

Notations

$$\Phi = \phi + \sqrt{2}\lambda\theta + F\theta^2$$

$$V = -\overline{\theta\sigma_\mu\theta}A_\mu + i\theta^2\overline{\theta\lambda} + i\overline{\theta^2}\theta\lambda - \frac{i}{2}\theta^2\overline{\theta^2}D$$

$$W^\alpha = -\lambda^\alpha + \theta^\alpha D + \frac{1}{2}[\sigma_\mu\overline{\sigma}_\nu\theta]^\alpha F_{\mu\nu} - \theta^2 i\overline{\mathcal{P}}^{\alpha\dot{\alpha}}\overline{\lambda}_{\dot{\alpha}}$$

$$\sigma_\mu^{\alpha\dot{\alpha}} = \begin{pmatrix} 1, & -i\tau^a \end{pmatrix}, \quad \overline{\sigma}_{\mu\dot{\alpha}\alpha} = \begin{pmatrix} 1, & i\tau^a \end{pmatrix}$$

$$\begin{aligned} D^\alpha &= \partial^\alpha - i\overline{\mathcal{D}}^{\alpha\dot{\alpha}}\overline{\theta}_{\dot{\alpha}} & \epsilon_{\alpha\beta} &= \epsilon_{\dot{\alpha}\dot{\beta}} & \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} & \psi_\alpha &= \epsilon_{\alpha\beta}\psi^\beta & \overline{\psi}_{\dot{\alpha}} &= \epsilon_{\dot{\alpha}\dot{\beta}}\overline{\psi}^{\dot{\beta}} \\ \overline{D}_{\dot{\alpha}} &= \overline{\partial}_{\dot{\alpha}} - i\overline{\mathcal{D}}_{\dot{\alpha}\alpha}\theta^\alpha & \epsilon^{\alpha\beta} &= \epsilon^{\dot{\alpha}\dot{\beta}} & \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} & \psi^\alpha &= \epsilon^{\alpha\beta}\psi_\beta & \overline{\psi}^{\dot{\alpha}} &= \epsilon^{\dot{\alpha}\dot{\beta}}\overline{\psi}_{\dot{\beta}} \end{aligned}$$

$$W^2 = W_\alpha W^\alpha, \quad \overline{W}^2 = \overline{W^{\dot{\alpha}}W_{\dot{\alpha}}}$$

$$\overline{W}_{\dot{\alpha}} = -\overline{\lambda}_{\dot{\alpha}} + \overline{\theta}_{\dot{\alpha}}D - \frac{1}{2}[\overline{\sigma}_\mu\sigma_\nu\overline{\theta}]_{\dot{\alpha}} F_{\mu\nu} - \overline{\theta}^2(i\overline{\mathcal{P}}\lambda)_{\dot{\alpha}} \quad (\text{unconfirmed})$$

$$x_L \equiv y \equiv x_\mu + i\overline{\theta\sigma_\mu\theta}, \quad \Phi = \Phi(y), \quad \overline{\Phi} = \overline{\Phi}(x_R)$$

$$\nabla_\mu = \partial_\mu - iA_\mu^a \frac{\tau^2}{2}, \quad \text{for SU(2)}$$

$$V(y) = -\overline{\theta\sigma_\mu\theta}A_\mu(y) + i\theta^2\overline{\theta\lambda}(y) + i\overline{\theta^2}\theta\lambda(y) - \frac{i}{2}\theta^2\overline{\theta^2}[D(y) - \partial_\mu A^\mu(y)]$$

$$W^\alpha = -\frac{i}{4}\overline{D}\overline{D}D^\alpha V \quad \left(\text{has to be renormalized for } e^{-2V} \text{ in the chiral representation} \right)$$

$$\text{Shift: } x_L \rightarrow x \quad \text{is} \quad e^{-i\overline{\theta}\overline{\mathcal{D}}\theta}$$

