Magnetic **Proof that** (lie algebra). [HW].

(a) $\left[L^2, L_i\right] = 0$ (b) $\left[L_i, L_j\right] = i\hbar L_k$.

(c) $L_z = -i\hbar \frac{\partial}{\partial \phi} = -i\hbar\left(x\frac{\partial}{\partial y} - y\frac{\partial}{\partial x}\right)$.

(d) $S^2 = S_x^2 + S_y^2 + S_z^2$.

$= \frac{1}{2}\left(S_+ S_- + S_- S_+\right) + S_z^2$.

(f) $\left[S_z, S_{\pm}\right] = \pm S_{\pm}$.

(e) $\left[S^2, S_z\right] = 0$.