§4.2 Compactifications of 6d (1,0) SCFT's

The $\mathbb{Z}_K$ orbifold of $\mathcal{N}=2$ linear quivers

Want to look at compactifications of

$\mathcal{T}_K^N(1,0)$ SCFT's: N M5 branes probing A_{K-1} singularity

"A-type conformal matter"

brane setup:

M-th.:

	x^0	x^1	x^2	x^3	x^4	x^5	x^6	x^7	x^8	x^9	x^{10}
						$\mathbb{C}^2/\mathbb{Z}_K$					
N M5	x	x	x	x	x						x

$\downarrow$ identify x^{10} with M-theory circle

IIA:

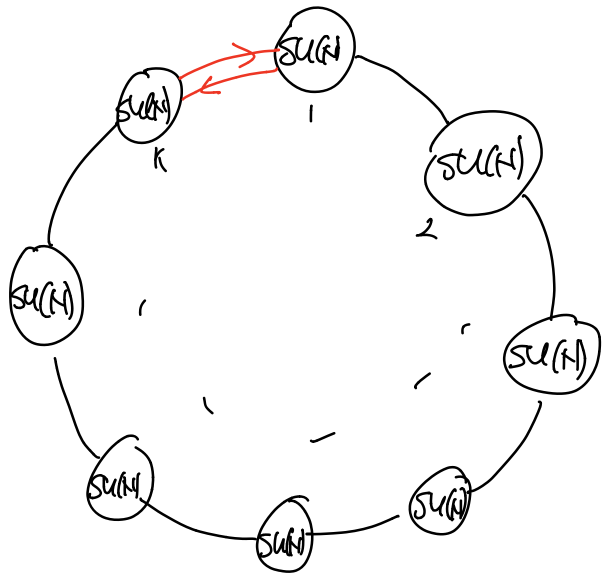
	x^0	x^1	x^2	x^3	x^4	x^5	x^6	x^7	x^8	x^9
						$\mathbb{C}^2/\mathbb{Z}_K$				
N D4	x	x	x	x	x					

$\longrightarrow \left(\mathcal{N}=2 \text{ 5d } U(N) \text{ SYM}\right)/\mathbb{Z}_K$

scalars: x^9, $x^5+ix^6 = Y_1$, $x^7+ix^8 = Y_2$

$\mathbb{Z}_K$: $\quad 1 \qquad e^{2\pi i/K} \qquad e^{-2\pi i/K}$

resulting 5d quiver theory:



5d theory has $U(1)^{2K}$ global symmetry

$\subset SU(K)_\beta \times SU(K)_\gamma \times U(1)_t$

Non-abelian symmetry is broken by Wilson lines for $SU(K)_\beta \times SU(K)_\gamma$

$\longrightarrow$ perturbative gauge theory description in 5d

$$\tau = \sum_{i=1}^{K} \tau_i = \sum_{i=1}^{K} \frac{4\pi^2}{g^2_{YM,i}} = \frac{1}{R}$$

radius of X^{10}-circle

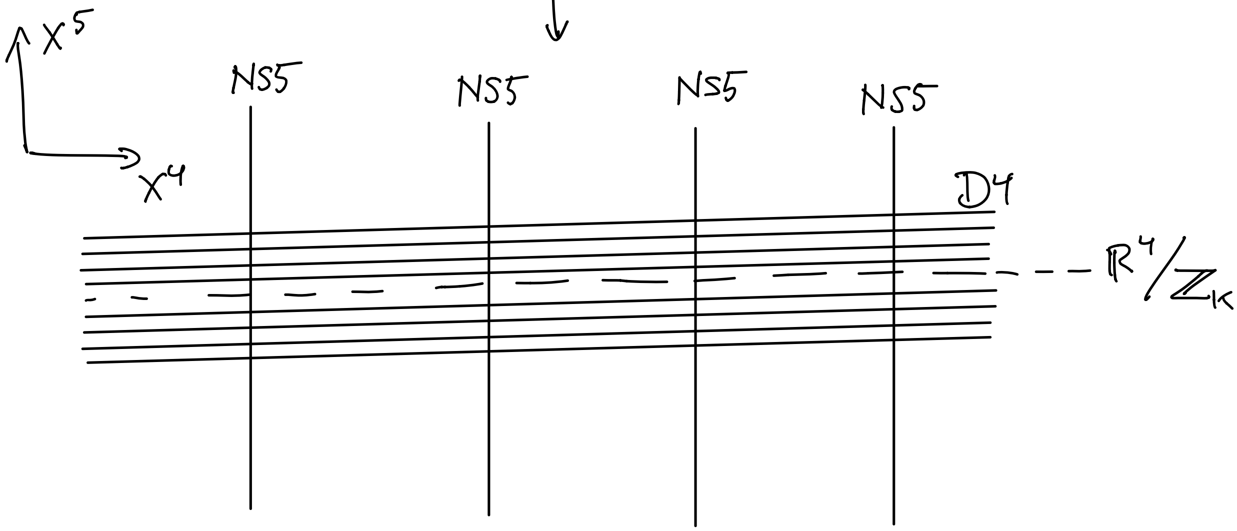
$$\tau_i = \int_{C_i} B \quad \text{B-field}$$

