ED 182

PhD student's Congress

2024 edition

ABSTRACTS BOOKLET

Collège Doctoral Européen
Strasbourg, France

21st March 2024

Université de Strasbourg

ED 182
PhD student's Congress
2024 edition

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Organizers

Lamiae EL KHABCHI (IPCMS, 2nd year) - lamiae.elkhabchi@ipcms.unistra.fr

Ronan VIEL (IPCMS, 2nd year) - ronan.viel@ipcms.unistra.fr

Leïla GARNIER (ICS, 2nd year) - leila.garnier@ics-cnrs.unistra.fr

Yassin Rany KHALIL (Observatoire, 2nd year) - Yassin-rany.khalil@etu.unistra.fr

Krystyna HERASYMENKO (IPCMS, 2nd year) - krystyna.herasymenko@ipcms.unistra.fr

Matthew MGBUKWU (IPCMS, 3rd year) - matthew.mgbukwu@ipcms.unistra.fr

Tatiana ROMAN (INSERM, 2nd year) - tatiana.roman.m@gmail.com

Victor IGBOKWE (INSERM, 2nd year) - victor.igbokwe@etu.unistra.fr

Hasan SHAMAS (IPHC, 1st year) - hasan.shamas@iphc.cnrs.fr

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Program

8:30 – 9:00		PhD Students' welcoming - Registration Goodies distribution
9:00 – 9:10		Introduction words (ED 182 – M. Brinkmann or A. Dinia)
9:10 – 9:15	Sponsors segment Chair: Lamiae El Khabchi (Amphitheatre)	SATT Connectus – Antoine PARMENTIER
9:15 – 9:20		SCF representative – Stefan CHASSAING
9:20 – 9:25		SFP representative – Fabrice THALMANN
9:25 – 9:30		IRMIA++ ITI representative – Laurent NAVORET
9:30 – 9:35		QMat ITI – Lamiae El Khabchi
9:40 – 9:55	First Oral session Chair: Krystyna Herasymenko (Amphitheatre)	**Speaker 1 -Hajar EL HACHMI ,** IPCMS. Anionic metalo-carbenes: synthesis, study and vectorization for cancer treatment.
10:00– 10:15		**Speaker 2 - Guillaume COTTE-CARLUER,** ICS. Solidification of polyurethane foams via UV external stimulus.
10:15 – 10:30		**Speaker 3 - Romain BERTHIOT,** IPCMS. From Light to Life: Luminescent Imidazolium Salts as Versatile Tools for Mitochondrial Probing and Gene Delivery.
10:30 – 11:00		Coffee break + **First Poster session** (Winter Garden)
11:00 – 11:15	Second Oral session Chair: Yassin Rany Khalil (Amphitheatre)	**Speaker 4 - Thibault BARNOUIN,** Observatoire. The heart of galaxies under the scope of polarimetry: going below the pixel scale.
11:15 – 11:30		**Speaker 5 - Florian MAURER,** IPCMS/ISIS. Quantum description of surface plasmon polaritons in different gauges.
11:30 – 11:45		**Speaker 6 - Jonathan COLLIN,** IPHC. Validation of Monte Carlo simulation by neutron-induced activation measurements around a photon cyclotron
11:45 – 12:00		**Speaker 7 - Quentin FENOY,** IPCMS. Towards mechanically-detected antiferromagnetic 2D magnons
12:00 – 13:10		Lunch (Winter Garden)
13:10-13:20		Group photo
13:30 – 14:00		Invited speaker **-Florian MICONI**
14:00 – 14:15	Third Oral session Chair: Ronan Viel (Amphitheatre)	**Speaker 8 - Guillaume MICHALUSZKO,** IPCMS. Design of photophysically-tuned TADF organic dyes
14:15 – 14:30		**Speaker 9 - Souhail ESSADIKI,** ICS. Fabrication and characterization of porous conductin polymers
14:30 – 14:45		**Speaker 10 -Chenyue HU,** IPCMS. Ferroelectric materials for efficient light harvesting applied to solar cells
14:45 – 15:00		**Speaker 11 - Srikanth T. NAGESH,** Observatoire. Galaxy clusters in MOND: the case of ultra diffuse galaxies in the Coma cluster.
15:00-15:15		**Speaker 12 - Simon Ali RINCON CELIS,** IPCMS. Ultrafast spectroscopy of TB dyes for Dye-Sensitized Solar Cells
15:15 – 16:20		**Second Poster session** (Winter Garden)
16:20 – 16:30		Coffee break + discussions // Jury deliberation
16:30 – 16:45		Closing words (ED 182 – M. Brinkmann or A. Dinia)
16:45 – 18:00		Awards ceremony / Final discussions

