The energy of particular m_s state will be affected by nuclear spin – electron spin interaction energy

The energy varies the product of m_s and m_I, given by $A m_s m_I$, where A is hyperfine splitting constant.

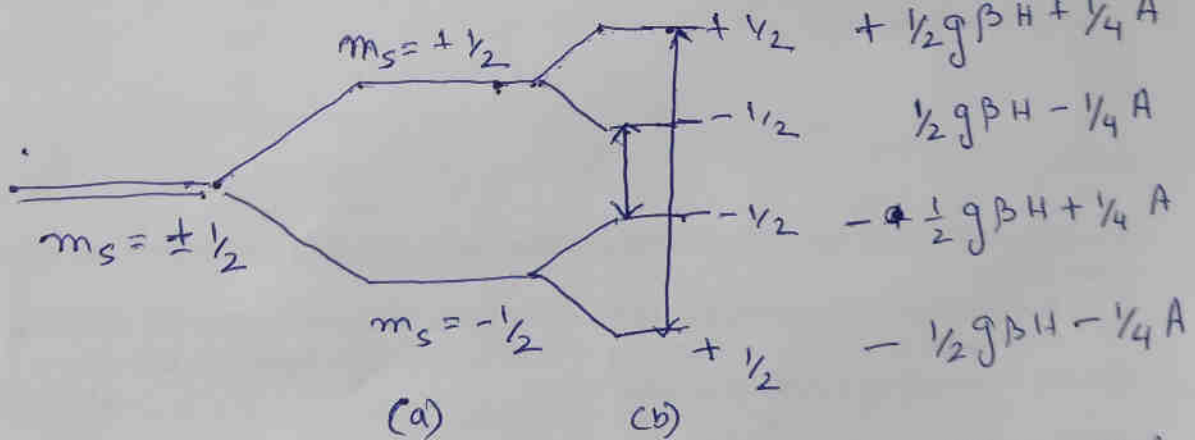
The energy of different levels are given by

$$E = g\beta m_s + A m_s m_I$$

g = g-splitting factor

β = Bohr magneton

The four possible energy levels for hydrogen atoms are



According to ESR selection rules two transitions are possible $+\frac{1}{2}$ to $\frac{1}{2}$ and $-\frac{1}{2}$ ~~and~~ to $-\frac{1}{2}$

(VII)

Here (a) ~~is imp in presence of~~ in presence of.

Here (a) is for electron spin and (b) is interaction of electron spin and nuclear spin.

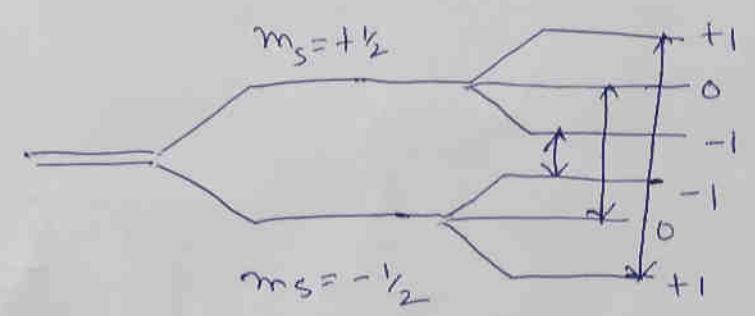
Deuteriam

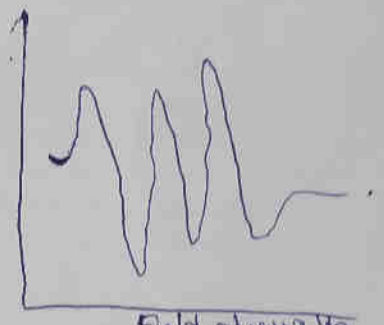
Deuterium has one unpaired electron ($m_s = \frac{1}{2}$) interacts with nuclear spin

I value of $^{2}_{1}H$ is 1, therefore $m_I = +1, 0, -1$,

$[2I + 1 = 3]$.

The six possible energy levels for deuterium are.





ESR spectra of Deuterium.

But the number of ESR lines are 3 (ie $2I+1$).

only three transitions are possible according to ESR selection rule.