

Errata in "A First Course in String Theory" 2nd  
ed. by B. Zwiebach

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This file contains errata, comments, opinions, and mistakes. If you want to add to it, comment on it, or correct any mistakes in it, contact me at the e-mail address below. If I incorporate your input, I will give you credit for your effort.

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**Page ii, Third line of text (Quote by M. Gleiser).** It says "test". It should say "text".

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**Page 5, First line of text in the second paragraph.** Here it says "strong color force". In the next to last paragraph on page 4, it is called the "strong force" and the "color force".

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**Page 5, Last line of text in second paragraph.** It says "Quarks can come in three colors". It should say "Quarks come in one of three colors".

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**Page 15, First line of text in section 2.2.** It says "speed of light". It should say "speed of light in a vacuum".

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**Page 15, Fifth line of text below (2.7).** In some contexts you identify a 4-vector by a name, in this case  $x'$  which is transformed from  $x$ . Then you consider the coordinates of the vector, in this case  $x'^{\mu}$ . In other contexts, for instance in (3.83)(59)  $x^{\mu}$  are the coordinates of an unnamed vector which are transformed one-by-one. That is,  $x'^{\mu}$  vs  $x^{\mu'}$ . Also note (6.40)(111) where the prime follows the index even though X is named and has a prime of its own in (6.39) on the same page.

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**Page 15, Second line of text below (2.8).** It says "spacelike". It should say "spacetime". My thanks to Luc Longtin for pointing this out to me.

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**Page 17, First line of text.** It says "minus sign in (2.13)". It should say "minus sign on the rhs in (2.13)".

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**Page 19, (2.34).** Second line of text below (2.35) it says "changing the order of the first two equations." Why not have them in that order to begin with?

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**Page 24, First line of text below (2.60).** It says "(2.3)". It should say "(2.58)".

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**Page 25, Last statement before QC2.3.** It says "There is no Lorentz transformation that takes ...". It should say "There is no boost that takes ...". There is an improper Lorentz transformation that works.

$$\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 & 0 \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

My thanks to Luc Longtin for pointing this out to me.

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**Page 28, Second line of text in Section 2.5.** It says "(2.3)". It should say "(2.58)".

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**Page 29, (2.91).** The arguments on the lhs are  $t, \vec{x}$ , but the  $t$  becomes  $x^0$  in the middle expression, and then it all becomes  $x$  on the rhs. In (2.92) the notation is more consistent with the 4-vector on the lhs and its coordinates on the rhs.

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**Page 29, (2.93).** Here the right-pointing arrow means "implies", but in (3.21)(49) it means "transforms to".

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**Page 31, Next to last line of text.** It says "integer number of". I prefer "integral multiple of", but perhaps that's mathematical jargon.

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**Page 34, Figure 2.7.** The square is drawn as a rectangle. Both points  $A$  are labelled, but only one point  $A'$ .

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**Page 35, (2.105).** 0, which does not have an arg, needs to be included into the fundamental domain.

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**Page 37, (2.110).** Since the author references (2.32)(18), this definition is redundant.

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**Page 38, Figure 2.10.** What are the grey rectangles in the top left image?

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**Page 39, Second line of text below (2.121).** Replace "sines and cosines." with "sines and cosines, with  $l = 0, 1, 2, \dots$ ."

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**Page 40, Problem 2.1 part (b).** Standard nomenclature is 'kelvins', not "degrees kelvin".

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**Page 48, Fourth line of text below (3.11).** It says "vector  $\vec{E}$ ". It should say "vector field  $\vec{E}$ ", to contrast with scalar field  $B_z$ .

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**Page 51, Second line of text below (3.35).** It says "(3.15)". It should say "(3.25)."

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**Page 52, (3.37).** Change the period to ",  $l = 1, 2, \dots, d$ ," On the following lines add "where  $d$  is the number of spatial dimensions."

