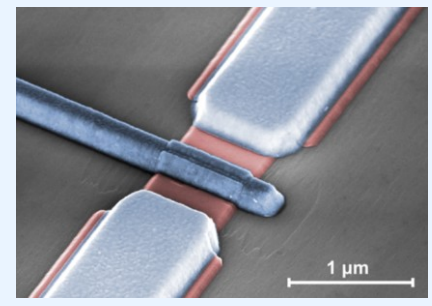
Master's Theses in Nanoelectronics

The nanoelectronics group at the department of Electrical and Information Technology (EIT) is offering master projects in different areas. If you are a highly motivated student interested in a project in a very exciting and active field of research please contact us. You will be supervised by an experienced researcher but you are still expected to be able to work at a high level of independency. Below we present the research areas of the group.

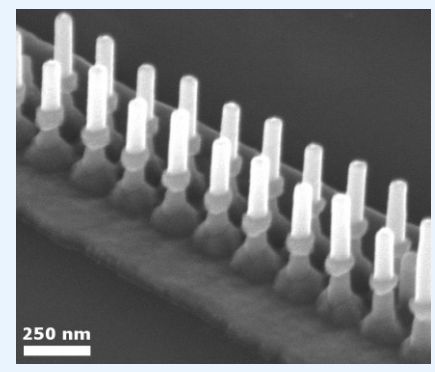
NANO ELECTRONICS GROUP

Nanowire Transistors
We utilize a bottom-up approach to epitaxially grow III-V nanowires for high performance transistors. All material growth, processing and electrical (DC and RF) characterisation are performed in-house.



Lateral InGaAs MOSFETs - Our transistors operate close to the ballistic limit where carrier scattering in the channel becomes negligible resulting in state-of-the-art performance.

Vertical InAs/InGaAs MOSFETs - We use a nanowire with a larger band gap drain region to achieve low off-state currents and high breakdown voltages while relying on the good transport properties of InAs in the channel.



Vertical InAs/GaSb CMOS Integration - To use III-V technology for digital applications we integrate both n- and p-type nanowire transistors on Si and demonstrate logic gates.

Tunneling Field-Effect Transistors - To enable low power operation we utilise a heterostructure nanowire to achieve subthreshold slopes below the thermal limit and achive better performance than state-of-the-art Si MOSFETs at low biases.

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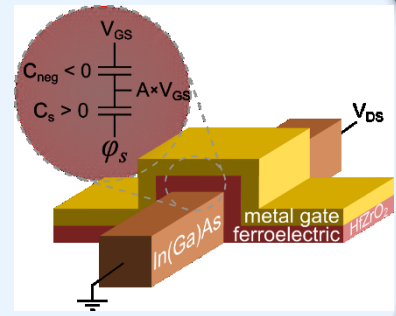
Ferroelectrics for Negative Capacitance Transistors
We investigate ferroelectric materials that can be integrated in the gate stack of MOSFET to enable a negative capacitance region resulting in a steep subthreshold slope



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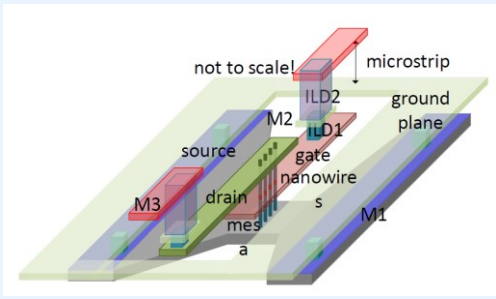
Nanowire Amplifier Circuits
Our lateral and vertical nanowire transistors are integrated in amplifier circuits using a back-end-of-line process. We model and design the circuits to match the passive elements and interconnects to the performance of the transistor technology. There is also involvement possibilities in a startt -up



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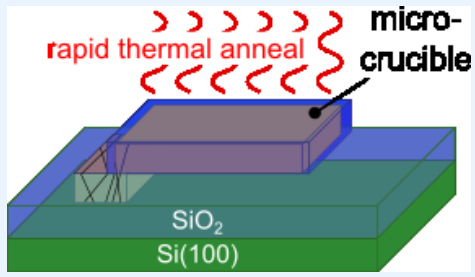

Rapid Melt Growth of III-V Semiconductors
By rapid heating of group III and group V materials deposited on a wafer it is possible to form a high quality III-V crystal starting at a Si nucleation site. We aim to accurately control the composition of InGaAs to be used e.g. for nanowire transistors.

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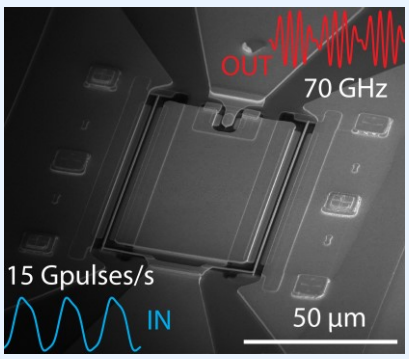

Pulse Generators
We are developing low-power, mm-wave pulse generators based on III-V resonant tunnel diodes (RTDs). Applications of these circuits range from spectroscopy and high resolution imaging (e.g. for medical applications) to consumer applications like gesture control of handheld devices.

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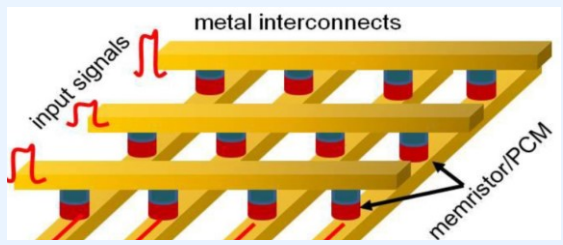
Neuromorphic Circuits
New device concepts and geometries are needed for low power parallel brain-inspired computing. We are combining our vertical nanowire transistors with memresistors to construct neuromorphic networks.



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