10/30 Jorge Kurchan

know know "know" expect - suspect.

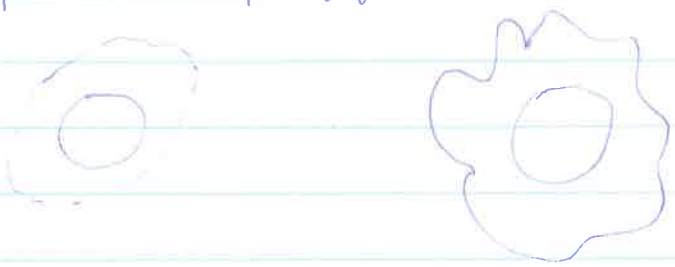
$\sum_{i=1}^{N} s_i^2 = N$

$E = \sum_{i_1 \cdots i_p} J_{i_1 \cdots i_p} s_{i_1} \cdots s_{i_p}$

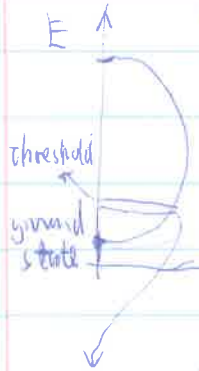
$p = 2$ $\sum_{ij}$ (all pairs) $J_{ij} s_i s_j$ $J_{ij}$ random, $s_i \in \{\pm 1\}$

Sherrington - Kirkpatrick Parisi

$p > 2$ spherical



$\sum_{ik} J_{ijk} s_i s_k = z s_i$




$\# = e^{N f(E)}$ → $\ln z = \overline{\ln \sum_{s \in S_N} e^{-\beta E}}$ → $\beta \to +\infty$

$z^n$ $n = 0, 1, 2 \ldots$ replica.

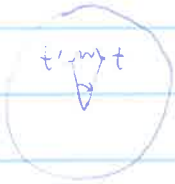
ln # critical pts $\lim_{n \to 0} \frac{z^n - 1}{n}$


$E = \sum_{i \neq j} (A A^+)$

$\left( \frac{+1}{-1} \right)_{ij}$

$$\frac{\partial S_i}{\partial t} = -\frac{\partial E}{\partial S_i} - z(t) S_i + \text{noise}$$

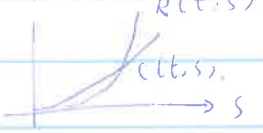
$$\frac{1}{N} \sum_i S_i(t) S_i(t') = C(t,t')$$

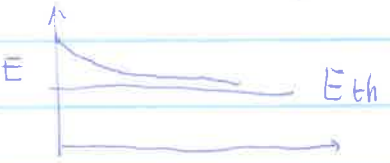


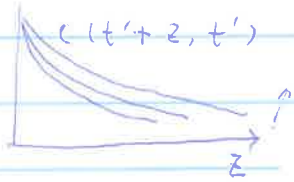

$$\frac{\partial R(t,t')}{\partial t} = z(t) R(t,t') + \frac{p(p-1)}{2} \int_{t'}^{t} ds\, C^{p-2}(t,s) R(t,s) R(s,t')$$

$$\frac{\partial C(t,t')}{\partial t} = -z(t) C(t,t') + \frac{p}{2} \int_0^{t'} ds\, C^{p-1}(t,s) R(t',s) + \frac{p(p-1)}{2} \int_0^{t} ds\, C^{p-2}(t,s) R(t,s) C(s,t')$$

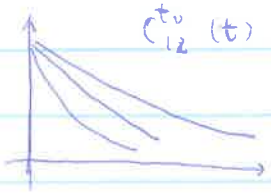
$$z(t) = \frac{p^2}{2} \int_0^t ds\, C^{p-1}(t,s) R(t,s)$$

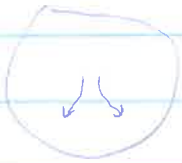


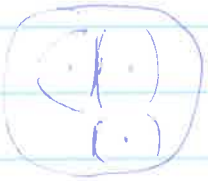



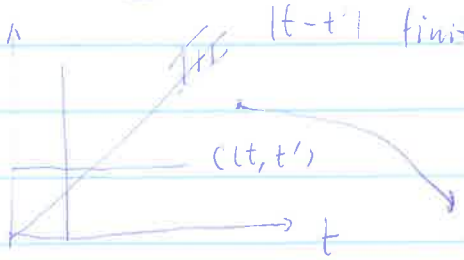

↑ as t' increases.





random points typically on boundaries of attractions basin




N finite large  t large  + noise.  $t \sim e^{aN}$