

March 28, 2016

Conditions on the Effective D-term $G(u, v)$

(5)

$$\underline{|dG|^2}$$

$$\begin{aligned} \int d^4\theta G(u, v) &= -\frac{1}{4} \left\{ \bar{D}_R D_L \bar{D}_L D_R G(u, v) \right\} = \\ &= -\frac{1}{4} \left\{ \bar{D}_R D_L \bar{D}_L (G_u \cdot D_R u) \right\} = \\ &= -\frac{1}{4} \left\{ \bar{D}_R D_L (G_{uu} \bar{D}_L u D_R u + G_u \bar{D}_L D_R u) \right\} = \\ &= -\frac{1}{4} \bar{D}_R \left\{ G_{uu} D_L u \bar{D}_L D_R u + G_{uu} D_L \bar{D}_L u D_R u + \right. \\ &\quad \left. + G_u \bar{D}_L u D_L D_R u + \right. \\ &\quad \left. + G_u D_L u \bar{D}_L D_R u + G_u D_L \bar{D}_L D_R u \right\} = \end{aligned}$$

(2)

D

need only bosonic terms - first term has fermions.

$$-\frac{1}{4} \int G_{\mu\nu} D_\mu \bar{D}_\nu u \cdot \bar{D}_\mu D_\nu u + \text{[crossed out]}$$

+ 0

$$+ G_{\mu\nu} \bar{D}_\mu D_\nu u \cdot \bar{D}_\mu D_\nu u + G_{\mu\nu} \bar{D}_\mu D_\nu \bar{D}_\mu D_\nu u \Bigg] =$$

$$= -\frac{1}{4} \int G_{\mu\nu} (-2i\delta_{\mu\nu} u)(-2i\delta_{\mu\nu} u) +$$

$$+ G_{\mu\nu} \bar{D}_\mu D_\nu u \cdot \bar{D}_\mu D_\nu u +$$

$$+ G_{\mu\nu} (-2i\delta_{\mu\nu})(-2i\delta_{\mu\nu})u \Bigg] =$$

(3)

$$= -\frac{1}{4} \left\{ G_{uv} (-4) \delta_{uv} \delta_{uv} + \right. \\ \left. + G_{uv} \cdot \overline{D}_L D_R u \cdot \overline{D}_R D_L v + \right. \\ \left. + (-4) G_u \cdot \square u \right\} =$$

$$= G_{uv} \delta_{uv} \delta_{uv} - \frac{1}{4} G_{uv} \overline{D}_L D_R u \cdot \overline{D}_R D_L v + \\ + G_u \cdot \square u =$$

(4)

$$= G_{\mu\nu} \left\{ \partial_\mu u \cdot \partial_\nu u \right\} - \frac{1}{4} G_{\mu\nu} \overline{D}_\mu D_\nu u \cdot \overline{D}_\mu D_\nu v \Bigg\} +$$

$$+ G_{\mu\nu} \cdot \partial_\mu u \Bigg\} =$$

now only allow spacetime derivatives to act on Σ (or ϕ) and keeping only bosons

$$\supset G_{\mu\nu} (-1) \frac{iD - F_{03}}{|L\phi|^4} \partial_\mu |L\phi|^2 \cdot (-1) \frac{iD - F_{03}}{|L\phi|^4} \partial_\nu |L\phi|^2 -$$

$$- \cancel{G_{\mu\nu}} \frac{1}{2} \overline{D}_\mu D_\nu u \cdot \frac{1}{2} \overline{D}_\mu D_\nu v \Bigg\} +$$

$$+ G_{\mu\nu} (iD - F_{03}) \cdot \partial_\mu \left(- \frac{1}{|L\phi|^4} \partial_\nu |L\phi|^2 \right) =$$

