Modulbezeichnung:	**Molecular nanoscience (MSM-nano)** (Molecular nanoscience)	**30 ECTS**
Modulverantwortliche/r:	Andreas Hirsch	
Lehrende:	Franziska Gröhn, Hubertus Marbach, Andreas Hirsch, Jürgen Schatz, Julien Bachmann, Dirk Guldi, Rainer Fink,	

Startsemester: SS 2019	Dauer: 2 Semester	Turnus: halbjährlich (WS+SS)
Präsenzzeit: 450 Std.	Eigenstudium: 450 Std.	Sprache: Englisch

Lehrveranstaltungen:

Mandatory courses (A): Lectures & Seminars:

A1: Supramolecular Chemistry I (2L) & II (2L)
A2: Nanoparticles and nanostructured thin films I (1L) & II (1L)
A3: Nanoprobes I (2L) & II (2L)
A4: Molecular Nanoscience SEMINAR I (2S) & SEMINAR II (2S)
A5: LAB COURSE Molecular Nanoscience (7LAB)

Supramolecular Chemistry - Molecular Materials II (SS 2019, Vorlesung, 2 SWS, Andreas Hirsch)
Supramolecular Chemistry I / Molekulare Materialien I, Supramolekulare Chemie I (WS 2019/2020, Vorlesung, 2 SWS, Andreas Hirsch)
Nanoparticles and Nanostructured Thin Films / Nanopartikel und nanostrukturierte dünne Schichten (WS 2019/2020, Vorlesung, 2 SWS, Julien Bachmann)
Nanoparticles and Nanostructured Thin Films / Nanopartikel und nanostrukturierte dünne Schichten - Seminar (WS 2019/2020, Seminar, Julien Bachmann)
Nanoprobes I (WS 2019/2020, Vorlesung, 2 SWS, Rainer Fink)
Nanoprobes II (SS 2019, Vorlesung, 2 SWS, Rainer Fink)
Seminar Molecular Nanoscience II (SS 2019, Seminar, 2 SWS, Franziska Gröhn et al.)
Seminar Molecular Nanoscience I (WS 2019/2020, Seminar, 2 SWS, Franziska Gröhn et al.)
Lab Course Molecular Nanoscience/Molecular Materials (SS 2019, Praktikum, 7 SWS, Rainer Fink et al.)

Elective courses (B) (in total 9 SWS*):

Courses of the student's choice related to the module and with approval by the representative of the study course

- **choose a minimum of 4 lectures (2L each) and 1 seminar (1S)**

B1: Characterization of nanosized systems (2L)
B2: Organic thin films (2L/1S)
B3: Formation and characterization of supramolecular nanostructures (2L/2S)
B4: N.N.
B5: Nanoscale semiductor materials (2L)
B6: Modern techniques in surface science (2L/2S)
B7: Metallic Nanoparticles in medicine

Characterization of Nanosized Systems (WS 2019/2020, Vorlesung, 2 SWS, Dirk Guldi)
Organic Thin Films (WS 2019/2020, Vorlesung, 2 SWS, Rainer Fink)
Seminar Organic Thin Films (WS 2019/2020, Seminar, 1 SWS, Rainer Fink et al.)
Formation and Characterization of Supramolecular Nanoparticles (WS 2019/2020, Vorlesung, 2 SWS, Franziska Gröhn)
Seminar Formation and Characterization of Supramolecular Nanoparticles (WS 2019/2020, Seminar, 1 SWS, Franziska Gröhn et al.)
Nanoscale semiconductors (SS 2019, Vorlesung, 2 SWS, Julien Bachmann)
Modern Techniques in Surface Science (SS 2019, Vorlesung, 2 SWS, Christian Papp et al.)
Seminar Modern Techniques in Surface Science (SS 2019, Seminar, 1 SWS, Christian Papp et al.)
Metallic Nanoparticles in Medicine (SS 2019, Vorlesung, 2 SWS, Carola Kryschi)

Empfohlene Voraussetzungen:

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

Inhalt:

A1: Concepts in supramolecular chemistry; host-guest chemistry; energetics of supramolecular complexes: experimental methods; templates and self-assembly. Molecular devices. Supramolecular catalysis:

principles of supramolecular catalysis, supramolecular metal catalysis, self-assembled catalysts, metal-free catalysis, enzyme mimics, antibodies, imprinted polymers.
A2: Synthesis of n-dimensional nano-materials. Systematic approaches towards nano-particles of defined size and structure are the basis to prepare materials with taylor-made electronic, optical or catalytic properties. The interplay between nano-particles, nano-rods, nano-wires, 2- and 3-dimentional materials are highlighted.
A3: Nanoscaled systems, general issues of microscopic techniques; experimental techniques with nanometer resolution: STM/AFM and 8 related scanning probes; light microscopy, confocal microscopy; electron microscopy (SEM, TEM, FEM/FIM, LEEM, PEEM), x-ray microscopy and synchrotron radiation.
A4: Specific topics in synthesis and analysis of specific molecule-based nanoscale objects
A5: focused topics in fundamental and applied research on nanoscale materials

Lernziele und Kompetenzen:

The students are able
- to explain the fundamental chemical and physical properties of nano-scale materials
- to distinguish and to compare some properties, structure and applications of different nanomaterials
- to describe and to evaluate the major concepts in supramolecular chemistry
- to explain the general issues of selected microscopic techniques and to evaluate their applications to different materials
- to prepare and to characterize nano-sized samples (thin films, nano-tubes, molecular materials, nanoparticles) using selected experimental methods and techniques (includes experiment planning and data evaluation)
- to interpret and to critically summarize measurements results in written (lab report in paper-style format) and partly oral form
- to get used to perform research-related experiments within a smaller team.

Studien-/Prüfungsleistungen:

Molecular Nanoscience (Prüfungsnummer: 30701)
(englische Bezeichnung: Molecular Nanoscience)

Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 45
Anteil an der Berechnung der Modulnote: 100%
weitere Erläuterungen:
Assessment and examinations: Portfolio: PL: Oral examination (45 min, 3 examiners); LAB (SL, AP)
Calculation of the grade for the module: 100% from oral examination

Erstablegung: WS 2019/2020, 1. Wdh.: SS 2020
1. Prüfer: Andreas Hirsch
1. Prüfer: Dirk Guldi
1. Prüfer: Franziska Gröhn
1. Prüfer: Rainer Fink
1. Prüfer: Julien Bachmann

Organisatorisches:

Frequency of offer: Annually/start of studies is available in summer and winter term Courses "I" in winter term, courses "II" in summer term
A5: LAB Course upon individual appointments with respective contact persons
B1 - B3: winter term
B5-B7: summer term

Bemerkungen:

Courses of study for which the module is acceptable: M.Sc. Molecular **Nanoscience**