

Roskilde University

**MSc / cand.scient.**

# **Physics and Scientific Modelling**

Master's Programme



# Physics and Scientific Modelling

**Physics and Scientific Modelling provides training in experimental, theoretical, and numeric methods to solve problems in physics and other fields. The weighting of experiments, theory and numeric techniques is determined by your choices in the study programme.**

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The point of departure is the understanding of physics and the laws of nature, but in this study programme, there is a special focus on independent work in identifying which physical concepts and mathematical and numerical methods that are relevant to solve a given problem. In the projects, it is possible to immerse yourself in experimental, computer science and / or mathematical aspects of modelling. At the same time, it is possible to apply the physics competencies outside of classical physics subjects if you want a clear interdisciplinary profile.

The aim of the study programme is to give you competencies and methods to work systematically and critically with physics, modelling and data science in connection with problems in a wide range of fields.

The programme can be tuned to give different profiles depending on how the elective courses are chosen and the type of projects the student works with. Particularly there is the option of following one of three predefined thematic profiles, while it is also possible to follow the programme with an individual profile based on combining elements from the thematic profiles or including other elements.

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# Physics and Scientific Modelling

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**At RUC, you do not only study in the traditional sense. At RUC you find a problem you want to solve, and then you acquire the skills and knowledge needed to solve it.”**

Rasmus Godiksen, Director, Head of Risk Management,  
EKF Denmark's Export Credit Agency

The three predefined thematic profiles are:

**Experimental and computational physics:**

The focus in this theme is on the practical implementation of physics and scientific modelling. This includes a focus on the process of acquiring data via experiments or scientific computing and on data analysis and data science.

**Mathematical foundation of physics and scientific modelling:**

The focus in this theme is on the role of mathematics in modelling and gives insight into the mathematical way of thinking and how it differs from physics. The theme has a focus on logic and proofs and gives a classical academic profile which for example is relevant for teaching.

**Experimental and computational bio-**

**physics:** The theme is analogous to that of experimental and computational physics, but with a focus on data acquisition, analysis and modelling in the specific area of biophysics, biochemistry, and bioscience.

# 1<sup>st</sup>

SEMESTER

Through exemplary work in a semester project and mini-project based courses you will get experience with and knowledge about the interplay between experiment, theory, models and numerical methods in physics and scientific modelling. The courses cover both experimental and computational skills while the project can be tuned in a theoretical, experimental, or computational direction depending on your interest.

# 2<sup>nd</sup>

SEMESTER

The second semester is the profiling semester where you start working with the thematic profile of choice or begin designing your individual profile. You may dive into fundamental mathematical structures and/or develop your skills in scientific computing and data science. In this semester you can also choose the course biophysical chemistry or choose courses in other branches of science to create an interdisciplinary profile.

# 3<sup>rd</sup>

SEMESTER

In the third semester the course problem solving in physics II serves as a culmination of the training in working with modelling in a problem-solving context. You will learn to tackle an openly formulated problem, formulate it in terms of physics and mathematics, solving the problem and evaluating the solution. The semester is also your specialisation semester where you via the project and a profile/elective course develop your profile further. This may include internships and/or preparatory studies for your master thesis.

# 4<sup>th</sup>

SEMESTER

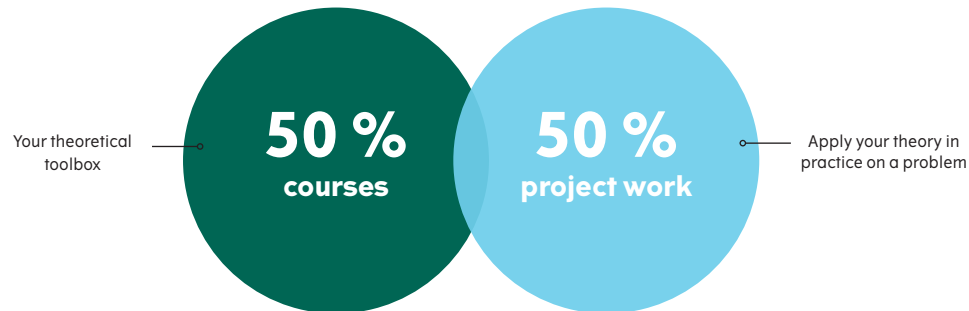
The objective of the master's thesis is that you reach the research front in a selected area within physics and/or scientific s.

# Form of Study

Through your education, you get the opportunity to create your own individual education profile and your own independent specialization in accordance with the idea of the problem-oriented, interdisciplinary and project-oriented teaching method at Roskilde University.

## THE STUDY FORM IS A COMBINATION OF

- Problem-oriented project group work
- Courses that are organized as teaching in small groups, where the focus is on theories, methods, and problems in an interaction between teacher and student



The project work and guidance are prioritized at Roskilde University. We also prioritize that you gain experience with the production and processing of empirical data as well as the practical application of theories and methods.

All master's programmes offer project-oriented internships and / or studies at other universities at home and abroad with credit transfer.

# Project Examples

- How does the self assembly of the ABC miktoarm star terpolymer thin films look in-silico using Dissipative Particle Dynamics?
- Under what conditions will Ice Slabs be formed in the GEUS Surface Energy Balance and Firn Model?
- To what extent is it possible to categorize mathematical proofs in terms of the strategies and techniques used to derive them?
- How can differential dynamic microscopy be used to characterize colloidal dispersions?
- How does experimental data on fire front propagation of discrete fuel beds compare to existing models?
- What is the vorticity topology of the core-growth model in the case of two vortices in a Couette flow?
- Can the time evolution of the dielectric properties be used to understand the embrittlement of candidates for sustainable LEGO-material substitutes?
- What is the status of the experimental tests of Bell's Inequality today and what can we conclude about the debate between Bohr and Einstein?
- Do molecular dynamics simulations of  $\text{UO}_2$  crystals give evidence for isomorphs?

The master's programme in Physics and Scientific Modelling will give you a strong professional position in the labor market and a solid starting point for research. The programme will enable you to:

Apply knowledge of fundamental theories of physics in problem solving

Tackle an openly formulated problem by reformulating it in terms of physics and

# Further information



You can find admission requirements, application deadlines and other information about Physics and Scientific Modelling at Roskilde University here:

[ruc.dk/en/master/physics-and-scientific-modelling](https://ruc.dk/en/master/physics-and-scientific-modelling)

Contact us if you have questions about Physics and Scientific Modelling:

RUC Study & Career Guidance

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