Gauge @ IGAP

Chiral algebras from 3d – S. Gukov

- based on work ① w/ C. Manolescu, ② "3d Modularity" w/ F. Ferrari

- BPS/CFT [Nakajima, ...]

- 4-mfd $M_4 \rightsquigarrow Z_{VW}(q) = \sum_n \chi(\mathcal{M}^{n=c_2}_{inst})\, q^n$

$$\overset{?}{=} \chi_{VOA[M^4]} = \text{ch. alg of } 2d \text{ CFT } T[M_4]$$

- 3-mfd $M_3 \rightsquigarrow \hat{Z}(M_3) = \underline{\Pi}_{GGP}(T[M_3])$

$$= \chi_{\log\text{-}VOA[M_3]}$$

conjectured 3d modularity

- 3d TQFT à la Atiyah-Segal

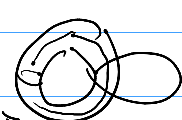
$M_3 \rightsquigarrow \hat{Z}(M_3, G, q)$

2-mfd $\Sigma \rightsquigarrow \mathcal{H}(\Sigma)$ Hilb. sp.

Thm (Lickorish–Wallace, Kirby, ...)
Every connected oriented closed 3-mfd arises by performing an integral Dehn surgery along a link $L \hookrightarrow S^3$

$\nu(L) = \coprod S^1 \times D^2$

$\partial(S^1 \times D^2) = T^2$

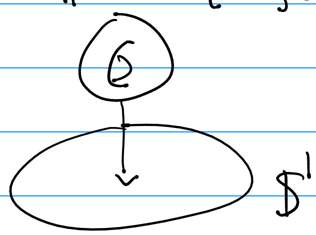


$p_2 \in \mathbb{Z}$

p_1

$\varphi = \begin{pmatrix} p & q \\ * & * \end{pmatrix} \in SL(2,\mathbb{Z}) = MCG(T^2)$

- Q. (M. Freedman):
  - L. Funar "Torus bdls not distinguished by TQFT invariants" (2013)
  - $M_3 = \mathbb{T}^2 \times [0,1]/\sim$, $(x,0)\sim(\varphi(x),1)$
    $\varphi \in SL(2,\mathbb{Z})$



- examples:

  - $\varphi = -STST = \begin{pmatrix} 1 & 1 \\ -1 & 0 \end{pmatrix} \Rightarrow M_3 = S^3_0\,(3_1)$
  - $\varphi = -STST^{-1} = \begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix} \Rightarrow M_3 = S^3_0\,(4_1)$