Introduction to Neutron Scattering

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Neutron Scattering is a very powerful method to investigate novel materials. Especially when focusing on magnetic properties or light atoms, neutron scattering is often the first-choice method. As neutron wavelength and neutron energy are simultaneously in the range of interatomic distances and nuclear or magnetic excitations, neutron scattering has proven to be a key technology in materials science.
In the introduction, we will start with the history of the detection of the neutron in 1932 as a neutral particle with a mass similar to a proton [1] and a magnetic moment as first reported five years later [2]. Over the first experiments in neutron diffraction on polycrystalline samples [3] and in neutron spectroscopy on single crystals [4], you will be guided to the upcoming specialized talks in diffraction, magnetic structure determination, small angle scattering and imaging.
The second part will give an overview of the different possibilities to produce neutrons in high quantities and the existing neutron sources as well as the upcoming sources such as the ESS in Lund, Sweden. This later source will go operational in the next decade. A small insight to the concept of micro-sources, a possible way to build small in-house sources at university sites, will round up this introduction.

[1] J. Chadwick: Possible Existence of a Neutron. Letter to Nature (Feb. **1932**)
[2] O. Halpern and M.H. Johnson: Magnetic Scattering of Slow Neutrons. Phys. Rev. **52**, 52 (1937)
[3] E. O. Wollan and C.G. Shull: The Diffraction of Crystalline Powders. Physical Review **73**,8 (1948)
[4] B. N. Brockhouse, A. T. Stewart: Scattering of Neutrons by Phonons in an Aluminum Single Crystal. Physical Review, Band **100**, 75 (1955)