Useful formulae

$$\theta^\alpha \theta^\beta = \frac{1}{2} \theta^2 \epsilon^{\alpha\beta}$$

$$\theta_\alpha \theta_\beta = -\frac{1}{2} \theta^2 \epsilon_{\alpha\beta}$$

$$\overline{\theta^{\dot{\alpha}} \theta^{\dot{\beta}}} = -\frac{1}{2} \overline{\theta}^2 \epsilon^{\dot{\alpha}\dot{\beta}}$$

$$\overline{\theta_{\dot{\alpha}} \theta_{\dot{\beta}}} = \frac{1}{2} \overline{\theta}^2 \epsilon_{\dot{\alpha}\dot{\beta}}$$

$$\theta \lambda \theta \psi = -\frac{1}{2} \theta^2 \lambda \psi$$

$$\sigma_\mu \overline{\sigma}_\nu \sigma_\rho = \eta_{\mu\nu} \sigma_\rho + \eta_{\nu\rho} \sigma_\mu - \eta_{\mu\rho} \sigma_\nu - \epsilon_{\mu\nu\rho\lambda} \sigma_\lambda$$

$$\overline{\sigma}_\mu \sigma_\nu \overline{\sigma}_\rho = \eta_{\mu\nu} \overline{\sigma}_\rho + \eta_{\nu\rho} \overline{\sigma}_\mu - \eta_{\mu\rho} \overline{\sigma}_\nu + \epsilon_{\mu\nu\rho\lambda} \overline{\sigma}_\lambda$$

$$Tr(\overline{\sigma}^\mu \sigma^\nu) = 2\eta^{\mu\nu}$$

$$\partial_\alpha \theta_\beta = \epsilon_{\alpha\beta}$$

$$\partial^\alpha \theta^2 = 2\theta^\alpha$$

$$\partial^2 \theta^2 = -4$$

$$\epsilon_{\alpha\gamma} \epsilon^{\gamma\beta} = \delta_\alpha^\beta$$

$$\epsilon^{\alpha\gamma} \epsilon_{\gamma\beta} = \delta_\beta^\alpha$$

$$\sigma^{(\mu} \overline{\sigma}^{\nu)} = 2\eta^{\mu\nu}$$

$$D_\alpha D^\alpha = \partial^2 - 2i\partial_\alpha \not{\partial}^{\alpha\dot{\beta}} \overline{\theta}_{\dot{\beta}} + \square \overline{\theta}^2$$

$$\overline{D^{\dot{\alpha}} D_{\dot{\alpha}}} = \overline{\partial}^2 + 2i\overline{\theta}_{\dot{\alpha}\alpha} \theta^\alpha \overline{\partial}^{\dot{\alpha}} + \theta^2 \square$$

$$\{D^\alpha \overline{D}^{\dot{\alpha}}\} = 2i \not{\partial}^{\alpha\dot{\alpha}}$$

$$\theta^1 \theta^2 = -\frac{1}{2} \theta^2$$

$$\theta_1 \theta_2 = -\frac{1}{2} \theta^2$$

$$\overline{\theta^1 \theta^2} = \frac{1}{2} \overline{\theta}^2$$

$$\overline{\theta_1 \theta_2} = \frac{1}{2} \overline{\theta}^2$$

$$\overline{\theta \lambda \theta \psi} = -\frac{1}{2} \overline{\theta}^2 \overline{\lambda \psi}$$

$$\sigma_\mu^{\beta\dot{\beta}} \overline{\sigma}_{\dot{\alpha}\alpha}^\mu = 2\delta_\alpha^\beta \delta_{\dot{\alpha}}^{\dot{\beta}}$$

$$\overline{\sigma}^\mu \theta \overline{\theta} \sigma^\nu \theta = \frac{1}{2} \theta^2 \overline{\theta}^2 \eta^{\mu\nu}$$

$$\overline{\partial^{\dot{\alpha}} \theta^{\dot{\beta}}} = \epsilon^{\dot{\alpha}\dot{\beta}}$$

$$\overline{\partial_{\dot{\alpha}} \theta^2} = 2\overline{\theta}_{\dot{\alpha}}$$

$$\overline{\partial^2 \theta^2} = -4$$

$$\epsilon_{\dot{\alpha}\dot{\gamma}} \epsilon^{\dot{\gamma}\dot{\beta}} = \delta_{\dot{\alpha}}^{\dot{\beta}}$$

$$\epsilon^{\dot{\alpha}\dot{\gamma}} \epsilon_{\dot{\gamma}\dot{\beta}} = \delta_{\dot{\beta}}^{\dot{\alpha}}$$

$$\not{\partial} \overline{\not{\partial}} = \overline{\not{\partial}} \not{\partial} = \square$$

