

731 Homework set 10 (due Nov. 25)
(well, due on the 28th. Happy Thanksgiving!)

1. Consider a spin-1 particle. Under the $|j, m\rangle$ basis:
 - (a). Identify the spin-1 operators S_x , S_y , S_z (or the $j = 1$ angular momentum operators) in the explicit matrix form. (5 points)
 - (b). Evaluate the expectation values $\langle S_x \rangle$, $\langle S_y \rangle$, and $\langle S_z \rangle$. (10 points)
 - (c). Evaluate the matrices of the operators $S_z(S_z + \hbar)(S_z - \hbar)$, and $S_x(S_x + \hbar)(S_x - \hbar)$. Explain your findings. (15 points)

2. Under $|j, m\rangle$, the common eigenstates of \mathbf{J}^2 and J_z ,
 - (a). Show that $\langle J_x^2 \rangle = \langle J_y^2 \rangle$ and calculate the value in terms of j , m . (10 points)
 - (b). Calculate the product $\Delta J_x \cdot \Delta J_y$, where $\Delta A = (\langle A^2 \rangle - \langle A \rangle^2)^{1/2}$. (10 points)
 - (c). Compare your above result with that obtained by the uncertainty relation, and discuss when the minimum uncertainty is reached. (10 points)