„A research centered university with a personal atmosphere and multicultural flair …„”
The functionality of any modern technical product depends decisively on the specific properties of the materials used. Novel materials based on polymers, metals, semiconductors, composites or nanostructures represent challenges to basic research in terms of understanding existing materials and developing new ones. Condensed matter physics is about explaining and predicting the relationship between the atomic and electronic structure of materials on the microscopic level and their properties (such as colour, elasticity, conductivity) on the macroscopic scale.

Objectives This masters programme will

- provide you with a solid, detailed, and broad education in the field of condensed matter physics
- introduce you to current research topics
- give you the opportunity to take part in cutting-edge research
- train you for a modern international research environment
- foster autonomous scientific work and problem solving
- teach you a goal-oriented, well-structured working style
- enable you to present and defend scientific results
- prepare you for leading positions in science and high-tech industry
- prepare you for the entrance exam to the ‘stage pédagogique’ as a physics teacher in Luxembourgish high schools.
What are my careers options as a graduate of the Masters in Condensed Matter Physics?

- Condensed matter physics is a very active and expanding field in international research institutions. This masters programme is an ideal preparation for any PhD programme in this field.

- Physicists with a solid background in condensed matter physics work successfully in all branches of industry, from electronics to automotives, to aerospace and biomedical industries.

- This masters programme in condensed matter physics, together with the physics-track of the Bachelors in Sciences and Engineering provides the student with a solid education in theoretical and experimental physics. Together they offer an excellent training for eventually becoming a teacher in Luxembourgish secondary schools.

- Physicists learn how to build mathematical models of reality and how to make predictions. These skills are also sought after in the financial sector. Physicists work successfully in banks, insurance or consulting companies.
ENTRY REQUIREMENTS

We expect that you

- are interested in physics and up-to-date research
- want to know how things work and how the world functions
- are curious and committed
- have a bachelors degree in physics or a related subject
- have successfully attended a course in quantum mechanics

REASONS TO STUDY

Why should I study condensed matter physics in Luxembourg?

- We offer a specialised course in condensed matter physics
- We present the field in its full scope from soft matter to solid-state physics
- We have small class sizes, which allow for a very high level of personal interaction between students and professors
- We involve you in current research activities from the very beginning of your studies
- Many of our projects have close ties to industry
- Our research is of high and internationally recognized quality; we publish our results in high impact peer-reviewed journals
- Professors and students originate from different cultural and language backgrounds
- Luxembourg has been repeatedly voted as one of the European capitals with the highest quality of life
- The enrolment fee is low: only 200€/semester
The programme is a 2 year (120ECTS) masters course, according to the standards of the Bologna process.

The programme, for the first two semesters, consists of lectures, homework exercises, experimental and theoretical lab classes, and a seminar.

The lectures have a relatively small number of students and we encourage you to actively participate in the courses. We foster an atmosphere that promotes discussion and involvement.

Homework exercises accompany the major lectures. Each week you are given tasks to answer at home, which are then discussed in a special exercise course.

The lab class will prepare you for the research work of your master’s thesis. Most lab experiments will be part of our research laboratories and theoretical groups.

In the seminar you will be asked to prepare a presentation on a modern research topic. We will help you find the material, but will also expect that you start exploring scientific literature on your own.

The second year is devoted to a preparatory lab class and the master’s thesis. In general, both will be done in the same research group, on the same research topic. They are complemented by a presentation about your research during the third semester.

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<th>Course (hrs)</th>
<th>Exercise (hrs)</th>
<th>ECTS</th>
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<td><strong>1st Term</strong></td>
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<tr>
<td>Solid State Physics</td>
<td>120*</td>
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<td>Polymers</td>
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<td>Computational Methods</td>
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<td>Bonding and Phonons</td>
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<td>Magnetism</td>
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<td>Literature Seminar</td>
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<td>Elective Courses</td>
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<td><strong>2nd Term</strong></td>
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<td>Soft Matter Physics</td>
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<td>Semiconductor Physics</td>
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<td>Lab class</td>
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<td>Elective Courses</td>
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The preparatory lab class and the master’s thesis are based on research you will do on a current topic in one of our research groups:

- **LPV**, the laboratory for photovoltaics, develops new processes for thin film solar cells based on chalcopyrites and kesterites, aiming at low cost and high efficiency. The fundamental semiconductor physics of these novel materials is investigated by a variety of opto-electronic methods.

- The theoretical solid-state physics group works on the electronic structure of nanomaterials and of novel materials for photovoltaics. We look specifically at the electronic excitations that occur during interaction of light with matter. In close collaboration with experimental groups, we calculate and interpret spectroscopic data such as optical absorption, luminescence, and Raman spectroscopy.

- **TSM**, the theory of soft matter group, develops computer simulation methods to study properties of soft matter. Soft matter means biological substances as well as plastics and glass.

- **LPM**, the laboratory for physics of advanced materials, is interested in tailoring the functionality and generating self-organization of polymers by manipulating the molecular structure, inducing internal and external interfaces and influencing the thermodynamic state.

- The Complex Systems and Statistical Mechanics group studies the thermodynamic and stochastic properties of small “machines”, such as quantum dots, molecular motors or even biochemical networks, operating far from equilibrium.

- The NanoMagnetism group employs and develops neutron-scattering techniques for studying the impact of internal interfaces and the consequences of crossing length scales on the magnetic properties of nanomagnets.
Among the elective subjects, we offer didactics and paedagogy. These courses serve as a preparation for the 'stage pegagogique' in Luxembourgish secondary schools. Thus the Master in Condensed Matter Physics gives you the basic training needed to become a highschool teacher.
PRACTICAL INFORMATION

• the teaching language is English
• the programme starts each year in September
• for online registration go to www.maphysics.uni.lu

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