

Polarized muons as microscopic probes of materials, thin films and heterostructures

Elvezio Morenzoni^A

^APaul Scherrer Institut, 5232 Villigen PSI, Switzerland

Abstract

The muon spin rotation/relaxation/resonance technique (μ SR) is making increasingly significant contributions to condensed matter and material science research.

In μ SR, positive fully polarized muons are thermalized in matter where they act as a non-destructive microscopic probe for local investigations and provide unique information about electronic, magnetic and superconducting properties of materials. At the Paul Scherrer Institute (PSI) the μ SR facility provides six instruments offering a wide choice of sample environment and physical parameters. Bulk probes as well as thin films and heterostructures can be investigated. Dedicated instruments allow experiments under pressure or in high magnetic fields. An extension of the technique is given by the availability of muons with 100 % spin polarization and whose energy can be continuously varied in the sub-keV keV range (Low energy μ SR). After a brief introduction of the facility, I will give some representative scientific examples in magnetism (e.g. study of magnetic structures and phase transitions) and superconductivity (e.g. study of superconductivity close to a structural quantum critical point) in bulk materials, as well as about spin transport in thin heterostructures.

