2nd set of corrections to Relativity, Gravitation and Cosmology 2e
by Ta-Pei Cheng (August, 2010) — four pages

- p.114, right hand side of Eq (6.38): Remove the minus sign so that the displayed equation reads as

$$\kappa = \frac{8\pi G_{\mathrm{N}}}{c^4}. \tag{6.38}$$

- p.137, right hand side of Eq.(7.84): Remove last part of the equation so that the displayed equation reads as

$$ct_\delta\left(r, r_0\right) = \frac{r^*}{2} + r^* \ln\left(\frac{2r}{r_0}\right). \tag{7.84}$$

- p.137, Eq.(7.85) as well as the sentence above this equation:

  Modify last part of the sentence and the displayed equation so that they read as

  "Thus, when the distance from the spherical gravitational source M to the closest point r_0 is much smaller than either of the distances to A or to B, the total time delay for a light pulse traveling round trip between A and B, obtained by using (7.72,), (7.73) and (7.84), is:

$$\begin{aligned}\Delta t_\delta &= 2\left[t_\delta\left(r_A, r_0\right) + t_\delta\left(r_B, r_0\right)\right] \\ &= \frac{4G_{\mathrm{N}}M}{c^3}\left[\ln\left(\frac{4r_A r_B}{r_0^2}\right) + 1\right]. \end{aligned} \tag{7.85}$$

- p.238, one line below subsection heading "**Λ as a modification of the geometry side**": Remove the minus sign in front of the expression $8\pi c^{-4}G_{\mathrm{N}}$ so that the inline equation reads as " $\kappa = 8\pi c^{-4}G_{\mathrm{N}}$."

- p.238, left hand side of Eq (11.1): Change the minus sign to a plus sign in front of the Greek symbol Lambda so that the displayed equation reads as

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \kappa T_{\mu\nu}. \tag{11.1}$$

- p.239, middle part of the first displayed equation on this page (no equation number): Insert a minus sign in front of the Greek symbol Lambda so that the displayed equation reads as

$$G_{\mu\nu} = -\Lambda g_{\mu\nu} \equiv \kappa T_{\mu\nu}^{\Lambda}.$$

- p.323, right hand side of Eq (14.21): Insert a minus sign in front of the factor of $\frac{1}{2}$ so that the displayed equation reads as

$$R_{\mu\nu\alpha\beta} = -\frac{1}{2}\left(\partial_\mu\partial_\alpha g_{\nu\beta} - \partial_\nu\partial_\alpha g_{\mu\beta} + \partial_\nu\partial_\beta g_{\mu\alpha} - \partial_\mu\partial_\beta g_{\nu\alpha}\right). \tag{14.21}$$

- p.323, right hand side of Eq (14.22): Insert a minus sign in front of the factor of $\frac{g^{ij}}{2}$ so that the displayed equation reads as

$$R_{00} = g^{ij} R_{i0j0} = -\frac{g^{ij}}{2} \left(\partial_i \partial_j g_{00} - \partial_0 \partial_j g_{i0} + \partial_0 \partial_0 g_{ij} - \partial_i \partial_0 g_{0j} \right). \quad (14.22)$$

- p.323, right hand side of Eq (14.23): Insert a minus sign in front of the factor of $\frac{1}{2}$ so that the displayed equation reads as

$$R_{00} = -\frac{1}{2} \nabla^2 g_{00}. \quad (14.23)$$

- p.323, left hand side of the last equation at the bottom of the page: Remove the minus sign in front of the expression $\frac{1}{2}\nabla^2 \left(1 + 2\frac{\Phi}{c^2}\right)$ so that the displayed equation reads as

$$\frac{1}{2}\nabla^2 \left(1 + 2\frac{\Phi}{c^2}\right) = \frac{1}{2}\kappa\rho c^2,$$

- p.324, right hand side of Eq.(14.24): Remove the minus sign so that the displayed equation reads as

$$\nabla^2 \Phi = \frac{1}{2}\kappa\rho c^4. \quad (14.24)$$

- p.324, right hand side of Eq.(14.25): Remove the minus sign so that the displayed equation reads as

$$\kappa = \frac{8\pi G_N}{c^4}. \quad (14.25)$$

- p.324, right hand side of Eq.(14.26): Remove the minus sign so that the displayed equation reads as

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \frac{8\pi G_{\mathrm{N}}}{c^4} T_{\mu\nu}, \quad (14.26)$$

- p.324, right hand side of Eq.(14.27): Remove the minus sign so that the displayed equation reads as

$$R_{\mu\nu} = \frac{8\pi G_{\mathrm{N}}}{c^4} \left(T_{\mu\nu} - \frac{1}{2} T g_{\mu\nu} \right). \quad (14.27)$$

- p.324, sidenote 3: Change the last minus sign to a plus sign in $(++-)$ as well as inserting a phrase "to $[S2]$ as well as" after the word "related" so that the side note reads as

"[3]Beware of various sign conventions $[S] = \pm 1$ used in the literature:

$$
\begin{aligned}
\eta_{\mu\nu} &= [S1] \times \mathrm{diag}(-1,1,1,1), \\
R^{\mu}_{\lambda\alpha\beta} &= [S2] \times (\partial_\alpha \Gamma^{\mu}_{\lambda\beta} - \partial_\beta \Gamma^{\mu}_{\lambda\alpha}, \\
&\quad + \Gamma^{\mu}_{\nu\alpha}\Gamma^{\nu}_{\lambda\beta} - \Gamma^{\mu}_{\nu\beta}\Gamma^{\nu}_{\lambda\alpha}) \\
G_{\mu\nu} &= [S3] \times \frac{8\pi G}{c^4} T_{\mu\nu}.
\end{aligned}
$$

Thus our convention is $[S1, S2, S3] = (+++)$. The sign in the Einstein equation $[S3]$ is related to $[S2]$ as well as to the sign convention in the definition of the Ricci tensor $R_{\mu\nu} = R^{\alpha}_{\mu\alpha\nu}$." (To copy editor: please make sure that the square brackets are not omitted.)

