Problem Set 9
Phy 211 - Fall 2003
Assigned: Sunday, Nov. 30; Due: Thursday Dec. 4

Problem 1: Uncertainty Principle for the Hydrogen Atom

Shankar, Problem 9.4.2 and 9.4.3

Problem 2: Uncertainty Relations for Angular Momentum

a) Use the commutation relations for angular momentum, $[\hat{L}_x, \hat{L}_y] = i\hbar\hat{L}_z$, etc., to derive uncertainty relations for the components of angular momentum.

b) The total angular momentum squared operator is defined by

$$\hat{L}^2 = \hat{L}_x^2 + \hat{L}_y^2 + \hat{L}_z^2 \, .$$

Evaluate $[\hat{L}^2, \hat{L}_i]$, $i = x, y, z$. Of the observables $\hat{L}^2, \hat{L}_x, \hat{L}_y$ and $\hat{L}_z$, which can observed simultaneously?

Problem 3: Angular Momentum in 2-D

Shankar, Problem 12.3.3, 12.3.4, 12.3.5, 12.5.1

Problem 4: 2-D Oscillator in Radial Coordinates (Graduate Student Problem)

Shankar, Problem 12.3.7

Problem 5: Angular Momentum in 3-D

Shankar, Problem 12.5.3, 12.5.12, 12.5.13,

Problem 6: Spherical Potential Well (Graduate Student Problem)

Shankar, Problem 12.6.9