

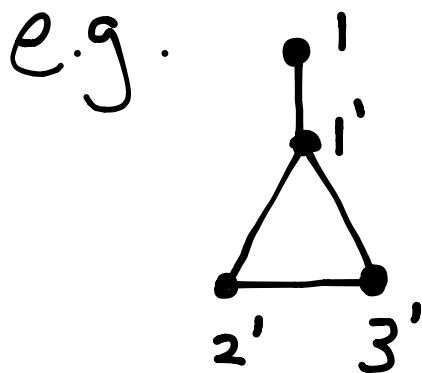
Diagrammatic Rep. of Correlation functions

$$\tilde{G}_{12}^{(2)^{-1}} \quad \text{---}$$

$$\tilde{G}_{123}^{(3)} \quad \triangle$$

$$\tilde{G}_{1234}^{(4)} \quad \square$$

with touching dots meaning
integration over same \vec{r} (opposite \vec{q})



$$= \tilde{G}_{1'2'3'}^{(3)} \tilde{G}_{1'1}^{(2)^{-1}}$$

Mean field vertices with replica trick

$$\Gamma^{(2)} \text{ (with circle)} = m \text{ (with two dots)} - 2\chi$$

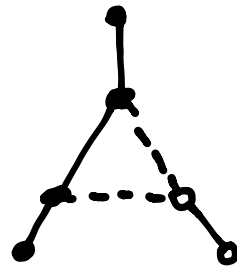
$$\tau(3) \quad \text{[diagram of a sphere with three lines passing through it]} = m \quad \text{[diagram of a triangle with three lines extending from its vertices]}$$

$$\begin{aligned} \tau^{(4)} \text{ (diagram)} &= m \left[\text{diagram 1} - 3 \text{diagram 2} \right] \\ &+ 3m(m-1) \left\{ \text{diagram 3} - \text{diagram 4} \right\} \end{aligned}$$

where $\delta(\vec{k})$ contributions to ρF are omitted

e.g. $\Gamma^{(3)}$

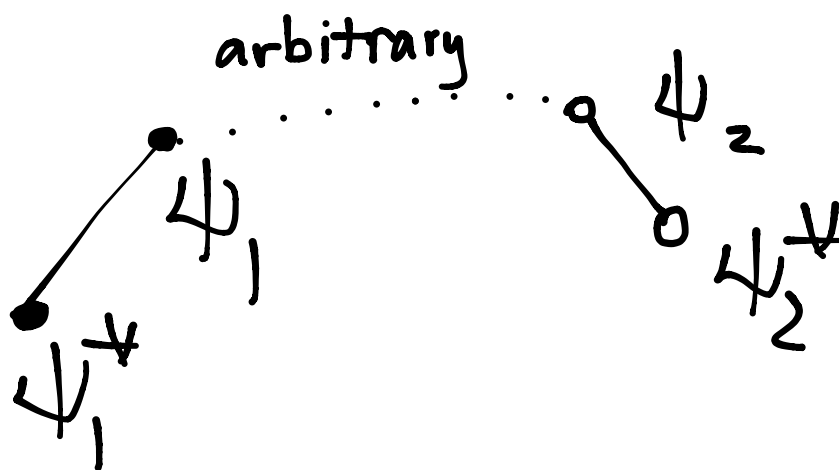
$3m(m-1)$



non-local interaction in $\Gamma^{(4)}$

$$\{ \} = \Gamma_{nl}^{(4)} = \delta(\vec{q}_1 + \vec{q}_2) \delta(\vec{q}_3 + \vec{q}_4) \dots$$

$$\rho F_{nl} = \int d\vec{q}_1 d\vec{q}_2 \Gamma_{nl}^{(4)}(\vec{q}_1, \vec{q}_2) \psi_1^2(\vec{q}_1) \psi_2^2(\vec{q}_2)$$



One-loop Corrections of Correlation

$$\text{Diagram 1} = -2\chi + \text{Diagram 2} + \frac{1}{2} \text{Diagram 3} - \frac{1}{2} \text{Diagram 4}$$

$$\text{Diagram 5} = \text{Diagram 6} - \frac{3}{2} \text{Diagram 7} + \frac{1}{2} \text{Diagram 8}$$

$(\vec{k}_1 \neq -\vec{k}_2)$

$$\text{Diagram 9} = \text{Diagram 10} - 3 \text{Diagram 11} + 1 \text{Diagram 12}$$