PROBLEM SHEET 10
FYS3110

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Problem 10.1

The Zeeman correction, when choosing the external field $\mathbf{B}_{ext}$ to lie along the z-axis, can be expressed by the following condensed formula.

$$E_Z^1 = \mu_B g_J B_{ext} j_z, \tag{1}$$

where

$$\mu_B = \frac{e\hbar}{2m} = 5.788 \times 10^{-5} eV/T \tag{2}$$

is the Bohr magneton, and

$$g_J = 1 + \frac{j(j+1) + \frac{3}{4} - l(l+1)}{2j(j+1)} \tag{3}$$

is the Landé g-factor. Adding the fine structure equation

$$E_{nj} = -\frac{13.6eV}{n^2}\left[1 + \frac{\alpha^2}{n^2}\left(\frac{n}{j+\frac{1}{2}} - \frac{3}{4}\right)\right] \tag{4}$$

to the Zeeman correction (equation 1) yields an equation for total energy in presence of weak-field Zeeman effect

$$E_{nljj_z} = -\frac{13.6eV}{n^2}\left[1 + \frac{\alpha}{n^2}\left(\frac{n}{j+\frac{1}{2}} - \frac{3}{4}\right)\right] + \mu_B g_J B_{ext} j_z. \tag{5}$$

For $n = 2$

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