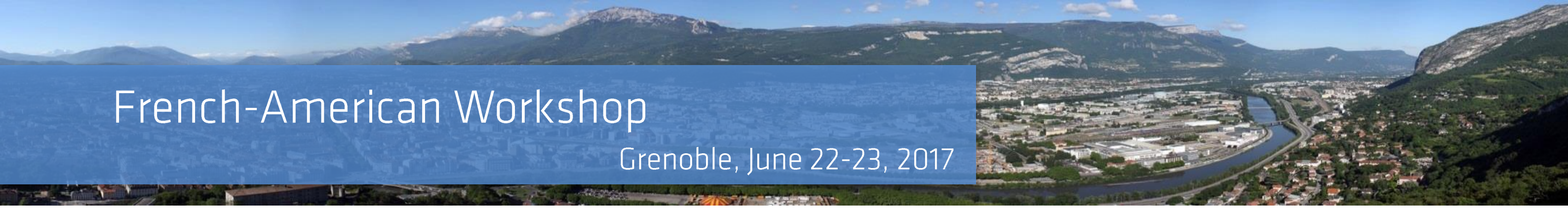


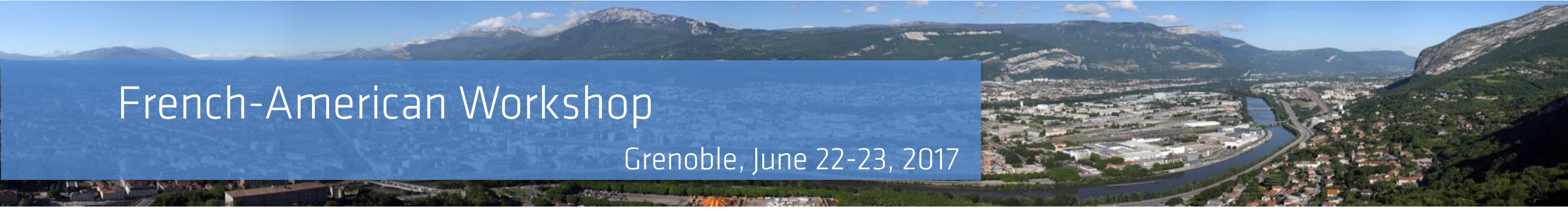
FRENCH AMERICAN WORKSHOP

Program, Speakers, & Abstracts

June 22-23, 2017

Grenoble – Maison MINATEC

GIANT
INNOVATION CAMPUS



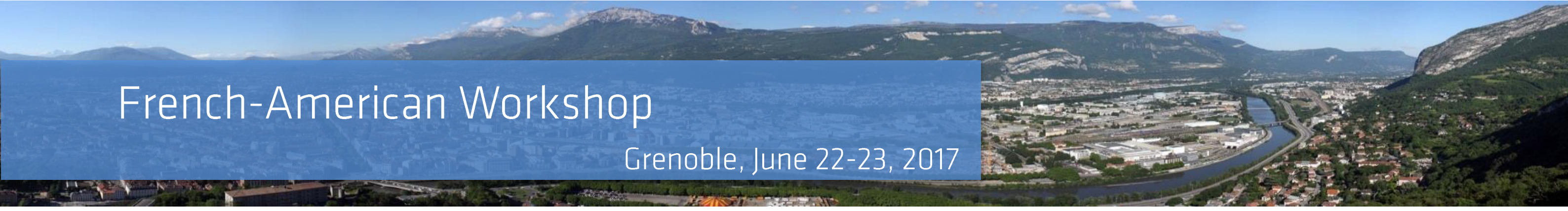
Contents

Acronym guide

CEA: Commissariat à l'Energie Atomique et aux Energies alternatives
CNRS: Centre National de la Recherche Scientifique
EMBL: European Molecular Biology Laboratory
ESRF: European Synchrotron Radiation Facility
GEM: Grenoble Ecole de Management
GIANT: Grenoble Innovation for Advanced New Technologies
Grenoble INP: Institut National Polytechnique de Grenoble
ILL: Institut Laue-Langevin
UGA : Université Grenoble Alpes

