Modulbezeichnung:	**Physical chemistry (MSM-ME3)** (Physical chemistry)	**15 ECTS**
Modulverantwortliche/r:	Rainer Fink	
Lehrende:	Andreas Heßelmann, Wolfgang Hieringer, Jannis Erhard, Bernd Meyer, Andreas Görling	

Startsemester: SS 2018	Dauer: 2 Semester	Turnus: halbjährlich (WS+SS)
Präsenzzeit: 210 Std.	Eigenstudium: 240 Std.	Sprache: Englisch

Lehrveranstaltungen:

Please check **UnivIS** for further lectures/seminars

NB: no overlap with courses in Mandatory Module allowed!

Mandatory courses:

A. Lab course:

Attendance in lab courses is compulsory!

Lab Course Advanced Physical Chemistry (SS 2018, Praktikum, 7 SWS, Guido Sauer et al.)

B. Lectures & Seminars:

please choose additional 6L and 2S, e.g.:

B1: Characterization of Nanosized Systems (2L)

Characterization of Nanosized Systems (WS 2018/2019, Vorlesung, 2 SWS, Dirk Guldi)

B2: Organic thin films (2L/1S)

Organic Thin Films (WS 2018/2019, Vorlesung, 2 SWS, Rainer Fink)

Seminar Organic Thin Films (WS 2018/2019, Seminar, 1 SWS, Rainer Fink et al.)

B3: Modern Methods in Mass Spectrometry (2L/1S)

Modern Methods in Mass Spectrometry (WS 2018/2019, Vorlesung, 2 SWS, Thomas Drewello)

Seminar Modern Methods in Mass Spectrometry (WS 2018/2019, Seminar, 1 SWS, Thomas Drewello et al.)

B4: Symmetry and Group Theory (2L/1S)

Symmetry and Group Theory (WS 2018/2019, Vorlesung, 2 SWS, Jörg Libuda)

Seminar Symmetry and Group Theory (WS 2018/2019, Seminar, 1 SWS, Jörg Libuda et al.)

B5: Interface Science and Catalysis (2L/1S)

Advanced Physical Chemistry I - Interface Science and Catalysis (WS 2018/2019, Vorlesung, 2 SWS, Jörg Libuda)

Advanced Physical Chemistry I - Seminar Interface Science and Catalysis (WS 2018/2019, Seminar, 1 SWS, Jörg Libuda)

B6: Solar Energy conversion (2L)

Solar Energy Conversion (SS 2018, Vorlesung, 2 SWS, Dirk Guldi)

B7: Formation and characterization of supramolecular nanoparticles (2L/1S)

Formation and Characterization of Supramolecular Nanoparticles (WS 2018/2019, Vorlesung, 2 SWS, Franziska Gröhn)

Seminar Formation and Characterization of Supramolecular Nanoparticles (WS 2018/2019, Seminar, 1 SWS, Franziska Gröhn et al.)

B8: Modern techniques in surface science (2L/2S)

Modern Techniques in Surface Science (SS 2018, Vorlesung, 2 SWS, Christian Papp et al.)

Seminar Modern Techniques in Surface Science (SS 2018, Seminar, 1 SWS, Christian Papp et al.)

B9: Metallic Nanoparticles in medicine (2L)

Metallic Nanoparticles in Medicine (SS 2018, Vorlesung, 2 SWS, Carola Kryschi)

B10: Catalysis & Kinetics (2L/1S)

Catalysis and Kinetics (SS 2018, Vorlesung, 2 SWS, Jörg Libuda)

Seminar Catalysis and Kinetics (SS 2018, Seminar, 1 SWS, Jörg Libuda et al.)

B11: Advanced Electrochemistry (2L/1S)

Energy-related Advanced Electrochemistry (SS 2018, Vorlesung, 2 SWS, Christian Ehli et al.)

Seminar Energy-related Advanced Electrochemistry (SS 2018, Seminar, 1 SWS, Dirk Guldi et al.)

