

Homework 8 (10)

1. Show *that* :

$$[J_z, J_{\pm}] = \pm J_{\pm}$$

$$[J_+, J_-] = 2 J_z$$

$$[J_{\pm}, J^2] = 0$$

2. Show *that*

$$J_{\pm} | \psi_{j,m} \rangle = \sqrt{j(j+1) - m(m \pm 1)} | \psi_{j,m \pm 1} \rangle$$

3. Show *that* $[p_i, L_j] = i \sum_k \epsilon_{ijk} p_k$ and $[r_i, L_j] = i \sum_k \epsilon_{ijk} r_k$

4. Obtain the expression for the operator L when it projected to the coordinate space.

5. Show *that* $Y_1^m(\pi - \theta, \phi + \pi) = (-1)^l Y_1^m(\theta, \phi)$.

Explain why this relation defines the parity of the wave function for the case of centrally symmetric potential.