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## State Integral Partition function of knots and links

We briefly review  $SL(2, \mathbb{C})$ -Chern-Simons partition function  $Z[\mathcal{M}]$  on a closed three-manifold  $\mathcal{M}$  obtained from Dehn fillings on a link complement  $\mathbf{S}^3 \setminus \mathcal{L}$ . We focus on links  $\mathcal{L}$  which are connected sum of a knot  $\mathcal{K}$ with a Hopf link H ( $\mathcal{L} = \mathcal{K} \# H$ ). Motivated by our earlier work on topological entanglement and the reduced density matrix  $\sigma$  expression for such link complements, we wanted to determine a choice of Dehn filling so that  $\operatorname{Tr} \sigma = Z[\mathcal{M}]$ .

Using \textt{SnapPy}, we deduce a choice of the Dehn fillings which gives the

imaginary part of the leading order term in the perturbative expansion of  $Z[\mathcal{M}]$  to be the hyperbolic volume of the knot  $\mathcal{K}$ . We have given explicit results for knots  $\mathcal{K} = 4_1, 5_2, 6_1, 6_2$  and  $6_3$ .

## Field of contribution

Theory

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