Empfohlene Voraussetzungen:

Admission to the M. Sc. program Molecular Science or Chemistry

Inhalt:

A: Advanced course lab experiments and/or lab project close to actual research topics

B1: Fullerenes; carbon nanotubes; graphene; endohedral metallo fullerenes; peapods; carbon nanohorns and nanoonions; synthesis and analytical techniques.

B2: Preparation techniques (Langmuir-Blodgett films, self-assembled monolayers, sublimation, spin-casting, spraying), self-assembly, structural and spectroscopic analytical techniques, heterostructures, phase diagrams.

B3: Ionisation methods (EI, CI, FD, FI, SIMS, FAB, MALDI and ESI), ion formation mechanisms, analysers (ToF, sector field, quadrupole, ion trap, FT-ICR, orbitrap), tandem mass spectrometry, ion activation and fragmentation, thermochemical and analytical applications.

B4: Symmetry of molecules, symmetry operations and point groups; symmetry of periodic systems; compact course to group theory; group theory and quantum mechanics; symmetry and spectroscopy: vibrational spectroscopies; tensor description of physical properties; band structures.

B5: Surfaces of metals, oxides and ionic crystals; surface analytical techniques; bonding of molecules to surfaces: bonding mechanisms; Blyholder model; adsorbate interactions and superstructures; temperature programmed desorption/reaction; concepts and definitions in catalysis; microkinetics of catalystic processes; transport limitations; surface dynamics and surface kinetics; model catalysis.

B6: Energy portfolio; electron transfer; Si solar cells; dye-sensitized solar cells; organic photovoltaics; multiple excition generation cells; photosynthesis; artificial photosynthesis

B7: Self-assembly of surfactants; self-assembly of more complex amphiphilic molecules; nteraction forces in colloidal systems; osmometry; light scattering; form factor as key to particle shape; dynamic Light Scattering; fractionating Methods for Nanoparticle Analytics; combined Use of Characterization Methods; supramolecular nanoparticles by H-bridges and metal coordination; special Behaviour of polyelectrolytes; nanostructures with polyelectrolytes

Lernziele und Kompetenzen:

The students are able

- to understand the advanced principles of experimental techniques in physical chemistry
- to evaluate the application of experimental and/or theoretical techniques in modern material science/materials research
- to plan and perform advanced lab experiments and/or lab project related to actual research topics in physical chemistry
- to utilize selected preparation techniques for sample preparation
- to apply and understand modern experimental methods for sample characterization
- to interpret and to critically summarize their experimental results in written form (lab report, sometimes in paper-style format).

Literatur:

Manuscripts for most lectures available on **StudOn** or on lecturers' website

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

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

[1] **Molecular Science (Master of Science)**
(Po-Vers. 2007 | NatFak | Molecular Science (Master of Science) | alte Prüfungsordnungen | Masterprüfung | Wahlpflichtmodul Molecular Science)

[2] **Molecular Science (Master of Science)**
(Po-Vers. 2013 | NatFak | Molecular Science (Master of Science) | Wahlpflichtmodul Molecular Science)

Studien-/Prüfungsleistungen:

Physikalische Chemie - Physical Chemistry (Prüfungsnummer: 30803)
(englische Bezeichnung: Physical Chemistry)
Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 45
Anteil an der Berechnung der Modulnote: 100%
weitere Erläuterungen:
Assessment and examinations: O45 (PL) + LAB (SL): oral examination (45 min, 2 examiners) + lab course protocol(s), ungraded
Calculation of the grade for the module: 100% from oral examination
Prüfungssprache: Englisch

Erstablegung: WS 2018/2019, 1. Wdh.: SS 2019
1. Prüfer: Jörg Libuda

Organisatorisches:
Intended stage in the degree course: Mandatory elective module (Wahlpflichtmodul) or Elective Module (Wahlmodul) semester 1 - 3
Frequency of offer: A: upon appointment with course lab supervisor or research lab supervisors **B1-B5, B7:** winter term, **B6, B8-B11:** summer term
Bemerkungen:
Courses of study for which the module is acceptable: M.Sc. Molecular Science (as mandatory elective module) and M. Sc. Chemistry (as elective module). *)
) No overlap with courses in Mandatory elective Module "Interface phenomena" or Mandatory Module allowed!