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Neutron instrumentation for materials structure and dynamics investigation, fundamental and nuclear physics research: An overview from neutron source to science

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A handful of neutron sources around the world provide beams of 'thermal', 'hot' or 'cold' neutrons to dedicated and specifically tailored instrumentation for materials structure and dynamics investigation as well as providing a source of neutrons for fundamental and nuclear physics research. The production of neutrons for research instrumentation is for the most part limited to large-scale facilities requiring nuclear regulation, costly infrastructure and running costs. Access to facilities to use instrumentation is highly competitive, neutron beams are typically 'weak' compared to other sources of radiation for experimentation (e.g. X-rays) and the neutron interaction with matter can be weak or subtle. These considerations mean that neutron sources and associated instrumentation must be highly optimised in terms of neutron production, transport, optical devices, and detection with dedicated instruments tailored specifically for intensity, sensitivity and resolution in the domains of material length scale and/or energy transfer to best address scientific challenges across a broad range of material disciplines from physics, chemistry, magnetism, soft matter, biosciences and fundamental and nuclear physics. An overview of neutron instrumentation from neutron source to science will be presented with particular emphasis on the European neutron facility, the Institut Laue-Langevin in Grenoble, France.

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