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**Page 56, Second line of text above (3.68).** Change "subspace" to "subset".

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**Page 59, Second line of text below (3.77).** It says "diagonal". It should say "diagonal, and zero elsewhere".

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**Page 59, (3.83).** Here we have " $x^{\mu}$ " while in (2.36)(19) we have " $x'^{\mu}$ ".

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**Page 60, Second and seventh line of text below (3.84).** Change " $\mathcal{O}(h)$ " to " $\mathcal{O}(\epsilon, h)$ ".

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**Page 66, Second line of text below (3.114).** Replace "Since the effective ...  $V_g^{(5)}$  . with "Moreover the four-dimensional gravitational potential, which is the average of  $V_g^{(5)}$  over  $X^4$ , is just " $V_g^{(5)}$ ", and as noted above,  $V_g^{(5)}$  is independent of  $X^4$  . Therefore, "

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**Page 66, Second line of text above (3.116).** It says "more than one extra dimension". It should say "more than one curled up extra dimension". My thanks to Luc Longtin for pointing this out to me.

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**Page 67, (3.117).** Below this equation there should be the following text, or something like it. "This equation holds for any case of compactification of extra dimensions, not just curled up dimensions."

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**Page 74, Paragraph above (4.4).** Up and down are true for the curve drawn in Fig 4.1, but are not generally true. It is an artifact of the way the image in Fig. 4.1 is drawn. The real reason for the signs is that  $T_0$  points in the same direction as the tangent at  $x + \delta x$ , but in the opposite direction of the tangent at  $x$ .

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**Page 77, Second line of text below (4.18).** It says " $y(x, t) = A_0$ ". It should say " $y_0(x) = A_0$ ". My thanks to Luc Longtin for pointing this out to me.

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**Page 77, (4.20).**  $y$  in the first term,  $y(x)$  in the second,  $\frac{\mu}{T_0}\omega^2$  in the second term. Contrast with (4.15)(76).  $y(x)$  in both terms and  $\frac{\omega^2\mu}{T_0}$  in the second. My thanks to Luc Longtin for pointing this out to me.

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**Page 79, caption to Fig. 4,4.** Both  $x(t)$  and  $x(t) + \delta x(t)$  are called the variation.

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**Page 80, Seventh line of text from the bottom.** It says "(4.5)". It should say "(4.28)".

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**Page 93, Third line of text above (5.12).** The "it" in "it describes" refers to the world-line P, 2 sentences earlier.

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**Page 102, Third line of text above (6.2).** Parallelogram here, but quadrilateral between (6.29) and (6.30) on page 107. In fact it is neither in general since it is not 2-dimensional nor made of straight lines.

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**Page 102, Second line of text above (6.2).** They are not images of the the vectors the author indicates. For instance,  $dv_1$  is a vector from the image of the point  $(\xi^1, \xi^2)$  to the image of the point  $(\xi^1 + d\xi^1, \xi^2)$ .

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**Page 106, (6.24).** The final tilde is misplaced.

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**Page 107, Fig 6.4.** The image of the selected square is not square. The text 2 lines above (6.30) correctly calls it a rectangle.

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**Page 107, Second line of text above (6.30).** A quadralateral is not defined by two lines, but rather by 4. The image is not a quadralateral since the sheet is not a plane. The vectors defining the image shape are not  $dv_1^\mu$ , but the vector pointing from  $v_1^\mu$  to  $v_1^\mu$  to  $dv_1^\mu$ .

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**Page 108, Seventh line of text from the bottom.** It says "joint". It should say "join".

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**Page 110, Figure 6.6.** It says "spacelike, or timelike". It should say "spacelike, timelike, or null".

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**Page 113, First line of text below (6.52).** This is true because the first term on the rhs is zero. However, we won't know this until we get to (6.57) on the following page.

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**Page 114, Second line of text above (6.54).** It says "(6.5)". It should say "(6.56)". My thanks to Luc Longtin for pointing this out to me.

