gravity $S[g] = \int dx \sqrt{g}\,(\frac{1}{G}\Lambda + \frac{1}{G}R) + \text{matter}\ldots$

cosmological constant

$\hookrightarrow$ quantize "$\prod_x dg_x$"

$\langle O\rangle = Z = \int [d\phi]\, e^{-S[\phi]}$

$\langle\ldots\rangle$ field ϕ

$Z = \int [dg]\, e^{-S[g]}$

'all metrics'!

discretizations

"Z" $= \sum_{T \text{ discretizations}} C(T)\, e^{-S[T]}$ measure $\hookrightarrow$ discrete version of $\int \sqrt{g}\,(\frac{\Lambda}{G} + \frac{1}{G}R)$

first $D=2$ then $D\geq 3$

"Universal machine" to generate random triangulations

$\hookrightarrow$ patterns of gluings

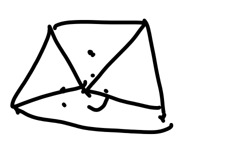
"Matrices, Tensors" $= \sum_{\text{Triangulations combinatorial}} e^{-S}$

Simplest ones λ N $\leftarrow$ large parameter

Tuned parameter

D-simplices $= \sum_{\text{triangulations } D \text{ dim.}} \lambda^{\#(D\text{-simplices})} N^{\#(D-2)\text{-simplices}}$

D_1, D_2 glue $(D-1)$



$S = \int \sqrt{g}\,(\frac{1}{G}\Lambda + \frac{1}{G}R) \equiv$ equilateral $\mathcal{J}$ $\quad K_D \,\#D\text{-simplices} = K_{D-2}\,\#D-2\text{-simplices}$

Interpretation

$Z = \sum_{\text{equilateral triangulations}} e^{-S_{\text{discretized}}(T)}$

λ, N typical Δ that dominate K_D, K_{D-2}

$D=2$ random surfaces $\langle d_H\rangle = 4$

$V \sim R^{d_H}$

Brownian sphere

$\langle d_S\rangle = 2$

random walk

$P(t) \sim \frac{1}{t^{d_S}}$ back at 0

3 Δ

$\frac{3n}{2} = \ldots$ edges

$n=1$

$n=2$

$n=3$

$n=4$

$\vdots$

∞

$\hookrightarrow Z = \sum_{\text{topologies}}$ + ...

topology

$n \to n+2\epsilon$

$n_H \leftarrow$

random space

tune some parameters in order to favor $n \to \infty$

$\to \sum_{\text{triangulations}} \sim \sum_{\text{Topologies}} \left(\sum_{\text{fixed topology}}\right)$

$\sim \sum_{\omega\geq 0} \left(\sum_{W(G)=\omega} \text{triangulations}\right)$

triangulations pseudo-manifolds

$\to \sum_{\text{melons of } \partial \text{ of the sphere}} (\ldots) + \sum_{\omega\geq 1} (\text{junk})$

$\to e^{-S_{\text{discrete}}[\mathcal{J}]}$ equilateral

$n=1$

$n=2$

$n=3$

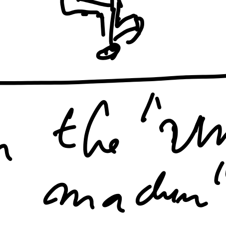
$\vdots$

$\langle d_H\rangle = 2$

$\langle d_S\rangle = 4/3$

topological dim. 0

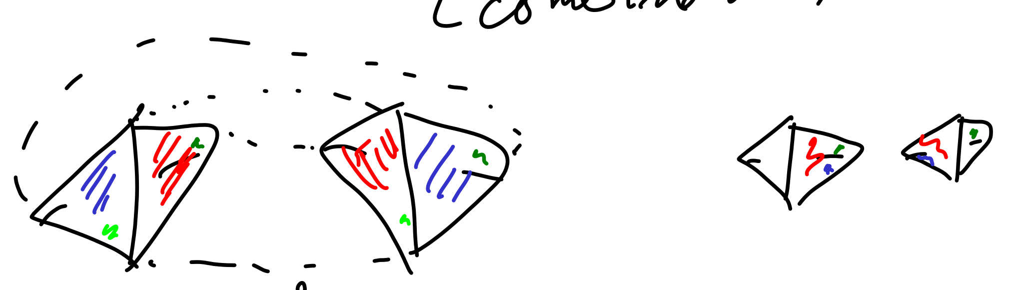
if equilateral $\to$ Branched polymer



Are there other models (on the "universal machine" side)

Yes but

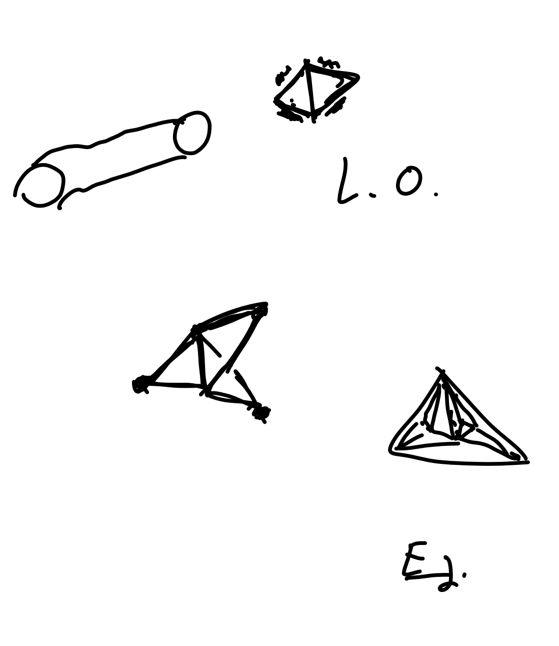
+ explain the L.O. triangulations (combinatorial)



S^3

B^3

L.O. is thing S^3 is S^3



$D=3$ Apolonian?

$\#n \sim K^n$

$e^{-EM_{\text{all}} + \frac{\ldots}{\ldots}R^2}$ if the # tetrahedra

E.g. minimal $R > 0$

$2 - 2g = V - E + F$

$3F = 2\cdot E \Rightarrow E = 3/2\, F$