ED 182
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Invited Speaker

Florian MICONI

E-mail address: florian.miconi@e-i.com

After completing a PhD in particle physics at IPHC in 2012 on the Higgs Boson at the Do experiment at Fermilab, I joined Euro-Information (the technological subsidiary of Crédit Mutuel's Group) as an analyst developer. In 2016, I helped founding the "Cognitive Factory" dedicated to the development and integration of AI solutions. I was in charge of the R&D and of the development of specific tooling for training models. In late 2022, I took charge a new initiative exploring the potential benefits of quantum computing which resulted in the creation of the "Quantum Factory" dedicated to the exploration and industrialization of quantum technologies.

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ORAL CONTRIBUTIONS

Speaker 1

Anionic Metalo-Carbenes: Synthesis, Study AndVectorization For Cancer Treatment

Author: **Hajar El Hachmi**
E-mail address:
Hajar.elhachmi@ipcms.unistras.fr
Supervisor: Stéphane BELLEMIN-LAPONNAZ

PhD year: 1st

Institute: IPCMS

Brief presentation

Hello everyone, I'm Hajar. Originally from Madrid, I've always had a passion for exploring new places, experiencing different cultures, and cherishing moments with my loved ones.

My journey led me to Strasbourg, where I embarked on a thrilling academic adventure pursuing a double diploma at the engineering school ECPM in Cronenbourg. Through dedication and hard work,I earned my engineering degree, specializing in organic chemistry.

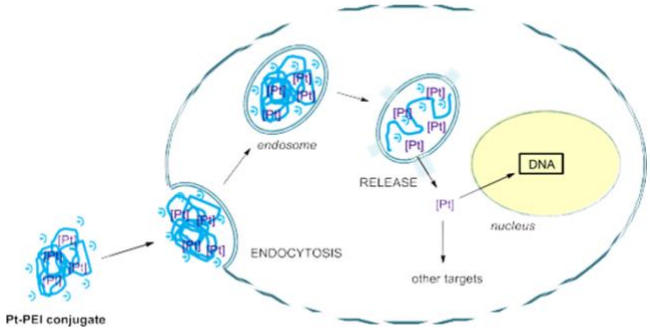
During my enriching two years at ECPM, I had the opportunity to do practical experiences through internships. I did my M1 internship with the Department of Organic Materials at IPCMS. Additionally, I had a valuable experience at Solvay in Lyon for my M2 internship, where I gained insights into industrial applications of organic chemistry. These experiences had let me to come back to the IPCMS to pursue my PhD in organic chemistry.

Beyond academia, I find immense joy in traveling, immersing myself in new environments, and forming connections with people from diverse backgrounds.

Abstract

Glioblastoma, a lethal brain tumor, poses a significant challenge in oncology due to its high resistance to conventional treatments. Platinum-based drugs, such as cisplatin and oxaliplatin, have shown limited efficacy against glioblastoma due to side effects and resistance development in other cancer types. Recently, platinum complexes incorporating N-heterocyclic carbenes (NHCs) have emerged as promising candidates for glioblastoma therapy. Moreover, the tunable nature of NHC complexes allows for facile post-functionalization, facilitating molecular diversity and efficient drug design. Despite advancements, the clinical translation of these complexes faces challenges, including poor water solubility and cellular uptake inefficiencies.

To address these limitations, my PhD aims a novel approach involving the design of negatively charged carbene complexes. Leveraging established delivery methods utilized in gene transfer, these complexes can be vectorized via electrostatic interactions with cationic vectors, using polymers such as PEI. This interdisciplinary project integrates principles from organic, inorganic, and organometallic chemistry to be applied in biology.



Speaker 2

Solidification of polyurethane foams via UV externalstimulus

Author: **Guillaume Cotte-Carluer**

E-mail address: guillaume.cotte-carluer@ics-cnrs.unistra.fr

Supervisor: Wiebke Drenckhan, Aurélie Hourlier-Fargette

Pronouns (He/She/They):

PhD year: 2nd

Institute: CNRS UPR 22- Institut Charles Sadron

Brief presentation

Guillaume Cotte-Carluer comes from a small town near Lyon, and after a preparatory class in Lyon, 3 years at the European School of Chemistry, Polymers and Materials Science in Strasbourg, he choseto do his PhD thesis in the MIM team where he performed his Master 2 internship. As his thesis is labelled by the ITI HiFunMat, most of his activities outside of research are linked to this Interdisciplinary Thematic Institute, by taking part in the different trainings proposed by the institute or participating to the HiFunMat stand at the *Fête de la Science*. Otherwise, he really enjoys running and climbing as well as reading and sculpting.

