NMR (Nuclear Magnetic Resonance)

Introduction

* NMR Spectroscopy deals with nuclei.
* It deals with those nuclei which behaves as tiny magnet.

Which nuclei do behave as tiny magnet?

Those nuclei which possess mechanical Spin or angular momentum behave as tiny magnets. Since such a nucleus contains positive charge & if it spins around its axis it would produce a magnetic field. The total angular momentum would depend on the I which may have values $0, \frac{1}{2}, 1, 3/2, 5/2, 2, 3, \ldots$ etc. depending on a particular nucleus. This numerical values of Spin no. I is related to the mass no. and atomic no. of the nucleus. From this relation nuclei can be divided into three types as shown below:

Type	Mass No.	Atomic no.	Spin no.	Examples
I	Odd	even or odd	$\frac{1}{2}, 3/2, 5/2$ etc.	${}_1^1H$, ${}_6^{13}C$, ${}_7^{15}N$
II	even	odd	1, 2, 3 etc.	${}_1^2H$, ${}_5^{10}B$
III	Even	even	0	${}_6^{12}C$, ${}_8^{16}O$

Nuclei of Type - I & II having $I \neq 0$. These types of nuclei behaves as tiny magnet and can be studied by NMR Spectroscopy. Nuclei of type III, where $I = 0$ can not consider in NMR Spectroscopy because they cannot consider as tiny magnet.

Date
Page

Ref. Book → (i) Pania
(ii) P. S. Kalsi
(iii) C. N. Banwell

Related Questions / Study:

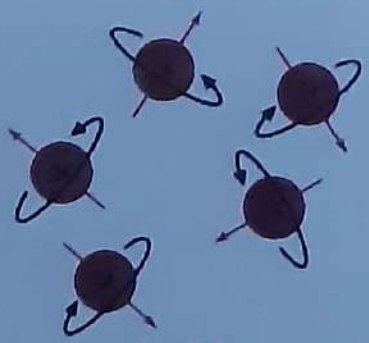
(i) How I value can be Calculated ?

(ii) Why N_7^{14} NMR Spectra is broad ?

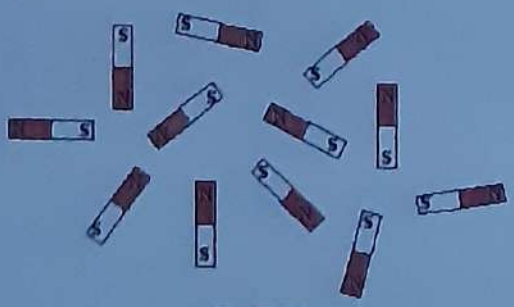
(iii) Why C_6^{12} does not give NMR Signal ?

(iv) Why H_1^1 (Proton NMR) spectra gives sharp peak than N_7^{14} ?

NMR – Spins in a Magnetic Field



No field

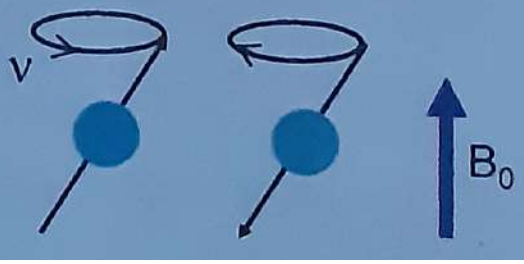


No Field

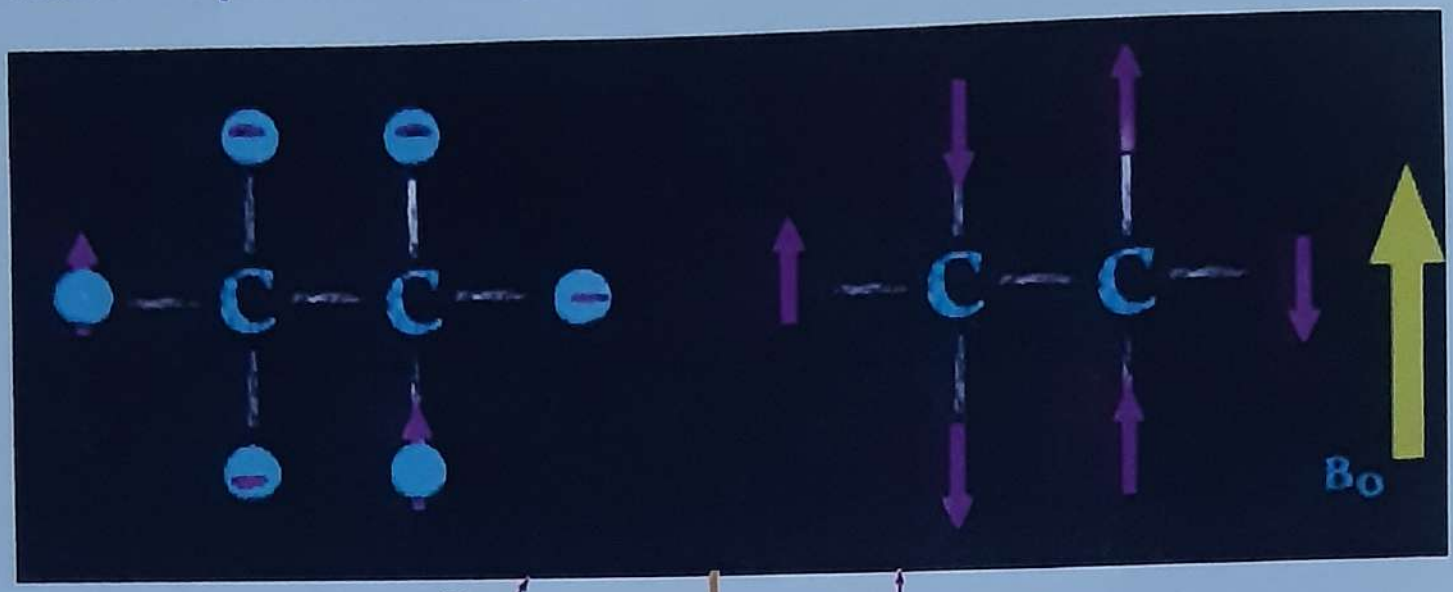
Nuclei have spin, some have a charge and act like magnets

Apply a magnetic field:

- "precess"
- two possible states

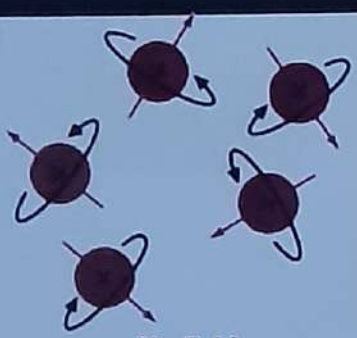


NMR – Spins in a Magnetic Field



In the absence of an External Magnetic Field

- Random spins
- No alignment of nuclei spins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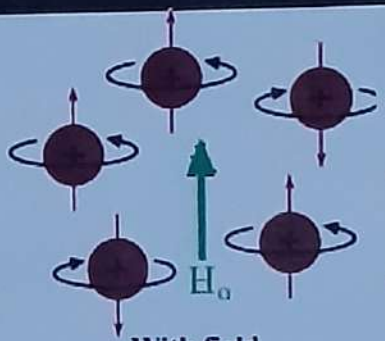

With field

With an External Magnetic Field

- Nuclei spins are aligned
- Strong magnet needed

NMR – Spins in a Magnetic Field