Thursday, June 22 - morning Maison MINATEC – 3 Parvis Louis Néel, Grenoble	
8.30am	Welcome Coffee
8.45am - 9.30am	**Opening addresses** Chairwoman : Francine Papillon – GIANT/CEA Elisa Glangeaud, Communauté Université Grenoble Alpes Dr Minh-Hà Pham, French Embassy in Washington Rebecca Kimbrell, US Consul in Lyon, tbc Dr Alain Fontaine, Nanosciences Foundation Prof Russell Composto, University of Pennsylvania Molly Schneider, Managing Director, MIT-France, Belgium, Switzerland, MIT
9.30am-10.30am	**1st Plenary session** **Prof Marc Fontecave** Professeur au Collège de France Chemistry of Biological Processes Laboratory – UMR 8229 *"Catalysis for energy storage: bioinspired molecular and solid catalysts"*
10.30am-11am	Coffee Break
11.am-12.00pm	**One minute for one researcher** 1-minute clip or 1-slide presentation introducing students & research fellows
12pm	**Poster session** GIIP students introduce their background with a poster and discuss their research experience and new opportunities with senior researchers and faculty, industry representatives and diplomatic staff
12.30pm-2pm	Buffet lunch

Thursday, June 22 - afternoon Maison MINATEC – 3 Parvis Louis Néel, Grenoble	
2.00-4.00pm	**Research opportunities for international students** 1. Presentations by experts & heads of programs (15 minutes/talk, 5 minutes/Q&A) Molly Schneider, MIT MISTI Dr Alain Fontaine, Nanosciences Foundation Dr Minh-Hà Pham, French Embassy in Washington 2. Testimonials Current Chateaubriand fellows and former GIIP participants REACT fellows
4pm-4.30pm	Coffee break around posters
4.30pm-5.30pm	**2nd plenary session** **Prof William E. Bailey** Associate Professor, Columbia University Chair of Excellence, Nanosciences Foundation *"Magnetization dynamics at fast timescales and small dimensions"*
7pm	Dinner at La Bastille, restaurant Le Téléférique (By invitation)



Friday, June 23 Maison MINATEC – 3 Parvis Louis Néel, Grenoble	
9am- 9.30am	Welcome coffee
9.30- 10.45 am	**Scientific talks – session 1** Prof Zahra Fakhraai – University of Pennsylvania *"Higher Order Plasmon Resonances in Disordered Nanoparticles; Quadrupole Enhanced Raman Scatterng (QERS) and Strong Optical Magnetic Plasmons"* Dr Louis Hutin – CEA *"SOI MOS Technology for Quantum Information Processing"* Prof Alexander Zaslavsky – Brown University *"Is there hope for tunneling field-effect transistors?"*
10.45- 11am	Coffee break around posters Best poster award
11 am- 12.15am	**Scientific talks – session 2** Prof David Spivak – Louisiana State University *"Molecularly Imprinted Polymers at the Molecular and Macromolecular Stage"* Dr Myriam Cubizolles – CEA *"Blood capillary microfluidics in Point-Of-Care systems development for healthcare"* Dr Marine Cotte – ESRF *"Synchrotron-based micro-analyses of artistic materials at ID21, ESRF"*
12.30pm	**Midi-MINATEC** *(special edition in English)* **Prof Pascal Poignard** **CHU/UGA, IBS, The Scripps Institute** *"Broadly neutralizing antibodies offer new prospects for an HIV vaccine"*
2.30- 4.30pm	Visits of GIANT labs and facilities (by registration, with passport) European Synchrotron Radiation Facility Institut de Biologie Structurale European Molecular Biology Laboratory

Prof Marc Fontecave – Keynote speaker

Professeur au Collège de France
Chemistry of Biological Process Laboratory, UMR8229 CNRS-Collège de France

