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 \( n = i \):
  \[
  \mathcal{P}(i \rightarrow n) = |c_n^{(0)} + c_n^{(1)}(t) + c_n^{(2)}(t) + \ldots|^2
  \]

- 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 \( \Gamma_i \)” should read “a rate we’ll call \( \Gamma_i / \hbar \)”.

- 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:
  
  \[ e^{-ikaq} (A e^{iqa} - Be^{-iqa}) \]

  should have the \( x \) replaced by \( a \). So it should read

  \[ e^{-ikaq} (A e^{iqa} - Be^{-iqa}) \].

• 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 \( T_{ijk \ldots} = \ldots \) 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 \( \int d^3 \bar{p} \) should actually be \( \int d^3 \bar{p}' \), 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:

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

\[= -\text{Pr}\left(\frac{1}{-E + H_0}\right) + i\pi\delta(-E + H_0)\]

\[= \text{Pr}\left(\frac{1}{E - H_0}\right) + i\pi\delta(E - H_0)\]

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, \(\kappa\) is renamed \(\kappa'\), 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 \((S = 0)\ldots\)” should actually be: “There is also an anti-parallel spins \((S = 0)\ldots\”.

- 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 “\(\tilde{r}''\)” at the very bottom should be \(\tilde{r}'\).

- Page 122, last line:
  The “\(q(t)\)” under the summation sign should be \(\tilde{r}(t)\).
• Homework solutions 3, problem 2:
  Several instances of “|0, 0, 0⟩” should actually be “|1, 0, 0⟩”.

• 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.)