Exercise Set 4

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Phys 633

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Monday

Exercise 1

The "actual" current distribution can be thought of as a linear superposition of classical circular trajectories. The linearity allows the logic to carry through.

Tuesday

Exercise 1

$$
\begin{aligned}
\Delta E_{\text{hfs}}(1\text{S}, F) &= -\frac{2\pi g_I g_S \alpha^2 a_0}{3m_e} \left\langle \vec{S} \cdot \vec{I} \right\rangle \left| \psi_{100}(\vec{0}) \right|^2 \\
&= -\frac{2\pi g_I g_S \alpha^2 a_0}{3m_e} \left(\frac{\hbar^2}{2} F(F+1) - \frac{3}{4} \right) \left(\frac{1}{\pi a_0^3} \right) \\
&= -\frac{g_I g_S \alpha^2 \hbar^2}{6m_e a_0^2} \begin{cases} \times 1 & \text{if } F = 1 \text{ (triplet)} \\ \times(-3) & \text{if } F = 0 \text{ (singlet)} \end{cases}
\end{aligned}
$$