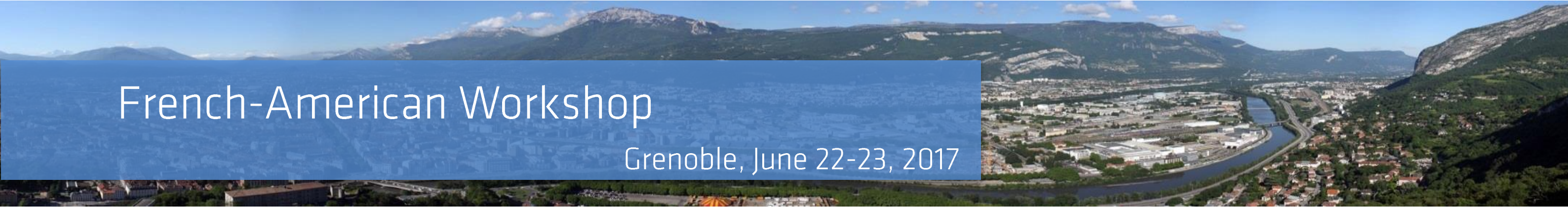
Catalysis for energy storage: bioinspired molecular and solid catalysts

Abstract

The development of intermittent renewable solar energy requests new efficient energy storage technologies. One scenario resides in its conversion into chemical energy (chemical bonds) within electrolyzers and photoelectrolyzers. One such “solar fuel” is hydrogen, derived from water splitting. Another example is energy-dense organic compounds, such as carbon monoxide, formic acid, methanol and hydrocarbons, derived from reduction of CO2. To achieve this challenging goal one needs to optimize cheap, selective and stable catalysts for electro-reduction of CO2. Natural enzymes (hydrogenases, formate dehydrogenases and CO dehydrogenases) as well as natural processes (photosynthesis) provide a unique source of inspiration. Here we illustrate the bioinspired chemistry approach using a variety of examples for proton reduction, CO2 reduction and water oxidation.

Biography

Marc Fontecave, born 27-09-1956, is the Director of the Laboratory of Chemistry of Biological Processes at the Collège de France, Paris, France. He got his PhD in 1984 at the Ecole Normale Supérieure and, after 2 post-doctoral years at Karolinska Institute, Stockholm, Sweden, he was appointed in 1989 as Professor at the University Joseph Fourier, Grenoble, France. He is currently a Member of the French Academy of Sciences since 2005 and a Professor at the Collège de France since 2008. He is also President of the Foundation of the Collège de France. Marc Fontecave research aims at understanding the structure and reactivity of metal centers present in metalloproteins, with applications in the field of health and energy. He is developing a bioinspired approach, such as in the case of artificial photosynthesis and storage of solar energy, to develop novel (photo)catalysts based on non-noble metals for hydrogen production and oxidation as well as for carbon dioxide reduction and their implementation in fuel cells and (photo)electrolyzers. He is the author of 350 publications (h -index 70) and 8 patents, and has given 395 conferences and invited seminars.



Prof William E. Bailey – Keynote speaker

Materials Science & Engineering, Dept of Applied Physics and Applied Mathematics
Columbia University

Magnetization dynamics at fast timescales and small dimensions

Abstract

Ultrathin magnetic films, dozens of atoms thick, are central to magnetic information storage in hard disk drives and magnetic random access memory. The response of magnetization to fast (nanosecond to picosecond) applied magnetic fields sets attainable data rates for these devices. Because magnetization dynamics relate fundamentally to the flow of electron spin, magnetization can be controlled through electrical currents; such "spin torques" have been investigated intensively over the last 20 years. In this talk, I will review the technological context and some basic aspects of magnetization motion in modern structures. I will also describe some of our efforts, in collaboration with groups in Grenoble, to characterize resonant magnetization dynamics in some extreme limits: at very high frequencies (with LNMCI-G), in very thin layers (with SPINTEC and ESRF), and with nanoscale spatial resolution (at SOLEIL.)

Biography

Prof. William Bailey holds A.B. and Sc. B degrees in Political Science and Materials Engineering from Brown University and M.S. and Ph.D. degree in Materials Science and Engineering from Stanford University. He was an Office of Naval Research (ONR) Graduate Fellow at Stanford and a National Research Council (NRC) Postdoctoral Fellow at N.I.S.T. in Boulder CO. He joined the Department of Applied Physics and Applied Mathematics at Columbia University in 2001, and is the recipient of the NSF CAREER and ARO Young Investigator Awards for research in thin-film magnetism at Columbia. He is currently Associate Professor of Materials Science and Engineering at Columbia and since 2014, has held the Chaire d'Excellence of the Nanosciences Foundation, Grenoble.

