

Mattias Borg  
NanoLund: Centre for Nanoscience  
LTH Profile Area: Nanoscience and Semiconductor Technology  
LU Profile Area: Light and Materials  
Electromagnetics and Nanoelectronics  
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## Research

I do fundamental research with strong industrial relevance having had previous positions both at IBM Research (2012-2016) and Ericsson Research (2022-2024).

My research interests lie in the development of nanotechnology for applications in electronics and neuromorphic computing.

I do materials-driven research with the aim to realize new device concepts through understanding and controlling the physics and chemistry of heterogeneous nanomaterials.

**Ferroelectric memristors:** I currently focus on developing ferroelectric tunnel junction memristive devices based on HfO<sub>2</sub> thin films, and novel methods for their integration with III-V semiconductors and CMOS backend. I am exploring the ability of these devices to function as synapses in artificial neuromorphic systems and in-memory computing.

**3D heterointegration:** I explore how to integrate III-V nanostructures into the back-end-of-line in Si CMOS technology, using novel epitaxial methodologies with low thermal budget, based on Rapid Melt Growth and Template-Assisted Selective Epitaxy.

**Previously:** I pioneered antimonide-based nanowire synthesis during my PhD work, I have been strongly involved in InAs/GaSb-based tunnel field effect transistor (TFET) research both in Lund and at IBM, and at IBM I co-invented a novel method for CMOS-compatible III-V integration on Si, called Template-Assisted Selective Epitaxy (TASE).

Teaching at LTH:

Memory technology for Machine Learning (EITP25)

*The purpose of this course is to give an in depth understanding for the physics of common memory device technologies with focus on non-volatile memories. Furthermore, the course covers how these memory devices can be integrated to create neuromorphic hardware for applications in machine learning and artificial intelligence. Finally, the course gives an introduction to the architectures and algorithms that are used in machine learning, to give a basic understanding for the needs that memory devices and their connections need to fulfil.*

Electronics (EITA35)

*This is the first course of the E program, aiming to provide an introduction to Electronics both at a theoretical and practical level.*

## Qualifications

Nanoelectronics, Readership, Readership in Nanoelectronics, Lund University  
Award Date: 2018 Feb 20

## Employment

**Member of Strategic Research Area**  
NanoLund: Centre for Nanoscience

Lund University  
Lund, Sweden  
2016 Mar 1 → present

**Profile area member**

LTH Profile Area: Nanoscience and Semiconductor Technology  
Lund University  
Sweden  
2022 Aug 30 → present

**Profile area member**

LU Profile Area: Light and Materials  
Lund University  
Sweden  
2023 Jan 1 → present

**Project manager, Senior lecturer**

Electromagnetics and Nanoelectronics  
Lund University  
Sweden  
2024 May 31 → present

**Master Researcher**

Ericsson AB  
Sweden  
2022 Mar 1 → present

**Research Staff Member**

IBM Research Zurich  
Rüschlikon, Switzerland  
2014 Jun 1 → 2016 Feb 29

**Post doctoral researcher**

IBM Research Zurich  
Rüschlikon, Switzerland  
2012 May 27 → 2014 May 29

## Activities

**AI & Digitalization Breakfast Seminar: Neuromorphic technology – Rethinking the computer for AI**

Borg, M. (Keynote/plenary speaker), Behmanesh, B. (Keynote/plenary speaker) & Lönnqvist, S. (Organiser)  
2025 Dec 10

**Simulations of current transport phenomena in ferroelectric tunnel junctions**

Borg, M. (First/primary/lead supervisor) & Lind, E. (Examiner)  
2022 Jan → 2022 Jun

**Semiconducting TiO<sub>2</sub> for High Performance Ferroelectric Tunnel Junctions**

Borg, M. (First/primary/lead supervisor), Atle, R. (Second supervisor) & Lind, E. (Examiner)  
2022 → ...

**Hub AI: Brain-Inspired Computing**

Wisbrant, J. (Organiser), Borg, M. (Speaker), Wernersson, L.-E. (Speaker), Heinze, S. (Speaker) & Winge, D. (Speaker)  
2021 Dec 6

**Automating Feature-Extraction for Camera Calibration Through Machine Learning and Computer Vision**

Borg, M. (First/primary/lead supervisor) & Åström, K. (Second supervisor)

2021 Jun 15

**Stochastic spiking neural networks based on ferroelectric memory devices**

Borg, M. (First/primary/lead supervisor)

2021 May 31

**AI Lund lunch seminar: In-memory computing to solve AI's energy consumption bottle-neck**

Wisbrant, J. (Organiser), Wisbrant, J. (Chair) & Borg, M. (Keynote/plenary speaker)

2021 May 5

**Fredrik Lindelöw**

Lind, E. (First/primary/lead supervisor), Borg, M. (Joint second supervisor) & Wernersson, L.-E. (Joint second supervisor)

