

Physics 4410
Quantum Mechanics 2

Lecture 15

Review: rotational symmetry

October 2, 2020

1. Describe how to solve spherically symmetric problems.

2. Describe the angular momentum algebra.

3. What are the eigenvectors/eigenvalues of \mathbf{L}^2 and L_z ?

Activity: Buckyball.

A buckyball is a 60-carbon molecule that we can approximate as a sphere of radius R . The Hamiltonian of an electron moving on the buckyball can be approximated as

$$H = \frac{\mathbf{L}^2}{2m_e R^2}.$$



- (a) Find the eigenvalues of H , along with their degeneracies.

(b) If each carbon atom contributes one mobile (non-interacting) electron (described by H), describe the ground state of the buckyball.

- (c) The longest wavelength photon absorbed by the buckyball is $\lambda \approx 4 \times 10^{-7}$ m. Using $m_e \approx 10^{-30}$ kg, $\hbar \approx 10^{-34}$ J · s, and $c \approx 3 \times 10^8$ m/s, determine the radius of the buckyball.