, where C_i are 2-cycles in the resolution of A_{K-1}-sing.

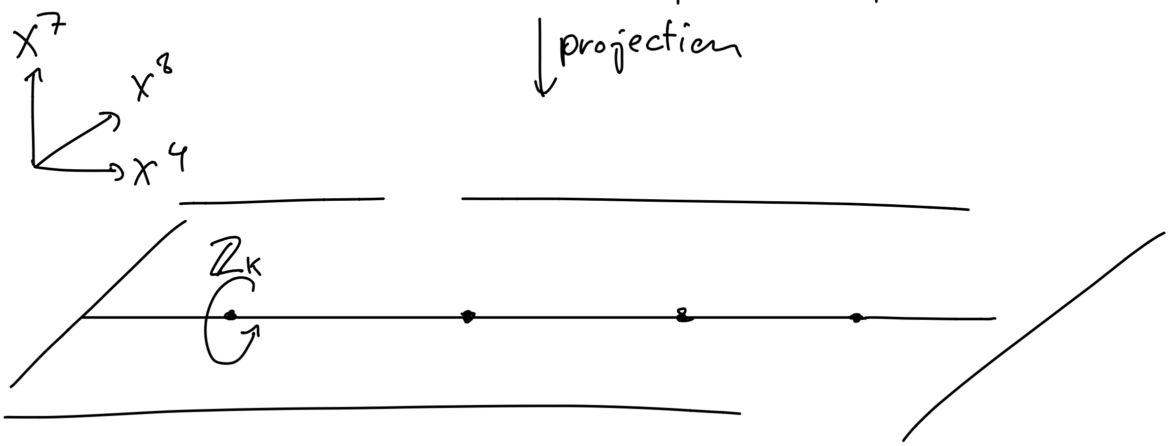
Further compactification on S^1 would give
4d $\mathcal{N}=2$ theory

$\longrightarrow$ to get $\mathcal{N}=1$ gauge th. in 4d,
need to include NS5-branes :

	x^0	x^1	x^2	x^3	x^4	x^5	x^6	x^7	x^8	x^9
						$\mathbb{C}^2/\mathbb{Z}_K$				
N D4	x	x	x	x	x					
n NS5	x	x	x	x		x	x			



projection



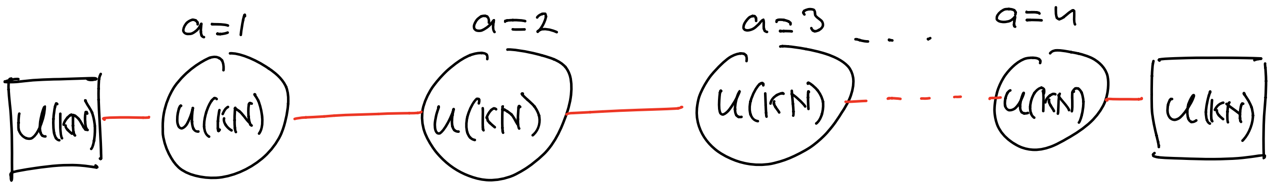
→ KN fractional D4-branes intersected by n NS5-branes

