Nuclear Magnetic Resonance (NMR)

A Brief Introduction and Applications

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Overview

1. Principles of NMR

2. Second Section

Setup

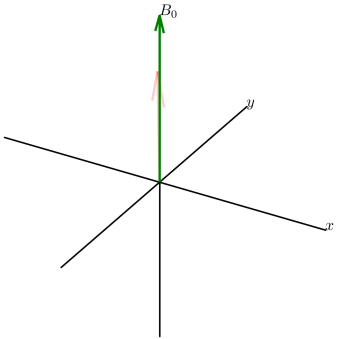

Figure: Typical $\vec{B}_0$ and vector aligned with field

- Spin $1/2$ nuclei
- Strong magnetic field, denoted $\vec{B}_0$

Energy and Hamiltonian

Magnetic moment of nucleus

$$\vec{\mu} = \gamma \vec{S} \tag{1}$$

Yields energy and Hamiltonian of

$$E = -\vec{\mu} \cdot \vec{B}_0 \tag{2}$$

$$H = -\gamma \vec{B}_0 \cdot S \tag{3}$$

Larmor Precession

Evolving an arbitrary spin vector

$$|\psi\rangle = \cos(\theta/2)\,|+\rangle + e^{i\phi}\sin(\theta/2)\,|-\rangle$$

yields,

$$\langle S_x\rangle = \frac{\hbar}{2}\sin(\theta)\cos(\gamma B_0 t)$$
$$\langle S_y\rangle = \frac{\hbar}{2}\sin(\theta)\sin(\gamma B_0 t)$$
$$\langle S_z\rangle = \frac{\hbar}{2}\cos(\theta)$$

with the characteristic **Larmor frequency**

$$\omega_0 = \gamma B_0 \tag{4}$$

Blocks of Highlighted Text

In this slide, some important text will be highlighted because it's important. Please, don't abuse it.

Block

Sample text

Alertblock

Sample text in red box

Examples

Sample text in green box. The title of the block is "Examples".

Multiple Columns

Heading

1. Statement
2. Explanation
3. Example

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Table

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table: Table caption

Theorem

Theorem (Mass–energy equivalence)

$E = mc^2$

Figure

Uncomment the code on this slide to include your own image from the same directory as the template .TeX file.

Citation

An example of the `\cite` command to cite within the presentation:

This statement requires citation [?].

References

The End