



$$\underline{2n} \quad (2n-1)!!$$

$$T_n(N) = \sum N^{\# \text{вершин.}} =$$

по всем
склейкам

$$= \sum_{g=0}^{\infty} \varepsilon_g(n) N^{n+1-2g}$$

$$T(N, s) = 1 + 2Ns + 2s \sum_{n=1}^{\infty} \frac{T_n(N)}{(2n-1)!!} s^n$$

$$= \left(\frac{1+s}{1-s} \right)^N$$

$$\frac{T_n(N)}{(2n-1)!!}$$

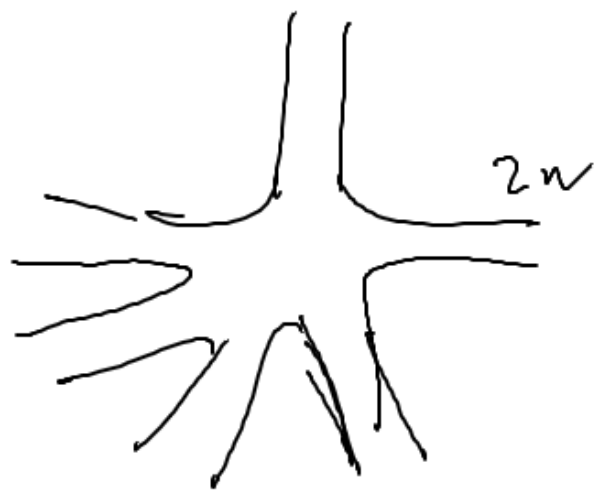
$$\frac{2^{\frac{N(N-1)}{2}}}{(\pi)^{\frac{N^2}{2}}} \int \text{Tr}(H^{2n})$$

$$\mathcal{H}_{N \times N}$$

$$H^T = H^* = H$$

$$e^{-\text{Tr}(H^2)}$$

dit is de Re hifm hij
 $i < j$



$$= \langle \text{Tr}(H^{2n}) \rangle$$

$$\langle 1 \rangle = 1$$

$$\int \mathbb{1} \cdot e^{-\left(\sum_{ii} h_{ii}^2 + \sum_{ij} \left(2(\operatorname{Re} h_{ij})^2 + 2(\operatorname{Im} h_{ij})^2\right)\right)} dh \dots$$

\uparrow
 F_2
 $N(N-1)$

$$\mathcal{H}_{N \times N} = \left(\sqrt{\pi}\right)^N \cdot \left(\frac{\sqrt{2}}{\sqrt{2}}\right)^{N(N-1)} \left(\sqrt{\pi}\right)^{N(N-1)} = \left(\sqrt{\pi}\right)^{N^2} \cdot \left(\frac{1}{\sqrt{2}}\right)^{N(N-1)}$$

$$\langle \text{Tr} (H^{2n}) \rangle = \sum \langle h_{i_1 i_2} h_{i_2 i_3} \dots h_{i_{2n} i_1} \rangle$$

$$1 \leq i_1, i_2, \dots, i_{2n} \leq N$$

$$\langle h_{ij} h_{ji} \rangle = \frac{1}{2}$$

$$\sum \frac{\langle h_i h_i \rangle \langle h_i h_i \rangle \dots \langle h_i h_i \rangle}{2}$$

partitions

$$\sum_{\text{no. perm. } 2n} N$$



$$\langle h_{i_1 i_2 i_3 i_4} \rangle = \frac{1}{2} \quad \langle h_{ij} h_{ji} \rangle = \frac{1}{2}$$

$$\langle h_{ij} \cdot h_{ij} \rangle = \langle (\operatorname{Re} h_{ij})^2 + (\operatorname{Im} h_{ij})^2 \rangle$$