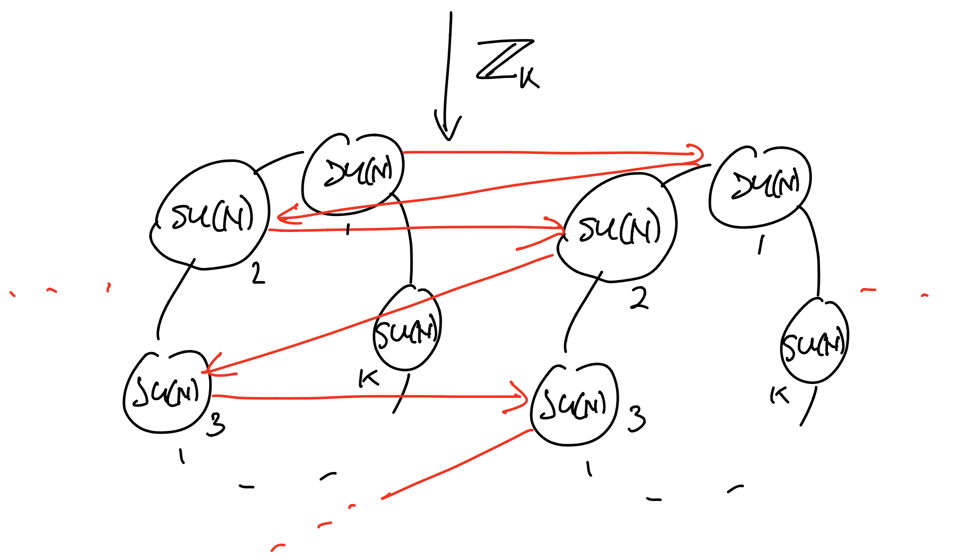
→ $\left(\mathcal{N}=2 \text{ linear quiver of 4d } U(KN) \text{ gauge groups}\right) / \mathbb{Z}_K$

↓

$\mathcal{N}=1$ SUSY

by embedding $\mathbb{Z}_K$ into $SU(2)_R \times U(1)$ R-symmetry



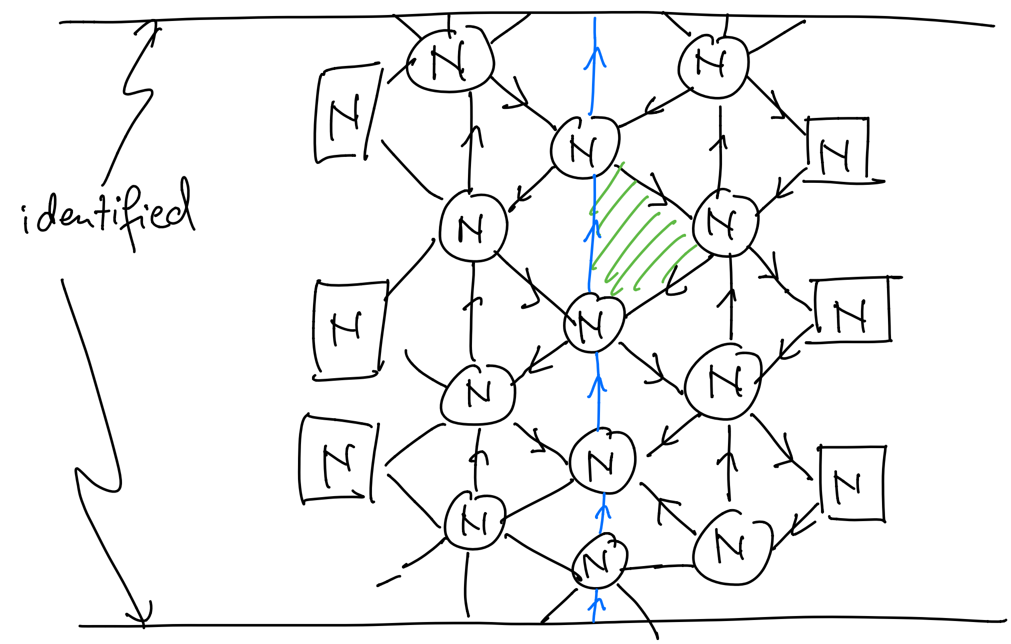


necklace $\mathcal{N}_a$ $\mathcal{N}_{a+1}$

each $\mathcal{N}=2$ hyper-multiplets splits to 2 $\mathcal{N}=1$ chiral multiplets going from

