LUND UNIVERSITY

FACULTY OF SCIENCE

Programme sheet

Master Programme in Computational Science, Physics, 120 credits

September 2024 – June 2026

Computations are becoming more and more important in research and industry. To make predictions, analysis or to replace experiments, we make use of numerical simulations and machine learning on large computers. We generate and store large amounts of data and use data science to search for patterns, connections, and trends.

The Master Programme in Computational Science with specialisation in Physics will give you detailed knowledge about the underlying methods with respect to physics. You will learn how to study complex processes in natural sciences, and how Computational Science can contribute to knowledge evolution in society. A few of many examples are studies in, and research on, environment and climate change, accelerator physics, cell dynamics and super novae. The programme will prepare you for a professional career in academia as well as in business and industry.

Programme overview

This interdisciplinary education will give you foundational knowledge in the field of computational science. If you already have a bachelor's in physics, you will deepen your physics knowledge, especially in areas that require computational methods. You can also follow the programme without a previous bachelor's in physics – if so, you will get a broad overview of physics both at basic and advanced level that illustrates the interplay between computational methods and theoretical models.

In addition to knowledge in theory for computational science, there will be an emphasis on obtaining knowledge about the practical tools that are used by professionals in the field and you will amongst several things train your skills in programming. You will get generic knowledge and skills of importance for computationally intensive working tasks, such as problem formulation, information search, data processing, scientific writing, and presentation techniques.

The programme has three separate specialisations: Geoscience, Physics and Scientific Computing. You will study several courses together with students from another specialisation than your own and there will opportunities to do common projects and thesis work. During your studies, an interdisciplinary perspective is emphasized and you will also study together with students from biology, geology, environmental sciences, physical geography and chemistry.

The education has a strong connection to research. You will meet and be taught by active and internationally well recognized researchers, and you will be in contact with several research groups. You will at the same time be prepared for a career in business and industry.

Programme structure

Computational Physics is a branch within computational science where analytical, numerical and statistical methods are used to analyse and draw conclusions from physical models, as well as huge datasets from physics experiments. The programme contains a mix of courses in physics, mathematics and computational science that will give you broad knowledge in numerical methods within data science, Monte-Carlo simulations and solutions to differential equations. You will also get insight into the interplay between computational methods and the underlying physical phenomena and models that are studied.

Compulsory courses 37.5 credits

BERN01	Modelling in Computational Science 7.5 credits
FYSB22	Basic Quantum Mechanics, 7.5 credits
FYSB23	Basic Statistical Physics and Quantum Statistics, 7.5 credits
FYSB24	Atomic and Molecular Physics, 7.5 credits
NUMN32	Numerical Methods for Differential Equations, 7.5 credits

Alternative-compulsory (elective) courses 22.5 credits

One of the following courses:

FYTB13	Electromagnetism, 7.5 credits
FYSC22	Nuclear Physics, 7.5 credits
FYSC24	Particle Physics, Cosmology and Accelerators, 7.5 credits

At least two of the following courses:

BERN02	Reproducible Data Science and Statistical Learning 7.5 credits
FYTN03	Computational Physics, 7.5 credits
BERN04	Introduction to Artificial Neural Networks and Deep Learning, 7.5 credits
MASM11	Monte Carlo Methods for Statistical Inference, 7.5 credits
MASM22	Linear and Logistic Regression, 7.5 credits
NUMN21	Advanced Course in Numerical Algorithms with Python/SciPy, 7.5 credits
NUMN28	Numerical Simulations of Flow Problems, 7.5 credits

Optional courses 30 credits

The optional courses should be selected so that the student among the compulsory, alternative-compulsory and optional courses study at least 30 credits advanced level physics and 30 credits advanced level in mathematical sciences (mathematics, numerical analysis, mathematical statistics).

