

Turner: $\Sigma^2, \partial\Sigma = S^1$

$$M = \text{Mod}(\Sigma) \hookrightarrow \mathcal{H}(\Sigma)$$

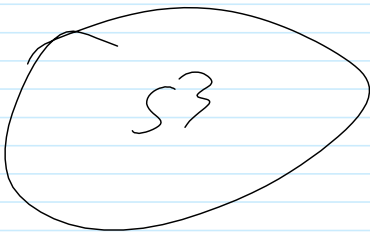
$$\downarrow$$

$$\hat{M} = \text{Aut}(\tilde{\pi}, [\partial\Sigma])$$

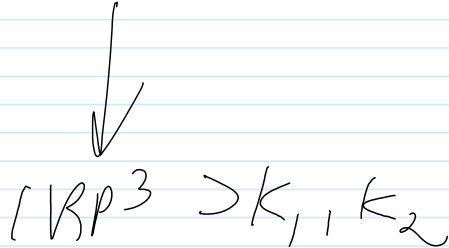
← TQFT

π : Fund group
 $\tilde{\pi}$: nilpotent completion

Motzkin: 1.



$\exists? K_1 \neq K_2$ whose lifts are the same.



2. conjecture: $\overset{\text{Hauptgenus}}{\downarrow} g(M^3) = 2 \Rightarrow M$ can be obtained from S^3 by surgery on a 4-component link.

Blanchet Find a non-trivial element in the kernel of non-semisimple TQFT. ...

Vesnin ... volume conjecture, Kashaev ...

Machin ... T , ... naturally invariant?

Verstehen: Is P/B_1 residually nilpotent?