Prof Zahra Fakhraai

Assistant Professor, Department of Chemistry
University of Pennsylvania

Higher Order Plasmon Resonances in Disordered Nanoparticles; Quadrupole Enhanced Raman Scatterng (QERS) and Strong Optical Magnetic Plasmons[1]

Abstract

The top-down approach in design of plasmonic sensors for biological applications relies on precise design of nanostructures. Here we present an alternative paradigm in sensor design. Disordered and randomly packed nanostructured synthesized using bottom-up methods show highly tunable emergent properties, and exceptional optical response. I present two examples:

1-Spiky nanoshells, composed of randomly packed sharp gold cones on polystyrene core show strong Quadrupole Enhanced Raman Scattering (QERS) that can be tuned by simple modifications of the nanoshell geometry. The combination of tunability, high efficiency, and reproducibility makes these nanoshells excellent candidates for biosensing applications.

2- Raspberry-like magnetic metamolecules, composed of up to 800 surfactant-protected, closely-packed gold nanobead show strong magnetic resonances in optical frequency. These nanoparticles are isotropic and present strong scattering peaks that are omni-directional. Furthermore, these structures have numerous built-in hotspots that makes them ideal Raman substrates.

Biography

Zahra Fakhraai received her B.Sc. and M.Sc. degrees in physics from Sharif University of Technology in Iran. She then joined Jamie Forrest's group at the University of Waterloo to study the dynamics of polymers in thin films and on their surfaces (2003-2007). She received the American Physical Society's Padden award (2007) for her work towards PhD. Zahra worked in the Gilbert Walker's group at the University of Toronto (2008-2009) where she performed near-field infrared imaging of the structure and chemical composition of protein aggregates. Zahra received NSERC post-doctoral fellowship in 2009 and moved to Mark Ediger's lab at the University of Wisconsin-Madison to study properties of stable glasses (2009-2011). Zahra joined the department of Chemistry at the University of Pennsylvania in 2011 where she explores structure and dynamics of materials at nanometer lengths scales. She is the recipient of the NSF Career award (2014), Sloan fellowship in Chemistry (2015), and the The Journal of Physical Chemistry JPC-PHYS lectureship award (2017).

[1] Zahra Fakhraai1, Simon Hastings1, Zhaoxia Qian2, Chen Li1, So-Jung Park3, Nader Engheta4
1 Department of Chemistry, University of Pennsylvania, Philadelphia, PA, 19104, USA
2 Department of Chemistry, University of Washington-Seattle, Seattle, WA, USA
3 Department of Chemistry & Nano Science, Ewha Womans University, 11-1, Daehyeon-dong, Seodaemun-gu, Seoul, South Korea

Dr Louis Hutin

CEA Leti

SOI MOS Technology for Quantum Information Processing

Abstract

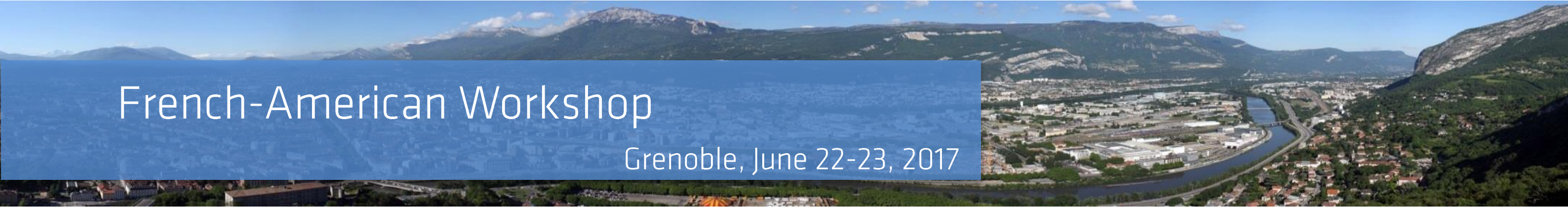
Built-in parallelism, stemming from the quantum mechanical principles of superposition and entanglement of quantum bits (qubits), is a key asset of the quantum computation paradigm.