Abstract

Polyurethane foams usually exhibit complex morphologies and the number of different mechanisms taking part in their formation make the production of simpler model foams difficult. Millifluidic techniques were already used to solve this issue and to generate monodisperse foams with varied morphologies. However, in order to solidify the liquid foam in its desired state, the formulation needs to be carefully adjusted. We propose here a more flexible way to start the solidification at a chosen moment using UV photocatalysis (Figure 1, left).

We will present the production method of liquid foams using millifluidics and the controlled solidification of these liquid foams using a photobase generator. The use of this photocatalyst allows us to tune the time between the formation of liquid foams and their solidification, and therefore to change the morphology of the obtained foams by taking advantage of the ageing of the liquid foams. To analyse the changes in foam morphology and their impact on foam properties, we combine X-ray microtomography (Figure 1, right) and mechanical characterisation.

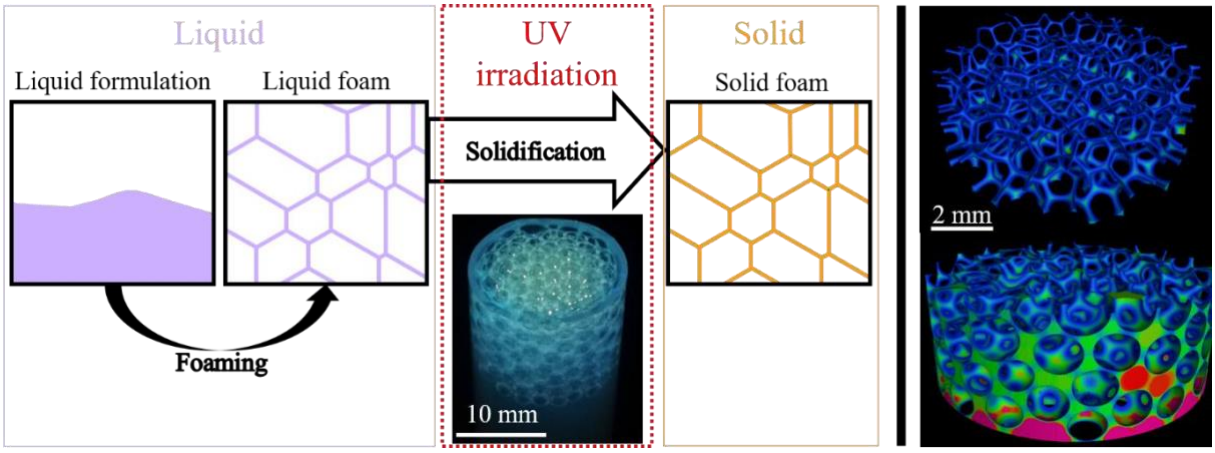


Figure 1: Left: Strategy to produce solid polyurethane foams with controlled morphology using UV photocatalysis. Right: Three dimensional reconstruction of polyurethane foams obtained via X-ray microtomography.

Speaker 3

From Light to Life: Luminescent Imidazolium Salts as VersatileTools for Mitochondrial Probing and Gene Delivery

Author: **Romain Berthiot**
E-mail address:
romain.berthiot@ipcms.unistra.fr
Supervisor: Pr. Laurent Douce

