Physics 8.321, Fall 2002
Homework #11

Due **Wednesday, December 4** by 4:30 PM in the 8.321 homework box in 4-339B.

1. Sakurai: Problem 24, Chapter 3 (page 246)

2. Sakurai: Problem 28, Chapter 3 (page 247)

3. Sakurai: Problem 29, Chapter 3 (page 247)

4. Solve the eigenvalue problem for bound states in the spherically symmetric potential

$$V(\mathbf{r}) = \begin{cases} -V_0, & r \leq a \\ 0, & r > a. \end{cases}$$

   Derive a transcendental equation for bound state energies and express the radial wave functions in terms of Bessel functions. What is the minimum value of V_0 which supports a bound state for a given value of a?

5. Find the energies and radial wave functions for the lowest energy states with $l = 0, l = 1$ in the spherically symmetric potential

$$V(\mathbf{r}) = -\frac{a}{r}.$$

6. Given particles of spin $j_1 = 1, j_2 = 3/2$, compute the eigenstates $|j, m\rangle$ of the total angular momentum operators explicitly in terms of the basis $|m_1, m_2\rangle$.

7. Given 3 spin 1/2 particles, compute the eigenstates $|j, m\rangle$ of the total angular momentum operators explicitly in terms of the basis $|\pm, \pm, \pm\rangle$.