Magnetism of atoms

Virginie Simonet
Institut Néel, CNRS & Univ. Grenoble Alpes, Grenoble, France
* Virginie.Simonet@neel.cnrs.fr

This lecture is devoted to the building of the isolated magnetic moment at the atomic scale. The magnetic moment is equivalent to a current loop, which allows us to describe quantum mechanically the magnetic moment resulting from one orbiting electron as a combination of orbital and spin angular momenta. The Hund's rules are then recalled that permit to determine the multi-electron magnetic moments of one atom, resulting from Coulomb energy minimization, Pauli exclusion principle and spin-orbit coupling. The spin-orbit interaction and its consequences are detailed. Finally, the temperature anf field-dependent behavior of an assembly of non-interactiong magnetic moments is decribed.

Lecture topics:

1. Formation of a magnetic moment at the atomic scale
2. Hund's rules
3. Spin-orbit interactions in atoms
4. Diamagnetism and paramagnetism of local moments without interactions

Recommended reading:

[1] J. M. D. Coey, *Magnetism and Magnetic Materials*, Cambridge University Press, 2010; Chapters 3, 4 and 9.
[2] S. Blundell, *Magnetism in Condensed Matter*, Oxford University press (2003); chapters 1, 2.
[3] L. Ranno, *Introduction to magnetism*, collection SFN volume 13, 01001, (2014), EDP Sciences, free access
DOI: https://doi.org/10.1051/sfn/20141301001