from NMR and EPR to ENDOR

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comparing NMR and EPR

Advantages of NMR:
- smaller number of resonances than EPR, easier to analyze the nature of a spectrum
- easy to assign a resonance to a specific isotope
- you always get a resonance, whatever the environment of your nucleus

Disadvantages of NMR:
- quite a large amount of nuclei needed to get a measurable radiowave absorption

Advantages of EPR:
- less atoms needed to get a measurable microwave absorption

Disadvantages of EPR:
- larger number of resonances
- not a priori obvious which atom is responsible for an observed resonance
- if there are no unpaired electrons, there will be no resonance.

Can the advantages of NMR and EPR be combined?

Electron-**N**uclear **DO**uble **R**esonance spectroscopy (ENDOR)

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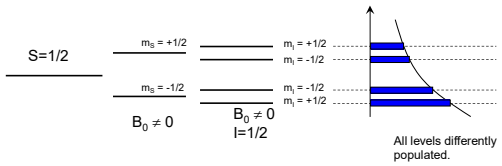
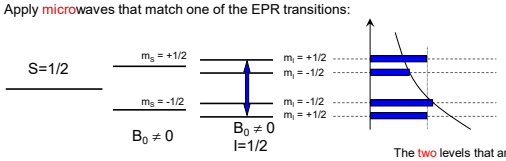
ENDOR

Boltzmann distribution for the occupation of the hyperfine split levels for S=1/2 and I=1/2 :



All levels differently populated.

Apply microwaves that match one of the EPR transitions:



The two levels that are involved become equally populated.

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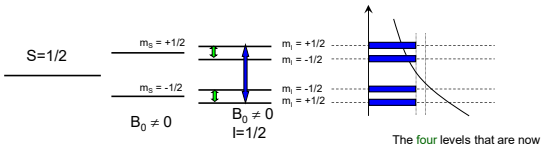
3

ENDOR

Apply radiowaves (=NMR) that match the hyperfine splitting:



The four levels that are now involved become equally populated.

In an ENDOR experiment, the applied field and microwave radiation are such that the EPR transition is matched. The intensity of this transition (i.e. the amount of microwave energy that is absorbed) is monitored as a function of the frequency of the radiofield. For the frequency that matches the NMR-transition, the EPR intensity drops.

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