Over the past four years, having shown outstanding performance in terms of quantum coherence and fidelity, silicon spin qubits have emerged as promising building blocks for quantum logic. Simultaneously, the extreme downscaling in gate sizes and pitches in advanced CMOS technology nodes makes it possible to realize arrays of closely spaced quantum dots with nearest-neighbor coupling, offering a unique opportunity to bridge the worlds of fundamental physics and IC engineering towards novel quantum circuits.

Using SOI field-effect transistors to confine elementary carriers (holes), we have shown that a localized hole-spin can be efficiently manipulated by an electric-field mediated microwave excitation applied to the confining transistor gate. This has led to the first demonstration of an electrically-driven hole spin qubit issued from Si CMOS technology. In this talk, we will discuss the potential advantages of the SOI-based technology for the development of large-scale quantum processors and the co-integration of qubits with their classical control electronics.

Biography

Louis Hutin received the Ph.D. degree in Electrical Engineering from Grenoble Institute of Technology in 2010. From 2007 to 2010, his research at CEA-Leti focused on high-mobility channel MOSFETs on advanced substrates and Schottky-Barrier transistors. He joined the University of California, Berkeley in 2010, where he worked towards the optimization and scaling of micro/nanoelectromechanical relays for Ultra-Low-Power digital logic and Non-Volatile Memory. He returned in 2013 to CEA-Leti as a device integration engineer. In particular, he currently investigates possible implementations of quantum logic based on Si CMOS technology.



Prof Alexander Zaslavsky

Prof. of Engineering and Physics
Brown University

Is there hope for tunneling field-effect transistors?

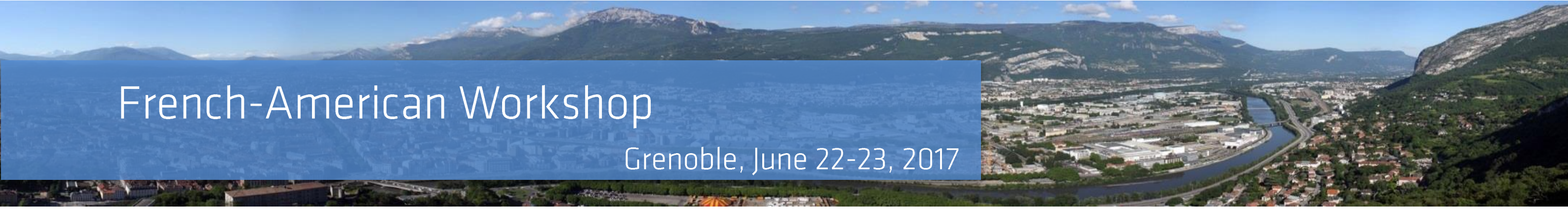
Abstract

Modern computing and, in fact, modern civilization is based on digital switching by complementary (CMOS) field effect transistors (FETs). There is a limit on how sharply the FET current can be turned off, due to thermionic injection over a voltage-controlled potential barrier. Sharper switching, which is necessary if silicon transistor downscaling is to proceed beyond the next decade, requires transistors based on alternative physical mechanisms, such as quantum mechanical tunneling.

After briefly discussing the physical mechanisms responsible for the switching limits on standard FETs, we will discuss the promise of the currently popular tunneling FETs (TFETs). They are CMOS-compatible, at least in principle, and provide sharp switching, but face a major challenge is providing sufficient I_{ON} current drive. We will discuss several approaches intended to improve I_{ON}, including bandgap engineering, increased tunneling area via bilayer geometry, and bipolar amplification.

Biography

Alexander Zaslavsky received the Ph.D. degree from Princeton University in 1991. He was a post-doctoral scientist with IBM T. J. Watson Research Center 1991-1993 and then joined Brown University, where he is currently a Professor of Engineering and Physics. He has also been a visiting Senior Chair of Excellence at the Grenoble Nanosciences Foundation 2009-12. His research interests are focused on semiconductor device and nanostructure physics, particularly tunneling and hot-electron devices.



