



Module

Beyond Bragg – Material characterization with electrons and X-rays

with Dr. Thomas Lunkenbein

Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin

04.-06. April 2018
Bayreuth, Berlin

Module Coordination:
Prof. Anna Schenk
Prof. Mirijam Zobel

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This advanced module within the Elite Study Program “Macromolecular Science” is dedicated to the application and use of scattering techniques to answer current scientific questions in the field of chemistry, physics and material science. The aim of the seminar is an introduction to research possibilities at large scale research facilities. The seminar covers an introduction to the generation of brilliant X-ray beams at synchrotron radiation facilities and includes a guided tour, seminars and a live-experiment at the facility. Furthermore, the renowned Fritz-Haber–Institut der Max-Planck-Gesellschaft is presented in a guided tour and dedicated lectures on the use of transmission electron microscopy (TEM) and X-ray photoelectron spectroscopy (XPS) for the study of heterogeneous catalysts are presented.

The module consists of 3 parts

- (i) Introductory lectures: 04.04.2018 (Prof. Anna Schenk, Prof. Mirijam Zobel)
- (ii) A 3-day excursion to Berlin for visits of the FHI and BESSY: 04.04. - 06.04.2018
- (iii) Student seminar: to be announced, PNS seminar room, UBT

I. Introductory lectures & Travel to Berlin, by bus

04.04.2018, Seminar room S32

The introductory lectures are meant to present the basics of scattering techniques and how matter interacts with X-rays, respectively electromagnetic waves. They also shed light on the production of X-rays at synchrotron facilities and how the quality of X-ray light at synchrotrons differs from lab experiment, being the basis for in-depth insight into the structure of modern functional materials, such as catalyst particles, nanoparticles as well as hierarchically structured biomaterials. The in-house experimental facilities concerning small angle X-ray scattering (SAXS), XPS and TEM will be presented in a short guided tour including methodological insight. During our stay in Berlin we will then contrast the lab facilities of Bayreuth to the more advanced experimental capabilities of the FHI and BESSY at dedicated in-situ TEM and XPS setups, as well as a SAXS beamline.

09.00	Introduction to in-house experimental scattering and electron microscopy possibilities (SAXS, XPS, TEM) in the BPI keylabs
11.00	Travel by bus to Berlin
13.00	How are x-rays generated in a synchrotron? Prof. Anna Schenk
15.00	How do X-rays interact with matter? Prof. Mirijam Zobel
18.00	Common dinner at restaurant (tba)
Overnight stay in Berlin (accommodation will be provided in double rooms)	

II. Visit to FHI and BESSY

Scattering techniques in general are based on the interaction of electromagnetic waves with matter. Electrons also underlie the fundamentals of scattering processes. Therefore, at FHI transmission electron microscopy is presented, which can not only be employed for getting beautiful and representative images of the materials in question. TEM can furthermore be used to study crystals using the diffraction information or by carrying out PDF analysis on electron diffraction data.

At BESSY, we visit a national synchrotron light source, which is specialized for the X-ray energy range of up to 30 keV, i.e. involving SAXS, various spectroscopic techniques such as XPS and many more. Overview talks will introduce the facility and its capabilities before we will get into the experimental hall to see how experiments are run in practice at a synchrotron radiation facility.

Fritz-Haber-Institute, 05.04.2018

09.00	Welcome at FHI Prof. Robert Schlögl, Fritz-Haber-Institut
09.30	Insights into TEM – The versatility of electrons Dr. Thomas Lunkenbein, Fritz-Haber-Institut
10.15	In-situ EM N.N., Fritz-Haber Institute
11.00	Short break
11.15	XPS Investigation of Catalysts Dr. Axel Knop-Gericke, Fritz-Haber Institut
12.00	Lunch at canteen
13.00	Guided lab tour / TEM experiment
19.00	Dinner with FHI scientists at restaurant (tba)
	Overnight stay in Berlin

Photon source BESSY II, Helmholtz-Zentrum Berlin, 06.04.2018

10.00	Welcome and overview on the facility Helmholtz-Zentrum Berlin
10.30	Guided tours through BESSY in 3 small groups BESSY scientists <ul style="list-style-type: none">• Storage ring and beamlines• Demonstration ISIS and EMIL• Demonstration μ-Spot Beamline
13.00	Lunch at BESSY canteen
14.00	Drive back to Bayreuth – arrival ca. 22.00

III. Seminar

Date to be fixed, Room PNS, 5.1.00.001, University of Bayreuth

The aim of the seminar is to discuss benefits of scattering experiments or large scale research options to the research of the participants. He / She shall show how the technique can be employed to gain further insight into his / her own research. The presentation shall be 10 min for one participant, or min for two participants sharing the same experimental technique.

If no connection can be found between a technique and one's own research, one of the speakers or one of the institutes can be presented.

Please consult Dr. Th. Lunkenbein, Prof. A. Schenk or Prof. M. Zobel for any queries.