Chiral Superfields

$$\begin{aligned}\Phi(y) &= \phi(y) + \sqrt{2}\psi\theta + F\theta^2, & y^\mu &= x^\mu + i\bar{\theta}\sigma^\mu\theta \\ \bar{\Phi}(\bar{y}) &= \bar{\phi}(\bar{y}) + \sqrt{2}\bar{\psi}\bar{\theta} + \bar{F}\bar{\theta}^2, & \bar{y}^\mu &= x^\mu - i\bar{\theta}\sigma^\mu\theta\end{aligned}$$

$$\begin{aligned}\Phi(y) &= \phi(x) + \sqrt{2}\theta\psi + \theta^2 F + i\bar{\theta}\bar{\theta}\theta\phi - i\frac{\sqrt{2}}{2}\theta^2\theta\bar{\theta}\psi - \frac{1}{4}\theta^4\Box\phi \\ \bar{\Phi}(\bar{y}) &= \bar{\phi}(x) + \sqrt{2}\bar{\theta}\bar{\psi} + \bar{\theta}^2\bar{F} + i\theta\bar{\theta}\bar{\theta}\bar{\phi} - i\frac{\sqrt{2}}{2}\bar{\theta}^2\theta\bar{\theta}\bar{\psi} - \frac{1}{4}\theta^4\Box\bar{\phi}\end{aligned}$$

$$\begin{aligned}\int d^4\theta &= \frac{1}{16}D^2\bar{D}^2\Big| & \int d^4\theta &= \frac{1}{16}\bar{D}^2D^2\Big| \\ \int d^2\theta &= -\frac{1}{4}D^2\Big| & \int d^2\bar{\theta} &= -\frac{1}{4}\bar{D}^2\Big|\end{aligned}$$

$$\begin{aligned}D^\alpha\Phi\Big| &= \sqrt{2}\psi^\alpha & \bar{D}_{\dot{\alpha}}\bar{\Phi}\Big| &= \sqrt{2}\bar{\psi}_{\dot{\alpha}} \\ D^2\Phi\Big| &= -4F & \bar{D}^2\bar{\Phi}\Big| &= -4\bar{F} \\ \bar{D}^{\dot{\alpha}}D^\alpha\Phi &= 2i\bar{\theta}^{\dot{\alpha}\alpha}\Phi & D^\alpha\bar{D}^{\dot{\alpha}}\bar{\Phi} &= 2i\bar{\theta}^{\dot{\alpha}\alpha}\bar{\Phi} \\ \bar{D}_{\dot{\alpha}}D^2\Phi &= 4i\bar{\theta}_{\dot{\alpha}\beta}D^\beta\Phi & D^\alpha\bar{D}^2\bar{\Phi} &= 4i\bar{\theta}^{\alpha\dot{\beta}}\bar{D}_{\dot{\beta}}\bar{\Phi} \\ \bar{D}_{\dot{\alpha}}D^2\Phi\Big| &= 4\sqrt{2}i\bar{\theta}_{\dot{\alpha}\beta}\psi^\beta & D^\alpha\bar{D}^2\bar{\Phi}\Big| &= 4\sqrt{2}i\bar{\theta}^{\alpha\dot{\beta}}\bar{\psi}_{\dot{\beta}} \\ \bar{D}^2D^2\Phi &= -16\Box\Phi & D^2\bar{D}^2\bar{\Phi} &= -16\Box\bar{\Phi}\end{aligned}$$

$$\begin{aligned}\ln\Phi(y) &= \ln\phi + \sqrt{2}\theta\psi/\phi + \theta^2\left(F/\phi + \frac{1}{2}(\psi/\phi)^2\right) \\ \ln\bar{\Phi}(\bar{y}) &= \ln\bar{\phi} + \sqrt{2}\bar{\theta}\bar{\psi}/\bar{\phi} + \bar{\theta}^2\left(\bar{F}/\bar{\phi} + \frac{1}{2}(\bar{\psi}/\bar{\phi})^2\right)\end{aligned}$$

