IIB_action

Type IIB supergravity action

These are given in [1]

String frame (split into NS/R/CS)

$$S_{\mathrm{IIB}} = S_{\mathrm{NS}} + S_{\mathrm{R}} + S_{\mathrm{CS}}.$$

$$S_{\mathrm{NS}} = \frac{1}{2\kappa_{10}^2}\int d^{10}x(-G)^{1/2}e^{-2\Phi}\left(R + 4\partial_\mu\Phi\partial^\mu\Phi - \frac{1}{2}|H_3|^2\right). \quad (1)$$

$$S_{\mathrm{R}} = -\frac{1}{4\kappa_{10}^2}\int d^{10}x(-G)^{1/2}\left(|F_1|^2 + |\tilde{F}_3|^2 + \frac{1}{2}|\tilde{F}_5|^2\right). \quad (2)$$

$$S_{\mathrm{CS}} = -\frac{1}{4\kappa_{10}^2}\int C_4 \wedge H_3 \wedge F_3. \quad (3)$$

Einstein frame (directly from string frame)

We define the Einstein-frame metric by the Weyl rescaling

$$G_{\mu\nu}{}^{(E)} = e^{-\Phi/2}G_{\mu\nu}.$$

In terms of G_E the action becomes

$$S_{\mathrm{IIB}} = S_{\mathrm{NS}}{}^{(E)} + S_{\mathrm{R}}{}^{(E)} + S_{\mathrm{CS}},$$

$$S_{\mathrm{NS}}^{(E)} = \frac{1}{2\kappa_{10}^2}\int d^{10}x(-G_E)^{1/2}\left(R_E - \frac{1}{2}(\partial\Phi)^2 - \frac{1}{2}e^{-\Phi}|H_3|^2\right), \quad (4)$$

$$S_{\mathrm{R}}^{(E)} = -\frac{1}{4\kappa_{10}^2}\int d^{10}x(-G_E)^{1/2}\left(e^{2\Phi}|F_1|^2 + e^{\Phi}|\tilde{F}_3|^2 + \frac{1}{2}|\tilde{F}_5|^2\right). \quad (5)$$

Equivalently, combining the NSNS and RR sectors into a single Einstein-frame integral and keeping the Chern-Simons term separate,

$$S_{\mathrm{IIB}} = \frac{1}{2\kappa_{10}^2}\int d^{10}x(-G_E)^{1/2}\left(\left(R_E - \frac{\partial_\mu\bar{\tau}\partial^\mu\tau}{2\tau_2^2}\right) - \frac{1}{2}\left(e^{-\Phi}|H_3|^2 + e^{\Phi}|\tilde{F}_3|^2\right) - \frac{1}{4}|\tilde{F}_5|^2\right) - \frac{1}{4\kappa_{10}^2}\int C_4 \wedge H_3 \wedge F_3. \quad (6)$$

Einstein frame (SL(2)-covariant form)

$$S_{\mathrm{IIB}} = \frac{1}{2\kappa_{10}^2}\int d^{10}x(-G_E)^{1/2}\left(R_E - \frac{\partial_\mu\bar{\tau}\partial^\mu\tau}{2(\mathrm{Im}\tau)^2} - \frac{\mathcal{M}_{ij}}{2}\tilde{F}_3^i\cdot\tilde{F}_3^j - \frac{1}{4}|\tilde{F}_5|^2\right) - \frac{\epsilon_{ij}}{8\kappa_{10}^2}\int C_4 \wedge$$

References

---

1. J. Polchinski, *String Theory, Volume 2: Superstring Theory and Beyond*, Cambridge University Press (1998).↩