

c) Check explicitly your result in the weak field regime and Paschen-Beck limit. Plot them schematically as a function of Zeeman field.

3) Problem 6.38.

In addition, please find all the eigen states. Express the wave functions in terms of product spin states we discussed during the lectures, i.e. in terms of deuteron ($S=1$) and electron ($1/2$) spin wave functions. (No need to show the orbital wave functions.)

4) Consider the Heisenberg spin exchange model for two spin-1/2 electrons (one localized at site 1 and the second one localized at site 2).

$$H = J \vec{S}_1 \cdot \vec{S}_2, \quad J \text{ is the exchange interaction constant.}$$

a) Find all the eigen states and eigen values.

\vec{S}_1, \vec{S}_2 are spin operators.

b) Consider an initial state with spin up at site 1 and spin down at site 2. What happens after time t ? Find out the probabilities of finding both spin up, both down and up at site 1 (2) and down at site 2 (1).