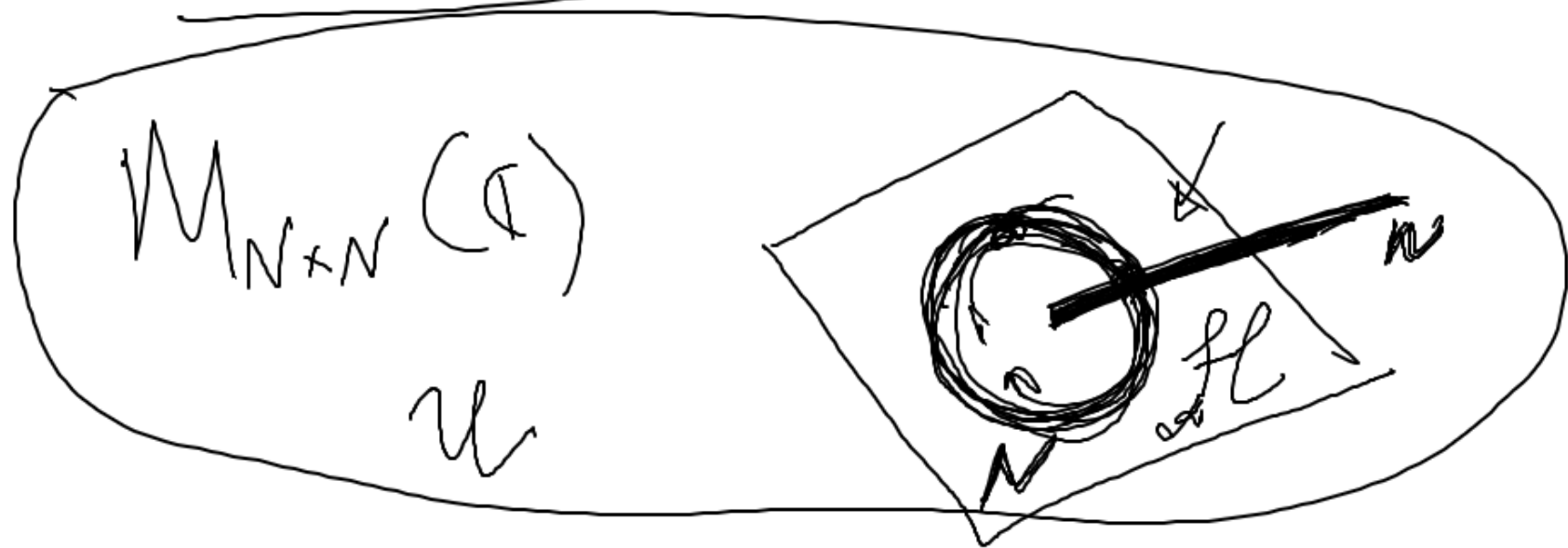
$$= \langle (\operatorname{Re} h_{ij})^2 \rangle + \langle (\operatorname{Im} h_{ij})^2 \rangle \xrightarrow{\frac{1}{4}} \frac{1}{\sqrt{\pi}} \int y^2 e^{-y^2} dy = \frac{1}{4}$$

$$\frac{1}{\sqrt{2}} \frac{1}{\sqrt{2}} \frac{1}{\sqrt{\pi}} \int \sqrt{2} x^2 e^{-2x^2} dx = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$$

$$\langle T_n(H^{2n}) \rangle = \frac{T_n(N)}{2^n}$$

The image shows a handwritten equation with annotations. On the left side, the expression is $\langle T_n(H^{2n}) \rangle$. Two arrows point upwards from below: one points to the T_n and the other points to the $2n$ in the exponent. On the right side, the expression is $\frac{T_n(N)}{2^n}$. An arrow points upwards from below to the 2^n in the denominator.