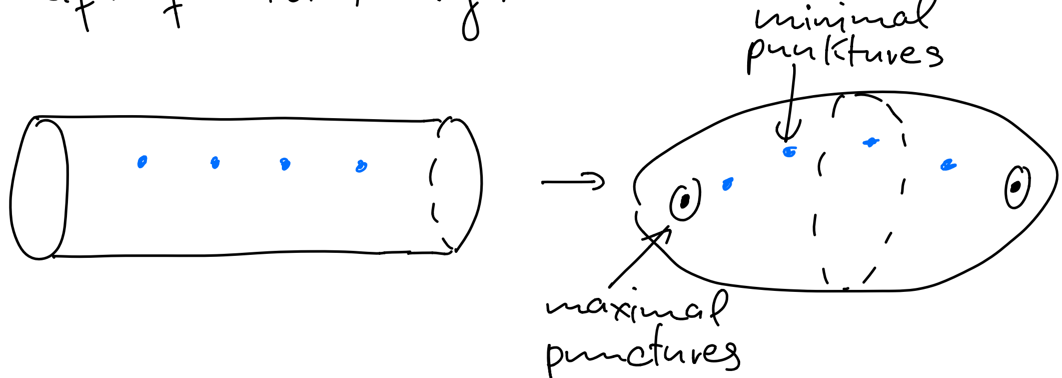
$\mathcal{N}_{a,i} \longrightarrow \mathcal{N}_{a+1,i}$ and $\mathcal{N}_{a+1,i} \longrightarrow \mathcal{N}_{a,i+1}$

Resulting structure is tessellation of cylinder



triangular faces associated to cubic superpotentials

6d-lift of 4d theory:



with $SU(N)^k$ flavor-sym.

each minimal puncture carries $U(1)_\alpha$ global symmetry

$\longrightarrow$ $n+1$ $U(1)$'s

Altogether: $U(1)^{2K+n}$ global symmetries

remaining $U(1)^{2K-1} \longleftarrow$ Cartan generators of $SU(K)_\alpha \times SU(K)_\beta \times U(1)_t$

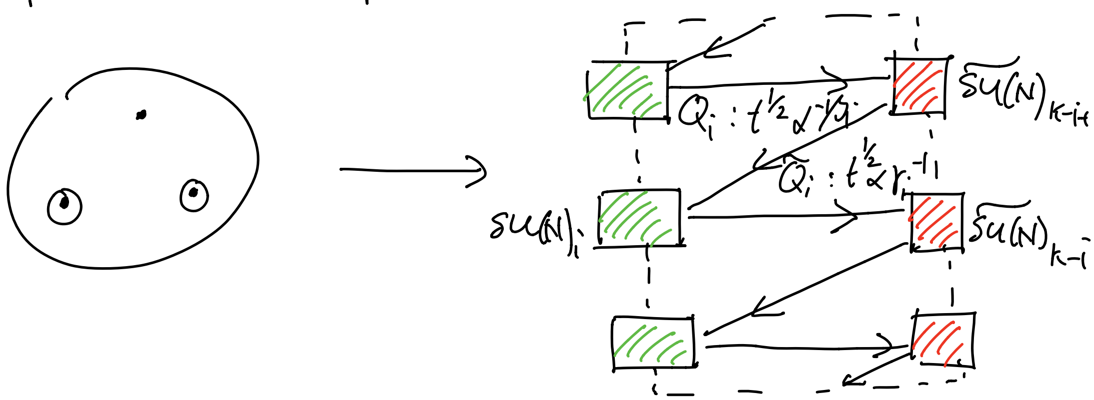
$$U(1)_t \times \left[\frac{U(1)^K}{U(1)}\right]_\beta \times \left[\frac{U(1)^K}{U(1)}\right]_\gamma$$

$\longrightarrow$ n marginal couplings:

relative positions of $n+1$ minimal punctures

The free trinion

sphere with 3 punctures



$2KN^2$ free chiral fields:

- $Q^{a_i}{}_{b_i}$ in $SU(N)_i \times \widetilde{SU(N)}_{K-i+1}$
- and $\tilde{Q}_{a_i}{}^{b_{i+1}}$ in $\overline{SU(N)}_i \times \widetilde{SU(N)}_{K-i}$

K $SU(N)_i$ and K $\widetilde{SU(N)}_i$ global symmetries

$\longrightarrow$ maximal punctures