

## Neutron scattering

Virginie Simonet  
Institut Néel, CNRS, Grenoble, France  
\*[Virginie.Simonet@neel.cnrs.fr](mailto:Virginie.Simonet@neel.cnrs.fr)

This lecture will introduce various techniques based on neutron scattering, in particular in the field of magnetism. The properties of the neutron will be recalled, before describing the formalism of the neutron-matter interactions leading to the nuclear and magnetic scattering cross-sections. The diffraction by a magnetic crystal will be presented as a tool to determine magnetic structures. Then I will discuss the use of inelastic neutron scattering to explore magnetic excitations and magnetic hamiltonians. The use of polarized neutrons will be detailed in the context of complex magnetic materials. If time permitted, neutron techniques devoted to nanoscopic objects will be addressed.

### Lecture topics:

1. The neutron as a probe of condensed matter
2. Neutron-matter interactions: scattering techniques to probe correlations
3. Diffraction by a crystal: nuclear and magnetic structures.
4. Inelastic neutron scattering: nuclear and magnetic excitations
5. Polarized neutrons: magnetic domains, magnetization density maps, magnetic chirality
6. Reflectometry and small angle scattering

### Recommended reading:

- [1] *Neutrons and magnetism*, collection SFN, volume 13, (2014) EDP Sciences, chapitres 2 to 6, free access  
<https://www.neutron-sciences.org/articles/sfn/abs/2014/01/contents/contents.html>
- [2] G. L. Squires, *Thermal neutron scattering*, Cambridge University Press (1978).
- [3] S. W. Lovesey, *Theory of Neutron scattering from condensed matter*, Oxford, Clarendon Press (1984).