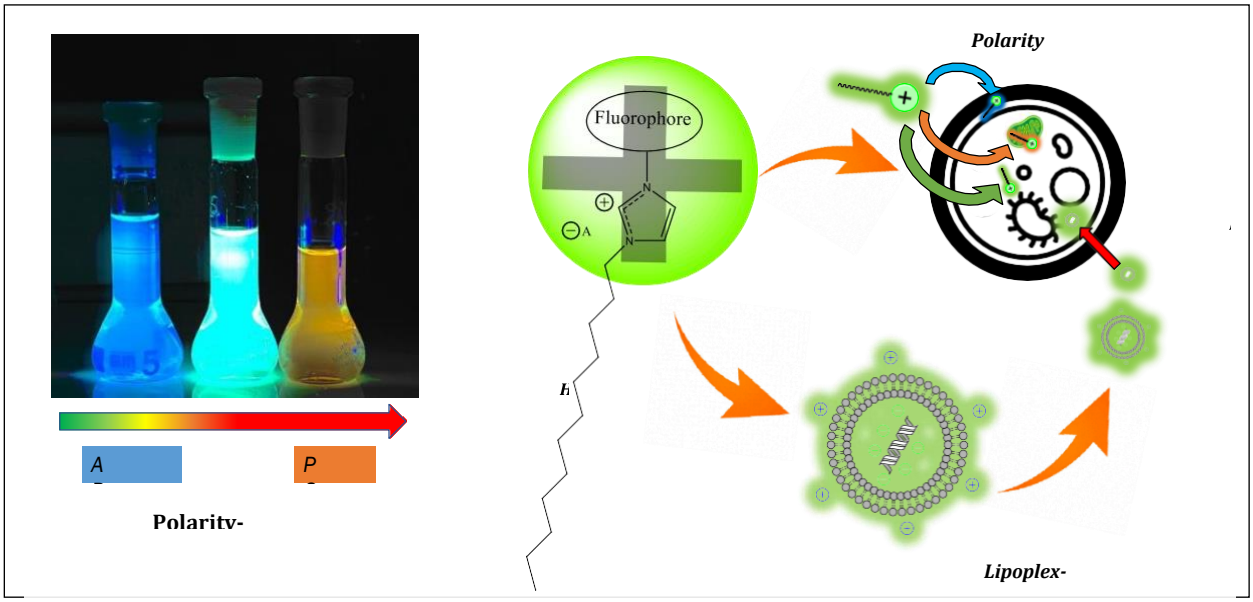
Pronouns: He
PhD year: 3rd
Institute: IPCMS

Brief presentation

After obtaining a DUT and a BSc in Chemistry, and with a passion for medicinal chemistry and chemical biology, I pursued the MSc in Chemistry, Biology and Drug Design at the University of Strasbourg. Then, I started a PhD at the IPCMS. I presented my work at an international conference and co-authored 2 articles, including one review. I co-supervised 3 trainees. As an instructor, I taught chemistry at undergraduate level. Finally, I love cooking, hiking and trekking, and I have been a scoutleader for five years!

Abstract

Luminescence is an extremely sensitive tool for exploring the infinitely small. Molecular salts, particularly those based on imidazolium, have original properties and structural versatility. When theycontain both hydrophilic (water-loving) and lipophilic (oil-loving) parts, they are capable of self- organizing into layers or columns where order and mobility reign (liquid crystal state). Combined withfluorophores, these salts become valuable in a variety of applications. They can act as receptors for negatively charged species, aid cell imaging and even demonstrate controlled toxicity for potential antibacterial and anticancer treatments. Using luminescence, we can observe how these molecules interact and understand their mechanisms of action, paving the way for new approaches to therapy and diagnosis known as theranostics. In this presentation, we will discuss the design and synthesis of new families of highly luminescent materials, exploring their properties in different states of matter (liquid, liquid crystal and crystalline) and their roles as mitochondria-targeting dyes and gene deliveryagents.



Speaker 4

The heart of galaxies under the scope of polarimetry:going below the pixel scale.

Author: **Thibault Barnouin**
E-mail address:
thibault.barnouin@astro.unistra.fr
Supervisor: Dr Frédéric Marin

Pronouns: He
PhD year: 2nd
Institute: Observatoire Astronomique de Strasbourg

Brief presentation

I am a Strasbourg-born, mountain-raised young researcher. I had an extensive education in mathematics and high energy physics and I try to bring the mathematical rigor into my research in astrophysics. Outside of work I am a computer enthusiast and build and maintain systems and servers for personnal use. This shows in my approach of the research work: build everything from the ground-up.

Abstract

Polarimetry (and ultraviolet – UV – polarimetry in particular) has proven to be one of the most resourceful observational method to constrain the multi-scale geometry and composition of Active Galactic Nuclei (AGNs). Because of its vectorial nature, the polarisation of the emitted, scattered or absorbed light is independent of the size of the source region. It allows us to study objects that remain spatially unresolved to modern telescopes or that are hidden behind absorbing material. UV polarimetry knew a golden age in the 90's, but it ended in the mid 2000s when the last space-based far-UV polarimeter instrument was decommissioned. All that is left are archival data from WUPPE that flew 2 times onboard space shuttles andfrom the Faint Object Camera (FOC) and the Faint Object Spectrometer (FOS) that equipped HST until 2002 and 1997 respectively. In this talk, I will present why and how we study the polarisation of AGNs, and what do we learn from it. I will show how UV polarimetry – even +20 years old archival data – along with multi- wavelength analyses allows us to precisely study the physical processes occurring in the innermost regions of these complex sources. This work, based on archival data from a decommissioned instrument, remains state-of-the-art 20 years later and pave the way for future polarimetric instruments in the UV band.