2020 May

**Harald Havir**

Borg, M. (First/primary/lead supervisor) & Burke, A. (Second supervisor)

2020 Feb → 2020 May

**Development of Ferroelectric Hafnium Oxide for Negative Capacitance Field Effect Transistors**

Borg, M. (First/primary/lead supervisor)

2018 Sept 1 → 2019 Feb 14

**Robin Athle**

Borg, M. (First/primary/lead supervisor) & Svensson, J. (Second supervisor)

2018 Sept → 2019 Feb

**Nanotechnology (Journal)**

Borg, M. (Advisor)

2018 Jan 1 → 2019 Dec 31

**Cezar Zota**

Lind, E. (First/primary/lead supervisor), Borg, M. (Joint second supervisor) & Wernersson, L.-E. (Joint second supervisor)

2017 Apr

**Sang Lun**

Borg, M. (First/primary/lead supervisor)

2017 Jan → 2018 Jan

**Broadening of length distributions of InAs nanowires**

Berdnikov, Y. (Presenter), Dubrovskii, V. G. (Contributor), Sibirev, N. (Contributor), Gomes, U. P. (Contributor), Ercolani, D. (Contributor), Zannier, V. (Contributor), Sorba, L. (Contributor), Schmidtbauer, J. (Contributor), Borg, M. (Contributor), Storm, K. (Contributor), Deppert, K. (Contributor) & Johansson, J. (Contributor)

2017

**Device Research Conference (DRC) (Event)**

Borg, M. (Editorial board member)

2016 Oct 1 → 2019 Jul 1

**Andreas Malmgren**

Borg, M. (First/primary/lead supervisor)

2016 → 2017

### **IEEE Transactions on Nanotechnology (Journal)**

Borg, M. (Associate editor)

2015 Nov 1

## **Prizes and Distinctions**

### **Göran Linds Pris**

Borg, M. (Recipient), 2019

### **Senior IEEE Member**

Borg, M. (Recipient), 2022 Jun

### **SSF ICA-7**

Borg, M. (Recipient), 2017 Apr 10

## **Awards**

### **Ferroelectric Tunnel Junctions at the Ultimate Scaling Limit**

Borg, M. (PI)

Swedish Research Council: SEK3,710,000.00

2024/01/01 → 2028/12/31

## **Projects**

### **SEQUENCE: Cryogenic 3D Nanoelectronics (Sense and Readout Electronics Cryogenically Integrated for QUantum ENhanced Computation and Evolving Communication)**

Svensson, J. (Administrator), Borg, M. (Researcher), Fhager, L. (Administrator), Lind, E. (CoPI), Wernersson, L.-E. (Project coordinator) & Södergren, L. (Research student)

2020/01/01 → 2023/12/31

### **Ferroelectric Tunnel Junctions at the Ultimate Scaling Limit**

Borg, M. (PI)

Swedish Research Council

2024/01/01 → 2028/12/31

### **III-V Devices for Emerging Electronic Applications**

Olausson, P. (Research student), Lind, E. (Supervisor) & Borg, M. (Assistant supervisor)

2019/07/01 → 2024/02/23

### **INSIGHT: Integration of III-V Nanowire Semiconductors for next Generation High Performance CMOS SOC Technologies**

Wernersson, L.-E. (Project coordinator), Borg, M. (Administrator), Svensson, J. (Researcher), Zota, C. (Research student), Lindelöw, F. (Research student), Jönsson, A. (Research student), Lind, E. (Researcher), Kilpi, O.-P. (Research student), Fhager, L. (Researcher), Andric, S. (Research student) & Hellenbrand, M. (PI)

2015/12/01 → 2019/05/31

### **Integration of III-V semiconductor on Si by Rapid Melt Growth**

Menon, H. (Researcher) & Borg, M. (Supervisor)

2018/05/01 → 2023/06/30

### **MAGMA: Melting into Applied inteGrated MAterials**

Borg, M. (PI) & Menon, H. (Research student)

Swedish Foundation for Strategic Research, SSF

2017/09/01 → 2020/09/01

**NIPS: Neuromorf innovationsplattform för Sverige**

Behmanesh, B. (CoPI), Borg, M. (CoPI) & Mikkelsen, A. (CoPI)  
Swedish Government Agency for Innovation Systems (Vinnova)  
2024/11/12 → 2025/07/11

**Robust neuromorphic computing using ferroelectric memristors**

Borg, M. (Researcher)  
Swedish Foundation for Strategic Research, SSF  
2022/03/01 → 2024/12/31

**Ultra-fast thermal processing for next-generation ferroelectric hafnia**

Borg, M. (PI)  
Swedish Research Council  
2019/01/01 → 2023/12/31