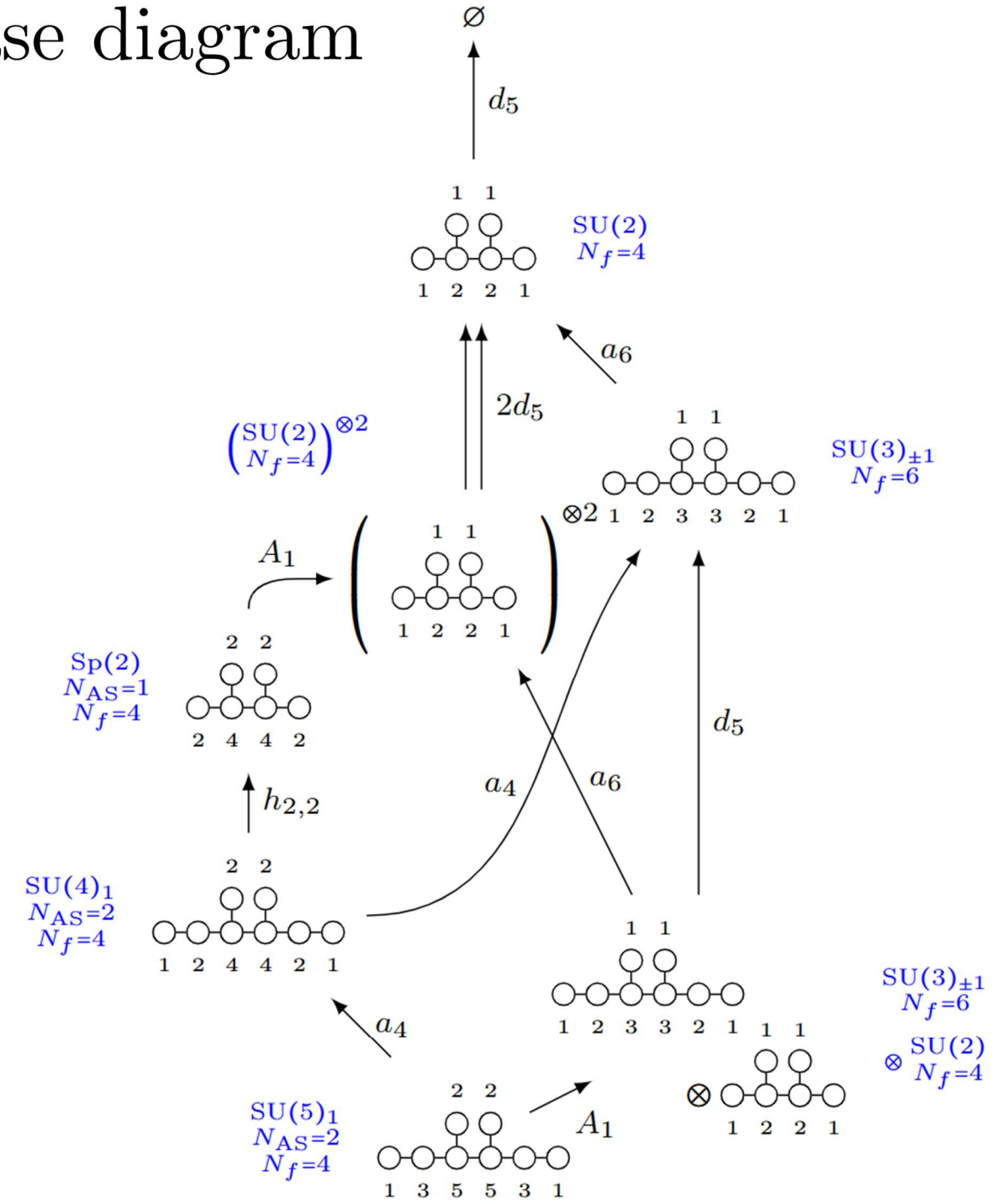
$SU(2)_1^{g\infty}$, $N_f = 4$
$N_{\rm AS} = 0$

