

## Physics 162a, Fall 2009 – Problem Set 7

Due Monday, Dec. 7, 5 PM at my office

1. Sakurai, Chapter 3, problem 20
2. Consider a positronium atom in the 1S state (this fixes the orbital degrees of freedom), in the center of mass frame. Place it in a constant magnetic field with magnitude  $B$  along the  $z$  axis. The Hamiltonian for the spin degrees of freedom is approximately

$$H = A\vec{S}^{e^+} \cdot \vec{S}^{e^-} + \frac{eB}{mc}(S_z^{e^-} - S_z^{e^+}) \quad (1)$$

Obtain the energy eigenvalues and eigenvectors of this system.

3. Sakurai, Chapter 3, problem 22.