

Assignment #19

Reading:

March 23 French and Taylor chapter 3-1 thru 3-6*March 25* French and Taylor chapter 3-6 thru 3-11

Problems:

161. Purcell 8.16

162. Purcell 9.2

163. Purcell 9.7

164. Purcell 9.9

165. Purcell 9.12

166. French and Taylor 1-11

167. French and Taylor 1-12

168. Show by explicit matrix multiplication that the following 3×3 matrices:

$$J_1 = \frac{\hbar}{\sqrt{2}} \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix} \quad J_2 = \frac{\hbar}{\sqrt{2}} \begin{pmatrix} 0 & -i & 0 \\ i & 0 & -i \\ 0 & i & 0 \end{pmatrix} \quad J_3 = \hbar \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & -1 \end{pmatrix}.$$

obey the commutation relations expected of angular momentum operators:

$$[J_i, J_j] = i\hbar \sum_{k=1}^3 \epsilon_{ijk} J_k.$$

To what value of j do they correspond?169. Show from the basic commutation relations between J_i and J_j that $[J_x, \vec{J}^2] = 0$ where $\vec{J}^2 = J_1^2 + J_2^2 + J_3^2$.