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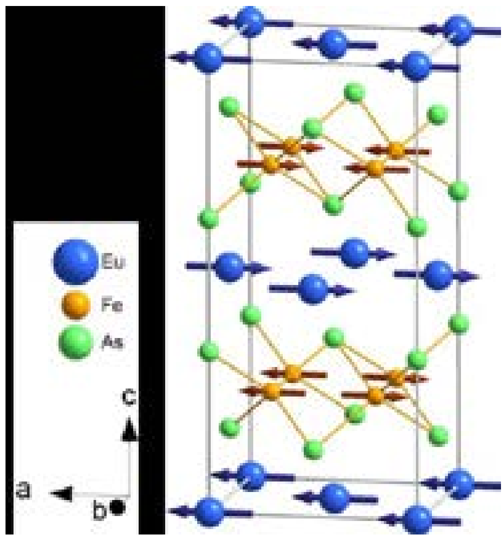
# ADVANCES AND APPLICATIONS OF NEUTRON SCATTERING AND DIFFRACTION

## Martin Meven

RWTH Aachen University, Germany

The unique features of Neutrons make them a valuable tool for many crystallographic studies on hot topics in physics, chemistry, biology and material sciences. Their interaction with nuclei yields not only high penetration depths but also interaction strengths that differ significantly from the those well known for X-rays, e.g. some light elements (H, O) show relative large scattering cross sections compared to many heavy elements while neighbored elements can differ strongly. Therefore, Neutron imaging can be used to perform in situ radiography of engines to study the different moving parts and liquids involved in its operation. In the area of energy applications are the non-destructive spacial reconstruction of the distribution of elements inside new battery types during charge-discharge-cycles. This can be combined with neutron diffraction studies on the underlying chemical processes to develop new materials, e.g. for Li-ion or sodium metal halide batteries [1, 2]. The sensitivity of neutrons for light elements plays also an important role, e.g. for the understanding of energy relevant compounds like ionic conductors based on layered perovskites [3]. This holds true also for for detailed studies on complex H bonds in minerals (phosphates, silicates, etc.) or organic matter/biological systems in life sciences, e.g. antibiotics [4]. The magnetic moment of neutrons allows detailed insights into magnetic order and related phase transitions. This feature is widely used in recent studies on multiferroics but also on modern high temperature superconductors based on cuprates [5] or iron arsenides [6] and played also an important role in the discovery of skyrmions [7].

The successful contribution of neutrons to various scientific applications has been made possible by advances in methods and instrumentation at existing neutron sources (e.g. in Europe ILL, MLZ, ISIS, etc.) in recent years. This and the installation of the new European Spallation Source ESS will support this trend also for the future.




Magnetic structure of EuFe2As2 at T=2.5K derived from neutron single crystal diffraction [6]

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## Biography

Dr. Martin Meven received his PhD in natural sciences at the Institute of Crystallography at RWTH Aachen University in 2001. Aside from his scientific work on HT superconductors during this time he gained experience in scattering methods with X-ray diffractometry including instrument development. He extended his expertise as postdoc at Munich, where he developed a new single crystal diffractometer for hot neutrons at the neutron source FRM II of the Heinz Maier-Leibnitz Zentrum (MLZ) in Garching, Germany. Since then he has been working as instrument scientist on various topics in the fields of crystallography, solid state chemistry and solid matter physics and material sciences. He has served as a board member of various scientific conferences and scientific referee at review panels at various neutron sources in Europe. He is the speaker of the Special Interest Group on Neutron Scattering (SG # 7) of the German Society of Crystallography (DGK) and organizes workshops on neutron scattering techniques for crystallographers to young scientists on a regular basis. (orcid.org/0000-0002-8079-5848).

martin.meven@frm2.tum.de