Master of Physics

2025-2026

University of Antwerp

Let's shape the future

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Our Master is challenging in many aspects, but enables the graduates to understand and design emergent technologies, rather than blindly apply them.

In brief

In this Master's programme, you will acquire knowledge in fundamental physics and material science, with an emphasis on nanoscience and quantum technology, and gain experience in suitable experimental and computational methods. The competences acquired through advanced practical sessions, projects and internships proposed within the programme are directed towards your future professional activities within both R&D and S&T aspects of academic life and industry. Exchanges to partner universities in France and Sweden are facilitated and can lead to double Master's degrees.

In detail

This Master's programme is built upon the **following points of view**:

- **Progress** in nanoscience and nanotechnology can only be made upon **thorough understanding** of underlying fundamental nanophysics.
- **Studying** nanophysics, preparatory for R&D work in nanotechnology, requires a study **period of two years**.
- **Proper training** in nanophysics demands access to different visions and different approaches even within the same topics.

To achieve the above goals, our courses in fundamental nanophysics and its applications in material science and quantum technology are combined in a full, **two-year Master's programme**, in collaboration with several other scientific institutions.

In our programme you will acquire the following **competences:**

- developing **analytical mindset** and **understanding** concepts used to describe matter at and below nanoscale
- mastering the **formalisms** and **methods** in order to perform theoretical studies and calculations with applications from atomistic to macroscopic scale
- evaluating and applying the **appropriate experimental techniques** to probe specific properties of matter
- developing **communication skills** and world-wide networking in a multi-cultural environment
- performing **independent research**, using relevant scientific literature, delimiting a scientific problem, choosing appropriate methods, interpreting and evaluating the results, and presenting the results to a large audience in correct language and in popular form (when needed).

Programme structure

Research within the programme
The Master's thesis is the final part (25%) of the Master's programme, and is entirely based on advanced research. You will acquire sufficient knowledge and skills to conduct, under supervision, a scientific study of current international relevance, publishable in international peer-review journals.

Practical skills within the programme
Our curriculum leaves room for practical education through the elective internship which can be performed on different levels and in different institutes or companies. Students are encouraged to find a physics-related topic of interest in a company, society, or higher education institution (around the world) and get practical working experience of their choice.
In addition to the optional internship, several compulsory nanophysics courses have a corresponding elective project where students can apply what they have learnt during the course.

Studying abroad
Our programme encourages exchanges (with scholarships) in and outside Europe, thanks to the University of Antwerp's bilateral agreements with many other universities worldwide. Within the International Master in Nanophysics and Material Science (Nanomat), it is possible to take parts of the curriculum at Université Pierre et Marie Curie in Paris, France or Uppsala University in Sweden and become eligible for a double degree.

Learning outcomes

Modelling and problem-solving competencies

1 The graduate should be able to identify the essence of a situation and to set up a working model. They must be able to make the necessary approaches and thus to think critically about the construction of models.

Problem solving skills

2 The graduate should be able to identify orders of magnitude in situations that are physically different but show analogies and in this way reuse known solutions in new problems.

Literature research

3 The graduate is able to search and apply physics literature and other technical literature, as well as other resources that are relevant to research and technical project development. Proficiency in scientific English is mandatory.

Learning skills

4 The graduate is able to explore new areas through independent study.

Modelling

5 The graduate is able to adapt existing models to new experimental data.

Theoretical comprehension

6 The graduate has a good understanding of the main physics theories (logical and mathematical structure, experimental support and described physical phenomena).

Basic and applied research

7 The graduate acquires an understanding of nature, of the way in which research in physics is performed, and how this research is applicable in many other domains such as engineering. They are able to design experimental and/or theoretical procedures to
   a. solve contemporary issues in academic or industrial research
   b. improve existing solutions.

Profound knowledge

8 The graduate has a profound knowledge of the foundations of modern physics, such as quantum mechanics.

Mathematical skills

9 The graduate understands and masters the use of the most common mathematical and numerical methods.

Breakthrough research

10 The graduate has a good knowledge of the current state of research in at least one active area of physics.

Solving problems and computer skills

11 The graduate is able to perform calculations independently, even if this requires the use of a computer and the writing of a computer code.

Experimental skills

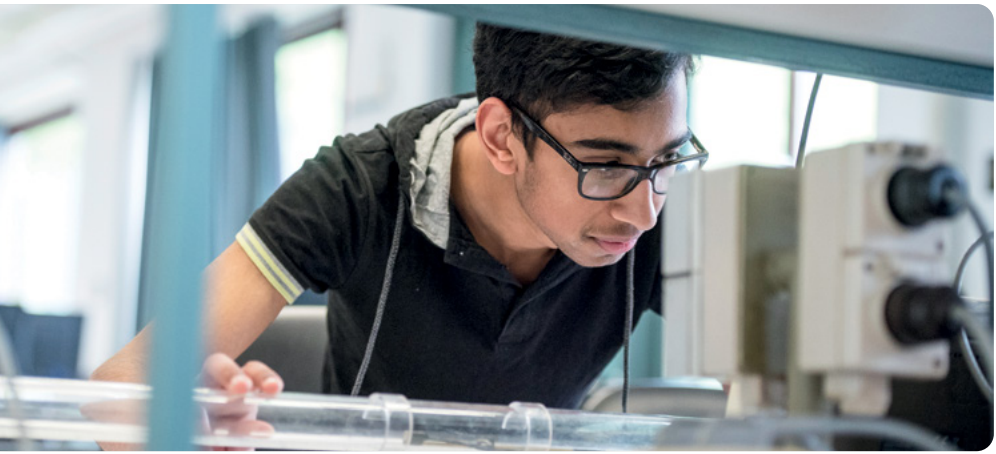
12 The graduate is familiar with the main experimental methods and is able to independently conduct experiments, and to describe, analyse and critically evaluate the results.

