

Studying magnetic order using muons as local probes

In this practical course, you will learn the basic principles of muon spin rotation and relaxation (μ SR) techniques and use the method to obtain local information about magnetic properties of a topical material which is relevant to our current research. You will learn how a μ SR experiment is performed and analyzed thereby receiving a detailed insight into a modern local probe technique of condensed matter research which makes use of an elementary particle beam at a large scale facility such as PSI.

The experiment is performed at the General Purpose Spectrometer GPS of the Swiss muon Source (<https://www.psi.ch/smus/ss-swiss-muon-source>). With the guidance of the instrument scientist, you will tune the beamline to steer the muons to the experiment, cool down the sample to a few kelvin temperatures with a Helium flow cryostat, and run and analyze the experiment using our computerized experimental control and data acquisition system.

Your research project addresses an actual topic of condensed matter physics as it aims to investigate the magnetic properties of the binary pnictide MnP as a function of temperature. This compound has recently attracted great attention in the scientific community due to its complex magnetic order and the possibility to induce superconductivity into the system by applying hydrostatic pressure. At normal pressure, the system undergoes two successive magnetic transitions from paramagnetic to ferromagnetic to helimagnetic when cooled down. You will use several μ SR techniques to investigate these three phases and to obtain information on the magnetic structure, the temperature dependence of the magnetic order parameter, the order of the transition and the magnetic volume fractions of the respective phases.

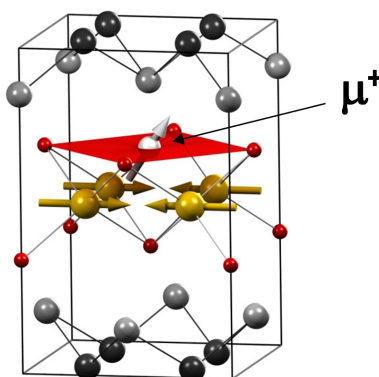


Figure 1: The positive muon with its magnetic moment is used in a μ SR experiment as a probe for the local magnetic properties of the specimen.