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MAGiC — polarized single-crystal diffractometer at ESS

One of the cornerstones of contemporary research on strongly correlated materials is magnetism and related phenomena in the solid state. This is a diverse and rapidly evolving subject flourishing by new fundamental developments like skyrmions, magnetic topological electronic states, and altermagnetism, among others, with great potential for various applications.

Polarized neutron scattering is one of the most powerful experimental tools for investigating magnetism on a microscopic scale in the solid state. However, many materials of interest cannot be studied due to the unavailability of sufficiently large single crystals or weak magnetic contributions to the diffraction pattern. The MAGiC instrument at the European Spallation Source will expand the horizon of neutron diffraction towards submillimeter-sized samples (10^{-3} mm³) and quantum magnets.

MAGiC is a single-crystal diffractometer specifically dedicated to study magnetic systems using permanently polarized neutron beam. It will utilize time-of-flight Laue diffraction with either cold (2-6 Å) or thermal neutrons (0.6-2.3 Å), offering the flexibility to trade between high neutron flux (4×10^9 n/s/cm²) and resolution. The instrument will feature a large detector with 2.8 steradian coverage for half-polarized experiments, as well as a wide-angle analyzer (120°) for XYZ polarization analysis. This setup will also enable the study of diffuse magnetic scattering.

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