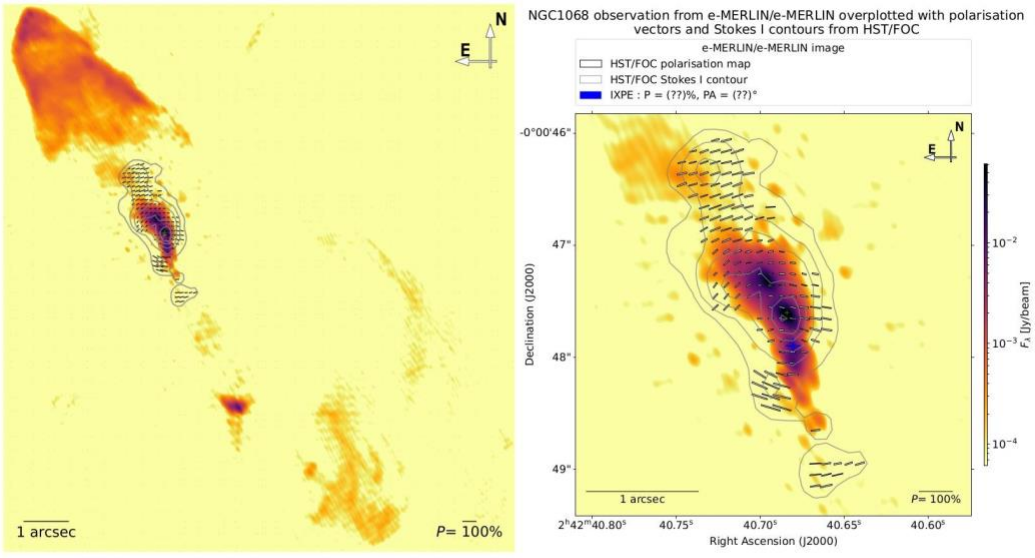


Figure 1: Combined VLA and e-MERLIN radio maps at 5GHz of NGC 1068 overplotted with the polarisation map obtained in near-UV by the HST/FOC. The IXPE analysis results remain to be published. Left: the original image. Right: a zoom at the center of the AGN.

Speaker 5

Quantum description of surface plasmon polaritons indifferent gauges

Author: **Florian Maurer**
E-mail address: florian.maurer@ipcms.unistra.fr
Supervisor: G. Weick (IPCMS) & D. Hagenmuller(CESQ-ISIS)

Pronouns: He
PhD year: 1st

Institute: IPCMS - CESQ-ISIS

Brief presentation

I am Florian Maurer. I graduated both from the « Condensed Matter and Nanophysics » master and the « Magistère de Physique Fondamentale » in 2023 after having studied in Strasbourg for five years.I am now doing my PhD both at IPCMS and at CESQ-ISIS. Besides that, I am a musician as I play the trombone. I am also the president of the Orchestre Universitaire de Strasbourg, a symphonic orchestra of more than 80 musicians.

Abstract

Extreme regimes of cavity quantum electrodynamics (QED), where electronic degrees of freedom in aquantum material strongly interact with the electromagnetic modes of a cavity resonator, have beenrecently investigated to engineer new phases of matter. In particular, so-called plasmonic resonators, allow for a large enhancement of the light-matter coupling. At the interface between a dielectric anda metal, surface plasmon polaritons (SPPs) do exist. They are evanescent waves that originate from the hybridization between light and matter degrees of freedom. They can be described classically, butproviding a quantum description of these hybrid modes is crucial to couple them to other excitationsin quantum materials. In order to do so, a gauge choice is required. Since the different gauges of QEDare linked by unitary transformations, the results should not depend on such a gauge choice.

However, it appears that a clever choice of gauge may allow for a more intuitive description of theproblem. We will in particular study the Coulomb and the PZW (Power-Zienau-Woolley) gauge.

Speaker 6

Validation of Monte Carlo simulation by neutron-induced activation measurements around a photon cyclotron

Author: **Jonathan Collin**
E-mail address: jonathan.collin@iphc.cnrs.fr
Supervisor: Abdel-Mjid NOURREDDINE

PhD year: 2nd

Institute: IPHC/CNRS

Brief presentation

Jonathan COLLIN is in his second year of PhD under the supervision of Abdel-Mjid NOURREDDINE, in the DeSIs (Dosimetry Simulation and Instrumentation) group of IPHC. After a double degree between Telecom Physique Strasbourg and the Subatomic Physics master of Strasbourg University, they joinedthe collaboration project between CNRS and Transmutex SA, a Genevan next gen nuclear reactor start-up, on Accelerator Driven System dismantling.

