On the nanoscale (~10^-9 meters) concepts of physics, chemistry and biology are unavoidably intertwined opening a new field of science, nanoscience. We study how quantum phenomena influence and even govern the functionality of electrical and optical circuits; we explore how organic molecules may be used in novel electronics; and we cover many other topics. Our programme has a physics stem with several different branches connecting to adjacent subjects in the nano-field. You will have the generic competences of an engineering physicist with specialization in an exciting new emerging field of technology, nanotechnology.
Counting single electrons - tick, tick, tick goes Jonas after laying the last piece to his research puzzle. And that piece completed the world’s first ammeter that works by counting the single electrons.

The point of using a chain of extremely small metal islands separated by tunnel barriers is that it forces the electrons to move one by one in an orderly fashion. In a usual conductor this motion is random.

Jonas Bylander, former PhD student at MC2. Now: MIT in Cambridge, USA.

INTRODUCTION AND MOTIVATION
The Master Programme in Nanoscale Science and Technology is tailored for students aiming at international careers in research and development in the field of nanoscience, both regarding the fundamental physics of nanoscience and how to design and build components on the nanoscale. On this scale, the nanoscale, quantum phenomena often influence, or even determine, the behaviour of electronic, optical, superconducting, and molecular devices. We foresee that many future applications in telecommunications, computing and information systems, natural and artificial biosystems, and medicine will be based on research and development of nanoscale technologies - at the interface between physics, chemistry, biology, and computer science. Theoretical and practical knowledge of these fields will therefore be important for research and development, both at the university and in industry.

PREREQUISITES AND DEGREES
The presumptive students should have a good background in Physics (Bachelor level).

Students in Nanoscale Science and Technology programme will graduate as: Master of Science and Engineering in Engineering Physics.

CAREER OPPORTUNITIES
What competences will be asked for in the field of nanoscience and technology in industry is still an open question as this field is usually referred to as emerging. However as we provide a broad education with a cutting-edge specialisation in to selected topics it is not unlikely that students from our programme form the entrepreneurial core of experts that matures the field in to a thriving technology.

Year 1

<table>
<thead>
<tr>
<th>Autumn</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Fundamentals of Micro- and Nano-fabrication (7.5p)</td>
<td>Superconductivity and low-temperature physics (7.5p)</td>
</tr>
<tr>
<td>Quantum Engineering (7.5p)</td>
<td>Elective (7.5p)</td>
</tr>
<tr>
<td>Nanoscience (7.5p)</td>
<td>Statistical Physics (7.5p)</td>
</tr>
<tr>
<td>Modelling and Fabrication of Nanodevices (7.5p)</td>
<td>Elective (7.5p)</td>
</tr>
</tbody>
</table>

Cover from left:
1. For successful results one needs:
2. experimental efforts
3. relaxing
4. some thinking
OBJECTIVES AND GOALS, LEARNING OUTCOMES

The programme is based firmly on physics of the nanoscale combined with several possible tracks for a minor subject in adjacent areas giving the possibility of truly multidisciplinary competence in the field of nanoscale science and technology. The students in the programme will study and work in the vibrant and strong research environment that MC2 offers. All of the teachers involved in the core of this programme are simultaneously researchers at the forefront of the nanoscience field both nationally and internationally. Generic competences emphasized are:

• broad working knowledge in physics
• an insight in available theoretical and experimental techniques
• ability to communicate and present technical information
• ability to analyse and identify a means to solve a given problem

The unique competences that the programme should deliver are:

• knowledge of the innovative possibilities of nanotechnology
• a solid theoretical background in the physics and technology of nanoscale devices
• experience of working in a clean room environment

PROGRAMME DESCRIPTION

The programme is associated with the Physics Centre at Chalmers. This is a natural tie since the programme identifies the core competences in physics that are fundamental to understanding and developing our understanding of nanoscale objects. We are also aware that nanoscale science and technology is a diverse field having interfaces to several other branches of science and hence putting the programme in an interdisciplinary focal point. To meet these challenges we make a programme with one compulsory and one elective block. Both blocks are of comparable size enabling students to find either a more focused traditional physics education or a truly interdisciplinary education with his or her unique flavour. Using the freedom of choice there is in choosing the minor subject each Master degree awarded will have a unique added competence that is up to the student to compile.

The compulsory block concentrates on the core knowledge in physics that both the more practical minded as well as the theoretically inclined student should master. Corner-stone courses are the theory based Quantum Engineering course, the processing technology course Fundamentals of micro- and nanofabrication, and the more hands on Modelling and Fabrication of nanodevices.

The elective block is, ideally, chosen from other existing masters programmes to make up a minor subject complementing the major in the physics of nanoscale science. The elective courses are then selected from the area that defines the minor track.

The Master thesis work will usually be made in a research environment on a subject close to current topics in the field. This will allow students to get involved with and exposed to the state-of-the art methods of nanoscience and technology in their own research project. The Master thesis will also serve as an opening for students to enrol in R&D efforts in industry or the MC2 graduate school.

For updated information about entry requirements, the application procedure and deadlines, please visit our website www.chalmers.se/master.html

ENTRY REQUIREMENTS

All applicants must meet the requirements listed at www.chalmers.se/master.html
All applicants must also meet the special requirements for each programme, please see the programme descriptions for each Master’s programme at our website.

Programme Director
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Department responsible for this programme
Microtechnology and Nanoscience - MC2
www.chalmers.se/mc2/EN
CHALMERS UNIVERSITY OF TECHNOLOGY
Chalmers conducts research and education in the main engineering sciences as well as in technology related mathematical and natural sciences. About 10,000 students are striving to become researchers, graduate engineers, architects, engineers, technicians or ship’s officers. The pursuit of new knowledge and improved technology has characterized Chalmers since its foundation in 1829 in accordance with the testament of William Chalmers, director of the Swedish East India Company. Our driving force is inspired by the joy of discovery and the desire for learning. Behind all that Chalmers accomplishes, the hope persists for participating in sustainable development – both nationally and globally. Two thirds of the university’s budget relates to research and about a thousand research projects are conducted on an ongoing basis, many of them at the forefront of international development. Research and education are conducted in close contact with industry and society to meet the demands of the world around. The Master’s Programmes at Chalmers are strongly linked to advanced research in areas of particular strength. Upon completion of studies, candidates will be granted a Master’s degree.

THE SMALL METROPOLIS – GÖTEBORG
Founded in 1621, Göteborg is a young city by European standards. Since formative years it has been an important port of international trade and today it is the largest in Scandinavia. With a population of about half a million, it is both friendly and cosmopolitan. Important events in culture and sports take place in Göteborg and there are plenty of pubs, cinemas, theatres and museums. The countryside and the coast can easily be reached by the local transport system.

SWEDEN
More information about Sweden and Swedish geography and society, art and culture, economy and government can be found at www.sweden.se

MASTER’S PROGRAMMES

HOW TO APPLY
For information about entry requirements, application procedure and deadlines, please visit our web site www.chalmers.se/masters.html

INFORMATION
General information about Chalmers:
www.chalmers.se/en/

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