ECS 521/641: Spintronics and Nanomagnetics

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HW #8

Problem 1

Derive the four different spinorial parts in a 2-electron system and apply the operators S^2 and S_z on them.

Problem 2

Show that when there are two electrons (or any two spin-1/2 particles), the 2-body wavefunction for which the sum of the two spins equals 1 does not change its value when the spin variables of the electrons are exchanged (i.e., the function is symmetric). The wavefunction for which the sum becomes 0 changes sign when the spin variables are interchanged (i.e., the function is antisymmetric). The 2-body wavefunction can be written as

$$\Psi_{2-body} = \begin{bmatrix} \Psi\left(+\frac{1}{2},+\frac{1}{2}\right) \\ \Psi\left(+\frac{1}{2},-\frac{1}{2}\right) \\ \Psi\left(-\frac{1}{2},+\frac{1}{2}\right) \\ \Psi\left(-\frac{1}{2},-\frac{1}{2}\right) \end{bmatrix}.$$

Problem 3

Derive and determine K_{1s1s}, K_{1s2s}, and J_{1s2s}.