

Anderson localization on a simplex

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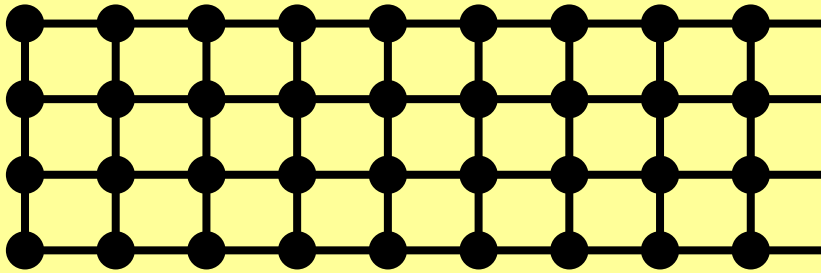
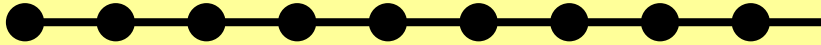


Anderson model

Hamiltonian on a d -dimensional lattice:



Solvable models

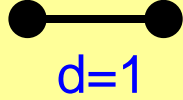


Outline

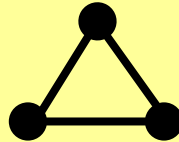
1. Definition of the simplex model and the moments of the eigenstates
2. Field-theoretical representation for the moments of the eigenstates
3. Moments of the eigenstates in the simplex model

Simplex model

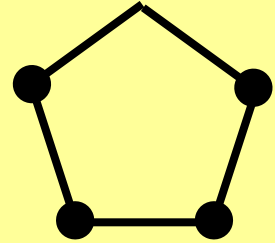
d-simplex



$d=1$



$d=2$



Supersymmetric representation

$$(e_{\alpha}(\dot{a}))$$

S_D, S_A commutative (bosonic) variables

χ_R, χ_A anti-commutative (fermionic) variables

$$\begin{aligned}
 & \int \prod_{i=1}^N dS_{D_i} dS_{A_i} \prod_{i=1}^N d\chi_{R_i} d\chi_{A_i} \exp\left(\sum_{i=1}^N \left[\frac{1}{2} S_{D_i}^2 + \frac{1}{2} S_{A_i}^2 + \chi_{R_i} \left(\sum_{j=1}^N \frac{1}{2} S_{D_j}^2 + \frac{1}{2} S_{A_j}^2 \right) + \chi_{A_i} \left(\sum_{j=1}^N \chi_{R_j} \left(\sum_{k=1}^N \frac{1}{2} S_{D_k}^2 + \frac{1}{2} S_{A_k}^2 \right) \right) \right] \right)
 \end{aligned}$$

