

**phys522: HW #9**

1. Consider two identical spin-1 particles with no orbital angular momentum. Define the product states as  $|1, m_1\rangle |1, m_2\rangle \equiv |m_1, m_2\rangle$ . Write explicitly the allowed states of total spin.
2. Discuss what would happen to the energy levels of a helium atom if the electron were a spin zero boson. Be as quantitative as you can.
3. The 1S-2P splitting in helium is  $2K$  where  $K$  is the exchange integral. Calculate the splitting. Use  $Z=2$  for the ground state wave function and  $Z=1$  for the 2P wave function to take into account the screening by the 1S electron. Hint: expand

$$\frac{1}{|\vec{r}_1 - \vec{r}_2|}$$

in terms of spherical harmonics.