Higgsing

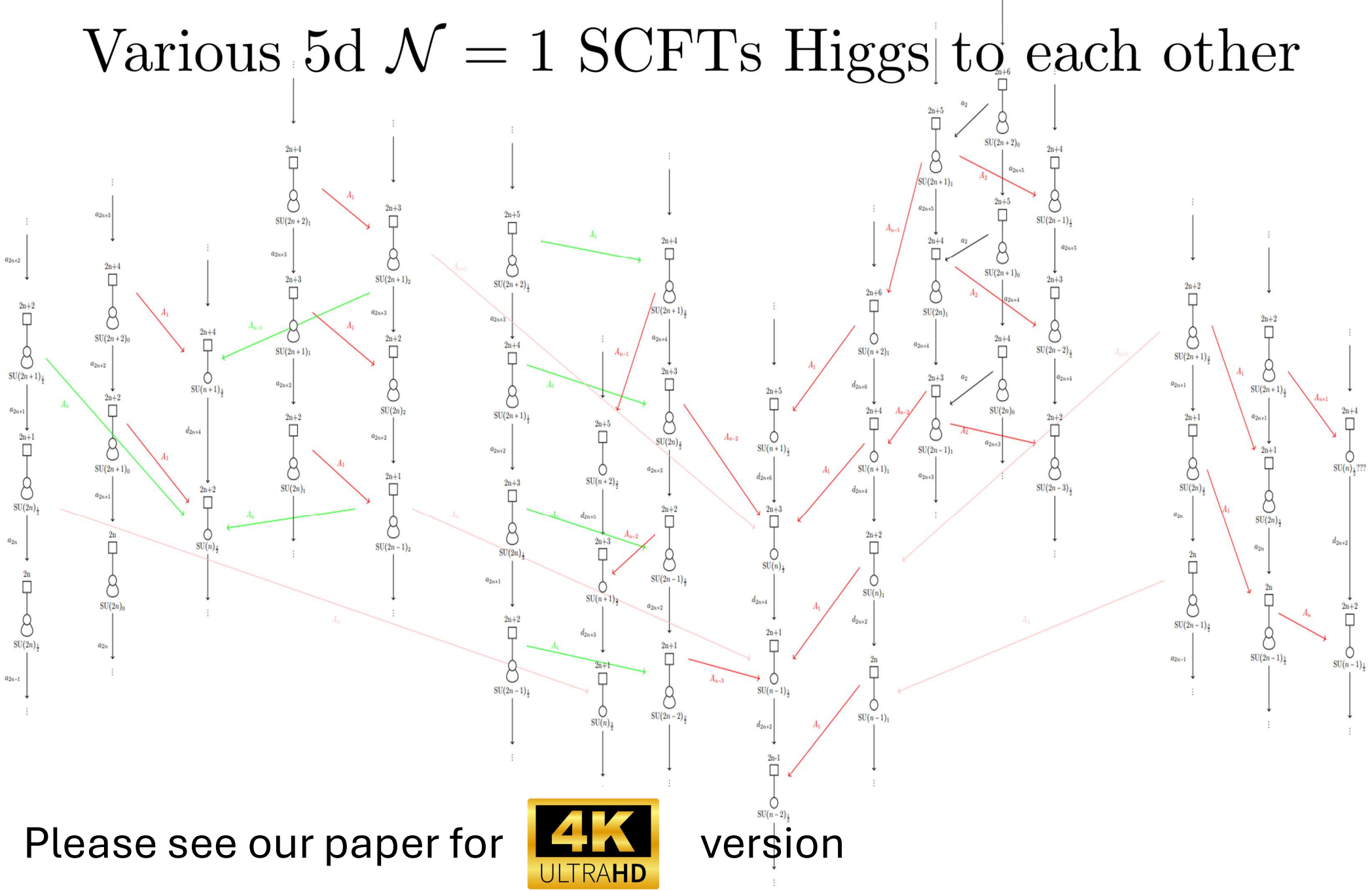
Higgsing

$SU(5)_1^{g\infty}$, $N_f = 4$
$N_{\rm AS} = 2$

Higgsing phase diagram



Various 5d $\mathcal{N} = 1$ SCFTs Higgs to each other



Please see our paper for 4K ULTRAHD version

Long version:
[2401.08757]

What we Higgsed so far

	SCFTs + more	
3d $\mathcal{N}=4$	T_ρ^σ theories	Mixed U(n) and SU(n) quiver theories
4d $\mathcal{N}=2$	Class $\mathcal{S}$ theories	Argyres-Douglas theories
	More exotic SCFTs	
5d $\mathcal{N}=1$	SQCD theories	
6d $\mathcal{N}=(1,0)$	Orbi-instanton	Higher-rank E-string
	Little string theories	