PhD

Career in industry/finance

Goal: Master of Science (M.Sc.)

Master-Thesis

- **Program duration** 4 semesters
- **Workload** 120 credit points (1 credit point represents 30 hrs. of student time)

Specializations
- Choice of atmospheric physics, computational electromagnetics, computational fluid dynamics, experimental particle physics, computational finance, imaging in medicine, materials science, theoretical chemistry, theoretical particle physics

Numerical Methods
- ordinary and partial differential equations
- linear algebra

Computer Science
- modern programming
- algorithms and data structures
- image processing and data visualization, tools, GRID

Computer Simulation
- Basic algorithms
- data analysis, lab courses
- parallel algorithms

START

Personal guidance

FURTHER INFORMATION

for international applicants:
www.uni-wuppertal.de/studium/index-en.html
www.csis.uni-wuppertal.de/
for applicants whose educational qualifications are from GER
www.studierendensekretariat.uni-wuppertal.de
examination regulations
www.zpa.uni-wuppertal.de/studiengaenge/master/master-ein-fach-studiengaenge/computer-simulation-in-science-msc.html

Foto: Herr Arnold, Bergische Universität Wuppertal

INFORMATION AND ADVICE

Program counsellor: Computer Simulation in Science

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Professor for High Performance Computing in Theoretical Physics
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Telephone: +49 202 439-2630
knechtli@physik.uni-wuppertal.de
Advice sessions: by appointment

International Office of the School of Mathematics and Natural Sciences & CSiS Secretary: Susanne vom Brocke
Room: Campus Grifflenberg, F.10.05
Telephone: +49 202 439-2594
vombrocke@uni-wuppertal.de
Advice sessions: Wed. and Thurs. 10:00 am-12:00 noon

Visit our department at: www.csis.uni-wuppertal.de
Faculty web site: www.fk4.uni-wuppertal.de

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www.internationales.uni-wuppertal.de

For up-to-date information see our ZSB-homepage.

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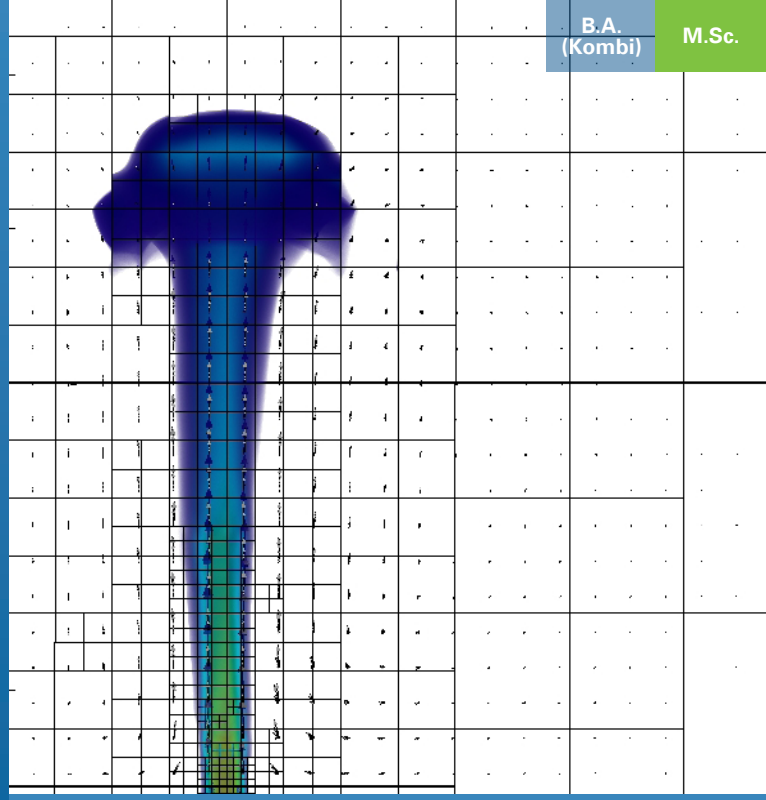
Herausgeber: Zentrale Studienberatung der Bergischen Universität Wuppertal

Für studiengangbezogene Inhalte ist die Studienfachberatung verantwortlich.

Stand: Mai 2021

PROGRAMM AKKREDITIERT Akkreditierungsrat

Dieser Studiengang trägt das Siegel des Akkreditierungsrates



B.A. (Kombi) | M.Sc.

Computer Simulation in Science

Master of Science (M.Sc.)

