

2021 - PHY 981 - Homework set 3 (Feb 10th 5pm)

1. We meet Tuesdays and Thursdays 2-3 pm link to zoom
Discussion session on Fridays 2-3 link to zoom
link to lecture notes
link to nushellx.zip
2. Do this before class on Tuesday
 - 1) download the zip file <http://babwww.com/2021-981/toi.zip>
 - 2) put the unzipped files on c:\aaa\nushellx
3. Read Chapters 8-10.
4. For the 2^+ to 2^+ gamma decay what are the allowed $\pi\lambda$ values? Which are the most probable?
5. For the allowed beta decay of a 2^+ states what are the allowed J_f^π values for the final state?
6. Find the probability for $m_s = 1/2$ (the m component of the spin wavefunction) in the $\ell - s$ coupled wavefunction $|f_{5/2}, m = 5/2\rangle$.
7. Derive Eqs. 10.71 and 10.72.
8. Find numerical values for $\langle s_{1/2} || Y^{(2)} || s_{1/2} \rangle$, $\langle d_{5/2} || Y^{(2)} || d_{5/2} \rangle$, $\langle d_{5/2} || Y^{(2)} || d_{3/2} \rangle$. Compare the results with Eq. 9.83.
9. When the $j - j$ coupled wavefunction $|([\ell, s, j)(\ell, s, j)]J\rangle$ is expanded into its $L - S$ coupled form $\sum_{L,S} a_{L,S} |[(\ell, \ell, L)(s, s, S)]J\rangle$, for $\ell = 2$, $j = 5/2$ and $J = 2$, what are values of $a_{L,S}$.
10. Calculate $\langle d_{5/2} || \vec{\sigma} || d_{3/2} \rangle$ where $\vec{\sigma} = 2\vec{s}$ is the nucleon spin operator.
11. Derive Eqs. 7.71 from Eq. 7.69.