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**Page 114, First line of text below (6.54).** It says "(6.5)". It should say "(6.56)". My thanks to Luc Longtin for pointing this out to me.

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**Page 118, Figure 6.9.** In the middle of the figure it says " $X^1(\sigma) = f(\sigma)$ ". It should say " $X^1(t, \sigma) = f(\sigma)$ " as in the caption. My thanks to Luc Longtin for pointing this out to me.

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**Page 123, First line of text below (6.87).** It says "Lagrangian density". It should say "Lagrangian density divided by  $-\frac{T_0}{c}$ ". Cf. (6.46)(112). My thanks to Luc Longtin for pointing this out to me.

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**Page 123, (6.90).** In (6.50)(113), the order is partial tau, partial sigma. Here the order is partial sigma, partial tau.

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**Page 125, Fourth line of text, (6.95), (6.96) and (6.97).** "the endpoints" should be "free endpoints", as stated in the second line of text in section 6.9 on page 124, My thanks to Luc Longtin for pointing this out to me.

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**Page 128, Problem 6.11.** It says "A Dp-brane is an extended object with p spatial dimensions: a p-dimensional hyperplane inside the d-dimensional space."

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But on the sixth line of text on page 116 it says "D-branes need not have infinite extent nor are they necessarily hyperplanes."

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**Page 132, First line of text below (7.4).** It says "open string endpoints". It should say "free open string endpoints", as stated in the second line of text in section 6.9 on page 124. My thanks to Luc Longtin for pointing this out to me.

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**Page 139, Figure 7.2.** Neither the arrow, nor the bold line represent  $\frac{2\sigma v_0}{c} = F(2\sigma_1) - F(0)$ . It should extend to  $F(2\sigma_1)$ . Also, there are only 18 hashmarks per cycle. If there were 19, then each one would represent  $.1\sigma_1$ . Luc Longtin helped me to clarify the text of this erratum.

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**Page 170, Third line of text in the second paragraph of Problem 8.1.** It says "at rest". It should say "at rest wrt frame S".

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**Page 171, First line of text above Problem 8.2(a).** It says "currents are taken to vanish at infinity". It will be necessary to assume that  $xj^x$  vanishes at infinity.

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**Page 178, First line of text below (9.11).** It says "In natural units equation (9.5) sets lambda proportional to alpha". In fact, it sets lambda proportional to alpha' in any units.

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**Page 182, First line of text below (9.31).** It says "factors of beta cancel". It should say "factors of beta and alpha' cancel".

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**Page 198, Second line of text below (10.21).** It says "It (the lhs of (10.21)) is the Fourier transform of ...". No it isn't. According to the definition in (10.19), the exponent has the wrong sign. To fix this, replace p in (10.21) with -p. (10.22) will come out the same.

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**Page 204, Second line of text.** Although technically correct, I think the author should reference (10.47)(202) rather than (10.47).

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**Page 208, Fifth line of text below (10.83).** It says "and the  $A^{-(p)}$  are". It should say "and  $A^{-(p)}$  is".

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**Page 211, text below (10.103).** It says "If (10.103) holds ...". 10.103 does hold. It should say "Plugging (10.103) into (10.102) we get".

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**Page 212, Third line of text above (10.109).** It says "fields  $h^{IJ}$  fields". The second fields is spurious.

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**Page 223, Fourth line of text above (11.40).** It says "to to". It should say "to".

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**Page 229, Second line of text in section 11.6.** It says "Lagrangian". It should say "Lagrangian density". My thanks to Luc Longtin for pointing this out to me.

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**Page 242, Third line of text above (12.39).** (12.2) should be (12.37).

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**Page 242, Second line of text above (12.39).** It says "sigma and sigma' cannot be equal". However, they can if  $\sigma = \sigma' = 0$ .

