

Errata and clarifications

(30 Dec 2024)

⇒ **page 2-15:**

Equation 2.52: A more precise value for the root mean square radius of the pion can be found in C. Hanhart C et al., Eur. Phys. J. C (2017) 77: 98: 0.6603(5)(4) fm.

⇒ **page 5-2:**

“The γ radiation can be expanded into multipole moments. The orbital angular momentum \vec{L} carried by the photon with spin \vec{s} is (angular momentum conservation)

$$\vec{J}_i = \vec{J}_f + \vec{\ell},$$

where...” should read “The γ radiation can be expanded into multipole moments. The orbital angular momentum \vec{L} carried by the photon with spin \vec{s} is given by

$$\vec{J}_i = \vec{J}_f + \vec{\ell}$$

(angular momentum conservation), where...”

⇒ **page 5-6:**

“...was observed by Irène and Frédéric Joliot-Curie...”

⇒ **page 5-8:**

“Odd-odd nuclei on the upper parabola do not have any stable isobar. There are four known exceptions: the light elements ${}^2_1\text{H}$ (deuterium), ${}^6_3\text{Li}$, ${}^{10}_5\text{B}$ and ${}^{14}_7\text{N}$,...”

Clarification: In addition there are 5 heavier nuclei which are quasi-stable (very long lifetimes) such as ${}^{40}_{19}\text{K}$ (figure 5.7).

⇒ **page 5-17, fig. 5.17:**

Room temperature $T_n = 3/2kT = 25$ meV

⇒ **page 9-6:**

Equation 9.13 should read

$$\Delta E [\text{MeV}] = 8.9 \times 10^{-2} \frac{E [\text{GeV}]^4}{\rho [\text{m}]}.$$

⇒ **page 10-4, footnote 2:**

Clarification: In atomic physics the quantum number $N = n + \ell + 1$ (where n is the number of nodes in the wavefunction) is used instead of $n + 1$ in the quark model. For example, for the hydrogen atom the lowest state ($n = 0$) for a given ℓ is denoted $1s$, $2p$, $3d$, ... instead of the $1S$, $1P$, $1D$, etc. used in the quark model.

⇒ **page 10-18, fig. 10.13:**

The horizontal scale should run up to 9 GeV.

⇒ **page 10-18:**

...Quantum mechanical interference is only possible...should read “The observed destructive quantum interference is only possible...”

⇒ **page 10-20:**

Therefore the $1S$ and $2S$ states cannot decay into $(D^0 \bar{D}^0)$ and have to disintegrate through OZI-suppressed processes or electromagnetically, which increases...[delete “(figure 10.16(c))”]

⇒ **page 10-21:**

“Narrow lines were observed at masses around 10 GeV” should read “A narrow line was observed around 10 GeV”.

⇒ **Equation 10.71, page 10-27:**

Clarification: Replace the flavours u, d, s by the colours R, G, B :

$$|R\bar{B}\rangle, |R\bar{G}\rangle, |B\bar{G}\rangle, |B\bar{R}\rangle, |G\bar{R}\rangle, |G\bar{B}\rangle, \frac{1}{\sqrt{6}}|R\bar{R} + G\bar{G} - 2B\bar{B}\rangle, \frac{1}{\sqrt{2}}|R\bar{R} - G\bar{G}\rangle$$

⇒ **Equation 11.18, page 11-4:**

Clarification: there are two types of equivalent transformations for unitary operators. Those with the plus sign in the exponent, such as (11.10) (11.16) and (11.18), transform the coordinate system (and are called passive), while those with a minus sign, e.g. $\exp(-i\vec{J} \cdot \vec{\chi})$, transform the physical system (and are called active).

⇒ **page 11-5:**

Equation 11.22 should read

$$\tilde{\psi}(r, \theta, \phi) = \chi(r)Y_\ell^m(\theta, \phi)$$

Equation 11.23 should read

$$PY_\ell^m(\theta, \phi) = Y_\ell^m(\pi - \theta, \pi + \phi) = (-1)^\ell Y_\ell^m(\theta, \phi).$$

⇒ **figure 11.11, page 11-20:**

The vertical scale is in arbitrary units

⇒ **page 11-27:**

Equation 11.119 should read

$$\omega_L = \frac{g_p e B}{2m_p}$$

⇒ **page 11-32:**

Ref. [1] should read “See e.g. Cohen-Tannoudji C, Diu B, Laloë F..”

⇒ **page 12-23:**

“...the isospinor behaves like spherical harmonics under rotations in three-dimensional space.” Equation 12.94 should read

$$e^{i\pi L_y} Y_\ell^0(\theta) = Y_\ell^0(\pi - \theta) = (-1)^\ell Y_\ell^0(\theta),$$

hence for $i_3 = 0$ mesons...

⇒ **page 13-7:**

Clarification: Equation 13.28 should read

$$\psi \propto \exp(i\vec{k} \cdot \vec{r}) = \exp(ikr \cos \theta) = \sum_{\ell=0}^{\infty} (2\ell + 1) i^\ell j_\ell(kr) P_\ell(\cos \theta)$$

“where $P_\ell(\cos \theta)$ are Legendre polynomials”.

⇒ **page 14-19:**

The first sentence of section 14.6 should read “The search for neutrino oscillations was

first proposed by Bruno Pontecorvo in 1968 to test... ”

⇒ **page 16-7:**

Reference [7] should be replaced by [16]: The measured value of $(1.230 \pm 0.004) \times 10^{-4}$ [16] for the ratio...

⇒ **page 16-24:**

Bottom: ref. should be (16.97). Lagrange’s equations of motion should read

$$\partial_\nu \left[\frac{\partial \mathcal{L}}{\partial (\partial_\nu \varphi)} \right] - \frac{\partial \mathcal{L}}{\partial \varphi} = 0 \quad (1)$$

⇒ **page 19-6:**

Missing unit “ps”: “The mean life of the K_1 is $\tau_S = 89.54 \pm 0.04$ ps”.

⇒ **page C-2:**

In table C.1, the MS flavour wavefunction of the Σ^- should be

$$\frac{1}{\sqrt{6}} |(ds + sd)d - 2dds\rangle$$