

Magnetic resonance

Laurent Ranno

Institut Néel-Université Grenoble Alpes, France

* laurent.ranno@neel.cnrs.fr

This lecture will introduce the concept of electron magnetic resonance. Placing electrons in an applied field induces a Zeeman splitting giving rise to electron spin resonance (ESR). In ferromagnetic materials, exchange interaction, magnetisation and anisotropies also play a role and ferromagnetic resonance (FMR) is an extension of ESR. Links between resonance and time-domain magnetisation dynamics (precession, reversal) will be discussed as well as applying similar concepts to nuclear spins (NMR).

Lecture topics:

1. Basic concepts
 - a. Electron properties
 - b. Spin dynamics
 - c. Magnetic Timescales
2. Electron spin resonance
 - a. Theory
 - b. Experimental Set-ups and Examples
3. Ferromagnetic resonance
 - a. From ESR to FMR
 - b. Uniform and Non Uniform Modes
 - c. Set ups and examples (cavity and broadband)
4. Nuclear magnetic resonance

Recommended reading :

- [1] J. M. D. Coey, Magnetism and Magnetic Materials, Cambridge University Press (2010).
- [2] S. Blundell, Magnetism in Condensed Matter, Oxford University Press (2001).
- [3] C. Kittel, Introduction to Solid State Physics, Wiley (2005).