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**Page 242, (12.41).** Since (12.40)(242) holds for  $\sigma, \sigma' \in [-\pi, \pi]$ , the limits of integration should be  $-\pi$  and  $\pi$ . The same goes for (12.43)(243). My thanks to Luc Longtin for pointing this out to me.

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**Page 250, (12.93).** " $P^J P^J(\tau)$ " should be " $P^J(\tau) P^J(\tau)$ ".

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**Page 254, Second line of text above QC 12.3.** It says "It is worth". It should say "It is worthwhile".

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**Page 254, First line of text above (12.120).** It says " $L_0$ ". It should say " $L_0^\perp$ ". My thanks to Luc Longtin for pointing this out to me.

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**Page 265, (12.174).** there should be no arrow over the last delta. My thanks to Luc Longtin for pointing this out to me.

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**Page 271, Figure 12.2.** The parabolae are arcs.

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**Page 271, Figure 12.2.** On the (b) side of the figure, " $M^2 > 0$ " should be " $M^2 < 0$ ". My thanks to Luc Longtin for pointing this out to me.

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**Page 296, First line of text of Section 13.5.** It says "Section 2.8". If I am not mistaken, this is the first use of the section symbol. Elsewhere the word "Section" is used. For example page 31, the next to last line of text in the first paragraph.

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**Page 296, First line of text above (13.87).** It says "transformation". It should say "transformation". My thanks to Luc Longtin for pointing this out to me.

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**Page 308, Third line of text in section 14.2.** It says "the  $X^\mu$ s become operators that do not generally commute." This should be clarified. Although it is true that in general, operators do not commute, the  $X^\mu$ s do commute with each other. See (12.7)(237). On the other hand, they are not in the center of the operator algebra. That is they don't commute with all operators. Is this what the author means?

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**Page 308, Fourth line of text in section 14.2.** The commutator of 2 operators does not encode the "failure to commute". The commutator exists for operators that do commute. Note the wording in the second line of text above (14.5)(308), "the failure to anticommute is measured".

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**Page 308, 1 line of text below (14.1).** It says "If  $b_1$  and  $b_2$  are anticommuting variables, more is true." It is misleading to imply that what follows is another condition that must be satisfied. In the line of text above (14.1), he did not state that

$b_1$  and  $b_2$  are distinct. So this "extra" condition is already satisfied. Delete everything from the line of text above (14.1) to the line of text above (14.3) and replace it with "A set of variables  $b_i$ , indexed by  $i$ , is a set of anticommuting variables if"

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**Page 308, Second line of text below (14.1).** It says " $b_1 b_1 = -b_1 b_1$ ". It should say " $b_i b_i = -b_i b_i$  for  $i = 1, 2$ ".

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**Page 309, Fourth line above (14.7).** It says " $f_{p,s}^\dagger$ ". It should say " $f_{\vec{p},s}^\dagger$ ".

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**Page 309, Second line of text in section 14.3.** It says "Recall ... world-sheet boson". Actually, this is the first use of the phrase "world-sheet boson" in the book, so we are unable to recall. What's worse, the phrase is not defined. In the fourth line of text world-sheet fermion is not defined, but described as "a fermion on the  $(\tau, \sigma)$  world".

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**Page 309, Sixth line of text in section 14.3.** "space-time fermion" used, but not defined.

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**Page 309, (14.8).**  $dp$  should be  $dp_1 dp_2$ .

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**Page 316, Middle line of text in (14.51).** There are two fractions  $1/2$  of differing sizes. The next line of text has small  $1/2$  and large  $1/24$ .

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**Page 318, Second line of text.**  $f_{12}$  is a poor choice of notation. Better would be  $f_{1,2}$ .

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**Page 318, First line of text below (14.61).** It says "physical that". It should say "physical than".

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**Page 323, Fourth line of text above (14.84).** It says "where interchanged". It should say "were interchanged". My Thanks to Robert Klauber for pointing this out to me.