School of Mathematics and Natural Sciences

BERGISCHE UNIVERSITÄT WUPPERTAL

DEGREE PROGRAMME PROFILE

The M.Sc. programme Computer Simulation in Science (CSiS) focuses on the development, implementation and application of computer-oriented simulation techniques and methods to modern research problems in natural sciences and engineering. All courses of this MSc programme are taught in English language. The programme is designed to be completed in four semesters. The required coursework for the programme includes courses in Computer Simulation, Computer Science, and Numerical Methods. In addition to the required coursework, you will take elective courses to earn a specialization in one of the following fields:

- **Atmospheric Physics:** simulation of chemical and physical processes in the atmosphere.
- **Computational Electromagnetics:** computer-aided simulation of electromagnetic field distributions and additional multi-physically coupled field effects in complex technological and biological systems.
- **Computational Finance:** solving mathematical problems specifically related to financial markets by numerical techniques.
- **Computational Fluid Mechanics:** pedestrian dynamics, fire simulation, multiphase flow, water flow.
- **Experimental Particle Physics:** simulations for large experiments like the accelerator LHC, the Pierre Auger cosmic ray observatory or the IceCube South Pole neutrino experiment.
- **Imaging in Medicine:** techniques for imaging in medicine and biology, image processing in particular analysis of medical images
- **Materials Science:** the physics of soft matter, for example polymers, surfactants or low-molecular weight liquids.
- **Theoretical Chemistry:** computations of inter- and intra-molecular interactions and spectra.
- **Theoretical Particle Physics:** theory of elementary particles and their interactions: Monte Carlo simulations of lattice gauge theories.

The programme web page is www.csis.uni-wuppertal.de

ADMISSION REQUIREMENTS AND APPLICATION

Bachelor's or diploma degree in applied science, business mathematics, chemistry, electrical engineering, mathematics, mechanical engineering, safety engineering, physics or a related field.

The programme assumes

- advanced knowledge (as specified on the web page) in the field of specialization chosen from atmospheric physics, computational electromagnetics, computational fluid mechanics, experimental particle physics, computational finance, imaging in medicine, materials science, theoretical chemistry, or theoretical particle physics.
- knowledge of at least one programming language.
- a grade of (or equivalent to) at least 3.0 after rounding down to the first decimal place in the German system.
- Sufficiently good proficiency in English.
- **if you are an international student:**
  documented by providing the results of a recently passed
  - TOEFL2 iBT (internet-based) with at least 79 points or
  - TOEFL PBT (paper-based) with at least 550 points or
  - IELTS test, academic module with at least 6.0 band score or
  - Cambrigde Certificate in Advanced English (Level 4) or
  - another language certificate at the level B2 of the European Framework of Reference.
- **if you are a student with a German Bachelor degree:**
  Knowledge of the English language at the level B2 of the European Framework of Reference. This can also be proven by the certificate of the „Abitur".

If the bachelor's degree programme was verifiably taught in English, an additional language test is not required.

The master's programme always starts in the winter semester. Information concerning the application procedure can be found on the programme web page.

PROGRAMME CONTENT AND STRUCTURE

State-of-the-art computing methods are used and will be further developed for research. In particular the MSc programme focuses on:

- Parallel computing, where several processors work together to perform one task. This requires specially adapted numerical algorithms and highly optimized communication software.
- GRID computing, which is often referred to as the next step of the World Wide Web. Wuppertal is actively developing tools in a worldwide framework to share computing resources.
- Advanced algorithms for simulation tasks using a large number of processors. Students will learn to apply and develop these techniques.

Basic technical and mathematical skills are acquired in the compulsory courses. 74 of the total of 120 credit points can be gained in these compulsory courses and 16 credit points in the elective courses in the field of specialization. The compulsory courses are distributed over three semesters, the elective courses over two semesters, the latter being taught in parallel for the different fields of specialization. Course examinations are held on an ongoing basis throughout the programme. Six months are allowed in the fourth semester for the master's thesis, which counts for 30 credit points. Wuppertal has a long tradition of computer simulation using high performance parallel computers. There are several new hardware developments, like a cluster of graphic cards and the parallel supercomputer QPACE, which ranked as the world's greenest supercomputer in 2009 and 2010. These clusters are used for our research, but they are also open to CSiS students. In addition a parallel computer dedicated to CSiS activities has been installed at the beginning of 2008 and extended in 2011 and 2014. There is a strong cooperation with the Research Centre FZ Jülich in the areas of FAIR physics, atmospheric physics and chemistry, supercomputing, lattice QCD simulation, modelling and simulation of pedestrian dynamics and imaging in medicine. Since January 2009 there is a cooperation with the M.Sc. in High-Performance Computing at Trinity College Dublin, Ireland.

DEGREE QUALIFICATION

The master's programme is research-oriented. Students who successfully complete the programme will be awarded the degree of Master of Science (M.Sc.).

PROFESSIONAL PERSPECTIVES

Students gain wide knowledge of model building and simulation. The ability to construct a model (abstract formulation of a problem) and interpret the results (simulation or experiment) are fundamental and require a broad basic technical education. With this knowledge graduates are well positioned to continue their education with a PhD, or to switch to industry or business. People who know how to perform computer simulations are sought by the research departments of industries where simulations are used in situations for which real experiments would be too dangerous or expensive. In recent years computer simulations have also taken on a prominent role in the finance and banking sectors (e.g. risk analysis). Please visit our alumni web page: https://www.csis.uni-wuppertal.de/en/alumni.html .