$$H = U^{-1} \Lambda U$$



$$\text{Tr}(U^{-1} H U)$$

$$= \text{Tr}(U U^{-1} H)$$

$$= \text{Tr}(H)$$

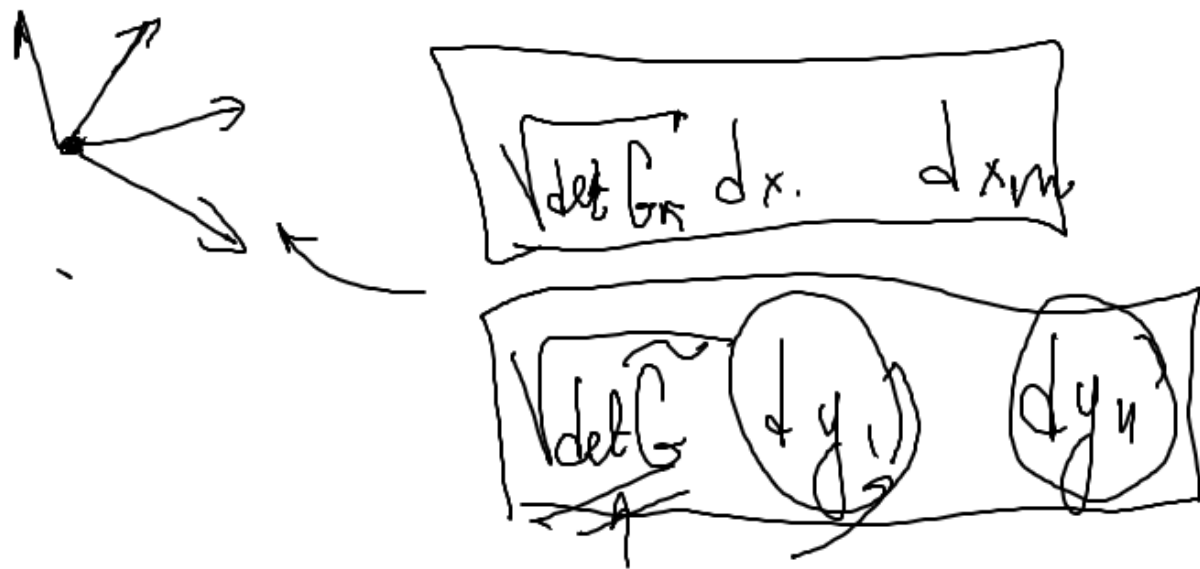
U -unit

$$U^\dagger U = E$$

$$U^T U = E$$

$$e^{-(T \times H^2)}$$

$\prod d h_{ij} \prod d R e h_{ij} \prod I m h_{ij}$



$$\sum_{j < k} dx_j dx_k$$

$\in M_n$

$dM = d$

$\begin{matrix} \downarrow & \downarrow \\ a_{ij} & b_{ij} \end{matrix}$

$\begin{pmatrix} a_{1n} \\ \vdots \\ a_{nn} \end{pmatrix}$

$$\text{tr} \left((dM) (dM)^+ \right)$$



$$= \sum_{1 \leq i, j \leq n} (da_{ij})^2 + (db_{ij})^2$$

$$= \sum (dx_{ii})^2 + \sum 2(da_{ij})^2 + (db_{ij})^2$$

$\sqrt{\det A}$ d hídRe hídI m h_i

$$\sqrt{2}^{N(N-1)}$$

$$\left(\begin{array}{cccc} 1 & & & \\ & 1 & & \\ & & 2 & \\ & & & 2 & \\ & & & & 2 \end{array} \right) \sqrt{2}^{N(N-1)}$$

$$\frac{1}{(\sqrt{\pi})^N} \int (a_{ij})^2 e^{-2(a_{ij})^2} \left(\frac{\sqrt{2}}{2}\right)^{N(N-1)} da_{ij} \dots =$$

fd

$$= \frac{1}{2} \frac{1}{\sqrt{\pi}} \int a^2 e^{-2a^2} \sqrt{2} da = \frac{1}{4}$$

$$\langle \text{Tr}(H^{2n}) \rangle = \int_{\mathcal{U}_N} d\mu \cdot \int_{\mathbb{R}^N} \text{Tr}(A^2)$$

$$\rightarrow \left| \begin{array}{cc|cc} 1 & 1 & 1 & 1 \\ \lambda_1 & \lambda_2 & \lambda_{N-1} & \lambda_N \\ \hline \lambda_1^{N-1} & & & \lambda_N^{N-1} \end{array} \right|^2 \int d\lambda_1 \dots d\lambda_N V(\lambda)$$