Capita Selecta Lectures of Nanoscience and Nanotechnology H6L3 & H6N2

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Program and Abstracts

Academic Year 2016-2017

Introduction

How does so-called Nanoscience and Nanotechnology impact on modern society?
What are important scientific and technological nanotech fields at present?
What novel properties are created by precise manipulation of materials at atomic scale?
Can we construct novel building blocks with nano-scale precision and for what purpose?
What is the link between nanotech and life science?
What are there ethical or legal aspects we should know and care about?
What business opportunities arise in e.g. life-science, biotech, ICT or consumer products?

In the academic year 2016-2017, the 11th edition, Capita Selecta Lectures of Nanoscience and Nanotechnology[1], comprises of 13 lectures that will address a.o. the above questions. The lecturers are local and international experts on the selected topics, of which you can find the program details in this brochure. The topics are selected with input from the Erasmus Mundus program partners[2] and input from the students.

The topics, dates and location of the 2016-2017 lectures are as follows:

	Name	**Affiliation**	Titel
14-Feb	Myny Kris	imec	Flexible circuits based on metal-oxide thin-film transistors
21-Feb	Sun Jie	Chalmers Univ. of Techn.	Delaminating CVD graphene from its metal substrate by “bubbling”
28-Feb	Splettstoesser Janine	Chalmers Univ. of Techn.	Thermoelectric effects at the nanoscale
7-Mar	Croy Alexander	Dresden Univ. of Techn.	Nanomechanical resonators: fundamental questions and current applications
14-Mar	Rottenberg Xavier	imec	Electrostatic transducers and photonic devices for sensing applications
21-Mar	Bardon Maria Garcia	imec	Design-technology co-optimization to push the scaling limits of digital CMOS circuits
28-Mar	Baets Roel	Univ. Gent	Silicon photonics: from transceivers to life science applications
18-Apr	Balland Martial	Univ. Joseph Fourier	New ways to interrogate cellular decision making
25-Apr	Vereecken Philippe	Imec	Nanomaterials for energy storage
2-May	Vergauwe Nicolas	Biocartis	From (bio)sensors to diagnostics: challenges and pitfalls
9-May	Chauvin Jérôme	l’Univ. Grenoble Alpes	Photo and electro-chemistry of molecular architectures based on coordination complexes
16-May	Barthelemy Mathieu & Kerstel Erik	l’Univ.Grenoble Alpes	Quantum Physics with a Nanosatellite
23-May	Urban Alan	NERF	Decoding the brain black box using innovative technologies

[1]These lectures are organized in the frame of the Courses H6L3 “Capita Selecta of Nanoscience and Nanotechnology” within the Master of Nanoscience and Nanotechnology at the K.U.Leuven and H6N2 “Erasmus Mundus Lectures on Nanoscience and Nanotechnology”.
[2]K.U.Leuven, TU Dresden, Chalmers University and the Université Jean Fourrier Grenoble.

All lectures are broadcast live by the Audio-Visual department of the K.U. Leuven (ICTS) to all Erasmus Mundus partner universities using a Virtual Classroom concept. The lectures are open to everyone interested in the field and compulsory for the students in both Master programs. All lectures are always followed by a discussion session involving the lecturers, the students and nanotechnology professionals.

We look forward to welcome you at the Capita Selecta Lectures.

Prof. Jo De Boeck, Coordinator H6L3/H6N2
December, 2016.

Capita Selecta of Nanoscience and Nanotechnology

Program, Abstracts and CV's

Program

Tuesday, 14 February 2017, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Kris Myny, imec, Belgium
Flexible circuits based on metal-oxide thin-film transistors

Tuesday, 21 February 2017, 5-7pm (Broadcast from Chalmers)
Dr. Sun Jie, Chalmers Univ. of Technology, Sweden
Delaminating CVD graphene from its metal substrate by "bubbling"

Tuesday, 28 February 2017, 5-7pm (Broadcast from Chalmers)
Dr. Janine Splettstoesser Janine, Chalmers Univ. of Technology, Sweden
Thermoelectric effects at the nanoscale

