

Scope of School

Neutron and photon sources offer unique possibilities by complementary use of the radiations for structural analyses of advanced engineering materials. By using neutrons and photons, information about materials' microstructures can be obtained non-destructively in the near-surface region as well as in the bulk of samples and components. Compared to conventional laboratory X-rays the spatial resolution achievable using synchrotron radiation can be improved by up to several orders of magnitude and neutrons provide complementary information due to their different interaction with matter.

Diffraction methods reveal information about crystalline phase volume fractions, texture and residual stresses, while tomography provides complementary 3-dimensional images of the material's microstructure. Both diffraction and tomography have increasing impact in the fields of design of tailored materials, their processing and lifetime assessment. Spectroscopy provides unique information about details of chemical bonding and helps to understand interatomic interactions. The current situation regarding the exploitation of photons and neutrons for engineering materials science is characterised by rapid developments: flux increase of photon and neutron sources, refurbishment of existing as well as design and construction of new beamlines and instruments with optimised beam optics and position sensitive detectors as well as increasing quality and quantity of data.

These new possibilities for microstructure analyses for advanced materials and multi-material systems meet with increasing demands from the materials engineering

point of view. In materials engineering, the establishment and refinement of relationships between microstructure parameters and macroscopic properties requires information on different length and time scales, both covering several orders of magnitude.

The MATRAC 2 School "Application of Neutrons and Synchrotron Radiation in Materials Science with special focus on Fundamental Aspects of Materials" is designed to provide a systematic overview of this field to students from all over Europe. The programme will cover all methods mentioned above in a focussed theoretical course.

Organisational Details

The school starts with two days of lectures. The manuscripts of all lectures will be provided in digital form.

The following two days will be spent at FRM II in Garching (near Munich) with practical training at the instruments of the MLZ (Heinz Maier-Leibnitz Zentrum).

The fifth day of the school will be devoted to further lectures as well as a summing-up and final discussions.

The MATRAC 2 School is significantly funded by German and Swedish authorities for their respective students. Furthermore, financial support for students from other EU countries is granted within the frame of the SINE2020 Neutron and Muon Advanced Schools. The participation fee amounts to 100 €.

Tentative Programme



Sunday, 31.03.2019

- Get-Together

Monday, 01.04.2019

- Fundamentals of Neutron Scattering and the Application of Synchrotron Radiation – Properties of Neutrons and Photons
- Scattering Theory, Correlation Function
- Structure Determination
- Real Structure, Defects and Residual Stresses
- Experimental Techniques I: Diffraction
- Engineering Materials Science
- Experimental Techniques II: Strain Scanning
- Poster Session

Tuesday, 02.04.2019

- Lattice Dynamics/Photons
- Experimental Techniques III: TAS, TOF
- Imaging and Tomography
- Large Scale Structures (Polymers, Porous Materials, Biomaterials)
- Experimental Techniques IV: SANS, Reflectivity
- Soft Matter Dynamics
- Experimental Techniques V: Spin Echo
- Spectroscopy
- Poster Session

Wednesday, 03.04.2019

- Experiments at FRM II

Thursday, 04.04.2019

- Experiments at FRM II

Friday, 05.04.2019

- Data Treatment and Modelling
- Results of Experiments
- Actual Topic of Materials Science
- Final Discussion



MATRAC 2:

Application of Neutrons and Synchrotron Radiation in Materials Science with special focus on Fundamental Aspects of Materials
31.03.-05.04.2019 in Herrsching/Garching