ж-Уравнение Движения

Полное уравнение:

$$E(x) = E_K(x) + E_T(x) + E_V(x) + E_S(x) = 0$$

1. Кинетический Вклад $E_K(x)$

$$\begin{split} E_K(x) &= -\frac{1}{2} \, \partial_\mu \left(G^{\mu\nu} D_\nu \varphi \right) + \frac{1}{2} G^{\mu\nu} T_a^\dagger \Gamma_a^\mu D_\nu \varphi \\ &+ \frac{1}{2} G^{\mu\nu} \varphi^\dagger T_a^\dagger \left(\kappa_1 \cdot \operatorname{Im} \left[\frac{\partial \varphi^\dagger}{\partial T} T_a \partial^\mu \varphi + \varphi^\dagger T_a \partial^\mu \left(\frac{\partial \varphi}{\partial T} \right) \right] + \kappa_2 \cdot \partial^\mu T(\varphi) \cdot \frac{d \mathcal{F}_a(T)}{dT} \right) \cdot \frac{\partial \varphi^\dagger}{\partial T} \, D_\nu \varphi \\ &+ \frac{1}{2} G^{\mu\nu} (D_\mu \varphi)^\dagger \left(\kappa_1 \cdot \operatorname{Im} \left[\frac{\partial \varphi^\dagger}{\partial T} T_b \partial^\nu \varphi + \varphi^\dagger T_b \partial^\nu \left(\frac{\partial \varphi}{\partial T} \right) \right] + \kappa_2 \cdot \partial^\nu T(\varphi) \cdot \frac{d \mathcal{F}_b(T)}{dT} \right) \cdot \frac{\partial \varphi^\dagger}{\partial T} \, T_b \varphi \\ &+ \frac{1}{2} \frac{\partial G^{\mu\nu}}{\partial T} \cdot \frac{\partial \varphi^\dagger}{\partial T} \cdot \langle D_\mu \varphi, D_\nu \varphi \rangle \end{split}$$

2. Когерентный Кинетический Член $E_T(x)$

$$egin{aligned} E_T(x) &= -rac{1}{2}\,\partial_T\left(G_TD_Tarphi
ight) + rac{1}{2}G_TT_a^\dagger\Omega_aD_Tarphi \ &+ rac{1}{2}G_Tarphi^\dagger T_a^\daggerrac{\partial\Omega_a}{\partial T}\cdotrac{\partial T}{\partial arphi^\dagger}D_Tarphi \ &+ rac{1}{2}G_T(D_Tarphi)^\daggerrac{\partial\Omega_b}{\partial T}\cdotrac{\partial T}{\partial arphi^\dagger}T_barphi \ &+ rac{1}{2}rac{dG_T}{dT}\cdotrac{\partial T}{\partial arphi^\dagger}\cdot\langle D_Tarphi,D_Tarphi
angle \end{aligned}$$

3. Потенциальный Член $E_V(x)$

$$E_V(x) = E_{V_0}(x) + E_{V_T}(x) + E_{V_Z}(x)$$

Где:

$$E_{V_{0}}(x) = 2\lambda_{1}\left(arphi^{\dagger}arphi - v^{2}
ight)\cdotarphi \ E_{V_{T}}(x) = 2\lambda_{2}\left(T(arphi) - T_{0}
ight)\cdot\left[lphaarphi + eta\cdotrac{\partial}{\partialarphi^{\dagger}}\mathrm{Im}\left(\log\det
ho(arphi)
ight) + \gamma E_{S}(x)
ight] \ E_{V_{Z}}(x) = \lambda_{3}\sum_{a}2\cdot\left(rac{\partial_{T}Z_{a}(T)}{Z_{a}(T)}
ight)\cdot\left[-rac{\partial_{T}Z_{a}(T)}{Z_{a}^{2}(T)}\cdotrac{\delta Z_{a}(T)}{\deltaarphi^{\dagger}} + rac{1}{Z_{a}(T)}\cdotrac{d}{dT}\left(rac{\delta Z_{a}(T)}{\deltaarphi^{\dagger}}
ight)
ight]$$

4. Энтропийный Член $E_S(x)$

$$egin{aligned} E_S(x) = & rac{Z(T)^2}{2b} \sum \operatorname{Re}\left[arphi^\dagger T_b arphi
ight] \cdot \operatorname{Re}\left[T_b arphi
ight] \cdot S_Z \ & -rac{Z(T)^2}{2a} \sum \operatorname{Re}\left[arphi^\dagger T_a arphi
ight] \cdot \operatorname{Re}\left[T_a arphi
ight] \cdot (1 + \log
ho_T(x)) \end{aligned}$$

где:

$$S_Z := \int d^4x' \, \left(1 + \log
ho_T(x')
ight) \cdot \left(\sum_a \left(ext{Re}[arphi^\dagger(x')T_aarphi(x')]
ight)^2 + \delta_0^2
ight)$$

5. Производные

5.1. Производная $\partial_T G^{\mu
u}(x)$

$$egin{aligned} rac{\partial G^{\mu
u}}{\partial T} &= -G^{\mulpha}G^{
ueta}rac{\partial G_{lphaeta}}{\partial T} \ & rac{\partial G_{lphaeta}}{\partial T} \ & rac{\partial G_{lphaeta}}{\partial T} &= \epsilon \cdot rac{\left(\partial_lpha\left(rac{\partial T}{\partial arphi}
ight)\partial_eta T + \partial_lpha T\partial_eta\left(rac{\partial T}{\partial arphi}
ight)
ight)(\Lambda^2 + \partial_
ho T\partial^
ho T) - (\partial_lpha T\partial_eta T) \cdot 2\partial^
ho T\partial_
ho\left(rac{\partial T}{\partial arphi}
ight)}{\left(\Lambda^2 + \partial_
ho T\partial^
ho T
ight)^2} \end{aligned}$$

5.2. Производная $\partial_T \Gamma_a^\mu$

$$rac{\partial \Gamma_a^\mu}{\partial T} = \kappa_1 \cdot ext{Im} \left[rac{\partial arphi^\dagger}{\partial T} T_a \partial^\mu arphi + arphi^\dagger T_a \partial^\mu \left(rac{\partial arphi}{\partial T}
ight)
ight] + \kappa_2 \cdot \partial^\mu T(arphi) \cdot rac{d \mathcal{F}_a(T)}{d T}$$

5.3. Производная $\frac{\partial T}{\partial \omega^\dagger}$

$$rac{\partial T}{\partial arphi^\dagger(x)} = lpha \cdot arphi(x) + eta \cdot rac{\partial arphi^\dagger(x)}{\partial \operatorname{Im} \log \det
ho(arphi)} + \gamma \cdot E_S(x)$$