$\mathcal{N} = 1$ Supersymmetry Transformations

$$\begin{aligned} Q^\alpha &= \partial^\alpha + i\bar{\theta}^{\alpha\dot{\alpha}}\bar{\partial}_{\dot{\alpha}} \\ \bar{Q}_{\dot{\alpha}} &= \bar{\partial}_{\dot{\alpha}} + i\bar{\theta}_{\dot{\alpha}\alpha}\partial^\alpha \end{aligned}$$

$$\begin{aligned} \delta\phi &= \sqrt{2}\epsilon\psi & \delta\bar{\phi} &= \sqrt{2}\epsilon\bar{\psi} \\ \delta\psi_\alpha &= i\sqrt{2}\epsilon^{\dot{\alpha}}\bar{\partial}_{\dot{\alpha}\alpha}\phi + \sqrt{2}\epsilon_\alpha F & \delta\bar{\psi}^{\dot{\alpha}} &= i\sqrt{2}\epsilon_\alpha\bar{\partial}^{\alpha\dot{\alpha}}\bar{\phi} + \sqrt{2}\epsilon^{\dot{\alpha}}F \\ \delta F &= -i\sqrt{2}\epsilon\bar{\partial}\psi & \delta F &= -i\sqrt{2}\epsilon\bar{\partial}\bar{\psi} \end{aligned}$$

Formulae for Two Dimensions

$$\begin{aligned}\partial_R &= \partial_0 + i\partial_3 & \partial_L &= \partial_0 - i\partial_3 \\ \not\partial &= \begin{pmatrix} \partial_L & \\ & \partial_R \end{pmatrix}^{\alpha\dot{\alpha}} & \bar{\not\partial} &= \begin{pmatrix} \partial_R & \\ & \partial_L \end{pmatrix}_{\dot{\alpha}\alpha}\end{aligned}$$

$$\begin{aligned}\xi_1 &\equiv \xi_R & \bar{\xi}_1 &\equiv \bar{\xi}_R & \epsilon\xi &= -\epsilon_{[R}\xi_{L]} & \xi^1 &= -\xi_L \\ \xi_2 &\equiv \xi_L & \bar{\xi}_2 &\equiv \bar{\xi}_L & \overline{\epsilon\xi} &= \overline{\epsilon_{[R}\xi_{L]}} & \xi^2 &= \xi_R\end{aligned}$$

$$\begin{aligned}\theta^2 &= -2\theta_R\theta_L & D^2 &= -2D_RD_L \\ \bar{\theta}^2 &= 2\overline{\theta_R\theta_L} & \overline{D^2} &= 2\overline{D_RD_L}\end{aligned}$$

$$\begin{aligned}D_R &\equiv D^1 & \overline{D_R} &\equiv \overline{D_2} = -\overline{D^1} \\ D_L &\equiv D^2 & \overline{D_L} &\equiv -\overline{D_1} = -\overline{D^2}\end{aligned}$$

$$\begin{aligned}\{\overline{D_R}D_L\} &= 0 & \{\overline{D_R}D_R\} &= -2i\partial_L \\ \{\overline{D_L}D_R\} &= 0 & \{\overline{D_L}D_L\} &= -2i\partial_R\end{aligned}$$

$$\begin{aligned}\vartheta_R &= \not\partial/\partial\theta_R & \vartheta_L &= \not\partial/\partial\theta_L \\ \bar{\vartheta}_R &= \not\partial/\partial\bar{\theta}_R & \bar{\vartheta}_L &= \not\partial/\partial\bar{\theta}_L\end{aligned}$$

$$\begin{aligned}D_R &= \vartheta_R - i\bar{\theta}_R\partial_L & \overline{D_R} &= \bar{\vartheta}_R - i\theta_R\partial_L \\ D_L &= \vartheta_L - i\bar{\theta}_L\partial_R & \overline{D_L} &= \bar{\vartheta}_L - i\theta_L\partial_R\end{aligned}$$

$$\begin{aligned}\sigma_\mu^{\beta\dot{\beta}}\bar{\sigma}_{\dot{\alpha}\alpha}^\mu &= 2\delta_\alpha^\beta\delta_{\dot{\alpha}}^{\dot{\beta}}\cdot\delta_{\alpha\dot{\alpha}}, & \mu &= 0, 3 \\ \sigma_k^{\beta\dot{\beta}}\bar{\sigma}_{\dot{\alpha}\alpha}^k &= 2\delta_\alpha^\beta\delta_{\dot{\alpha}}^{\dot{\beta}}\cdot\epsilon_{\alpha\dot{\alpha}}, & k &= 1, 2 \\ \theta_\alpha\bar{\theta}_{\dot{\alpha}} &= \frac{1}{2}\theta\sigma_\mu\bar{\theta}\cdot\bar{\sigma}_{\dot{\alpha}\alpha}^\mu\end{aligned}$$