Prof David Spivak

Professor, Organic, Polymer, and Bioanalytical Materials Chemistry
Louisiana State University

Molecularly Imprinted Polymers at the Molecular and Macromolecular Stage

Abstract

Molecular imprinting is a method of making polymeric receptors to a targeted molecule. Molecularly imprinted polymers (MIPs) are formed in several steps beginning with a solution phase supramolecular complex between a target molecule and an interactive polymerizable functional group. The complex is then copolymerized with additional monomers and crosslinkers to form a network material incorporating the polymerizable functional groups that are positioned in a complementary array to the target molecule. Removal of the template leaves cavities in the polymer network with the pre-organized functional groups "locked" into place, creating a specific receptor for rebinding the original template. Traditional approaches to molecular imprinting use large amounts of crosslinker, in the range of 50-90% of the overall material, which gives a rigid solid that can be used as an adsorbent. Proteins were imprinted by lowering the crosslinking drastically to 0.5%, which created a hydrogel supporting a loose network with polymerizable aptamers "locked" into place. The hydrogel imprinted materials showed good selectivity and binding affinity; however, a more interesting aspect of these materials is that they show volume-changing responses to the presence or absence of the proteins. While this phenomenon has been reported before, and interesting characteristic of these materials is that responses could be seen in the femtomolar range even though micromolar concentrations of protein were imprinted. This effect was coined "Macromolecular Amplification" and the origins of this effect are still being investigated. Several studies to probe the underlying mechanism for amplification, and optimization of the materials formulation will be discussed.

Biography

David Spivak received his B.S. degree in Chemistry from UC Berkeley in 1989, and his Ph.D. degree in Polymer/Organic Chemistry from UC Irvine in 1995, under the direction of Professor Ken Shea. He then was awarded an NIH Post-Doctoral Fellowship for his proposal to study catalytic antibodies for polymerization and other reactions at The Scripps Research Institute from 1995 to 1998. Afterward he began his professional career at Louisiana State University (LSU) in Baton Rouge, where he presently resides as an Associate Professor of Chemistry. Research in the Spivak Group is multidisciplinary, focused on Molecularly Imprinted materials, thin films and nanoparticles for biological and environmental analysis. In addition to research funding from NIH and NSF, including an NSF-CAREER award, Professor Spivak has received teaching awards from Research Corporation (Cottrell Scholar), and LSU (The LSU Athletic Foundation Undergraduate Teaching Award for 2001). He is also an Associate Editor for the Journal of Molecular Recognition, and was chair of MIP2010, the 6th international biennial symposium on molecular imprinting.

Dr Myriam Cubizolles

Biology and microsystems project manager
CEA Leti

Blood capillary microfluidics in Point-Of-Care systems development for healthcare

Abstract

Blood analysis is a key step in patient health care, for both diagnostic and treatment follow up. For that purpose, lots of rapid biological tests are currently developed. The development of medical devices for personalized diagnostic at the patient's bed, either at home or in hospital, often requires the use of microfluidics. In this presentation, a special focus will be given on capillary microfluidics in the context of Point-Of-Care systems development. The blood analysis is performed through the simple use of microfluidic components containing relevant embedded reagents. Examples of blood agglutination detection and blood plasma separation by means of passive microfluidics combined with polymers additives will be addressed.

Biography

Myriam Cubizolles owns a PhD in structural and functional biology. Her expertise is focused on sample preparation and analysis from complex biological matrices, more especially clinical samples. She spent 6.5 years in a biotechnology company, where she worked as a field research scientist and then as a clinical project manager. Her research activities and collaborations with customers deal with clinical sample preparation (fluids, biopsies) followed by mass spectrometry analysis. Since 2007, she joined CEA-LETI where her activity deals with sample preparation and analysis in the context of microfluidic devices use. Her main research focuses on the development of protein and cellular analysis from complex biological samples, such as blood, using micro- and nanotechnologies, more especially in the context of Point-Of-Care devices development. She is author and co-author in 20 international publications and 7 patents.

