Modulbezeichnung:	**Scattering Methods for Nanostructured Materials (IMN_M3/4/5/10/11-MWT_M8/9/10/11-NT_Scat)** (Scattering Methods for Nanostructured Materials)	**5 ECTS**
Modulverantwortliche/r:	Erdmann Spiecker	
Lehrende:	Johannes Will, Erdmann Spiecker	

Startsemester: WS 2022/2023	Dauer: 1 Semester	Turnus: jährlich (WS)
Präsenzzeit: 60 Std.	Eigenstudium: 90 Std.	Sprache: Deutsch und Englisch

Lehrveranstaltungen:

Scattering Methods for Nanostructured Materials (WS 2022/2023, Vorlesung, 2 SWS, Johannes Will et al.)

Exercise Scattering Methods for Nanostructured Materials (WS 2022/2023, Übung, 2 SWS, Johannes Will)

Inhalt:

The module focuses on the application of scattering methods for crystal structure determination in general (diffraction), the investigation of supported nanostructures and thin films (grazing incidence diffraction and reflectometry) and for the size and shape analysis of nanostructures in solution (small-angle scattering). Basic concepts of Fourier transforms will be applied to the interaction of a primary probe with a periodically ordered object. Moreover, the impact of multiple scattering events on the diffracted intensity and its angular dependence will be discussed in a unified model for neutrons, x-rays and electrons. Those theoretical considerations will built the basis for the understanding of the methods named above. For all methods, current published research examples will be showcased.

Lernziele und Kompetenzen:

Die Studierenden

Fachkompetenz

Verstehen

- Basics of Fourier transform and convolution
- Understanding of the interaction of neutrons, x-rays and electrons with atoms and their arrays
- Physical principles of the interaction of a scattering probe with an extended crystalline lattice
- Understanding how scattering methods contribute and which kind of information can be extracted for today's challenges in material science

Anwenden

- Each topic will be accompanied with suitable exercises

Literatur:

D.S. Sivia: Elementary Scattering Theory B.E. Warren: X-ray Diffraction J. M. Cowley: Diffraction Physics A. Authier: Dynamical Scattering Theory Als-Nielsen & McMorrow: Elements of modern X-ray physics J. Daillant and A. Gibaud: X.ray and Neutron Reflectivity: Principles and Applications Renaud et al. 2009, Probing surface and interface morphology with Grazing Incidence Small Angle X-ray Scattering, Surface Science Reports 64, 255-380. Rivnay et al. 2012, Quantitative Determination of Organic Semiconductor Microstructure from the Molecular to Device Scale, Chem. Rev. 112, 5488-5519.

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

Das Modul ist im Kontext der folgenden Studienfächer/Vertiefungsrichtungen verwendbar:

[1] **Nanotechnologie (Master of Science)**
(Po-Vers. 2020w | TechFak | Nanotechnologie (Master of Science) | Gesamtkonto | Kernfächer | Mikro- und Nanostrukturforschung | Scattering Methods for Nanostructured Materials)

[2] **Nanotechnologie (Master of Science)**
(Po-Vers. 2020w | TechFak | Nanotechnologie (Master of Science) | Gesamtkonto | 1. und 2. Naturwissenschaftlich-technisches Wahlmodul | Scattering Methods for Nanostructured Materials)

Dieses Modul ist daneben auch in den Studienfächern "Materialwissenschaft und Werkstofftechnik (Master of Science)" verwendbar.

Studien-/Prüfungsleistungen:

Scattering Methods for Nanostructured Materials (Prüfungsnummer: 62851)
(englische Bezeichnung: Scattering Methods for Nanostructured Materials)

Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 15
Anteil an der Berechnung der Modulnote: 100%
weitere Erläuterungen:
Prüfungssprache nach Wahl der Studierenden
Prüfungssprache: Deutsch oder Englisch

Erstablegung: WS 2022/2023, 1. Wdh.: SS 2023
1. Prüfer: Erdmann Spiecker