Chiral superfields

$$\begin{aligned}\Phi(y) &= \phi(y) - \sqrt{2}\theta_R\psi_L + \sqrt{2}\theta_L\psi_R - 2\theta_R\theta_L F \\ \Phi(\bar{y}) &= \bar{\phi}(\bar{y}) + \sqrt{2}\bar{\theta}_R\bar{\psi}_L - \sqrt{2}\bar{\theta}_L\bar{\psi}_R + 2\bar{\theta}_R\bar{\theta}_L \bar{F}\end{aligned}$$

$$\begin{aligned}y^0 &= x^0 + i(\bar{\theta}_R\theta_R + \bar{\theta}_L\theta_L) & y^3 &= x^3 + (\bar{\theta}_R\theta_R - \bar{\theta}_L\theta_L) \\ \bar{y}^0 &= x^0 - i(\bar{\theta}_R\theta_R + \bar{\theta}_L\theta_L) & \bar{y}^3 &= x^3 - (\bar{\theta}_R\theta_R - \bar{\theta}_L\theta_L)\end{aligned}$$

Twisted Chiral superfields

$$\begin{aligned}\Sigma(\tilde{y}) &= \sigma(\tilde{y}) - \sqrt{2}\theta_R\bar{\lambda}_L + \sqrt{2}\bar{\theta}_L\lambda_R + \sqrt{2}\theta_R\bar{\theta}_L \left(D - iF_{03} \right) \\ \bar{\Sigma}(\bar{\tilde{y}}) &= \bar{\sigma}(\bar{\tilde{y}}) - \sqrt{2}\theta_L\bar{\lambda}_R + \sqrt{2}\bar{\theta}_R\lambda_L + \sqrt{2}\theta_L\bar{\theta}_R \left(D + iF_{03} \right)\end{aligned}$$

$$\begin{aligned}\tilde{y}^\mu &= x^\mu + i\bar{\theta}\tilde{\sigma}_\mu\theta & \tilde{\sigma}_0 &= i\sigma_3 & \tilde{\sigma}_3 &= -i\sigma_0 \\ \bar{\tilde{y}}^\mu &= x^\mu + i\theta\tilde{\sigma}_\mu\bar{\theta} & \bar{\tilde{\sigma}}_0 &= i\bar{\sigma}_3 & \bar{\tilde{\sigma}}_3 &= -i\bar{\sigma}_0\end{aligned}$$

$$\begin{aligned}\tilde{y}^0 &= x^0 + i(\bar{\theta}_R\theta_R - \bar{\theta}_L\theta_L) & \tilde{y}^3 &= x^3 + (\bar{\theta}_R\theta_R + \bar{\theta}_L\theta_L) \\ \bar{\tilde{y}}^0 &= x^0 - i(\bar{\theta}_R\theta_R - \bar{\theta}_L\theta_L) & \bar{\tilde{y}}^3 &= x^3 - (\bar{\theta}_R\theta_R + \bar{\theta}_L\theta_L)\end{aligned}$$

$$\tilde{\partial} = \begin{pmatrix} \partial_L & \\ & -\partial_R \end{pmatrix}^{\alpha\dot{\alpha}} \quad \bar{\tilde{\partial}} = \begin{pmatrix} -\partial_R & \\ & \partial_L \end{pmatrix}_{\dot{\alpha}\alpha}$$