Abstract

Nuclear activation is the process of production of radionuclides by irradiation. This phenomenon concerns particle accelerators used in various fields, from medical applications to industrial ones, both during operation and at the decommissioning phase. For more than three decades, the possibility of using cyclotrons for nuclear power generation and nuclear waste reduction has also been discussed, i.e. in the case of Accelerator-Driven Systems. The radioprotection and dismantlingissues of accelerator facilities, that have been raised recently, is even more potent for such installations. Monte Carlo simulation are the most pertinent techniques to achieve an estimation ofradionuclide inventory.

In this work, we are particularly interested in the activation due to secondary neutrons produced by(p,n) reaction nearby accelerator's. This work focuses on the study of the radioactivity induced in various materials (Sc, Tb, W, Ta) around the operating IPHC's cyclotron CYRCé. The experimental results will be compared to estimation from Monte Carlo programs, including FLUKA, GEANT4 and PHITS. The capabilities of these programs will be discussed, as well as the importance of physics models choice (evaluated libraries).

Speaker 7

Towards mechanically-detected antiferromagnetic 2D magnons

Author: **Quentin Fenoy**
E-mail address:
quentin.fenoy@ipcms.unistra.fr
Supervisor: Arnaud Gloppe / Christian Meny

Pronouns: He

PhD year: 1st

Institute: IPCMS

Brief presentation

My name is Quentin Fenoy. I'm 23 years old, I'm French and I am a first year PhD student in physics, and more specifically, in condensed matter physics. I followed my master studies in Strasbourg in the condensed matter and nanophysics (MCN) master. Besides research, I am teaching physics tutorials inbachelor (L1 and L3). Out of my PhD I like doing some sports such as American football, soccer or chessand I'm also keen on mineralogy, metallurgy, beekeeping and learning languages!

Abstract

In 2016/2017, it has been shown [1, 2] that a magnetic order can be preserved in the monolayer limitof magnetic van der Waals materials. These magnetic materials can host collective spin excitations, inparticular antiferromagnetic magnons in the microwave range, demonstrated, so far, in bulk $CrCl_3$ [3],a lamellar material magnetically ordered at 14K. $CrCl_3$ presents striking features, especially an intralayer in-plane ferromagnetic order, expected to be responsible for topological phase transitions and tunable by strain in the monolayer limit [4]. These exfoliable systems, ideally constituted by only a few atomic layers, are promising candidates to investigate magnonics in 2D, with the exciting perspectives of suspending these structures as drum-like resonators to couple magnons to mechanicaldegree of freedom and build heterostructures to benefit from proximity effects. The persistence of these magnons down to the bilayer limit remains to be established.

Here, we suspend a heterostructure constituted by few atomic layers of $CrCl_3$ encapsulated by graphene and hexagonal boron nitride, forming a micrometric drum-like resonator. Thenanomechanical properties of the membrane are read by optical interferometry. Changes in the magnetic configuration will be imprinted into these properties through magnetostriction. This thesis aims at exploring microwave magnonics towards the bilayer limit in suspended magnetic heterostructures and investigating their coupling to mechanical degrees of freedom.

[1] J.-U. Lee et al., Ising-type magnetic ordering in atomically thin $FePS_3$, Nano Lett. **16**, 7433 (2016).

[2] B. Huang et al., Layer-dependent ferromagnetism in a van der Waals crystal down to the monolayer limit, Nature **546**,270 (2017).

[3] MacNeill et al., Gigahertz Frequency Antiferromagnetic Resonance and Strong Magnon-Magnon Coupling in the LayeredCrystal $CrCl_3$, Phys. Rev. Lett. **123**, 047204 (2019)

[4] Dupont et al., Monolayer $CrCl_3$ as an Ideal Test Bed for the Universality Classes of 2D Magnetism, Phys. Rev. Lett. **127**,037204 (2021)

Speaker 8

Design of photophysically-tuned TADF organic dyes

Author: **Guillaume Michaluszko**
E-mail address:
michaluso@etu.unistra.fr
Supervisor: Anthony D'Aléo

Pronouns: He
PhD year: 1st
Institute: IPCMS

Brief presentation

I began my studies as a biologist but I slowly fell into chemistry because of my interest for the topicsat the interface. During my two master internships, I worked around fluorescent dyes and it was great. I did not need more to convince me to pursue a PhD on that topic and this is what I'm doing now as I work on the design of photophysically-tuned TADF organic dyes. Beside research, I am not particularly involved in anything interesting, but i do play volley-ball in a club.