Reduced representation

7 out 8 variables can be integrated out in the limit $\epsilon \rightarrow 0$



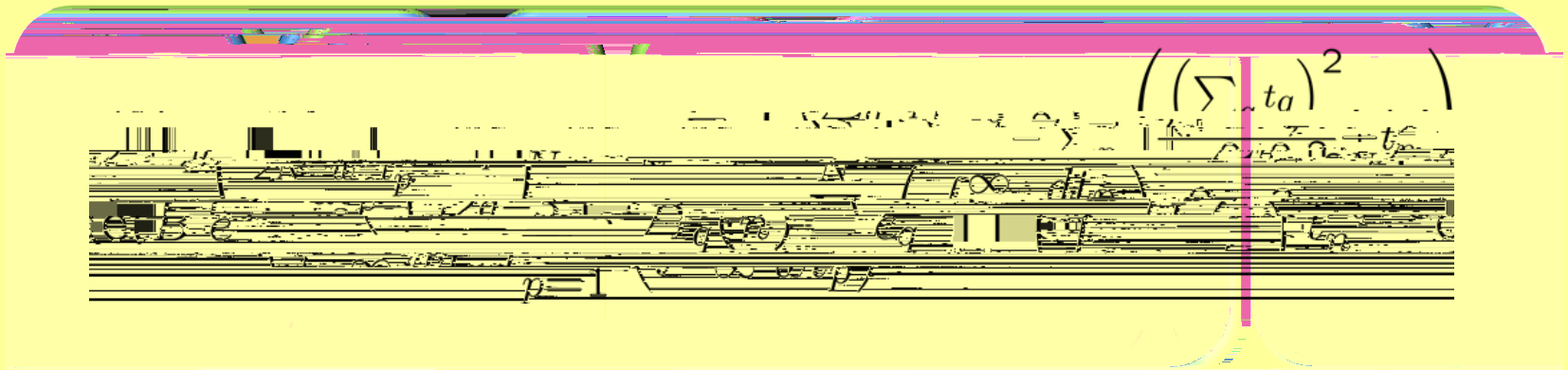
$$T_{pq} = \int_{t_p}^{t_q} dt \dots$$

Outline

1. Definition of the simplex model and the moments of the eigenstates
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Anderson model on a simplex