Dr Marine Cotte

Scientist at the ID21 beamline
European Synchrotron Radiation Facility

Synchrotron-based micro-analyses of artistic materials at ID21, ESRF

Abstract

The ID21 beamline is an analytical platform at the European Synchrotron Radiation Facility offering four end-stations: three in scanning mode, exploiting micro X-ray fluorescence (µXRF), micro X-ray absorption spectroscopy (µXAS), micro X-ray diffraction (µXRD) and infrared micro-spectroscopy (µFTIR) and one in full-field mode dedicated to X-ray absorption spectroscopy (FF-XAS). This beamline has an important activity in the field of cultural heritage [1]. Instruments can be efficiently used to gather information about the ways works of art were manufactured (choice of ingredients, being natural or synthetic, firing conditions, etc). Besides, many analyzes are dedicated to artwork conservation and preservation through a better understanding of the composition of degradation products formed with time, through the assessment of effects of external parameters (humidity, light, pollutants, etc) and internal parameters (material initial composition) on degradation processes and possibly through the evaluation of the efficiency of conservation treatments.

The current X-ray energy range (2.0-9.1keV) gives access not only to low Z elements such as S (present in many sulfide pigments), but also to most of the 3d transition metals (in particular Mn, Fe, Co, Cu, responsible for the color of many pigments). Heavier metals such as Sn, Sb, Pb can also be analyzed, through their L or M edges. Elements can be identified and localized with a submicrometric resolution thanks to µXRF. Their chemical and structural environment can then be further determined using spectroscopy and diffraction techniques.
The µFTIR operates in the mid-infrared domain (4000-700cm^{-1}) and is a very efficient instrument for the characterization of molecular groups, in particular in organic materials. Chemical maps can be obtained with a lateral resolution of a few microns.

The complementarity of the different instruments permits to study almost all types of materials, from hard matter (pigment, glass, ceramics) to soft matter (papyri, plastics) and also mixtures of these different materials (e.g. paint [2], modelling materials [3], photographs). Analyses are usually carried out on tiny fragments from historical artworks (e.g. paint fragments from Van Gogh's paintings [2]; modelling material fragments from Rodin's sculptures [3]) which can be completed by the analysis of model samples, mimicking historical ones, and possibly artificially aged. Different recent applications and perspectives related to the upgrade of the beamline will be presented.

Biography

After gaining the "agrégation" of chemistry at the "Ecole Normale Supérieure" of Lyon, **Marine Cotte** obtained her PhD for her research, at the C2RMF (Centre of Research and Restoration of French Museums, UMR171 CNRS), on lead-based cosmetics and pharmaceutical compounds used in Antiquity. During her post-doc at the ESRF (European Synchrotron Radiation Facility), she has enlarged the application of micro X-ray and FTIR spectroscopies to ancient paintings, glasses, plastics... She has now a twofold position: as a CNRS scientist at LAMS (Laboratoire d'Archéologie Moléculaire et Structurale) UMR-8220 (Paris), and as a beamline scientist, at the European Synchrotron Radiation Facility (Grenoble). She is in charge of the ID21 beamline, a beamline dedicated to X-ray and infrared micro-spectroscopy, with various applications in the fields of cultural heritage, biology and environmental sciences as well.

[1] Cotte, M., Pouyet, E., Salome, M., Rivard, C. De Nolf, W., Castillo-Michel, H., Fabris, T., Monico, L., Janssens, K., Wang, T., Sciau, P., Verger, L., Cormier, L., Dargaud, O., Brun, E., Bugnazet, D., Fayard, B., Hesse, B., Pradas del Real, A. E., Veronesi, G., Langlois, J., Balcar, N., Vandenberghe, Y., Sole, V. A., Kieffer, J., Barrett, R., Cohen, C., Cornu, C., Baker, R., Gagliardini, E., Papillon E. & Susini, J., 2017. *J. Anal. Atom. Spectr*., in press.
[2] Monico, L., Janssens, K., Hendriks, E., Vanmeert, F., Van der Snickt, G., Cotte, M., Falkenberg, G., Brunetti B. G., & Miliani, C., 2015, *Angew. Chem*., 127, 14129-14133.
[3] Langlois, J., Mary, G., Bluzat, H., Cascio, A., Balcar, N., Vandenberghe Y., & Cotte, M., 2016, Stud. Cons., in press

MINATEC® Les midis

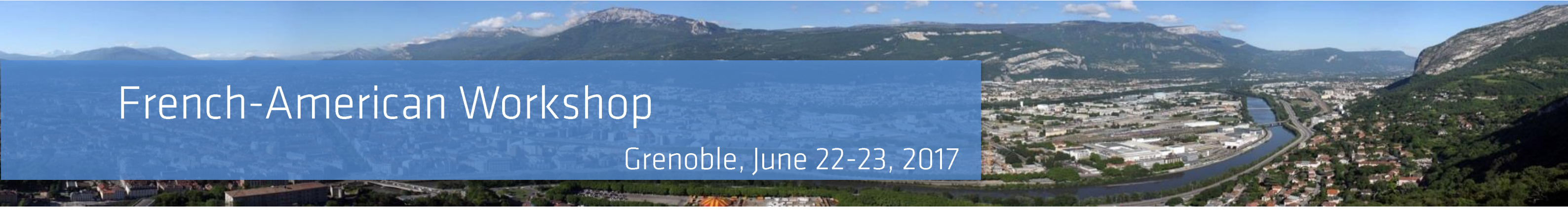
Prof Pascal Poignard

CHU/Université Grenoble Alpes
Institut de Biologie Sctructurale
The Scripps Institute

Broadly neutralizing antibodies offer new prospects for an HIV vaccine

Abstract

The immune response induced by HIV infection comprises in a subset of individuals broad and potent neutralizing antibodies (bNAbs) capable of blocking the replication of a large fraction of global HIV-1 isolates. The elicitation of such Abs prior to infection would presumably protect against infection by most circulating HIV strains and is thus considered one of the highest priorities of HIV vaccine research. However, no vaccine candidate has been successful at eliciting bnAbs thus far. We will review the latest findings and research that may lead to the development of a preventive Ab-based HIV vaccine



GIANT International Internship Programme

GIIP in a nutshell

- Formerly MINATEC Summer Program (2010-2013), now open to all GIANT labs
- 10-week research internship program for undergraduate and graduate students
- Non-European students, mainly US: University of Pennsylvania, MIT, UC Berkeley (summer intake)
- Mid-program event: French-American Workshop (next edition: June 14-15, 2018)
- Autumn intake to expand to partners in other countries: Japan, Argentina, China…
- 199 foreign students have come to the GIANT campus since 2011
- 11 new collaborative projects or co-funded programs
- 14 students came back to Grenoble: 2 as a PhD students, 1 as a postdoc fellow, and 11 as interns again; many are thinking of coming back in the coming years

GIIP for students

- Weekly visits or research facilities or scientific seminars held by researchers
- Visits of GIANT labs and large facilities
- Cultural and social activities
- A welcome services package helping students find accommodation and take care of administrative matters

GIIP for supervisors

- A framework for welcoming foreign students from prestigious universities
- The opportunity to foster new collaborations and develop existing ones
- The opportunity to develop their network with both foreign universities and other GIANT institutes

Interested in welcoming an international intern?

Contact internships@giant-grenoble.org or a member of the GIIP organization committee

- Sébastien Berger, CEA/GIANT: sebastien.berger@cea.fr
- Yanxia Hou-Broutin, CNRS: yanxia.hou-broutin@cea.fr
- Louis Hutin, CEA Leti: Louis.HUTIN@cea.fr
- Ed Mitchell, ESRF: mitchell@esrf.fr
- Francine Papillon, CEA/GIANT: francine.papillon@cea.fr
- Jérôme Planès, CEA: jerome.planes@cea.fr
- Patrice Rannou, CNRS: patrice.rannou@cea.fr
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Many thanks to our partners and sponsors!

They are hosting international students from the GIIP in their labs