Abstract

Organic Light-Emitting Diodes (OLED) that produce electroluminescence have shown great promises for solid-state lighting applications such as digital displays. Recently, there has been much interest concerning Thermally Activated Delayed Fluorescence (TADF) emitters. TADF presents the ability to harvest triplet excited states resulting in higher internal quantum efficiencies (representing the number of photon emitted compared to the quantity of excited state formed, *i.e* 100% represents onephoton emitted per excited state formed) than for conventional fluorescent OLEDs. Currently, OLEDs available on the market are made out of noble metals complexes which are getting sparser, thus more expensive. In this context, curcuminoid borondifluoride (CurcBF$_2$) derivatives have been proven to be TADF. Therefore there is a need to develop new CurcBF$_2$ dyes that are more efficient. In consequence,I will present new dyes and explain their properties compared to what has been published prior to myPhD thesis.

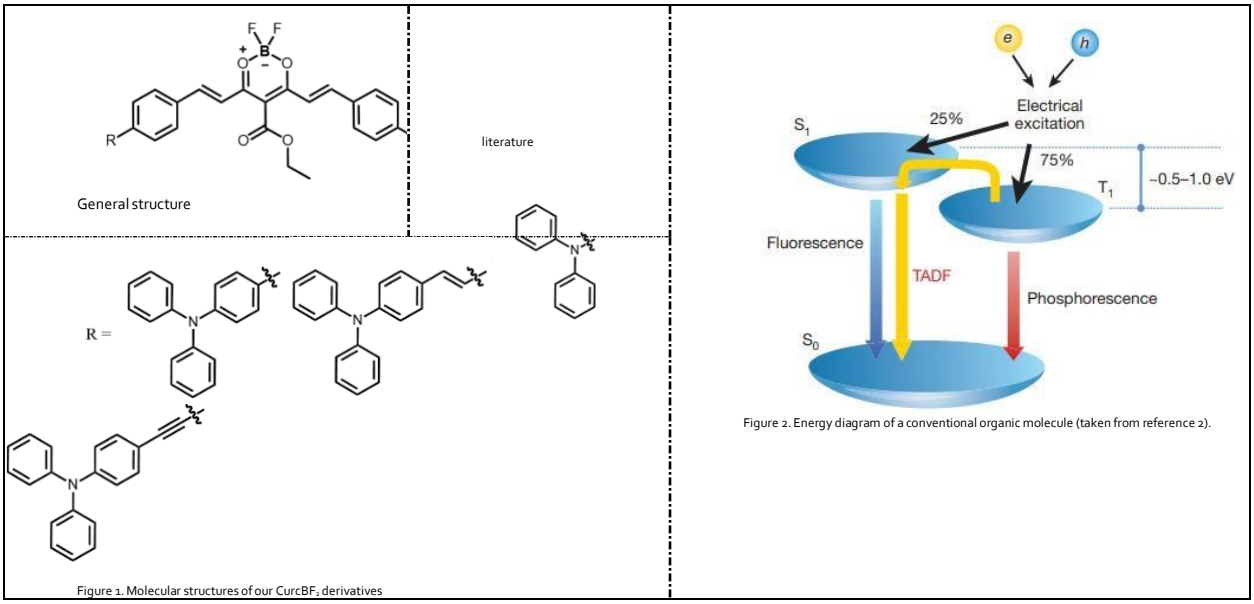


Figure 1. Molecular structures of our CurcBF$_2$ derivatives

Figure 2. Energy diagram of a conventional organic molecule (taken from reference 2).

References :

1. Sandanayaka, A. S. D. et al.; Indication of current-injection lasing from an organic semiconductor. Appl. Phys. Exp. 2019, 12, 061010.
2. Uoyama, H. et al.: Highly efficient organic lightemitting diodes from delayed fluorescence. Nature 2012, 492, 234-238. 3. Réservé
3. Kim, D.-H. et al.: High-efficiency electroluminescence and amplified spontaneous emission from a thermally activated delayed fluorescent near-infraredemitter. Nat Photon. 2018, 12, 98-104.
4. Ye, H. et al.: Near-Infrared Electroluminescence and Low Threshold Amplified Spontaneous Emission above 800 nm from a Thermally Activated Delayed Fluorescent Emitter. Chem. Mater. 2018, 30, 6702-6710.

