

Mattias Borg
Nano Electronics
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

Research:

My research interests lie in the development of nanotechnology for applications in electronics and neuromorphic computing. I do materials-driven research with the aim understand and control the physics and processes involved in realizing new nanoelectronic device concepts.

Ferroelectric memristors: I currently focus on developing ferroelectric tunnel junction memristive devices based on HfO₂ thin films, and their integration with III-V semiconductors. I am exploring the ability of these devices to function as synapses in artificial neuromorphic systems.

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

Project manager, Senior lecturer

Nano Electronics
Lund University
Sweden

2016 Nov 9 → present

Principal investigator

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

Simulations of current transport phenomena in ferroelectric tunnel junctions

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

Semiconducting TiO₂ 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

Neuromorf beräkning i memristorförbättrande analoga kretsar

Borg, M. (PI)

Swedish Foundation for Strategic Research, SSF: SEK2,500,000.00

2023/01/01 → 2027/12/31

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

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

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