

The following is a partial errata for the text *Quantum mechanics and Path Integrals* by R. Feynman edited by A. Hibbs (1965) Mc Graw Hill, New York.

If you have any additions, questions, comments or corrections please feel free to send them to me: tsh@mathematicuslabs.com

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Chapter-2

2.1) Page-28, equation 2-9 should read (add parentheses around the terms involving the x-end-points):

$$S_{cl} = \frac{mW}{2\text{Sin}WT} \left[(x_a^2 + x_b^2) \text{Cos}WT - 2x_a x_b \right]$$

Chapter-3

3.1) Page 63, the text in the parentheses just before Eq3-60 should read "Prob. 3-7".

3.2) Page 64, Eq 3-62 last term should read: $\frac{f^2 T^3}{24m}$

3.3) Page 64, Eq 3-63 the first term in the exponent should omit ω .

3.4) Page 73, Eq 3-89 The right hand side is missing a factor of $1/A$.

Chapter-6

6.1) Page121, Eq 6-7 The first occurrence of the $V[x(s)]$ should read; $V[x(s),s]$.

6.2) Page122: Merely a poor choice of editing and typesetting. The brilliant argument on page 122 leading to Eq(6-11) does not have the full immediate impact on most students that it should, since there is no explicit mention of the fact that the path integral is being reduced to an ordinary integral. Aside from the explicit mention of the action being taken, had the contents of pages 121 and 122 faced each other the presentation would have further improved.

6.3) Page 136 Fig 6-8: The term $R^2 d\sigma$ is incorrect. The solid angle is $d\sigma/R^2$, the area is $d\sigma$. The area at the point is then $(R_a+R_b)^2 d\sigma$. The ratio of the latter term and $R^2 d\Omega$ (area at point b) gives Eq 6-43 which is correct.

6.4) Page 137 Eq 6-46 the lhs is a differential cross section i.e. $d\sigma/d\Omega$

6.5) Page 138 Eq 6-53 the lhs is a differential cross section i.e. $d\sigma/d\Omega$.

6.6) Page 151, Eq 6-85: Personally I find the Fermi Golden rule not very useful, but if presented it must at least be qualified that it good only to $O(V^2)$ and then, when $V \neq V(E \text{ or } p)$.

6.7) Page 152 Eq 6-92: Same as above and that it is good for elastic scattering.

6.8) Page 153 Eq 6-96: The denominator term $d\pi$ should be changed to 2π .

6.9) Page 153 The very last sentence on the page should start with the word "By" instead of "In".

6.10) Page 155, Eq 6-101 The first term on the rhs, lower integration bound should be $-\delta T/\hbar$.

6.11) Pages 156&157 the notation has switched from δT to ΔT .

6.12) Page 157, Eq 6-109: The term multiplying $i\pi$ should be $\delta(E_k - E_m)$.

Chapter-7)

7.1) Page 169 Eq 7-16: A term $V(3)$ should be inserted between $K_0(4,3)$ and ψ .

7.2) Page 169 Eq 7-18: A symbol χ should be inserted in the bra on the rhs.

7.3) Page 172 Eq 7-27: The leading minus sign MAY be incorrect.

7.4) Page 172 second line of text after Eq 7-27. The referred equation should be (7-24) instead of (7-14).

7.5) Page 172 Eq 7-29: The last term before the ellipsis in the square brackets should contain the variation of S not s .

7.5) Page 172 Eq 7-30: The rhs term in the brackets should contain the variation of S not s .

Chapter 8)

Not completed

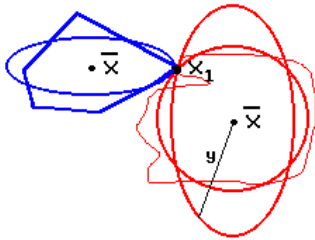
Chapter 9)

Not completed

Chapter 10)

10.1) Page 271 Eq 10-20: The lhs should be dQ/dV .

10.2) Page 276 Eq 10-44: The term $\text{Sinh}(\omega\beta\hbar)$ in the exponent should NOT be squared.



10.3) Page 281 Eq 10-55: The last term (iky) in the Hamiltonian has the incorrect units. It must be replaced by $(iky)/\beta$. This ostensibly due to some sloppiness in dropping the divisor correctly shown in Eq(10-50) but later dropped in two unnumbered Eqs immediately following Eq(10-53) as well as the delta function in the paragraph starting with "We now...".

10.4) Pages 280-281: The presentation of this very important treatment is to some extent botched in an apparent attempt to save a page of explanations. Firstly, It would be terribly helpful for the reader to see a graphical exposition of the method being applied:

The caption might read: "*The closed paths at each x are separated into groups based on their centroid. All path of a group have the same centroid \bar{x} . We sum over the paths in each group, then sum over the groups*".

As such, several important equations in the treatment are simply incorrect if only (manifestly) by their discrepant units: Eq's(10-51) and (10-53): The expression for Z must contain the sum over initial states (in this case over the x_1 variable).

Once the integration over the initial points is added, Z acquires a new unit of length(or volume) which is ostensibly incorrect. The latter error would be corrected if the method outlined in the drawing were implemented carefully (Fortunately these two wrong are related but in the end fail to cancel each other as we shall show).

If we implement the grouping idea we need to make a double sum but the two variables x_1 and \bar{x} are not entirely independent. Therefore a constraint is clearly needed. We also see that if the constraint were to have the units $[1/x^d]$, we will be ok on units. This is jointly achieved by the delta function. Therefore at the very beginning (Eq10-51) we must replace

$$\int dx_0 \rightarrow \int dx_1 \int d\bar{x} d\left(\frac{1}{b\hbar} \int_0^{b\hbar} (x(t) - \bar{x}) dt\right)$$

Once the y shorthand is introduced the correct form of Eq(10-55) will emerge as follows:

$$Z = \int dx \int dY \int \frac{dk_y}{2p_y} \int Dy(u) \left\{ \exp \left[- \frac{1}{\hbar} \int_0^{b\hbar} \left(\frac{m}{2} \dot{y}^2 + \frac{1}{2} V'' y^2 + \frac{iky}{b} \right) du \right] \right\}$$

$$Y = y(0) = y(\beta\hbar) = x_1 - \bar{x}.$$

10.5) Page 281 problem 10-5: If the correct form of Eq(10-55) is used no extra comment to the effect of summing over y is needed. Also it is useful to note that throughout page 281 $V''(0)=V''(y=0)=V''(\bar{x})$ which is a constant when summing over y .

10.6) Page 282 and page *xiii*: Insert a heading for the topic, "The effective potential method" starting on page 282.

10.7) Page 283 Eq(10-59): A minus sign must multiply the overall exponent.

10.8) Page 285 First expression is unnumbered. It must contain \dot{y}^2 instead of y^2 .

10.9) Page 285 Eq(10-66): leaving a free particle path integral in the equation is a bit silly. Also (for sticklers to detail), the font on the \hbar is different than the rest of the book.

10.10) Page 286 Eq(10-70): The term \hbar must be squared.

10.11) Page 286 Eq(10-74): The first integral in the exponent (the kinetic energy term) must contain:

- (i) A discrete sum over i and,
- (ii) the term \dot{R}^2 must be labeled with i .

10.12) Page 289 Eq(10-77): The integral sign for $d^N \mathbf{R}(0)$ is missing.

Chapter-11

11.1) Page 303 six lines above the start of section 11-2. The symbol for density matrix should be ρ not β

11.2) Page 303 four lines above the start of section 11-2. Change the verbiage "enters into a " to "enters as a ".

Chapter-12

Not completed.