Speaker 9

Fabrication and characterization of porous conductingpolymers

Author: **Souhail Essadiki**
E-mail address: souhail.essadiki@ics-cnrs.unistra.fr
Supervisor: BINIEK Laure

Pronouns: He
PhD year: 2nd
Institute: Charles Sadron Institut

Brief presentation

After obtaining his master's degree in material science in 2021 at the University of Abdelmalek EssaâdiTanger, Morocco He decided to come to France to dive deeper into the world of material science, He joined a 2nd-year master's program in 2022 at the University of Haute Alsace Mulhouse, France The vast world of polymer science triggered the sense of curiosity in him, and was the reason he chooses to pursue his studies in this field, but this time concentrating more on conjugated polymers and their thermoelectric applications Now, he's a 2nd year Ph.D. student under the supervision of Laure Biniek,at SYCOMMOR team at Charles Sadron Institute Besides his academic curriculum, Souhail is a cinephileand an essential defender in 5v5 Futsal.

Abstract

Conducting polymers have garnered significant attention in the field of thermoelectricity and researchers have made considerable breakthroughs in the charge transport properties of thesematerials. However, most of the research is dedicated to thin film study while thick materials could beeasier to implement into vertical thermoelectric generators. Meanwhile little is understood in terms of controlling thermal conductivity (κ) and the effect of doping on it. Our research group focuses on reducing κ by forming three-dimensional conducting polymers and engineering their porosity. [1] [2] This current study aims to fabricate a new material composed of a blend of insulating (syndiotactic polystyrene (sPS)) and semi-conducting (poly(3-hexylthiophene (P3HT)) polymers that exhibit very low thermal conductivity while maintaining acceptable power factor (PF) values. The P3HT/sPS aerogels with over 95% porosity and a thickness of 4-5 mm were fabricated through supercritical drying of the gels. The doping process was optimized to ensure homogeneous diffusion of the dopant within the few millimeter-thick samples, utilizing F4TCNQ as a doping molecule. We will describe here the measurement methods developed to characterize such new materials and the effect of dopingconditions on the thermoelectric properties. In particular, we observed a decrease in thermal conductivity with a higher doping level, which is unintuitive. This leads to a low thermal conductivity (κ = 25.2 $mW.m^{-1}.K^{-1}$) compared to the values seen in other P3HT/sPS aerogels (where κ = 36.1 $mW.m^{-1}.K^{-1}$ [3]) or in 100% P3HT foam (where κ = 135.5 $mW.m^{-1}.K^{-1}$ [4]).

1. L. Biniek et al. Front. Electron. Mater. 2022, 2:875856.
2. L. Biniek et al. J. Mater. Chem. C 2023, 11, 7802-7816.
3. T. Shimomura et al. ACS Appl. Polym. Mater. 2021, 3, 1, 455–46
4. C. Müller et al. Adv. Funct. Mater. 2017, 27, 1704183.

Speaker 10

Ferroelectric materials for efficient light harvestingapplied to solar cells

Author: **Chenyue Hu**
E-mail address:
chenyue.hu@ipcms.unistra.fr
Supervisor: Silviu Colis

PhD year: 1st

Institute: IPCMS

Brief presentation

I come from China and I have started my French journey in 2019, thanks to the student exchange program existing between the East China University of Science and Technology (ECUST) and ECPM. I obtained both my bachelor's and master's degrees in materials science. I am particularly interestedby materials for energy and therefore I started a PhD in this field aiming at understanding new mechanisms through which materials can store or convert different types of energy and look for new ideas of applications. Besides my research activity, I teach as a monitor at ECPM and I'm a delegate ofInternational Doctoral Program in University of Strasbourg, which allows me to interact with multidisciplinary and multicultural colleagues.

Abstract

Ferroelectric materials are widely exploited in microelectronics. In recent year their use expanded towards optoelectronic devices, with potential impact on photovoltaics. [1-2] Some perovskite oxides have attracted a particular attention in this sense. [3-5] The key property of these materials is their intrinsic polarization, giving rise to an electric field that facilitates the separation of charges created upon absorption of photons. The associated voltage was demonstrated to be larger than that of a p- n junction in conventional silicon based solar cells. Therefore, it is believed such cells may offer high conversion efficiencies. The key issue in the development of these ferroelectric materials for photovoltaic applications is the production of thin films with high crystalline quality containing lowerlevel of disorder and less defects. The aim of this subject is to make the correlation between the growth of thin films and their properties at both local and macroscopic scales. These results can be helpful for designing ferroelectric thin films with enhanced performances for optoelectronic devices.

[1] H. Huang and J.F. Scott (Ed)," Ferroelectric materials for energy applications" John Wiley & Sons Inc. (2018).
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Speaker 11

Ultra diffuse galaxies in the Coma cluster in MOND

Author: **Srikanth T. Nagesh**
E-mail address: togerenagesh@unistra.fr
Supervisor: Dr. Benoit Famaey and Dr. