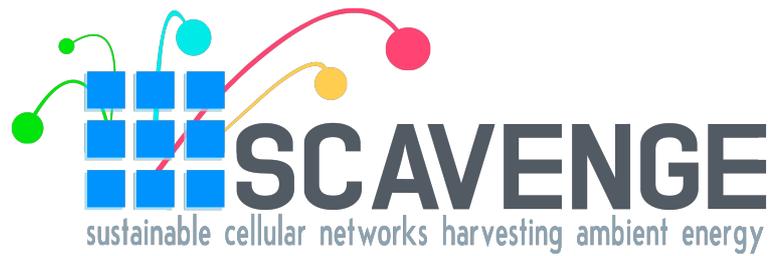


**University of Padova,  
Dept. of Information Engineering**

**2017 Summer School of Information Engineering,**

**Technologies for Energy Sustainability**



**Casa della Gioventu'  
via Rio Bianco  
39042 Bressanone (BZ), Italy  
July 2 – 8, 2017**

*the co-Directors*

prof. Gaudenzio Meneghesso, [gauss@dei.unipd.it](mailto:gauss@dei.unipd.it)

prof. Silvano Pupolin, [pupolin@dei.unipd.it](mailto:pupolin@dei.unipd.it)

**University of Padova, Dept. of Information Engineering**  
**2017 Summer School of Information Engineering,**  
**Bressanone (Brixen, BZ), Italy - July 2 – 8, 2017**  
**Technologies for Energy Sustainability**

**Sunday 2/7 (Grüner Baum Hotel)**

**17:00 – 19:00** SSIE Opening (Gaudenzio Meneghesso, Silvano Pupolin)

**Monday 3/7 (Casa della Gioventù)**

**9:00 – 10:00** **Gaudenzio Meneghesso, Michele Rossi**, *Department of Information Engineering, University of Padova*: “Summer School introduction, program description, introduction to InRel-NPower and SCAVENGE”

**10:00 – 12:30** **Paolo Dini**, *Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain*, **Plenary** “SCAVENGE: vision, achievements and research roadmap”

**14:00 – 16:30** **Peter Moens**, *On Semiconductor, Belgium* **Plenary** “General Overview of GaN based Power Devices”

**Tuesday 4/7: (Casa della Gioventù)**

**9:00 – 12:30** **Paolo Dini**, *Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain*, **Network** “Energy Sustainable Architecture and Methods for Future Mobile Communication Networks”

**14:00 – 15:30** **J. Derluyn**, *EpiGaN, Belgium*, **E. Meissners**, *Fraunhofer IISB, Erlangen Germany*, **Technology** “Materials and Epigrowths for wide bandgap semiconductors devices”

**16:00 – 17:30** **F. Medjdoub**, *CNRS-IEMN Lille, France*; **Technology** “Device processing and architectures in Gallium Nitride based semiconductors”

**Wednesday 6/7: (Casa della Gioventù)**

**9:00 – 10:30** **M. Meneghini**, *Department of Information Engineering, University of Padova*, **Technology** “Performances and Reliability of wide bandgap semiconductors devices”

**11:00 – 12:30** **M. Rittner**, *BOSCH, Germany*; **Technology** “Passives and Packaging of wide bandgap semiconductors devices”

**14:00 – 15:30** **M. Rossi**, *Department of Information Engineering, University of Padova* **Network** “Data Analytics for Smart Cities: the Vehicular Traffic Case”

**16:00 – 17:30** **L. Giupponi**, *Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain*, **Network** “Mobile Network Measurements with the OWL online LTE watcher”

**19:30 – 22:00** **Social Dinner**

**Thursday 7/7: (Casa della Gioventù)**

**9:00 – 10:30** **Workgroup, Network** “Energy Modelling”

**11:00 – 12:30** **Workgroup, Network** “Network Architecture and Management”

**14:00 – 15:30** **K. Kriegel**, *SIEMENS Germany*, **Technology** “Industrial applications of wide bandgap semiconductors devices”

**16:00 – 17:30** **P. Bleus** *CE+T, Belgium*; **Technology** “Applications in Energy saving of wide bandgap semiconductors devices”

**Friday 8/7: (Casa della Gioventù)**

**9:00 – 12:00** **A. Testolin**, *Department of General Psychology, University of Padova*. **Plenary** “Discovering latent structure from big data using neural networks”

**14:30 – 16:30** **Student Presentations Workshop**

**Saturday 9/7: (Grüner Baum Hotel)**

**9:00 – 11:00** **SSIE 2017 Closing - Final test (for those who need the 2 ECTS)**

Alternative: to write a report on a topic assigned by the Directors to be returned by the end of July 2017.

**Peter Moens, ON Semiconductors, Belgium**

“General Overview of GaN based Power Devices”

**Abstract:** this course will provide an introduction to GaN based power devices. The following topics will be addressed (each topic including state-of-the art literature review): 1) Why a new generation of more efficient power devices is needed? 2) Derive the Baliga Figure of Merit for power devices (student exercise) and interpretation of the result. Challenge the assumptions which are used to derive the equation. 3) Brief overview of the main materials for power devices (Si, SiC, GaN, AlN, Ga<sub>2</sub>O<sub>3</sub> and diamond); 4) Basic material properties of GaN; 5) Polar versus non-polar materials. 6) Concept of polarization charge; 7) Ternary and quaternary alloys; 8) Different device architectures: High Electron Mobility Transistors (“HEMT”) versus standard junction transistors: impact of device concept on on-resistance and capacitance (make link to the Baliga figure-of-merit); 9) Depletion mode and enhancement mode devices. Basic band structure; 10) Lateral and vertical GaN-based devices; 11) Dynamic Ron, and how to characterize; 12) Application testing results.

**Peter Moens** received a M.Sc. and a Ph.D. in solid state physics from the University of Gent, Belgium, in 1990 and 1993 respectively. From 1993 till 1996, he worked as a post-doctoral fellow in collaboration with Agfa-Gevaert, Mortsel Belgium. In 1996, he joined ON Semiconductor, Oudenaarde, Belgium where he was involved in the technology and device development for smart power applications, and the related reliability aspects. Since 2008 he is responsible for the development of 600V discrete power devices, both in silicon as well as in wide band gap materials. He is/was a member of the technical program committees of IEDM, ISPSD, IRPS, IRW, ESSDERC and ESDEOS Symposium. He was Vice-chair of the integrated power subcommittee of IRPS 2005 and 2008, and Chair of the same committee of IRPS 2006 and IRPS 2007. He was the Technical program chair of ISPSD 2009, and the General chair of ISPSD 2012. He was the subcommittee chair of the Power and Compound semiconductor devices subcommittee for IEDM 2014. He authored and co-authored over 150 publications in peer reviewed journals or conferences, of which over 60 as first author. He authored or co-authored of 12 invited papers and is the recipient of 3 best paper awards. He also presented tutorials on smart power reliability at IRPS 2005, IRPS 2006 and ISPSD 2007, and on GaN power device reliability at IRPS2015. He holds over 25 patents.

**Paolo Dini, Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain,**

“Energy Sustainable Architecture and Methods for Future Mobile Communication Networks”

**Abstract:** We are now living the digital era. Dematerialization is becoming a reality, and everybody and everything, including machines, is globally connected through the Internet. The trend is of a further increase in traffic demand, number of offered services and connected devices, especially mobile. However, the massive use of Information and Communication Technologies (ICT) is also increasing the level of energy consumed by that system and its footprint on the environment. In 2030 ICT is expected to consume 51% of the electricity generated and will be responsible of 23% of the carbon footprint by human activity. Sustainable design of ICT, and specially of mobile networks, is, therefore, a key and challenging sector for societal prosperity. In this talk, we will elaborate on the architecture of the future mobile networks, often referred to as 5G (5th Generation), and its interaction with the electricity grid. The integration of the radio access network with a distributed renewable energy system will be discussed, by reporting the main building blocks and methods to achieve the self-sustainability of the integrated system.

**Paolo Dini (MSc 2001, PhD 2005)** is a Senior Researcher at the Communication Networks division of the Centre Tecnològic de Telecomunicacions de Catalunya (CTTC). Formerly he worked as a research assistant in the Computer Science and Systems (DIS) and Information and Communication (INFOCOM) departments of the Università di Roma “La Sapienza” (2001 - 2005). In 2005 he worked with the Research Center on Software Technologies (RCOST) as a research assistant. In the same year he was also an assistant professor at INFOCOM department lecturing the course of “Comunicazioni Elettriche”. In 2008 and 2011 he received two grants from the Cisco Research Centre (San José, US) for his research on heterogeneous mobile networks. Paolo has an active participation in research projects and he is currently the coordinator of the SCAVENGE European Training Network on energy harvesting cellular networks. He published more than 50 papers in scientific journals, magazines and international conferences and serves many IEEE conferences and journals as a technical reviewer. His research interests encompass wireless networks modelling and optimization, with particular emphasis on energy saving and energy efficiency, energy sustainable network architectures, protocols and algorithms, smart grids, self-organizing networks, cognitive networking and machine learning, radio resource and mobility management.

