Hands on

$$< \delta^3(\underline{x}) > = < (\delta^{(1)} + \delta^{(2)} \cancel{+ \delta^{(3)}})^3 (\underline{x}) >$$

$$= \underbrace{< \delta^{(1)}(\underline{x})^3 >}_{=0} + 3 < \delta^{(1)}(\underline{x})^2 \delta^{(2)}(\underline{x}) >$$

for Gaussian initial field

$$= 3 \int \frac{d^3k_1\, d^3k_2\, d^3k_3}{(2\pi)^9} \exp\left[i\, \underline{x} \cdot (\underline{k_1} + \underline{k_2} + \underline{k_3})\right] < \delta^{(1)}(\underline{k_1}) \delta^{(1)}(\underline{k_2}) \delta^{(2)}(\underline{k_3}) >$$

redefine plug in F_2

$$= 3 \int \frac{d^3k_1\, d^3k_2\, d^3\tilde{k}_3\, d^3k_4}{(2\pi)^{12}} \exp\left[i\, \underline{x} \cdot (\underline{k_1} + \underline{k_2} + \underline{\tilde{k}_3} + \underline{k_4})\right] F_2(\underline{\tilde{k}_3}, \underline{k_4})$$

$$< \delta^{(1)}(\underline{k_1}) \delta^{(1)}(\underline{k_2}) \delta^{(1)}(\underline{\tilde{k}_3}) \delta^{(1)}(\underline{k_4}) >$$

$$(2\pi)^6 \Big[\delta_D(\underline{k_1} + \underline{k_2}) \cancel{\delta_D(\underline{\tilde{k}_3} + \underline{k_4})} P(k_1) P(\tilde{k}_3)$$
$$+ \delta_D(\underline{k_1} + \underline{\tilde{k}_3}) \delta_D(\underline{k_2} + \underline{k_4}) P_L(k_1) P_L(k_2)$$
$$+ \delta_D(\underline{k_1} + \underline{k_4}) \delta_D(\underline{k_2} + \underline{\tilde{k}_3}) P_L(k_1) P_L(k_2) \Big]$$

$$= 6 \int \frac{d^3k_1\, d^3k_2}{(2\pi)^6} F_2(-\underline{k_1}, -\underline{k_2}) P_L(k_1) P_L(k_2)$$

$$d^3k = dk\, k^2\, d\mu\, d\varphi$$

$$= 6 \cdot \left(\frac{5}{7} \cdot 1 + \frac{2}{7} \cdot \frac{1}{3} \right) < \delta_L^2 >^2 = 6 \cdot \frac{17}{21} < \delta_L^2 >^2 = \frac{34}{7} \sigma^4$$

$$\frac{< \delta^3 >}{< \delta^2 >^2} = \frac{34}{7}$$

$$F_2 = \frac{5}{7} \alpha + \frac{2}{7} \beta$$

$\alpha(\underline{k_1}, \underline{k_2})$ angular average $\bar{\alpha} = 1$

$\beta(\underline{k_1}, \underline{k_2})$ $\bar{\beta} = 1/3$

or bispectrum

$$< \delta^{(1)}(\underline{k_1}) \delta^{(1)}(\underline{k_2}) \delta^{(2)}(\underline{k_3}) > = \ldots$$

+cyclic

$$\Rightarrow B_{112}(k_1, k_2, k_3) = 2\big(F_2(\underline{k_1}, \underline{k_2}) P_L(k_1) P_L(k_2) + \text{cyclic}\big)$$