- p.333, right hand side of inline equation in item 1, three lines above Eq.(14.68): Remove the minus sign so that the line reads as

  "1. The $G_{00} = 8\pi G_{\mathrm{N}}\rho/c^2$ equation can then be written (again after a"

- p.333, right hand side of inline equation in item 2, two lines above Eq.(14.69): Remove the minus sign so that the line reads as

  "2. From the $G_{ij} = 8\pi G_{\mathrm{N}} p g_{ij}/c^4$ equation, we have the second"

- p.333, the right hand side of the inline equation just above Eq.(14.70): Remove the minus sign so that the inline equation reads as "(with $\kappa = 8\pi G_{\mathrm{N}}/c^4$)"

- p.333, left hand side of Eq.(14.70): Change the middle minus sign to plus sign so that the equation reads as

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \kappa T_{\mu\nu}. \tag{14.70}$$

- p.334, middle of Eq.(14.71): Change the middle plus sign to a minus sign so that the displayed equation reads as

$$G_{\mu\nu} = \kappa(T_{\mu\nu} - \kappa^{-1}\Lambda g_{\mu\nu}) = \kappa(T_{\mu\nu} + T^{\Lambda}_{\mu\nu}), \tag{14.71}$$

- p.334, one line below Eq.(14.71): Insert a minus sign in front of $\kappa^{-1}\Lambda g_{\mu\nu}$ on the right hand side of the inline equation so that the line reads as "where $T^{\Lambda}_{\mu\nu} = -\kappa^{-1}\Lambda g_{\mu\nu}$ can be called the "vacuum energy tensor."

- p.334, in the middle of Eq.(14.72): Insert a minus sign in front of Λ/κ so that the displayed equation reads as

$$T^{\Lambda}_{\mu\nu} = -\frac{\Lambda}{\kappa}\begin{pmatrix} -1 & 0 \\ 0 & g_{ij} \end{pmatrix} \equiv \begin{pmatrix} \rho_\Lambda c^2 & 0 \\ 0 & p_\Lambda g_{ij} \end{pmatrix}. \tag{14.72}$$

- p.334, in the middle of Eq.(14.73): Remove a minus sign in front of $\Lambda/\kappa c^2$ so that the displayed equation reads as

$$\rho_\Lambda = \frac{\Lambda}{\kappa c^2} = \frac{\Lambda c^2}{8\pi G_{\rm N}}, \tag{14.73}$$

- p.339, right hand side of Eq.(15.10): Remove a minus sign so that the displayed equation reads as

$$G^{(1)}_{\mu\nu} = \frac{8\pi G_N}{c^4} T^{(0)}_{\mu\nu}. \tag{15.10}$$

- p.348, right hand side of second equation from top (no equation number): Remove the minus sign so that the displayed equation reads as

$$R^{(b)}_{\mu\nu} - \frac{1}{2}\eta_{\mu\nu}R^{(b)} = \frac{8\pi G_{\rm N}}{c^4} t_{\mu\nu}.$$

- p.348, right hand side of Eq.(15.40): Insert a minus sign so that the displayed equation reads as

$$t_{\mu\nu} = -\frac{c^4}{8\pi G_N}\left(R^{(2)}_{\mu\nu} - \frac{1}{2}\eta_{\mu\nu}R^{(2)}\right). \tag{15.40}$$

- p.348, right hand side of Eq.(15.41): Insert a minus sign so that the displayed equation reads as

$$t_{\mu\nu} = -\frac{c^4}{8\pi G_N}\left[\left\langle R^{(2)}_{\mu\nu}\right\rangle - \frac{1}{2}\eta_{\mu\nu}\left\langle R^{(2)}\right\rangle\right] \tag{15.41}$$

- p.349, right hand side of the second set of displayed equation in Eq.(15.47): Insert a minus sign so that the displayed equations read as

$$R^{(2)}_{11} = R^{(2)}_{22} = 0 \quad \text{and} \quad R^{(2)}_{00} = R^{(2)}_{33} = -\frac{1}{2}\left(\partial_0 \tilde{h}_+\right)^2 \tag{15.47}$$

- p.371, answer key #9 to Review Questions of Chapter 14:

  Change the minus sign to a plus sign in the inline expression$\Lambda g_{\ \mu\nu}$ and change the plus sign to a minus sign in displayed equation (no equation number) so that #9 answer key reads as

  " 9. Moving the $+\Lambda g_{\mu\nu}$ term to the source side of the equation, we get

$$G_{\mu\nu} = \kappa(T_{\mu\nu} - \kappa^{-1}\Lambda g_{\mu\nu}) = \kappa(T_{\mu\nu} + T^{\Lambda}_{\mu\nu}).$$

  Thus, even in the absence of matter/energy source $T_{\mu\nu} = 0$ (i.e., a vacuum), space can still be curved by the Λ term."

- p.417, 14th line from the top: Remove the minus sign so the line reads as

  κ 6.3 gravity strength $(8\pi G_{\rm N}/c^4)$