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**Page 324, Third line of text.** It says "R-". What an unfortunate place for a hyphen. I recommend a nonbreaking word "R-R".

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**Page 326, Ninth line of text from the bottom.** The word 'naive' is italicized. 3 lines later, the word 'naive' is not italicized.

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**Page 331, Third line of text in section 15.1.** It says "In the presence of a D-brane, the endpoints of open strings must lie on the brane." It should say "In the presence of D-branes, the endpoints of open strings must lie on them."

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**Page 331, Third line of text in the second paragraph of section 15.1.** It says "A 0-brane is some kind of particle." However, in the first line of text in the same paragraph it implies that p-branes are extended objects, and a 0-brane is not an extended object.

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**Page 337, (15.33).** "alpha" should be "alpha'".

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**Page 344, Third line of text below (15.60).** On this line and the next, it says "U(1) Yang-Mills theory". But in order to be a Yang-Mills theory, the gauge group has to be non-abelian. U(1) is abelian.

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**Page 350, Line of text above (15.84).** It says "(15.50)". It should say "(15.51)".

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**Page 361, Fifth line of text below (16.28).** It says "for zero". It should say "for a zero".

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**Page 362, Fifth line of text below (16.29).** " $\nabla_j^0 = 0$  vanishes" is redundant.

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**Page 374, First line of text in problem 16.7.** It says " $H_{012} = h$  with all ...". It should say " $H_{012} = h$ " with appropriate values for permutations of the subscripts 012, and all".

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**Page 382, (17.28).** Compare (17.27)(382) and (17.29)(382) where  $\bar{\alpha}_0$  comes before  $\alpha_0$ .

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**Page 382, First line of text below (17.28).** "(17.3)" should be "(17.25)".

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**Page 383, First line of text above (17.31).** The first "(17.3)" should be "(17.30)". The second should be "(17.25)".

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**Page 384, (17.40).** Compare (17.35)(384) and (17.37)(384) where  $\bar{\alpha}_0$  comes before  $\alpha_0$ .

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**Page 384, Second line of text below (17.38).** "(17.32)" should be "(17.33)".

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**Page 384, First line of text above (17.41).** "(17.3)" should be "(17.29)". The author's errata page incorrectly says "(17.30)".

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**Page 385, (17.44).** Are we assuming  $\frac{l}{R} \ll 1$ ?

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**Page 391, First line of text.** It says in bold "with  $n = 0$  or with  $m = 0$ ". It should say "with  $n = 0$  or with  $m = 0$ , but not both". This is delayed until the next line of text but not in bold.

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**Page 398, Fourth line of text in problem 17.1.** It says "Find the action for  $x(\tau)$ " but I think it should say "Find the action for  $X(\tau, \sigma)$ ".

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**Page 398, text below (1) in problem 17.4.** It says "All other components of  $B_{\mu\nu}$  vanish". This can be easily fixed by changing (1) itself to read  $B_{23} = -B_{32} = \frac{1}{2\pi\alpha'} b$ .

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**Page 395, Fifth line of text below (17.79).** "(17.3)" should be "(17.31)".

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**Page 445, First line of text in QC 20.5.** It says " $F_{23} = B$  is the only". It should say " $-F_{32} = F_{23} = B$  are the only".

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**Page 451, Next to last line of text.** It says "The moduli space is simply the space of possible choices of the modulus  $R$ ". However, in the last sentence in the next to last paragraph on page (393), the moduli space is NOT the space of possible choices of  $R$ . Moduli less than  $R^*$  are not included.

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**Page 456, Sixth line of text below QC 21.4.** It says "on the  $T_6$ ". It should say "on  $T_6$ ".

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**Page 457, Sixth line of text above section 21.2.** It says " $\ell_1^{(a)} = \pm\ell_2^{(b)}$ ". It should say " $\ell_1^{(a)} = \pm\ell_1^{(b)}$ ". My Thanks to Robert Klauber for pointing this out to me.

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**Page 461, Fifth line of text below (21.22).** It says "U(1) Yang-Mills theory". But in order to be a Yang-Mills theory, the gauge group has to be non-abelian. U(1) is abelian. See erratum on page 344 for a similar erratum.

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**Page 475, First line of text above (21.56).** It says "Together with the" followed by (21.56). This does not make a sentence. Perhaps "Together with (21.51) and (21.54) we have" would be better.

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**Page 480, Thirtieth line of text.** It says "such space". It should say "such a space".

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**Page 489, First line of text in QC 21.20.** "six-hundred" should not be hyphenated.

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**Page 498, First line of text above (22.16).** It says "creation and annihilation", but in (22.16), the order is annihilation and creation.

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**Page 498, (22.16).** There is a space in the subscript for  $H_{\omega_0}$  so that the terms on the right line up. But there is no corresponding space in the subscript for  $SHO_{\omega_0}$  and the terms don't line up.

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**Page 502, Second line of text below (22.46).** It says "our accurate". Do the author means "our inaccurate"?

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**Page 516, Last line of text.** It says "in (22.6)". It should say "the first relation in (22.131)". Compare the first line of text on page 517. The author's errata page should be edited accordingly.

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**Page 522, First line of text In problem 22.5(a).** It says "(NS and R) sectors". It should say "(NS+ and R- sectors)".

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**Page 530, (23.22).** The parentheses in the last term are unnecessary.

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**Page 530, (23.23).** The parentheses in the last term are unnecessary.

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**Page 532, (23.32).** There are 3 significant digits for  $\gamma_4$ , and 4 for  $\gamma_3$

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**Page 539, Third line of text below Fig 23.6.** It says "such solution". It should say "such a solution".

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**Page 553, (23.98).** This equation should read

$$V^4(\bar{r}) = 2\pi^2(2R)^4 \frac{\bar{r}^4(3 - \bar{r}^2)}{12(1 - \bar{r}^2)^3} = \frac{R}{6}\bar{r}(3 - \bar{r}^2) \left( \frac{2\bar{r}R}{1 - \bar{r}^2} \right)^3 2\pi^2.$$

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**Page 553, (23.99).** This equation on the rhs should read

$$\frac{A_3(\bar{r})}{V_4(\bar{r})} = \frac{6}{R} \frac{1}{\bar{r}(3 - \bar{r}^2)}$$

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**Page 561, Third line of text.** It says "that the  $\eta/s$ ". It should say "that  $\eta/s$ ".

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**Page 562, Second unnumbered equation.**  $X^I \pm iX^2$  should be  $X^2 \pm iX^3$ . Both instances.

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**Page 562, Second line of text in Problem 23.2(c).** It says "expectations". It should say "expectation".

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**Page 563, Fourth line of text in Problem 23.3(c).** It says "areas". It should say "width". These can be equated since the embedding is isometric.

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**Page 564, First line of text in Problem 23.5(a).** It says "(23.9)". It should say "(23.90)".

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**Page 565, (3) in Problem 23.5(c).** It says " $\lim_{\rho \rightarrow \infty}$ ". It should say " $\lim_{\bar{\rho} \rightarrow \infty}$ ".

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**Page 566, First line of text below (1).** It says "timelike". On the author's errata page it says "timeline".

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**Page 566, First line of text in Problem 23.7(a).** It says "Exhibit the". It should say "Exhibit a".

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**Page 566, Second line of text in Problem 23.7(a).** Delete the text "with  $z \neq 0$  and at points with  $z = 0$ ".

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**Page 567, Last two lines of text.** Delete the last sentence.

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**Page 571, (24.12).** It says " $x^\mu$ ". It should say " $x_0^\mu$ ".

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**Page 574, Fourth line of text below (24.24).** It says "setting to zero the

states". I prefer "setting the states to zero".

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**Page 574, Seventh line below (24.24).** It says "Lorentz gauge". It should say "Lorenz gauge".

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**Page 575, First line of text below (24.32) (Virasoro primaries).** In the index "primary" points to "Virasoro primary" which point here. So "Virasoro" should be in italics.

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**Page 576, Fifth line of text.** It says "of". It should say "with".

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**Page 578, Third line of text below (24.40).** It says "up to a constant". It should say "up to a constant term".

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**Page 580, Second and last lines of text in Quick Calculation 24.4.** It says "Lorentz gauge". It should say "Lorenz gauge".

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**Page 582, Fourth line of text in Section 24.6.** Does the word "also" belong here?

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**Page 584, Second line of text below (24.76) (preliminary).** On the fourth line of text on this page we had "Enough of preliminaries".

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**Page 603, Figure 25.8.** On the left, the polygon has  $n$  points  $P_i$  while on the right, the half-plane has 3. The caption mentions points  $P_i$  but doesn't specify that  $i$  runs from 1 to  $n$ . Also, the mapping goes from right (the half plane) to left (the polygon) in contrast to other maps in other figures that go from left to right.

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**Page 608, Second line of text.** It says "The strings". This is technically correct, but confusing. In this sentence, the author is speaking of strings in general, but in the next sentence he speaks of a specific string in figure 25.11. I think this distinction could be made more clear by changing "The strings" to "Strings". My Thanks to Robert Klauber for pointing this out to me.

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**Page 609, First line of text.** It says "or modulus". It should say "or a modulus".

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**Page 611, Figure 25.13.** The fourth line of text above (25.57) Figure 25.13 (611) makes it clear that we are considering maps from the  $z$ -sphere to the  $w$ -sphere. However, the caption says the range of the map is the  $w$ -plane and does not mention the domain. My Thanks to Robert Klauber for pointing this out to me.

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**Page 612, Figure 25.14.** The fourth line of text on page 612 makes it clear that we are considering maps from the  $z$ -sphere to the  $w$ -sphere. However, the caption says the maps are from the  $z$ -plane to the  $w$ -plane. Also, in the  $w$ -plane, the point at infinity is shown as a generic point which is not in the  $w$ -plane. My Thanks to Robert Klauber for pointing this out to me.

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**Page 616, (25.73).** I get  $(z+1)/z = (w-1)/w$ .

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**Page 617, Third line of text in the caption to Fig 25.18.** It says " $P_4$  are go". It should say " $P_4go$ ".

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**Page 620, First line of text.** "(25.7)" should be "(25.84)"

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**Page 620, First line of text below (25.88).** "(25.7)" should be "(25.87)"

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**Page 622, Third line of text In the second paragraph in section 25.8.** It says "moduli space of surfaces". It should say "moduli space of the surfaces".

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**Page 622, Last line of text in the second paragraph in section 25.8.** It says "parameter space of the surfaces". It should say "moduli space of the surfaces".

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**Page 647, Second paragraph.** Although two of the images in Figure 26.15 are identified by "to the right" and "right-most", there is no reference to the "left-most" image. Why not use the labels (a), (b) and (c) clearly marked in the figure?

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**Page 658, First line of text in problem 26.6(b).** It says "(and its inverses)". Grammatically, it should say "(and their inverses)". However, there is no difference between the group generated by  $S$  and  $T$  and the group generated by  $S$ ,  $T$ ,  $^{-1}S$  and  $^{-1}T$ . Note that in the first line of text in the second paragraph on page 655, the definition of  $F'$  uses the word "set", not "group". In that case, the inclusion of the inverses of  $S$  and  $T$  is necessary. It might be better to have a single definition rather than two different but equivalent ones..

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**Page 658, Next to last line of text in problem 26.6(b).** It says "on  $\mathcal{F}_0$ ". It should say "in  $\mathcal{F}_0$ ".

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**Page 664, First line of text.** "introduction" should be capitalized.