Some nuclei (e.g., $^1\text{H}$, $^{13}\text{C}$) could exist in more than one spin state, which, in the absence of an external magnetic field, have identical energies. For example, $^1\text{H}$ nucleus could exist in two spin states, which, in the absence of an external magnetic field, have identical energies.

In an external magnetic field, they have different energies.

The frequency corresponding to the difference between the energies of the two spin states, $E_2 - E_1$, is called the precession frequency.

$$
\text{energy} = \text{Plank's constant } \times \text{ frequency}
$$

$$
E_2 - E_1 = \text{Plank's constant } \times \text{ precession frequency}
$$

$$
\text{precession frequency} = \frac{E_2 - E_1}{\text{Plank's constant}}
$$

$$
\text{precession frequency } \propto E_2 - E_1
$$

Thus, the greater the energy difference between the spin states, the higher the precession frequency. Since the energy difference between the spin states is directly proportional to the external magnetic field (see the graph below), the
stronger the external magnetic field, the higher the precession frequency.

![Diagram showing energy levels and external magnetic field](image)

see also resonance

Contributors

- Gamini Gunawardena from the OChemPal site (Utah Valley University)