Okayama University
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Exercises for Advanced Physics 2, 2018 term 3

Exercise Set 3
(Due date: Tuesday, October 30, 2018)

Exercise 5 (**Spin operator**) (5 points)

The eigenvalue equation for the electron spin S_z operator is

$$S_z \psi_{\text{spin}} = m_s \hbar \psi_{\text{spin}}$$

For a two-electron system, the total z-component operator is the sum of the S_z operators for each electron:

$$S_{z,\text{total}} = S_z(1) + S_z(2)$$

Determine if the spin wave function $\psi_{\text{spin}} = \psi_\alpha(1)\psi_\beta(2)$ is an eigenfunction of $S_{z,\text{total}}$, and give its eigenvalue.

Exercise 6 (**Hund's rules**) (5 points)

A d^8 electron configuration can lead to the following terms:

$$^1S, {}^1D, {}^1G, {}^3P, {}^3F.$$

Use the first two Hund's rules to properly order these terms according to energy. Then, determine the term symbols arising from each term, and use the third Hund's rule to complete the energy ordering. Explain your choices.