**Joff Derluyn, EpiGaN, Belgium, “Materials and Epigrowths for wide bandgap semiconductors devices”**

**Abstract:** This 1h course will provide an introduction to material aspects of GaN and its epitaxy. The following topics will be addressed: 1) III-V semiconductor overview (bandgap vs. lattice constant), 2) Device examples (build an LED); 3) Polarity in crystals, 4) QCSE; 5) Derive 2DEG from polarization charges; 6) HEMT / Surface passivation; 7) Epitaxial growth; 8) MOCVD and other techniques; 9) Basic concepts (Boundary layer model, thermodynamics); 10: Material characterisation techniques; 11) Mismatch; 12) GaN hetero-epitaxy, esp. GaN on Si; 13) Nucleation; 14) Buffer concepts.

**Joff Derluyn** Co-founder and CTO of EpiGaN ([www.epigan.com](http://www.epigan.com)), the leading and only European provider of GaN-on-Si and GaN-on-SiC epimaterial. In that capacity, responsible for the R&D roadmap, IP strategy and main responsible for public funded projects (ESA, EU-FP7, EU-H2020, EU-ECSEL). Experience working in a VC-backed company, with exposure to all facets of starting-up and growing a business. People-, project-, operational and strategic management skills. Team-player. Over 20 years of experience in MOCVD epitaxy and device processing of III-N and III-V semiconductor materials and devices. Profound understanding of epitaxial challenges, material properties and device physics. Design of epitaxial layer stacks and process flows for electronics and optoelectronics. Combination of creativity and scientific understanding, which resulted in over 10 granted patents and many more pending patent applications in the field of III-N electronics. Author or co-author of over 100 peer-reviewed publications. Reviewer for high impact scientific journals such as APL, EDL and TED. Member of NEREID expert committee to set up a roadmap for wide bandgap semiconductors. Member of several PhD committees on the topic of GaN.

**Farid Medjdoub**, *CNRS-IEMN Lille, France*

“Device processing and architectures in Gallium Nitride based semiconductors”

**Abstract:** Group-III nitride, gallium nitride (GaN) is a promising wide-bandgap semiconductor. GaN-based High Electron Mobility Transistors were originally developed for high-power high-frequency amplifiers, however, in the last decade research and dedicated development efforts were carried out on AlGaIn/GaN HEMTs grown on large diameter silicon substrates producing cost-effective high-efficiency power switching devices, which commercial companies have started to mass produce. They have a great impact on consumer electronics, permitting advanced power electronics due to their excellent performance such as low on-resistance and high switching speed. In this lecture, an in-depth description of the device processing and architectures in Gallium Nitride based semiconductors will be given.

**Farid Medjdoub** is a CNRS senior scientist and head of the wide bandgap activities at IEMN in France since 2011. He received his Ph.D. in Electrical engineering from the University of Lille in 2004. Then, he moved to the University of Ulm in Germany as research associate before joining IMEC as a senior scientist in 2008. Multiple state-of-the-art results have been realized in the frame of his work. Among others, world record thermal stability up to 1000°C for a field effect transistor, best cut-off frequency / breakdown voltage or highest lateral GaN-on-silicon breakdown voltage using a local substrate removal have been achieved. His research interests are the design, the fabrication, and characterization of innovative GaN-based devices. He is author and co-author of more than 100 papers in this field. He holds several patents deriving from his research. He serves as a reviewer for IEEE journals and is a TPC member in several conferences. He is also part of the French observatory of wide bandgap devices.

**K. Kriegel**, *SIEMENS Germany*,

“Industrial applications of wide bandgap semiconductor devices”

**Abstract:** The lecture starts with an overview of current silicon power electronics devices and the properties and existing problems. The new WBG materials silicon carbide (SiC) and Galliumnitride (GaN) and the power electronics devices from these materials will be introduced and their main properties are discussed. Then the lecture will give a wide overview of the different application fields e.g. industrial, automotive, aerospace and energy conversion. The lecture is as well on the special challenges on packaging for high temperature, high power density and high reliability.

**Dr. Kai Kriegel** received a degree in electrical engineering and a degree in business administration from the RWTH Aachen University. He was working at the Institute of Ferrous Metallurgy of the RWTH Aachen University and received the Dr.-Ing. degree in 2001. Since 2001 he has been working at Siemens Corporate Technology in Munich as project manager on different R&D projects in the field of power electronics and drive technology, especially for automotive and aerospace applications.