$$\begin{aligned}D_R &= \left. \frac{\partial}{\partial\theta_R} - 2i\bar{\theta}_R\partial_L \right|_{\tilde{y}} = \left. \frac{\partial}{\partial\theta_R} \right|_{\bar{\tilde{y}}} & \bar{D}_R &= \left. \frac{\partial}{\partial\bar{\theta}_R} \right|_{\tilde{y}} = \left. \frac{\partial}{\partial\bar{\theta}_R} - 2i\theta_R\partial_L \right|_{\bar{\tilde{y}}} \\ D_L &= \left. \frac{\partial}{\partial\theta_L} \right|_{\tilde{y}} = \left. \frac{\partial}{\partial\theta_L} - 2i\bar{\theta}_L\partial_R \right|_{\bar{\tilde{y}}} & \bar{D}_L &= \left. \frac{\partial}{\partial\bar{\theta}_L} - 2i\theta_L\partial_R \right|_{\tilde{y}} = \left. \frac{\partial}{\partial\bar{\theta}_L} \right|_{\bar{\tilde{y}}}\end{aligned}$$

$$\begin{aligned}\int d^4\theta &= \frac{1}{4} \overline{D}_R D_R \overline{D}_L D_L \Big| & \int d^4\theta &= -\frac{1}{4} \overline{D}_R D_L \overline{D}_L D_R \Big| \\ \int d^2\tilde{\theta} &= \frac{1}{2} \overline{D}_L D_R \Big| & \int d^2\tilde{\theta} &= \frac{1}{2} \overline{D}_R D_L \Big|\end{aligned}$$

$$\begin{aligned}D_R \sqrt{2} \Sigma \Big| &= -2 \overline{\lambda}_L & \overline{D}_R \sqrt{2} \overline{\Sigma} \Big| &= +2 \lambda_L \\ \overline{D}_L \sqrt{2} \Sigma \Big| &= +2 \lambda_R & D_L \sqrt{2} \overline{\Sigma} \Big| &= -2 \overline{\lambda}_R \\ \frac{1}{2} \overline{D}_L D_R \sqrt{2} \Sigma \Big| &= D - iF_{03} & \frac{1}{2} \overline{D}_R D_L \sqrt{2} \overline{\Sigma} \Big| &= D + iF_{03}\end{aligned}$$

$$\begin{aligned}\ln \Sigma(\tilde{y}) &= \ln \sigma - \sqrt{2} \theta_R \overline{\lambda}_L / \sigma + \sqrt{2} \overline{\theta}_L \lambda_R / \sigma + \theta_R \overline{\theta}_L \left(\frac{\sqrt{2} (D - iF_{03})}{\sigma} - 2 \frac{\overline{\lambda}_L}{\sigma} \frac{\lambda_R}{\sigma} \right) \\ \ln \overline{\Sigma}(\tilde{y}) &= \ln \overline{\sigma} - \sqrt{2} \theta_L \overline{\lambda}_R / \overline{\sigma} + \sqrt{2} \overline{\theta}_R \lambda_L / \overline{\sigma} + \theta_L \overline{\theta}_R \left(\frac{\sqrt{2} (D + iF_{03})}{\overline{\sigma}} - 2 \frac{\overline{\lambda}_R}{\overline{\sigma}} \frac{\lambda_L}{\overline{\sigma}} \right)\end{aligned}$$

Twisted Chiral Superfield \mathbf{S}

$$S = \frac{i}{2} \overline{D}_R D_L \ln \sqrt{2} \overline{\Sigma} \qquad \overline{S} = \frac{i}{2} \overline{D}_L D_R \ln \sqrt{2} \Sigma$$

$$S| = \frac{\sqrt{2}\overline{\sigma}(iD - F_{03}) - 2i\overline{\lambda}_R\lambda_L}{(\sqrt{2}\overline{\sigma})^2} \qquad \overline{S}| = \frac{\sqrt{2}\sigma(iD + F_{03}) - 2i\overline{\lambda}_L\lambda_R}{(\sqrt{2}\sigma)^2}$$

$$D_R S = \partial_L \frac{D_L \sqrt{2} \overline{\Sigma}}{\sqrt{2} \overline{\Sigma}} \qquad D_R S| = -2\partial_L \frac{\overline{\lambda}_R}{\sqrt{2}\overline{\sigma}}$$

$$\overline{D}_R \overline{S} = -\partial_L \frac{\overline{D}_L \sqrt{2} \Sigma}{\sqrt{2} \Sigma} \qquad \overline{D}_R \overline{S}| = -2\partial_L \frac{\lambda_R}{\sqrt{2}\sigma}$$

