
Errata for:

“Probing the Universe: A Geometrical View for Observers of Spacetime Physics”

Robin W. Tucker and Timothy J. Walton (Springer: 2026)



A list of typographical errors and correction for the book will be kept here. Corrections are emphasised in **red** text.

Please email TWalton@lancashire.ac.uk if you find any typographical errors not already listed.

page 376: The last displayed equation on this page should read:

$$\begin{aligned}\mathcal{G}_c &= \mathcal{R} \star e_c - 2(i_a P_c) \star e^a + \mathbf{2}(i_c i_a i_b \mathfrak{D} T^b) \star e^a \\ &= \mathcal{R} \star e_c - 2 \star P_c - 2i_a(i_c i_b \mathfrak{D} T^b) \star e^a\end{aligned}$$

page 383: The top displayed equation on this page should read:

$$\psi_2 = \dot{e}^{\mathbf{a}} \wedge e^b \wedge \star R_{ab}.$$

The displayed equation between (20.17) and (20.18) should read:

$$\begin{aligned}\mathfrak{D} \star e^{ab} &= \frac{1}{2} \epsilon^{ab}_{cd} \mathfrak{D} e^{cd} = \frac{1}{2} \epsilon^{ab}_{cd} (T^c \wedge e^d - e^c \wedge T^d) \\ &= \epsilon^{ab}_{cd} T^c \wedge e^d = T_c \wedge \star e^{abc}\end{aligned}$$

page 384: The line of text above equation (20.22) should read:

“In this case the 3-forms $\{\mathcal{G}_c^{(\text{EH})} \equiv -\frac{1}{2}\mathcal{G}_c\}$ define. . .”

page 385: Equation (20.24) should read:

$$\begin{aligned}\Lambda_{\text{TOTAL}}(e, \omega, A, \phi, \overline{\phi}) &\equiv \frac{\mathbf{1}}{\mathbf{2}\kappa} R_{ab}(\omega) \wedge \star e^{ab} + \kappa_A dA \wedge \star dA \\ &\quad + \kappa_1 \text{Re}(\overline{\mathfrak{D}_{U(1)} \phi} \wedge \star \mathfrak{D}_{U(1)} \phi) \\ &\quad + \kappa_2 \phi \overline{\phi} \star 1 + \kappa_3 R_{ab}(\omega) \wedge R^{ab}(\omega)\end{aligned}\tag{20.24}$$

page 386: Equation (20.30) should read:

$$\mathcal{I}_{\text{EH}}[e, \omega] \equiv \frac{1}{2\kappa} \int_{\mathcal{M}} R_{ab}(\omega) \wedge \star(e^a \wedge e^b), \quad (20.30)$$

and the displayed equation below becomes:

$$\mathcal{G}_c^{(\text{EH})} \equiv -\frac{1}{2} R_{ab} \wedge i_c \star(e^a \wedge e^b) = 0, \quad a, b, c = 0, 1, 2, 3, \quad e^a(X_c) = \delta_c^a$$

$$T^c = 0.$$

page 388: Equation (20.31) should read:

$$\text{Ein} \equiv (\star^{-1} \mathcal{G}_c^{(\text{EH})}) \otimes e^c = \kappa (\star^{-1} \tau_c^{(\text{SOURCE})}) \otimes e^c. \quad (20.31)$$

page 392: The first equation of section 20.4 should read:

$$\mathcal{I}_{\text{EH}}[e, \omega] \equiv \frac{1}{2\kappa} \int_{\mathcal{M}} R_{ab}(\omega) \wedge \star(e^a \wedge e^b), \quad (20.30)$$

and the second equation becomes:

$$\begin{aligned} \mathcal{I}_{\text{SOURCE}}[e, A, \phi, \bar{\phi}] \equiv & \kappa_A \int_{\mathcal{M}} \Lambda_2(e, A) + \kappa_1 \int_{\mathcal{M}} \Lambda_1(e, A, \phi, \bar{\phi}) \\ & + \mu^2 \int_{\mathcal{M}} \Lambda_3(e, \phi, \bar{\phi}) \quad (\kappa_1, \mu \in \mathbb{R}) \end{aligned}$$

page 395: The displayed equation immediately above equation (20.37) should read:

$$\widehat{\delta} \left(\mathcal{I}_{\text{EH}}[e, \omega] + \mathcal{I}_{\text{SOURCE}}[e, A, \phi, \bar{\phi}] \right) \simeq 0,$$

page 396: Equation (20.39) should read:

$$\frac{\mathcal{G}_c^{(\text{EH})}}{\kappa} = \tau_c \quad (20.39)$$

and the text immediately after this displayed equation becomes:

$$\text{“where } \mathcal{G}_c^{(\text{EH})} \equiv -\frac{1}{2} R_{ab} \wedge i_c \star e^{ab} \dots \text{”}.$$

The text in the first paragraph immediately below the last displayed equation of this page should be:

“Note $[\tau_c] = \mathbf{M}[c_0^2]$. Since the $\dot{\omega}_{ab}$ partial variations in $\mathcal{I}_{\text{EH}}[e, \omega]$ and $\mathcal{I}_{\text{SOURCE}}[e, A, \phi, \bar{\phi}]$ yield a set of zero-torsion connection 1-forms (see section

above), if these are assumed to be metric-compatible with respect to the metric tensor $g = \eta_{ab} e^a \otimes e^b$ then (??), (??), (??) constitute the necessary conditions for the functional $\mathcal{I}_{\text{EH}}[e, \omega] + \mathcal{I}_{\text{SOURCE}}[e, A, \phi, \bar{\phi}]$ to be extremal and (??) yields a *Levi-Civita Einstein tensor field equation with sources.* ”

page 402: The penultimate displayed equation on this page should read:

$$T^{(\text{MAX})}(X_0, X_0) = (\star \tau_c^{(\text{MAX})})(X_0) \delta_0^c = i_0(\star \tau_0^{(\text{MAX})})$$

page 414: Equation (22.8) should read:

$$\mathcal{G}_a^{(\text{EH})} = \kappa \tau_a^{(\text{SOURCE})}, \quad a = 0, 1, 2, 3. \quad (22.8)$$

The text immediately following this line should then read:

“Recall that it follows from $\left[\mathcal{G}_a^{(\text{EH})} \right]$ and . . .”.

Equation (22.9) should read:

$$\mathcal{G}_a^{(\text{EH})} = \kappa \sum_N \tau_a^N \equiv \kappa \tau_a^{(\text{SOURCE})}. \quad (22.9)$$
