22/11/06

$$G^{(n)R}_{s_1\ldots s_n}(k_1,\ldots,k_n,\vec{g}_R,\mu)=\left\langle \prod_{i=1}^{n}\tilde{\Phi}_{s_i R}(k_i)\right\rangle$$

$$\left\{\mu\frac{\partial}{\partial\mu}+\sum_\alpha \beta_\alpha(\vec{g}_R,\mu)\frac{\partial}{\partial g_{\alpha R}}+\sum_i \gamma_{s_i}(\vec{g}_R,\mu)\right\}G^{(n)R}_{s_1\ldots s_n}=0$$

Assume : $\gamma_{st}=\gamma_s\delta_{st}$

$$G^{(n)R}_{s_1\ldots s_n}(\lambda k_1,\ldots\lambda k_n,\lambda^{\Delta_\alpha}g_{\alpha R},\lambda\mu)=\lambda^{\sum d_{s_i}}\times G^{(n)}_{s_1\ldots s_n}(k_1,\ldots k_n;\{g_{\alpha R}\},\mu)$$

where d_s : dimension of $\tilde{\Phi}_s(k)$

and Δ_α : dimension of $g_{\alpha R}$

$$g_{\alpha R}\to\lambda^{-\Delta_\alpha}g_\alpha\ ,\ \mu\to\lambda^{-1}\mu$$

$$G^{(n)R}_{s_1\ldots s_n}(\lambda k_1,\ldots,\lambda k_n,\{g_{\alpha R}\},\mu)$$
$$=\lambda^{\sum_{i=1}^{n}d_{s_i}}G^{(n)R}_{s_1\ldots s_n}(k_1,\ldots,k_n;\{\lambda^{-\Delta_\alpha}g_{\alpha R}\},\lambda^{-1}\mu)$$

we get,

$$\lambda\frac{\partial G^{(n)R}_{s_1\ldots s_n}(\lambda k_1,\ldots,\lambda k_n,\{g_{\alpha R}\},\mu)}{\partial\lambda}$$

$$=\left(\sum_{i=1}^{n}d_{s_i}-\sum_\alpha\Delta_\alpha g_{\alpha R}\frac{\partial}{\partial g_{\alpha R}}-\mu\frac{\partial}{\partial\mu}\right)$$
$$\times\underbrace{\lambda^{\sum d_{s_i}}\times G^{(n)R}_{s_1\ldots s_n}(k_1,\ldots,k_n;\{\lambda^{-\Delta_\alpha}g_{\alpha R}\},\lambda^{-1}\mu)}_{G^{(n)R}_{s_1\ldots s_n}(\lambda k_1,\ldots,\lambda k_n;\{g_{\alpha R}\},\mu)}$$

$$\lambda \frac{\partial}{\partial \lambda} G^{(n)R}_{s_1 \dots s_n}(\lambda k_1, \dots, \lambda k_n, \{g_{\alpha R}\}, \mu)$$

$$= \left(\sum_{i=1}^{n} d_{s_i} - \sum_{\alpha} \Delta_\alpha g_{\alpha R} \frac{\partial}{\partial g_{\alpha R}} - \mu \frac{\partial}{\partial \mu} \right) G^{(n)R}_{s_1 \dots s_n}(\lambda k_1, \dots, \lambda k_n; \{g_{\alpha R}\}, \mu) \quad \text{(A)}$$

$$= \left[\sum_{i=1}^{n} \{ d_{s_i} + \gamma_{s_i}(\vec{g}_R, \mu) \} + \sum_{\alpha} \{ \beta_\alpha(\vec{g}_R, \mu) - \Delta_\alpha g_{\alpha R} \} \times \frac{\partial}{\partial g_{\alpha R}} \right]$$

$$\times G^{(n)R}_{s_1 \dots s_2}(\lambda k_1, \dots, \lambda k_n; \{g_{\alpha R}\}, \mu) \quad \text{(B)}$$

eqn. where there is no μ-derivative

- tells us how the Green's fn. when we scale out the momenta

→ But why is this possible? → bcos by dimensional analysis, we can transfer the change in momenta to other quantities

Suppose there was no need to renormalise the theory. In this case $\beta_\alpha = 0, \gamma_s = 0$

> The renorm. parameters | fields can be taken to be equal to non-renorm. parameters | fields

$$\lambda \frac{\partial}{\partial \lambda} G^{(n)R}_{s_1 \dots s_n}(\lambda k_1, \dots, \lambda k_n, \{g_{\alpha R}\})$$

$$= \left(\sum_{i=1}^{n} d_{s_i} - \sum_{\alpha} \Delta_\alpha g_{\alpha R} \frac{\partial}{\partial g_{\alpha R}} \right)$$

$$\times G^{(n)R}_{s_1 \dots s_n}(\lambda k_1, \dots, \lambda k_n; \{g_{\alpha R}\})$$

(This eqn should reflect the dimensional analysis)