$$\frac{1}{N} T_{pq}$$

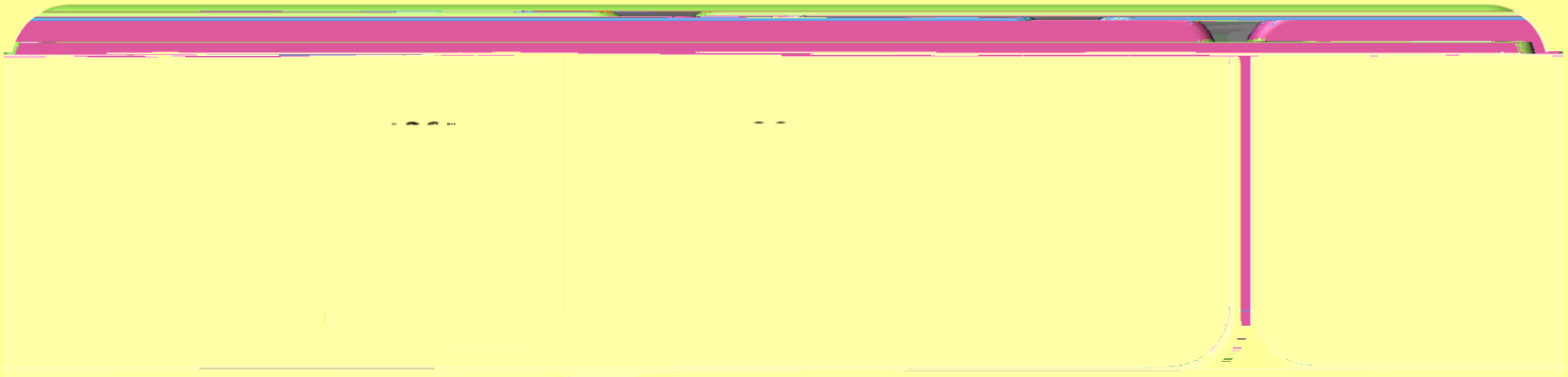


... N-2

$$\frac{1}{N} T_{pq}$$

variable

Anderson model on a simplex



$$s^2 - s^2 n^2 + i\theta n^1$$

1 2 3

Moments of the eigenstates in the thermodynamic limit

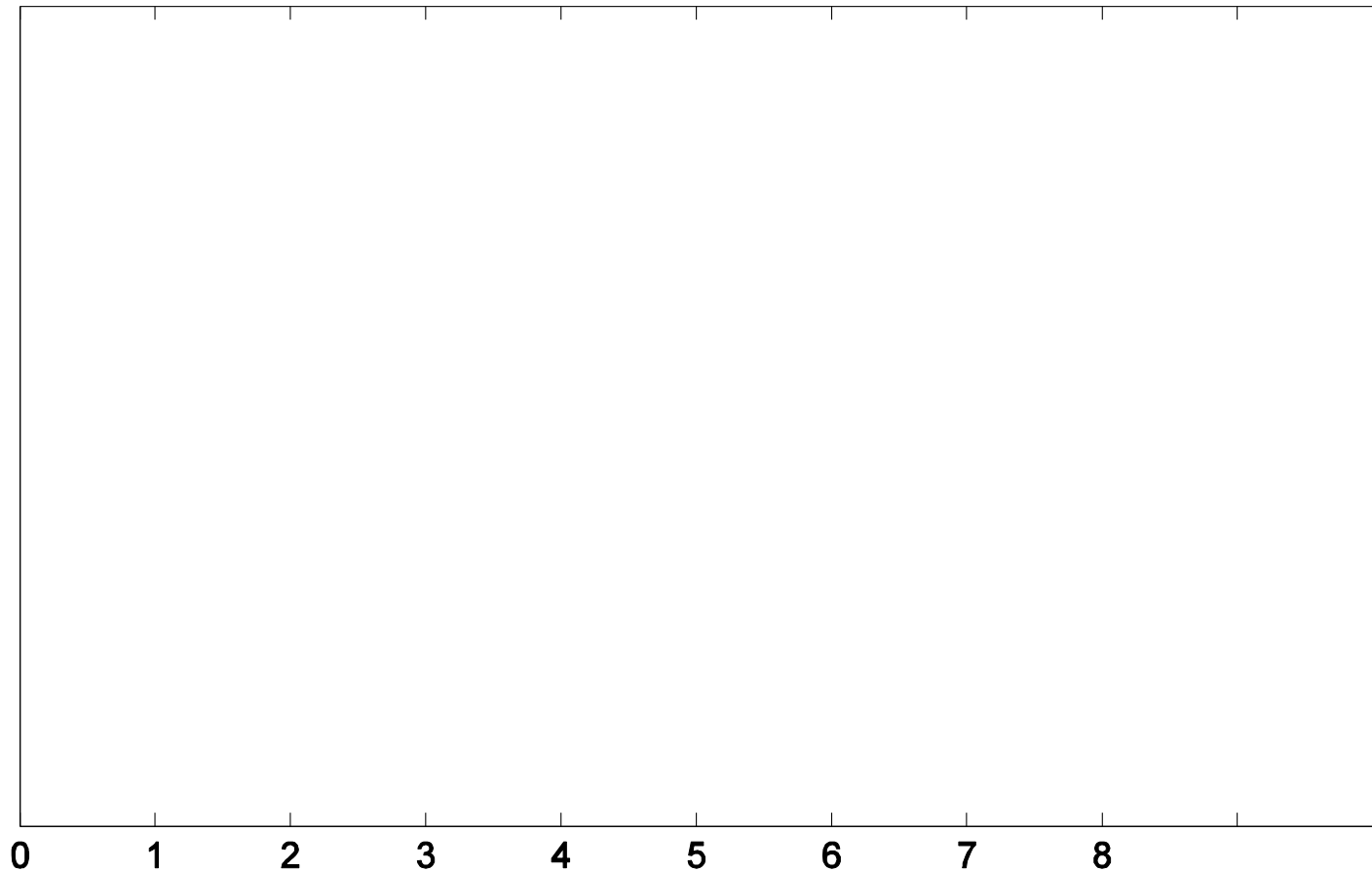
$$\Delta T \rightarrow 0, \quad \Delta T$$

$$\langle t | \alpha \rangle \rightarrow e^{-\frac{1}{2} \left[\frac{t^2}{\alpha} + \alpha \right]}$$