Specific communication skills

13 The graduate can work in a team, is able to present their own research as well as results of literature research to both professionals and the general public.

Management skills

14 The graduate can largely work independently and assume responsibility in terms of project planning and in the management of structures.



Social and professional skills

15 The graduate develops a personal sense of responsibility for assignments. They are is able to acquire a professional flexibility by the wide range of scientific techniques in the curriculum.

Broad overview of the field of physics

16 The graduate is familiar with the main domains of physics and the techniques applied in multiple disciplines.

Staying up to date

17 The graduate can keep up with new developments and methods and is able to provide professional advice on the possible applications of these developments.

Language proficiency (relevant to physics)

18 The graduate improved his/her command of foreign languages by following courses taught in a foreign language, for example through exchange programmes, and credits earned at other universities or research institutes.

Ethical awareness (relevant to physics)

19 The graduate is able to identify the social and ethical aspects of research and of professional activity in physics and its responsibility to protect the public health and the environment.

Absolute standards

20 The graduate is familiar with 'the results of ingenuity', that is, the variety and enjoyment of physics discoveries and theories and in this way develops a feeling for the highest standards in research.

The University of Antwerp hosts very productive research groups and the finest experts

Ivan Sudakov, Ukraine

Curriculum
Over two years, a student has to acquire a minimum of 120 ECTS credits.

Compulsory courses in general physics **ECTS credits 30**

Advanced Quantum Mechanics	6
Atom and Molecule Structure	6
Mathematical Methods in Theoretical Physics	6
Statistical and Mathematical Physics	6
Symmetry in Physics	6

Master's thesis Physics **ECTS credits 30**
including internship

Compulsory courses in Nanophysics **ECTS credits 18**

Computational Materials Physics	6
Microscopy and Spectroscopy of Nanosystems	6
Physics of Low-dimensional Systems	6

Optional courses in Nanophysics **ECTS credits 42**

A student chooses a total of 42 ECTS credits either from the list of 15 electives mentioned on the Master's website, or from another research module in the Dutch Master's programme, or (upon approval) from the general list of optional courses in the Dutch Master's programme or from another Master's programme (Please consult the course catalogue on www.uantwerpen.be/master-physics)

Total **ECTS credits 120**

Job opportunities

All the acquired competences in the Master of Physics will contribute to the easy integration of the graduates in the academic world, the European R&D base, as well as in the private job market. A large portion of our graduates continue their education in a PhD programme, but many of them also find careers in private companies (as scientists, engineers or managers) and at teaching or research institutions.

Why choose UAntwerp

Our university is located in the **city of Antwerp**, in the heart of Belgium and Europe. The port of Antwerp is one of the biggest in the world. Antwerp is not just an ancient medieval and baroque city, full of history. It is also a bustling metropolis with a vibrant social scene, impressive architecture and cultural contrasts. Over 170 nationalities live here, more than in New York! This cosmopolitan vibe is also reflected at the University of Antwerp. English is widely spoken in Antwerp, though if you learn Dutch during your stay here you will become a local in no time.

First-rate research and education make the University of Antwerp a wonderful place to study and to work. We foster the nexus between research and education. Internationalisation is key to our mission. It is no coincidence that the University of Antwerp is a partner in a highly promising European university network, the Young Universities for the Future of Europe www.YUFE.eu.

As home away from home to over **20,000 students**, the University of Antwerp prides itself on operating on a human scale. Our faculty and staff will welcome you into top-notch infrastructure on one of our four campuses. While you're here you are also invited to enjoy our vibrant cultural programme, sports facilities and many student services.

The University of Antwerp **scores extremely well** in Young University Rankings

Eligibility criteria

Diploma requirements

Direct access

- Academic Bachelor of Physics
- Academic Bachelor of Physics and Astronomy

Access after permission

- Other academic Bachelors and Masters in exact, medical, engineering or industrial sciences

The previously accumulated knowledge of a prospective student **should include, at least:**

Quantum Mechanics

- Heisenberg and Schrödinger picture of quantum mechanics
- Simple examples: square well potential, harmonic oscillator, transmission, reflection
- Hydrogen atom
- Perturbation theory
- Scattering theory: born approximation, notions of lifetime and line width, method of partial waves etc.