$$\overline{D}_L S = -\partial_R \frac{\overline{D}_R \sqrt{2} \Sigma}{\sqrt{2} \overline{\Sigma}} \qquad \overline{D}_L S| = -2\partial_R \frac{\lambda_L}{\sqrt{2}\overline{\sigma}}$$

$$D_L \overline{S} = \partial_R \frac{D_R \sqrt{2} \Sigma}{\sqrt{2} \Sigma} \qquad D_L \overline{S}| = -2\partial_R \frac{\overline{\lambda}_L}{\sqrt{2}\sigma}$$

$$\frac{1}{2} \overline{D}_L D_R S = -i \square \ln \sqrt{2} \overline{\Sigma} \qquad \frac{1}{2} \overline{D}_L D_R S| = -i \square \ln \sqrt{2} \overline{\sigma}$$

$$\frac{1}{2} \overline{D}_R D_L \overline{S} = -i \square \ln \sqrt{2} \Sigma \qquad \frac{1}{2} \overline{D}_R D_L \overline{S}| = -i \square \ln \sqrt{2} \sigma$$

Vector superfield

$$\begin{aligned}
 V(x) = & - A_L \bar{\theta}_R \theta_R - A_R \bar{\theta}_L \theta_L - i \sqrt{2} \sigma \bar{\theta}_R \theta_L - i \sqrt{2} \overline{\sigma} \theta_L \theta_R - \\
 & - 2 i \theta_R \theta_L \overline{\theta_{[R} \lambda_{L]}} - 2 i \overline{\theta_R \theta_L} \theta_{[R} \lambda_{L]} - 2 i \bar{\theta}_R \theta_R \bar{\theta}_L \theta_L D(x)
 \end{aligned}$$

$$\begin{aligned}
 V(x) = & - A_L \bar{\theta}_R \theta_R - A_R \bar{\theta}_L \theta_L - i \sqrt{2} \sigma \bar{\theta}_R \theta_L - i \sqrt{2} \overline{\sigma} \theta_L \theta_R - \\
 & - 2 i \theta_R \theta_L \overline{\theta_{[R} \lambda_{L]}} - 2 i \overline{\theta_R \theta_L} \theta_{[R} \lambda_{L]} - 2 i \bar{\theta}_R \theta_R \bar{\theta}_L \theta_L \left(D \mp i F_{03} \right)_{\tilde{y}, \bar{\tilde{y}}}
 \end{aligned}$$

$$\begin{aligned}
 A_R &= A_0 + i A_3 & \sigma &= - \frac{A_1 + i A_2}{\sqrt{2}} & \partial_{[R} A_{L]} &= - 2 i F_{03} \\
 A_L &= A_0 - i A_3
 \end{aligned}$$

$$\Sigma = \frac{i}{\sqrt{2}} D_L \bar{D}_R V \qquad \bar{\Sigma} = \frac{i}{\sqrt{2}} D_R \bar{D}_L V$$

Vortices

$$e^{i\alpha n\overline{n}} \cdot \hat{M} \cdot e^{-i\alpha n\overline{n}} = \hat{M} + i \sin \alpha [n\overline{n}, \hat{M}] - (1 - \cos \alpha) [n\overline{n} [n\overline{n}, \hat{M}]]$$

Profiles

$$A_{\pm}^{\text{U}(1)} = \mp i \frac{x^{\pm}}{r^2} \frac{1}{N} f(r)$$

$$A_{\pm}^{\text{SU}(N)} = \mp i \frac{x^{\pm}}{r^2} f_N(r) \left(n\overline{n} - 1/N \right)$$

$$\partial_r \left(\phi_1 \phi_2^{N-1} \right) = \frac{f}{r} \cdot \phi_1 \phi_2^{N-1}$$

$$\partial_r \frac{\phi_1}{\phi_2} = \frac{f_N}{r} \frac{\phi_1}{\phi_2}$$

Gauge Field Normalization

$$\hat{\mu}_1 = \sqrt{\frac{2}{N}} \mu_1 \qquad \hat{A}^a = \frac{1}{\sqrt{2N}} A^a \qquad \hat{T}^a = \sqrt{2N} T^a$$