Tuesday, 7 March 2017, 5-7pm (Broadcast from Dresden)
Dr. Alexander Croy, Dresden Univ. of Technology, Germany
Nanomechanical resonators: fundamental questions and current applications

Tuesday, 14 March 2017, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Xavier Rottenberg, imec, Belgium
Electrostatic transducers and photonic devices for sensing applications

Tuesday, 21 March 2017, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Maria Garcia Bardon, imec, Belgium
Design-technology co-optimization to push the scaling limits of digital CMOS circuits

Tuesday, 28 March 2017, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Roel Baets, Univ. Gent, Belgium
Silicon photonics: from transceivers to life science applications

Tuesday, 18 April 2017, 5-7pm (Broadcast from Grenoble)
Dr. Martial Balland, Université Joseph Fourier, France
New ways to interrogate cellular decision making

Tuesday, 25 April 2017, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Philippe Vereecken, Imec, Belgium
Nanomaterials for energy storage

Tuesday, 2 May 2017, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Nicolas Vergauwe, Biocartis, Belgium
From (bio)sensors to diagnostics: challenges and pitfalls

Tuesday, 9 May 2017, 5-7pm (Broadcast from Grenoble)
Dr. Jerome Chauvin, l'Univ. Grenoble Alpes, France
Photo and electro-chemistry of molecular architectures based on coordination complexes

Tuesday, 16 May 2017, 5-7pm (Broadcast from Grenoble)
Drs. Mathieu Barthelemy & Kerstel Erik, l'Univ. Grenoble Alpes, France
Quantum Physics with a Nanosatellite

Tuesday, 23 May 2017, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Alan Urban, NERF, Belgium
Decoding the brain black box using innovative technologies

Capita Selecta of Nanoscience and Nanotechnology

Abstracts & CV's

Tuesday, February 14, 2016, 5-7pm
Kris Myny, imec, Belgium

Flexible circuits based on metal-oxide thin-film transistors

Metal-oxide thin-film transistor technologies find today their application in display products acting as active component in backplanes to drive LCD or OLED frontplanes. These transistors implemented in a thin-film transistor circuit are also ideally suited for next generation connected products that embed such low-cost, flexible, ultrathin circuits in everyday items. Item-level Internet-of-Things applications are therefore the main driving force for the research on metal-oxide RFID circuits. In this lecture, we will discuss the current state-of-the-art of thin-film RFID tags, including the first product prototype together with our partner company Cartamundi. In addition, we will discuss the roadmap to upscaled manufacturing and the next generation thin-film circuit activities.

Dr. Kris Myny

Dr. Kris Myny (male; Senior researcher) was born in Hasselt, Belgium on July 26, 1980. He received the master degree at the Katholieke Hogeschool Limburg in Diepenbeek, Belgium in 2002. He joined imec in Leuven in 2004 as a member of the Thin Film Electronics group. In January 2013, he received the Ph.D. degree at the KULeuven on the design of thin-film transistor circuits. Today, Kris leads circuit design activities in emerging thin-film transistor technologies for IoT applications and published numerous ISSCC conference papers, amongst others RFID tags and the world-first flexible microprocessor. He received the imec 2010 scientific excellence award, the 2011-2012 IEEE SSCS Predoctoral Achievement Award and is co-recipient of the 2012 JSID Outstanding Student Paper of the Year Award.
He has recently been awarded with a prestigious ERC Starting Grant for the period 2017-2021 aiming to innovate on the field of metal-oxide thin-film circuits and systems.

Tuesday, February 21, 2017, 5-7pm
Jie Sun, Chalmers University of Technology, Sweden

Delaminating CVD graphene from its metal substrate by "bubbling"

Graphene is a new wonder material. It is one layer of carbon atoms in hexagonal lattice. High quality graphene has the world's highest electron mobility, thermal and electrical conductivity, flexibility, etc. It has high potential in future nanoelectronics. However, before we talk about any applications, we first need to synthesize graphene. Today the most electronic-industry compatible technology is CVD (chemical vapor deposition). But this is typically done on a metal substrate such as copper. How to nicely transfer the graphene from the metal substrate to the target substrate such as SiO_2 for practical use? How to make the process of low cost and environmental friendly? This talk will introduce the experiment and theory on an interesting process of delaminating graphene from metals by "bubbling". Some basic background knowledge of graphene will also be introduced, together with an overview into applications.

Prof. Jie Sun

Jie Sun (Senior member of IEEE) was born in 1977. He holds two PhD degrees from Institute of Semiconductors, Chinese Academy of Sciences, and Solid State Physics Division, Lund University, Sweden. He has been a Postdoctoral Fellow, Assistant Professor and Associate Professor in Chalmers University of Technology, Sweden. He is also an Adjunct Professor in Beijing University of Technology, China. His major is semiconductor and carbon materials and devices. In particular, he focuses on III-V and Si semiconductors, high-k dielectrics, ballistic and quantum transport, and carbon electronics. Currently, he is responsible for CVD of graphene and its applications in Chalmers and Beijing University of Technology. He has published about 80 papers covered by Web of Science. He is the only teacher of the world's first MOOC "Introduction to graphene science and technology" at edx.org. His current research results are in these fields:

1. *Catalytic and noncatalytic CVD of graphene on metals, dielectrics and semiconductors;*
2. *Eco-friendly electrochemical bubbling transfer of graphene (theory and technique);*
3. *CVD of h-BN, MoS_2 and hybrid electronic devices;*
4. *Graphene-GaN and graphene-organics optoelectronics;*
5. *Graphene in THz science;*
6. *Graphene's bio-applications (e.g. biochips).*

Tuesday, February 28, 2017, 5-7pm

Janine Splettstoesser, Chalmers University, Sweden

Thermoelectric effects at the nanoscale

I will start this lecture with a short introduction to thermoelectric effects in general, their applications and arising challenges.

The motivation to study **thermoelectric effects in devices at the nanoscale** is twofold. On one hand nanoelectronic devices are promising for applications in future information technology; naturally, cooling of these systems will be a true challenge that requires continued research efforts.

But there are also urging fundamental questions and new possibilities that emerge when studying the thermodynamics of nanoscale devices. This lecture will show how quantum effects (like a discrete energy spectrum) and the extremely small size of the devices (possibly smaller than the thermalization length) give rise to unexpected features relevant for thermoelectrics.

Dr. Janine Splettstößer

Janine Splettstößer received her Diploma in Physics from the University of Karlsruhe (TH) in Germany in 2003 and her PhD in 2007 as a combined degree from Ruhr-Universität Bochum in Germany and Scuola Normale Superiore di Pisa in Italy. After a postdoctoral research stay in the group of Markus Büttiker in Geneva in Switzerland, she has led a junior research group at the RWTH Aachen in Germany from 2009 to 2013. She is now an Associate Professor at the Department for Microtechnology and Nanoscience at Chalmers, Gothenburg, in Sweden. Janine Splettstößer's research in the field of Theoretical Physics deals with electronic and thermal properties and the dynamics of nanoscale devices.

Tuesday, March 7, 2017, 5-7pm
Alexander Croy, TU Dresden, Germany

Nanomechanical resonators: fundamental questions and current applications

The field of nanomechanics has been flourishing in the past couple of years. In particular the prospect of creating ultra-sensitive mass and force sensors was a major driving force. Moreover, the possibility to study fundamental aspects of (quantum) mechanical properties at the nanometer scale makes this subject very attractive and interesting. The low mass and small sizes of typical resonator devices allow for very high resonator frequencies and high quality factors. However, it was also found that nonlinear effects - like Duffing nonlinearity and nonlinear damping - play an important role for such systems. In this lecture I will introduce some of the relevant nonlinear properties, their physical origin and consequences. Additionally, recent and prospect developments in the field will be discussed.

Dr. Alexander Croy

Alexander studied physics at TU Chemnitz (Germany) and at the University of Warwick (UK), where he also got his MSc (by Research) in 2006. For his PhD he joined the Max Planck Institute for the Physics of Complex Systems (MPIPKS) in Dresden. There, he worked on time-dependent nano electronics. After being postdoc at MPIPKS and TU Chemnitz, Alexander joined the Condensed Matter Theory group at Chalmers University of Technology (Sweden). There the focus of his research shifted to (carbon-based) nanoelectromechanical systems. In 2014 he became Distinguished PKS Postdoctoral Fellow at the MPIPKS. In July 2016 he joined the chair of Prof. Cuniberti at TU Dresden, where he works on computational nanomechanics.

Tuesday, March 14, 2016, 5-7pm
Xavier Rottenberg, imec, Belgium

Electrostatic transducers and photonic devices for sensing applications

Microelectronics experiences since the early seventies a period of sustained run-away development. Researchers strive to keep up with and fulfill Moore's law by scaling transistors down thus cramming always more circuits, more computing power and more functions on a chip always smaller and faster. However, this More of Moore era is said to be coming to an end.

The past decades have seen a paradigm shift. Acknowledging the limitations of the scaling model for microelectronics, the emergence of novel technology drivers and appearance of new usage scenarios, e.g. low power, nomadism, health care and health monitoring, ..., researchers started exploring alternative technological paths. This defines the so-called More than Moore approach that departs from the one-technology-fits-all approach and aims at developing a plurality of diverse ad-hoc technologies and according interfacing solutions. MEMS (micromachining/microsystems) is one of these technologies that enables the development of novel transducers for always smarter systems.

This presentation introduces the basics of electrostatic MEMS devices, i.e. their actuation and operation as sensor, their functions through some sensor examples and their main reliability issues. Finally, this presentation will sketch the main characteristics of novel emerging photonic technologies for (bio-)sensing and imaging applications.

Dr. Xavier Rottenberg

Xavier (born 1976) obtained the M.S. degree in Phys. Eng. and the DEA in Theoretical Physics from the "Université Libre de Bruxelles" in 1998 and 1999, respectively. He obtained in 2008 his PhD degree in Elec. Eng. from the KULeuven. He worked one year at the Royal Meteorological Institute of Belgium in the field of remote sensing from space. He has been at IMEC Leuven, since 2000, where he contributes to research in the field of RF, RF-MEMS, photonics and microsystems modelization/integration. In these fields, he has co-authored over 60 peer-reviewed papers and has been issued various patents. He currently leads at IMEC the Microsystems Design and Modeling team working among other topics on photonics, sensors, acoustics, M/NEMS, etc.

Tuesday, March 21, 2017, 5-7pm
Marie Garcia Bardon, imec, Belgium

Design-technology co-optimization to push the scaling limits of digital CMOS circuits

Digital circuits have followed a constant pace of scaling: every two years, a new technology generation was produced with reduced area, reduced power, increased speed. The reduction of dimensions lead us today to fundamental limits in both fabrication and device physics. To continue this road of improvements and still get the most of CMOS based technologies, numerous disruptive innovations have to be considered at device and fabrication level, but also at circuit level. We will see how both technology and circuit are modelled and co-optimized in an early development phase to downselect the materials, devices, lithography, circuit options that allows to push forward the CMOS scaling roadmap.

Dr. Marie Garcia Bardon

Marie Garcia Bardon *received the M.Sc. degree in electromechanical engineering from the Université Catholique de Louvain, Louvain-la-Neuve, in 2004, and the Ph.D. degree in microelectronics from the Katholieke Universiteit Leuven, in collaboration with imec, in 2010. Her PhD was on the fabrication, characterization, and modeling of suspended-gate transistors. Since then, she has been modeling and evaluating several devices for digital logic and memory applications, including FinFETs, Nanowires, Tunnel FET, Resistive RAMs. She has specialized in holistic pre-silicon evaluation of technology and circuit options, working closely together with circuit designers, device integration specialists and imec industrial partners.*

Tuesday, March 28, 2016, 5-7pm
Roel Baets, imec, Belgium

Silicon photonics: from transceivers to life science applications

Over the past years silicon photonics has become a game-changing technology for high speed transceiver products in telecommunication and datacommunication. It builds on the technological legacy of the CMOS-world to enable datalinks at 100 Gb/s and beyond. But the application of the technology in sensing and life science may have an even larger impact in the future. In this talk the field will be introduced and a variety of examples will be given, both in datacom and in lice science.

Dr. Roel Baets

Roel Baets received an MSc degree in Electrical Engineering from Ghent University in 1980 and a second MSc degree from Stanford University in 1981. He received a PhD degree from Ghent University in 1984. From 1984 till 1989 he held a postdoctoral position at IMEC (with detachment to Ghent University). Since 1989 he has been a professor in the Faculty of Engineering and Architecture at UGent where he founded the Photonics Research Group. From 1990 till 1994 he has also been a part-time professor at Delft University of Technology and from 2004 till 2008 at Eindhoven University of Technology.
Roel Baets has mainly worked in the field of integrated photonic components. He has made contributions to research on photonic integrated circuits, both in III-V semiconductors and in silicon. He has led major research initiatives in silicon photonics in Europe. In 2006 he founded the Multi-Project-Wafer service for silicon photonics: ePIXfab.
As part of a team of 8 professors he leads the Photonics Research Group at Ghent University. With about 80 researchers this group is involved in numerous national and international research programs. The silicon photonics activities of the group are part of a joint research initiative with IMEC. Roel Baets is also director of the multidisciplinary Center for Nano- and Biophotonics (NB Photonics) at UGent, founded in 2010. He was co-founder of the interuniversity UGent-VUB MSc programme in Photonics and of the European MSc programme in Photonics.
Roel Baets is a grant holder of the Methusalem programme of the Flemish government and of the European Research Council (ERC advanced grant). He is a Fellow of the IEEE, of the European Optical Society (EOS) and of the Optical Society of America (OSA) He is also a member of the Royal Flemish Academy of Belgium.

Tuesday, April 18, 2017, 5-7pm

Martial Balland, ERC laureate, Univ. Grenoble, France

New ways to interrogate cellular decision making

To survive and assemble into multicellular organism, cells need to migrate in specific directions either in order to find nutriments or define polarity axis in biological tissues. Cellular decision-making in defining those direction relies on a complex integration of various types of signals. How cells integrate all these cues in space and time to establish and maintain polarity to perform directed migration is a fundamental but unresolved problem.

Using a highly interdisciplinary approach based on our unique joint expertise in light shaping, cellular optogenetics, advanced microscopy and cell mechanics, I will discuss the strategy we developed to probe how living cells deals with signal treatment.

Dr. Martial Balland

Dr. Martial BALLAND graduated in biomechanics from the University Denis Diderot Paris 7 in 2001. He was trained as a biomedical engineer at Polytech Marseille and obtained his PhD at the University Denis Diderot (Paris) in Physics in the group of François Gallet in 2004. From 2004 to 2007, he was post-doctoral fellow in the lab of Pascal Martin, at the Curie Institute in Paris working on collective effects of molecular motors. In 2007, he became assistant Professor at the Grenoble University in the LIPhy Laboratory. His lab is focused in understanding the mechanisms of cellular perception and particularly in cell cytoskeleton mechanosensitivity, essential component of cellular architecture. His group possesses a strong experimental expertise in the fabrication of lab on chip devices for cell mechanics and in the optical study (image analysis for life sciences). His analysis of biophysical phenomena also led him to propose several simple methods (Tseng & al LOC 2011, Mandal & al. Plos one 2012, Bureau & al. Methods in Cell Biol. 2014) and also to give new insights to the role of active generated forces in various cellular processes ranging from cell division to cell shape regulation (Lafaurie Janvore & al. Science 2013, Mandal & al. Nature communications 2014).

Tuesday, April 25, 2017, 5-7pm
Philippe Vereecken, imec and K.U.Leuven, Belgium

Nanomaterials for energy storage

The lithium-ion battery (LiB) celebrates its 25^{th} anniversary this year, Despite many promises and announcements of scientific breakthroughs, the pace of improvements in LiB cell performance remains slow. Nanomaterials and nano-architectures have indeed the potential to enhance the charging rate and energy density of the battery cell, but parasitic side reactions and material integrity issues hinder its practical implementation. In this lecture, we will explore the fundamental hurdles and challenges for the introduction of nanomaterials into cell technology. Also the next generation battery technology concepts and roadmaps will be discussed.

Prof. Philippe Vereecken

Dr. Philippe Vereecken is Principal Member of Technical Staff at imec and associate professor at the University of Leuven (KU-Leuven). He received his PhD degree in Physical Chemistry at Ghent University (Belgium) in 1998. He then spent 7 years in the USA, first as a postdoctoral associate in the department of Materials Science and Engineering at The Johns Hopkins University in Baltimore, MD (1998-2001) and subsequently as a Research Staff Member at IBM T. J. Watson Research Center in Yorktown Heights, NY (2001-2005). Dr. Vereecken returned to Belgium in 2005 to join imec, working on catalytic growth and integration of nanowires and nanotubes for post-CMOS applications. In 2009, Dr. Vereecken started up the energy storage activities in imec. In 2010 he was appointed associate professor at the Centre of Surface Chemistry and Catalysis, Faculty of Bio Science Engineering, KU-Leuven. His scientific interests are found in the combination of (photo-) electrochemistry, nanomaterials and solid state devices. The main focus currently lays on the development of solid-state lithium ion batteries.

Tuesday, May 2, 2017, 5-7pm
Nicolas Vergauwe, Biocartis, Belgium

From (bio)sensors to diagnostics: challenges and pitfalls

This talk will highlight the enormous potential (bio)sensors offers for diagnostic applications in the field of high-precision medicine. Yet, bringing a novel diagnostic device to the market holds several challenges which will be addressed during this talk. Topics such as clinical sample types, instrument robustness and performance will be addressed. Identifying these pitfalls is essential when bringing groundbreaking research to the clinic.

Dr. Nicolas Vergauwe

Nicolas Vergauwe graduated as Bioscience Engineer in 2007 at KU Leuven. He obtained his PhD in Bioscience Engineering at KU Leuven for studying the use of digital microfluidics for medical point-of-care applications.
Nicolas joined Biocartis in 2012 where he was involved in several research projects related to the fields of sepsis, multiplexed immunoassay detection and fully automated molecular diagnostics. During this period he came into contact with a wide variety of technologies, both from an engineering and biochemical perspective. Today, his research group works on new concepts and technologies to extend the possibilities of Idylla™, Biocartis' fully automated, real-time PCR based molecular diagnostics system. The most challenging part for his team is to bridge the gap between state-of-the-art technology and the complexity of biological samples.

Tuesday, May 9, 2016, 5-7pm
Jérôme Chauvin, Université Grenoble Alpes, France

Photo and electro-chemistry of molecular architectures based on coordination complexes

The development of (photo)redox active nanoarchitectures anchored on electrode is of large interest for solar energy conversion or molecular electronic devices. In such applications, transition metal-ligand complexes play an important role, owing to the great diversity of their properties depending on the metal and organic ligands used. In particular the electrochemical and photophysical characteristics of $[Ru(bpy)_3]^{2+}$-based complexes (bpy = 2,2' bipyridine) have been largely investigated as light harvesting unit for the design of photoresponsive surfaces. A particular design for photo-to-electric conversion is based on the well-ordered association on electrode of a photosensitizer unit with electron donor or acceptor, to funnel under irradiation the charge from or to the conducting surface. In this presentation some examples of well-ordered layers with photoredox properties will be discussed, aiming to understand some of the essential parameters that should be modulated in order to obtain more efficient photo-conversion devices.

Dr. Jérôme Chauvin

Jérôme Chauvin received his PhD degree in 1998 from Ecole Normale Superieure de Cachan (France) under the supervision of Pr Jacques Delaire and Keitaro Nakatani, working on photochromic materials for application in nonlinear optics. He spent two years as a research fellow in Japan (1999-2001) in the laboratory of Pr Masahiro Irie. In September 2001 he was promoted maître de conférences at University of Grenoble Alpes, where he conducts his research in the field of molecular materials for artificial photosynthesis. Jérôme Chauvin defended his habilitation in 2011, the same year he spent 6 months as a visiting research in the Group of Pr. D. Gust, T. & A. Moore in Arizona State University.

Tuesday, 16 May 2017, 5-7pm
Erik Kerstel and Mathieu Barthelemy,
Centre Spatial Universitaire de Grenoble (CSUG), France

Quantum Physics with a Nanosatellite

Following a brief presentation of the Grenoble University Space Center and its current cubesat missions, we will discuss one project in detail. This mission, baptized "NanoBob" and carried out in close collaboration with the Vienna Institute for Quantum Optics and Quantum Communication, wants to demonstrate a free-space full quantum communication uplink between a ground station and a 12U form factor (~10 kg) nanosatellite. Quantum communication is a strategic scientific domain that is expected to lead in the near future to the preferred method to transmit encrypted data by exchanging single photons between two stations. The photons are generated in highly correlated, entangled pairs with the information coded into their polarization state. The properties of an individual photon cannot be measured without impacting its state, making the exchange immune to eavesdropping. This allows for the sharing of a provably secure cryptographic key between two parties, called Alice (sender) and Bob (receiver). Importantly, eavesdropping by a third party (Eve) can be detected by Alice and Bob. On Earth, transmission is limited to distances of a few hundred km. Going to space enables increasing this distance, eventually enabling fully secure communication on a global scale, and investigating fundamental physical phenomena such as the interaction between entangled photons and the gravitational field.

Prof. Erik Kerstel

Erik Kerstel *is a professor at the Laboratory of Interdisciplinary Physics, University of Grenoble Alps. He received the M.Sc. degree in Engineering Physics from the Eindhoven University of Technology and the Ph.D. degree in chemical physics from Princeton University. He was a post-doc at the European Laboratory for Non-linear Spectroscopy (LENS) in Florence, Italy, and the University of Groningen, The Netherlands. He was awarded a Young Investigator Fellowship of the Royal Netherlands Academy of Arts and Sciences (KNAW) for pioneering work on laser-based stable isotope ratio measurements. In Grenoble since 2009, his research interests are in applying ultra-sensitive optical sensing techniques to the environmental sciences. He is also the Director for Educational Affairs of the CSUG and the Grenoble PI of the NanoBob project.*

Dr. Mathieu Barthélémy

Mathieu Barthélémy *is an astrophysicist at the Grenoble Institute for Planetology and Astrophysics (IPAG) His research is focused on Space Weather. From 1996 to 2004 he worked as a college teacher and senior lecturer. He obtained the Ph.D. degree in 2011 with a thesis on thermo- and ionospheric planetary emissions. He is the General Director of the Centre spatial universitaire de Grenoble (CSUG) and PI of its first satellite mission ATISE (Auroral Thermo- and Ionosphere Spectrometer Experiment).*

Tuesday, May 23, 2017, 5-7pm

Alan Urban, NERF and KULeuven, Belgium

Decoding the brain black box using innovative technologies

Our brain is composed of billions of neurons linked through trillions of synaptic connections. Decoding the brain functions represents a problem of immense complexity that has not yet been solved by computational studies. Currently, the best chance to understand it relies on combinatorial approaches allowing simultaneous manipulation of neuronal circuits, brain imaging and behavior analyses. During this seminar, I will present the most promising tools currently available in preclinical research. I will detail the advantages of genetically engineered animals and viral vectors for expression of actuators and/or sensors in specific cellular population as well as novel devices for recording and/or imaging brain activity at high spatiotemporal resolution in freely moving conditions.

Dr. Alan Urban

Dr. Alan URBAN received his PhD in Molecular and Cellular Biology from Lorraine University in 2008. He has been a fellow from the French Ministry of Research and Technology. In 2010, he gets a diploma in experimental surgery of Paris 5 University. From 2009 to 2012, he was assistant professor in the prestigious Engineer school Ecole de Physique et de Chimie Industrielles in Paris. From 2012 to 2016, he worked as a junior group leader at INSERM Hospital Sainte-Anne in Paris where he develops with industrial partners a novel brain imaging technology called functional ultrasound. Since April 2016, he is a group leader at the Neuro-Electronics Research Flanders (NERF) empowered by imec, VIB and KU Leuven. Alan was also working as invited scientist for the RIKEN Institute in Tokyo and for Tel-Aviv University in Israel. He is the recipient of numerous scientific and entrepreneurship awards such as the CIPP award in 1999, the Nobert Segard Price in 2013 and the C. Genial 2nd price in 2015. He created 3 companies and is a worldwide technological consultant in imaging technology. He is part time professor at the KULeuven.