I was impressed by the study conditions, the modern laboratories and the organisation of internships

Alexandra Evangeliou, Greece

Solid-state Physics

- Phonons
- Free electron gas
- Band structure
- Ferromagnetism, magnons
- Plasmons
- Dielectrics

Statistical Physics

- Ensembles: micro canonical, canonical, grand canonical
- Distributions: Bolzmann, Fermi-Dirac, Bose-Einstein
- Relation with thermodynamics
- Examples: ideal gas in equilibrium, harmonic oscillators

Calculus

- Ordinary differential equations
- Infinite series
- Evaluation of integrals
- Integral transforms (Fourier, Laplace)
- Legendre functions
- Bessel functions
- Calculus of variations (Euler-Lagrange)
- Elementary properties of complex functions (poles, branch limes, residue theorem)

Coming from the cradle of broad fundamental science, I really appreciated the focus of the courses on physics at the nanoscale and related nanotechnology

Mikhail Petrov, Russia

Since the programme is taught in **English**, candidates with a prior degree issued outside Belgium, the Netherlands or Luxembourg are required to demonstrate their proficiency in English. They can do so in two ways:

- Either by submitting a **language certificate** showing their TOEFL, IELTS, ITACE or Cambridge English test results (the level required can be checked on www.uantwerpen.be/admission)

- Or by submitting **proof** they have studied at least one academic year (or 60 ECTS credits) in an English-language Bachelor's or Master's programme.

Please note that the Board of Admission may still ask for additional proof of proficiency in English.

Application procedure

Candidates with a **Bachelor's** or **Master's** degree that gives direct access to the programme from a higher education institution in Belgium, the Netherlands or Luxembourg can enrol directly. Candidates who do not fulfil this condition or who need a visa must submit on online application through the online application tool **Mobility Online**. Applications for the academic year 2025-2026 can be started in Mobility Online from early November 2024 onwards.

Application deadlines
To submit an application through Mobility Online

- For non-EEA * nationals and for students who need a visa: **before 1 March 2025**
- For EEA nationals: **before 1 June 2025**

Enrolment deadline
Early October.
Enrolments start on 1 July 2025.

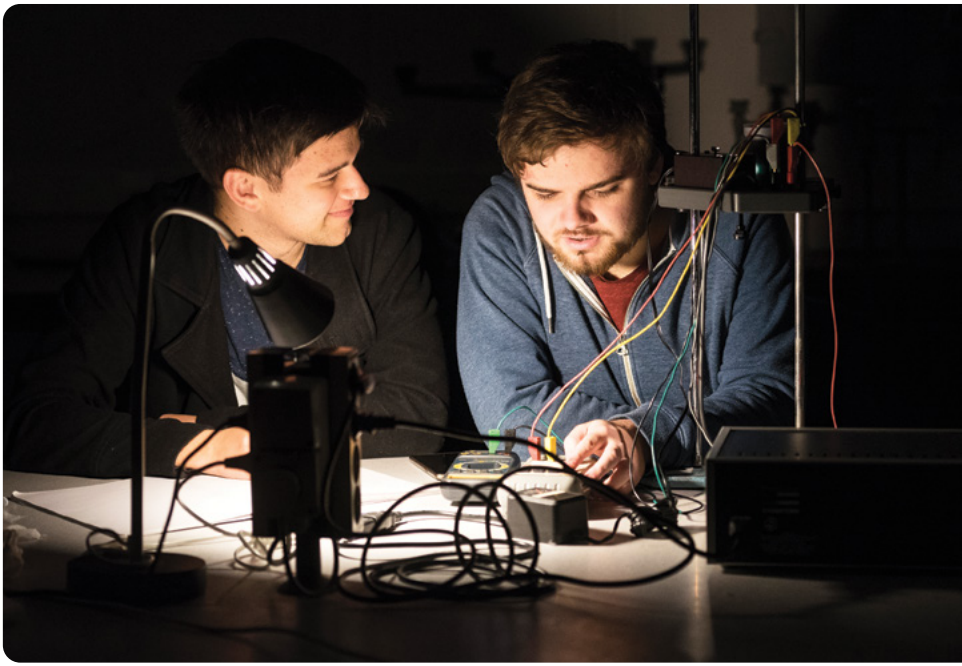
The academic year 2025-2026 starts on Monday 22 September 2025.

* **EEA** = European Economic Area
Member states: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxemburg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden

ECTS credits

The University of Antwerp applies the '**European Credit Transfer and Accumulation System**' (ECTS) in all its degree programmes.

A full-time one-year study programme amounts to **60 ECTS credits** (30 ECTS credits per semester), which implies a student workload of about 1500 to 1800 hours. One ECTS credit stands for 25 to 30 hours of work including contact hours, preparatory work, study and assessment.



Quick facts

Level
Master

Language
English

Credits
120 ECTS credits

Number of years
2

Tuition fee per year *
EUR 1157 for EEA nationals
EUR 5800 for non-EEA nationals

Campus
Groenenborger and Drie Eiken

Faculty
Science

More information
www.uantwerpen.be/
master-physics

* subject to yearly revision

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This brochure was published in September 2024.
As all information is subject to change,
please check our website for the latest updates.