

Secondary Area of Specialization: Molecular Physics

| Identification number | Workload | Credits | Term of studying | Frequency of occurrence | Duration |
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| MN-P-PN-Mol | 360 h | 12 CP | 1 st and 2 nd semester | Details are provided online in the table "Course Offerings". | 2 semesters |
| 1 | Type of lessons a) Lecture b) Problem class c) Practical course c) Exam | Contact times depending on the individual choice 1 h | Self-study times depending on the individual choice 24 h | Intended group size 15–20 students per problem class | |
| 2 | Aims of the module and acquired skills Understanding of the main concepts of molecular physics, use of computer programs for the analysis of molecular spectra (computer aided analysis of scientific data), application of molecular physics concepts to applications of current research in fundamental physics, atmospheric physics and astrophysics including lab courses (advanced experimental skills) and advanced seminars (presentation skills). | | | | |
| 3 | Contents of the module The module is subdivided into core courses, specialized courses and the advanced seminar: 1. Core courses <ul style="list-style-type: none"> • Molecular Physics I (3+1 HPW, 6 CP): Basics of Molecular Spectroscopy, Interaction of Radiation with Matter, Chemical Bond, Born- Oppenheimer-Approximation, Rigid Rotor, Harmonic Oscillator, Electronic States, Rotational Spectroscopy, Group Theory • Molecular Physics II (3+1 HPW, 6 CP): Rotational Spectroscopy, Vibrational Spectroscopy, Group Theory, Coupling of Rotation and Vibration, Transitions and Selection Rules, Nuclear Spin Statistics, Coupling of Angular Momenta, Hund's Cases, Fine Structure (FS), HFS 2. Specialized courses <ul style="list-style-type: none"> • Astrochemistry (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Introduction to Atmospheric Physics (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Measurement Techniques in Atmospheric Physics (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Experiments in Molecular Physics (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Methods of Molecular Astrophysics (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Experimental Methods in Astrophysics (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Fundamentals of Molecular Symmetry (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Fourier-Transform and its Applications (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • Star formation (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • The Physics of the Interstellar Medium (2+1 HPW, 4.5 CP) / (2 HPW, 3 CP) • and others, including fitting courses from Bonn University, if approved by the module coordinator The contents of the specialized courses can be found in the "kommentiertes Vorlesungsverzeichnis" and in the lecture descriptions online. | | | | |

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| 4 | <p>Teaching/Learning methods</p> <p>Besides the teaching in lectures, the self-study based on books and lecture notes plays an important role. The students work individually on problem sets. In discussions with others and in the problem classes, they learn to solve challenging problems in a team and to present their approaches and results. In the additional lab course the students also gain insight into state-of-the-art instrumentation by conducting experiments independently.</p> |
| 5 | <p>Requirements for participation</p> <p>Atomic Physics, Molecular Physics and Quantum Mechanics at the level of the bachelor courses in physics.</p> |
| 6 | <p>Type of module examinations</p> <p>The module is passed by passing an oral examination covering the topics of all attended courses. To be admitted to the exam, students must actively participate in the problem sessions (including the solution of homework problems). The grade given for the module is equal to the grade of the oral examination.</p> |
| 7 | <p>Requisites for the allocation of credits</p> <p>The courses can be chosen from the above set in order to acquire the necessary credit points.</p> |
| 8 | <p>Compatibility with other Curricula and Soft Skills</p> <p>As elective subject in other M.Sc. programs.</p> <p>Scientific reading and presentation skills, in particular oral presentations. Computer aided analysis of scientific data.</p> |
| 9 | <p>Significance of the module mark for the overall grade</p> <p>The weight of the module is $12/111 \approx 10.8\%$.</p> |
| 10 | <p>Module coordinator</p> <p>S. Schlemmer</p> |
| 11 | <p>Additional information</p> <p>Detailed information on the occurrence and the course contents are provided online and in the "kommentiertes Vorlesungsverzeichnis".</p> <p>Version: 23.04.2016 PN</p> |