For a student with a bachelor's in physics, the compulsory and alternative-compulsory courses in physics are covered by the student's pre-knowledge. The compulsory elements are then reduced to BERN01, Modelling in Computational Science, 7.5 credits, and NUMN32, Numerical Methods for Differential Equations, 7.5 credits. The extra available time for optional courses can be used to broaden the studies in advanced physics, or to specialize within, e.g., particle physics, atomic and molecular physics, solid state physics, nuclear physics, or theoretical physics.

Degree project 30 credits

BERMXX	Degree project Master of Science

Table 1 Course of study for students without a bachelor's in physics, example

Year 1	Autumn 1	Autumn 2	Spring 1	Spring 2
	BERN01 Modelling in Computational Science 7.5 credits	**FYSB22** Basic Quantum Mechanics, 7.5 credits	**FYSB23** Basic Statistical Physics and Quantum Statistics, 7.5 credits	FYTB13 Electromagnetism, 7.5 credits
	BERN02 Reproducible Data Science and Statistical Learning 7.5 credits	**NUMN32** Numerical Methods for Differential Equations, 7.5 credits	**FYSB24** Atomic and Molecular Physics, 7.5 credits	NUMN28 Numerical Simulations of Flow Problems, 7.5 credits
Year 2	**Autumn 1**	**Autumn 2**	**Spring 1**	**Spring 2**
	FYST57 Chaos for Science and Technology, 7.5 credits	BERN04 Introduction to Artificial Neural Networks and Deep Learning, 7.5 credits	**Degree Project 30 credits**	
	FYSN17 Quantum Mechanics, 7.5 credits	ASTM29 Statistical Tools in Astrophysics, 7.5 credits		

Table 2 Course of study for students with a bachelor's in physics, example

Year 1	Autumn 1	Autumn 2	Spring 1	Spring 2
	BERN01 Modelling in Computational Science 7.5 credits	**NUMN32** Numerical Methods for Differential Equations, 7.5 credits	FYSN23 Advanced Electromagnetism, 7.5 credits	NUMN28 Numerical Simulations of Flow Problems, 7.5 credits
	MASC14 Stationary Stochastic Processes, 7.5 credits	BERN04 Introduction to Artificial Neural Networks and Deep Learning, 7.5 credits	MASM11 Monte Carlo Methods for Statistical Inference, 7.5 credits	MASM15 Statistical Modelling of Extreme Values, 7.5 credits
Year 2	**Autumn 1**	**Autumn 2**	**Spring 1**	**Spring 2**

	FYST57 Chaos for Science and Technology, 7.5 credits	FYTN15 Statistical Mechanics, 7.5 credits	**Degree Project 30 credits**
	FYSN17 Quantum Mechanics, 7.5 credits	Optional course in Computational Science or in Physics 7.5 credits	

Career opportunities

After graduation, there are several different career paths depending on which subject profile you have chosen. The Master's programme gives you a solid ground for postgraduate education in natural sciences. You can also choose a career path outside academia and then find attractive jobs in areas where there is a need to solve computational problems both in industry and in public administration and other organisations.

Requirements and selection

Entry requirements

Bachelor´s degree in Physics of at least 180 credits.

Proficiency in English equivalent to English 6/B from Swedish upper-secondary school.

or

Bachelor’s degree of at least 180 credits in Science or Engineering. The degree should contain at least 30 credits mathematics, of which 6 credits in programming and 7.5 credits in statistics, and an additional 90 credits in mathematics and/or physics.

Proficiency in English equivalent to English 6/B from Swedish upper-secondary school.

Selection criteria

Based on grades awarded for previous academic courses, with majors in science, technology and mathematics, as well as a statement of purpose for the application in which applicants state their goals with the programme (from the applicant’s "Summary sheet").

Degree

Master of Science
Major: Computational Science with specialisation in Physics
Naturvetenskaplig masterexamen
Huvudområde: Beräkningsvetenskap med fördjupning i fysik

Application

Apply online using Universityadmissions.se
Application period: 16 October 2023 - 15 January 2024
Language of instruction: English

Contact

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