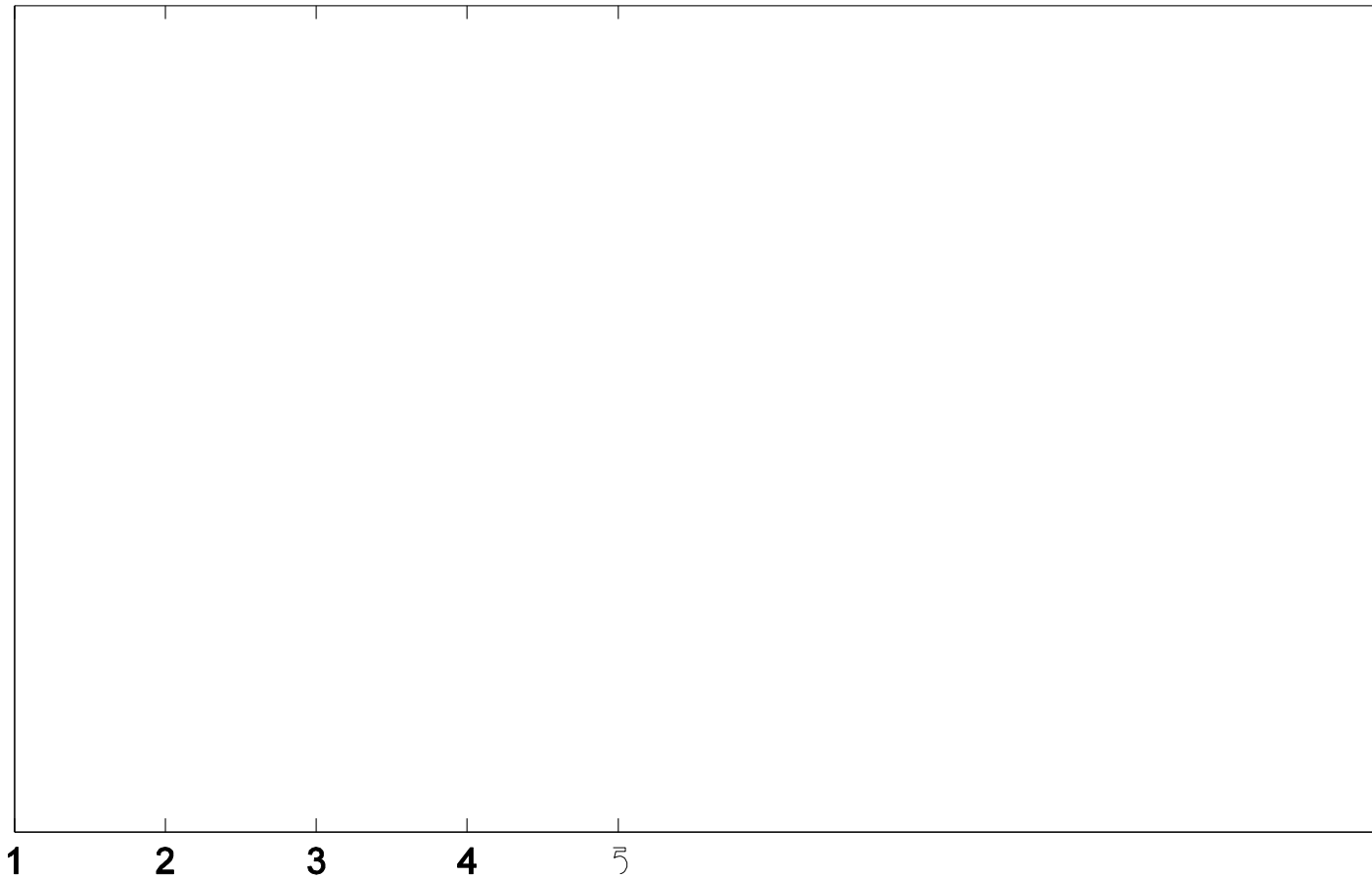
$$\langle t | \alpha \rangle = \frac{\sqrt{|t|}}{\sqrt{2}} \frac{(\alpha)^2}{e^{-\frac{t^2}{2\alpha}}} \frac{\sqrt{\pi} |\alpha|}{e^{-\frac{1}{2} \left[\frac{t^2}{\alpha} + \alpha \right]}}$$



Comparison with numerical simulations



Comparison with numerical simulations



Why eigenstates are localized?

Physical

