

Polarised neutrons for European Spallation Source users

Monday, 24 February 2025 11:00 (30 minutes)

Polarised neutrons have long been used in reflectometry, diffraction and inelastic scattering to study magnetic structures and dynamics in nano- to meso-scales [1]. Polarisation analysis also provide a complementary tool to deuteration in the determination of coherent and single-particle motions in soft matter studies [2,3], in imaging to quantitatively studying magnetic domain evolution in microscopic scale [4,5]. In fundamental physics, the search for the neutron electric dipole moment and the study of symmetry violation are two of the many examples that use polarised neutrons. Owing to the persistent push to advance the technology, polarised neutron has changed from a scarce resource that often requires an instrumentation expert to carry out measurements, to becoming a commonly available resource that can benefit a considerably wider research community. To date, 40% of instruments are providing polarised neutron capability.

To meet the coming user demand, twelve of the fifteen ESS instruments [6] under construction aim to offer polarised neutrons for user experiments. They include an imaging instrument (ODIN), a SANS instrument (SKADI), two reflectometers (ESTIA, FREIA), three diffractometers (DREAM, HEIMDAL, MAGiC), and four spectrometers (BIFROST, CSPEC, MIRACLES, T-REX). In conjunction with in-kind contributions and instrument grants, the ESS Polarisation Project will support eight of the eleven instruments to incorporate polarisation analysis capabilities [7]. Neutron spin filters based on polarised ^3He technologies - Metastable Optical Pumping and Spin Exchange Optical Pumping, and polarising supermirror devices are selected according to the different neutronic requirements and constraints on each instrument. An update of the project will be presented with highlights on some of the instrumentation innovations and improvements, alongside examples on the use of polarised neutrons in material studies.

[1] Chatterji, Tapan, ed. Neutron scattering from magnetic materials. Elsevier, 2005.

[2] A. Arbe, et. al., Phys. Rev. Research **2**, 022015(R) (2020).

[3] A. Arbe, et. al., J. Chem. Phys. **158**, 184502 (2023).

[4] A. Backs, et. al., EPJ Web of Conferences **286**, 05003 (2023).

[5] M. Strobl, et. al., J. Phys. D: Appl. Phys. **52** 123001 (2019).

[6] K. Andersen, et. al., Nucl. Instrum. Methods **A 957**, 164302 (2020).

[7] W.T. Lee et. al., EPJ Web Conf. **286** 03004 (2023).

E-mail of the corresponding author: waitung.lee@ess.eu

Primary author: LEE, Wai Tung (European Spallation Source ERIC)

Presenter: LEE, Wai Tung (European Spallation Source ERIC)

Track Classification: Download the latest program here