**Alberto Testolin**, *Department of General Psychology, University of Padova*.

“Discovering latent structure from big data using neural networks”

**Abstract:** Recent theoretical and technical progress in artificial neural networks has significantly expanded the range of tasks that can be solved by machine intelligence. In particular, the advent of powerful parallel computing architectures based on graphic processing units, coupled with the availability of “big data”, now allows to create and train large-scale, hierarchical neural networks known as deep neural networks (LeCun, Bengio, & Hinton, 2015). These powerful learning systems achieve impressive performance in many challenging machine learning tasks, such as visual object recognition, speech processing and natural language understanding. In this seminar I will review the main theoretical foundations of artificial neural networks, discussing both supervised and unsupervised forms of deep learning, and sequential architectures based on recurrent networks. I will then provide examples and case studies related to a variety of cognitive tasks, as well as their applications on difficult optimization problems. During a practical, “hands-on session” students will be encouraged to train and analyze their own models on a simple pattern recognition problem.

**Alberto Testolin** received the M.Sc. degree in computer science and the Ph.D. degree in cognitive science from the University of Padua, in 2011 and 2015, respectively. He is currently a post-doctoral researcher with the University of Padua, focusing on computational modeling of cognitive processes. His main interests include deep learning, recurrent neural networks and probabilistic generative models, which are applied to investigate visual processing and attentional mechanisms. During his PhD, he developed a neurocomputational framework to simulate cognitive functions based on unsupervised deep learning. Besides his primary interest in cognitive science, he works with computer scientists to improve the computational aspects of learning models, for example by exploiting parallel computing architectures (GPUs) or by inventing novel learning algorithms. He also collaborates with electronic engineers to improve telecommunication technologies by optimizing wireless and underwater data transmission. He has been recently invited as instructor to the annual meeting of the Cognitive Science Society, where he discussed his unsupervised modeling approach on a special workshop dedicated to deep learning

**General info.** All info can be found at: <http://www.dei.unipd.it/ssie>

**Venue:** Casa della Gioventù, via Rio Bianco, 39042 Bressanone, Italia

**Participation at the SSIE:** All those young researchers and PhD students who wish to participate at the SSIE must send an e-mail to: [gauss@dei.unipd.it](mailto:gauss@dei.unipd.it)

**How to Submit a Proposal** All those young researchers and PhD students who wish to present their research activities at the Workshop, should send an email to [gauss@dei.unipd.it](mailto:gauss@dei.unipd.it) clearly indicating:

- Name
- Affiliation/Postal Address
- Phone/Fax
- Contact Email
- Title of the Presentation
- Abstract (e-mail format is also OK)

Please use English language. **The deadline for submitting proposals is June 30th 2017.**

**Presenting your Research Activity at SSIE** Each presenter will be assigned a slot of 20 minutes, including 5 minutes for questions. All presentations will be in English.

**Registration & Fee** The organizing committee decided that the School has no registration fee for PhD students, but participants will have to pay for their travel and living expenses.

For organization purposes all the participants are invited to Register by sending an e-mail either to [gauss@dei.unipd.it](mailto:gauss@dei.unipd.it)

with subject: Registration to Summer School on Information Engineering 2016

clearly indicating:

- Name
- Affiliation/Postal Address
- Phone/Fax
- Contact Email

**Accommodation:** As for the past years we have an agreement with **Grüner Baum Hotels** ([www.gruenerbaum.it](http://www.gruenerbaum.it)) in Bressanone which will give lodging for all the persons attending the Summer School of Information Engineering (students, teachers and accompanying persons) at discount prices (**July 2th 2017 - July 7th 2017 only**) (see SSIE website for details: <http://www.dei.unipd.it/ssie>)

Net prices	
single room	69.00 Euro per person per day (breakfast included)
double room	53.50 Euro per person per day (breakfast included)
double room (single use)	90.50 Euro per person per day (breakfast included)
half pension supplement	17.50 Euro per person per day
meal	9,30 Euro for a first course
<b>Discount prices if staying for 3 or more nights</b>	
single room	57.50 Euro per person per day (breakfast included)
double room	46.50 Euro per person per day (breakfast included)
double room (single use)	74.00 Euro per person per day (breakfast included)

Taxes: Euro 2,00 per person/night.

Included in the prices:

- Breakfast Grande buffet
- Entrance to swimming pool
- The BRIXENCARD

**Bookings can be done by phone or FAX or e-mail with the reference: "Scuola Estiva Prof. Pupolin"**