

Corrections to NIU Spring 2009 PHYS 661 lecture notes.

Last updated May 1, 2009.

- Page 1, halfway down:
“ $\langle \chi |$ is a ket” should read “ $\langle \chi |$ is a bra”.
- Page 1, about 60% down:
“for each bra $|\psi\rangle$ ” should read “for each ket $|\psi\rangle$ ”, and
“a unique ket $\langle \psi |$ ” should read “a unique bra $\langle \psi |$ ”.
- Page 3, about 70% down, on the right side:
“ $s(s + 1)$ ” should read “ $\hbar^2 s(s + 1)$ ”, and
“ m_s ” should read “ $\hbar m_s$ ”.
- Page 6, about 35% down:
“Then label j isn’t needed” should be “Then label k isn’t needed”.
- Page 21, about 30% down the page:
In the formula for $c_n^{(2)}$, the upper limit of integration on the dt'' integral should be t' , not t'' .
- Page 21, about 45% down the page:
The formula for the probability should really include the $c_n^{(0)}$ term, to deal with the case $n = i$:

$$\mathcal{P}(i \rightarrow n) = |c_n^{(0)} + c_n^{(1)}(t) + c_n^{(2)}(t) + \dots|^2$$

- Page 31, last integral on the page:
“ $(c_1 - c_2 \cos \theta)$ ” in the denominator of the integrand should be raised to the 4th power: “ $(c_1 - c_2 \cos \theta)^4$ ”.
- Page 32, just less than 50% down the page:
“a rate we’ll call Γ_i ” should read “a rate we’ll call Γ_i/\hbar ”.
- Page 37, about 50% down the page:
The subscripts j appearing on m_j on three consecutive lines should be omitted for consistency.
- Page 44, second line:
This should actually read: $\omega_{RL} = (E_A - E_S)/\hbar$. The period of oscillation is $T_{RL} = 2\pi/\omega_{RL} = 2\pi\hbar/(E_A - E_S)$, as can be seen from the bottom of page 43.

- Page 49, about 40% down the page:
“ $\rightarrow e^{-ika}iq(Ae^{iqx} - Be^{-iqx})$ ”
should have the x replaced by a . So it should read
“ $\rightarrow e^{-ika}iq(Ae^{iqa} - Be^{-iqa})$ ”.
- Page 49, figure at bottom of the page:
The labels -1 and $+1$ on the vertical axis should obviously be interchanged. Also, this figure is badly distorted; see the handout excerpt from Baym for better artwork.
- Page 55, about 80% down the page:
The words “odd j ” and “ $j = \text{odd}$ ” should both read “half-integer j ”.
- Page 64, about 75% down the page:
“pretend the electrons” should be “pretend the particles”, since this discussion applies to both bosons and fermions. Also, the “ $S = 1$ ” and “ $S = 0$ ” statements just below should be deleted.
- Page 65, second line:
The statement “with spin $S = N/2$, totally symmetric” should be deleted and replaced by “with totally symmetric spin”.
- Page 73, 4th line:
The equation $T^{ijk\dots} = \dots$ should not actually be an equality, but rather a statement that the left side transforms into the right side under a rotation by R .
- Page 74, about 30% down the page to about 65% down the page:
The statements “($q = 0$)”, “($q = 1$)”, “($q = 2$)”, “($q = 0, 1, 2$)”, “($q = 0$)”, and “($q = +1, 0, -1$)” should all have q replaced by k .
- Page 75, about 65% down the page:
The $\sum_{q_1 q_2}$ should actually be $\sum_{q'_1, q'_2}$.
- Page 81, first line:
The $\int d^3\vec{p}$ should actually be $\int d^3\vec{p}'$, and the last $|\vec{r}\rangle$ should be $|\vec{r}'\rangle$.
- Page 92, about 70% down the page:
Five times in a row, $\frac{2m}{\hbar}$ should be $\frac{2m}{\hbar^2}$.
- Page 94, about 25% down the page:
The $E - H_0 + i\epsilon$ should read $E - H_0 - i\epsilon$, as in the previous line.
Note that then

$$\frac{1}{E - H_0 - i\epsilon} = \text{Pr} \left(\frac{1}{E - H_0} \right) + i\pi\delta(E - H_0),$$

as was correctly used in the notes. In class, a question arose: “what if we distributed the minus sign?” The answer is that nothing would have changed, because then we would have used:

$$\begin{aligned} -\left(\frac{1}{-E + H_0 + i\epsilon}\right) &= -\left(\Pr\left(\frac{1}{-E + H_0}\right) + (-i\pi\delta(-E + H_0))\right) \\ &= -\Pr\left(\frac{1}{-E + H_0}\right) + i\pi\delta(-E + H_0) \\ &= \Pr\left(\frac{1}{E - H_0}\right) + i\pi\delta(E - H_0) \end{aligned}$$

with the same result.

- Page 105, 75% down the page, on the right:
Beneath the word “attractive”, it should say $(V_0 < 0)$ instead of $(V_0 < R)$.
- Page 107, second line:
Should read $A_0 = \frac{\sinh(\kappa r)}{\kappa r}$ (note r instead of R). Also, in the homework, κ is renamed κ' , only so that there will be no confusion between it and k when both are handwritten.
- Page 107, last line, and page 108, third line:
The expressions for k' should have \hbar , not \hbar^2 , in the denominator.
- Page 109, first line:
In the second expression, the reduced mass should be $m_n m_p / (m_n + m_p) \approx m_p / 2$, not $(m_n + m_p) / 2$. The third expression is correct.
- Page 109, 20% down the page:
“There is also a parallel spins ($S = 0$) ...” should actually be: “There is also an anti-parallel spins ($S = 0$) ...”.
- Page 109, 25% down the page and 50% down the page:
Here the “ m ” that appears is actually the reduced mass, $m_n m_p / (m_n + m_p) \approx m_p / 2$.
- Page 112, second line, left-hand side:
The “ $S_\ell(k)$ ” should actually be $2ikf_\ell(k)$.
- Page 120, last line:
The “ \vec{r}'' ” at the very bottom should be \vec{r}' .
- Page 122, last line:
The “ $q(t)$ ” under the summation sign should be $\vec{r}(t)$.

- Homework solutions 3, problem 2:

Several instances of “ $|0, 0, 0\rangle$ ” should actually be “ $|1, 0, 0\rangle$ ”.

- Homework set 5, problem 2(b):

The infinite sum should actually be over ℓ , not n . So it should read:

$$c_n u_n = \sum_{\ell=-\infty}^{\infty} V_{n-\ell} u_\ell \quad (\text{for each } n)$$

(The version posted on the course web site has now been corrected.)