(5)

$$= G_{uu} \frac{(iD - f_{03})^2 \left(\sum_{\mu} |\kappa b|^2 \right)^2}{|\kappa b|^8} +$$

$$+ G_u \cdot (iD - f_{03}) \left[\frac{2 \left(\sum_{\mu} |\kappa b|^2 \right)^2}{|\kappa b|^6} - \frac{\square |\kappa b|^2}{|\kappa b|^4} \right] -$$

$$- G_{uv} \left\{ \frac{1}{2} \bar{D}_L D_R u \cdot \frac{1}{2} \bar{D}_R D_L v \right\}$$

$$\left\{ \frac{1}{2} \bar{D}_L D_R u \right\} = \frac{1}{2} \bar{D}_L D_R \frac{S}{\sqrt{\Sigma}} \Big| \supset \text{bosons only}$$

$$\supset \frac{\frac{1}{2} \bar{D}_L D_R S}{\sqrt{\Sigma}} \Big| - \frac{S}{(\sqrt{\Sigma})^2} \frac{1}{2} \bar{D}_L D_R \Sigma \Big| \supset \text{bosons only}$$

$$\supset \frac{-i \square \kappa \sqrt{\Sigma}}{\sqrt{\Sigma}} - \frac{iD - f_{03}}{(\sqrt{\Sigma}) (\sqrt{\Sigma})^2} \cdot (-i) (iD + f_{03}) =$$

$$= -i \frac{\square \kappa \sqrt{\Sigma}}{\sqrt{\Sigma}} + i \frac{(iD)^2 - f_{03}^2}{\sqrt{\Sigma} |\kappa b|^2}$$

(6)

$$\left| \frac{1}{2} \bar{D}_R D_L v \right| = \frac{1}{2} \bar{D}_R D_L \frac{s}{\sqrt{2}\Sigma} \Big| \supset \text{bosons only}$$

$$\supset \left| \frac{\frac{1}{2} \bar{D}_R D_L s}{\sqrt{2}\Sigma} \right| = \frac{s}{(\sqrt{2}\Sigma)^2} \cdot \frac{1}{2} \bar{D}_R D_L \sqrt{2}\Sigma \Big| \supset \text{bosons only}$$

$$\supset \frac{(-i) \frac{1}{2} \ln \sqrt{2}}{\sqrt{2}} - \frac{iD + f_{03}}{\sqrt{2} \cdot (\sqrt{2})^2} \cdot (-i)(iD - f_{03}) =$$

$$= -i \frac{\frac{1}{2} \ln \sqrt{2}}{\sqrt{2}} + i \frac{(iD)^2 - f_{03}^2}{\sqrt{2} |\sqrt{2}|^2}$$

(7)

$$\left\{ \frac{1}{2} \bar{D}_L D_{LL} u \cdot \frac{1}{2} \bar{D}_R D_{LR} v \right\} \supset$$

$$\left\{ \left(\frac{u \ln \bar{u} b}{\sqrt{u} b} + \frac{(iD)^2 - F_{03}^2}{\sqrt{u} b |u b|^2} \right) \left(- \frac{u \ln u b}{\sqrt{u} b} + \frac{(iD)^2 - F_{03}^2}{\sqrt{u} b |u b|^2} \right) \right\} \supset$$

\supset dropping higher derivatives of b

$$\supset - u (\ln \bar{u} b + \ln u b) \cdot \frac{(iD)^2 - F_{03}^2}{|u b|^4} + \frac{((iD)^2 - F_{03}^2)^2}{|u b|^6} \supset$$

—————
this was contributing
to potential — drop it

$$\supset - \frac{(iD)^2 - F_{03}^2}{|u b|^4} u \ln |u b|^2$$

(8)

$$\sup G_{uv} \frac{(iD - f_{03})^2}{|kb|^8} (\delta_\mu |kb|^2)^2 +$$

$$+ G_{uv} \cdot (iD - f_{03}) \int \left(\frac{2(\delta_\mu |kb|^2)^2}{|kb|^6} - \frac{\alpha |kb|^2}{|kb|^4} \right) -$$

$$- G_{uv} \cdot \frac{(iD)^2 - f_{03}^2}{|kb|^4} \alpha \ln |kb|^2$$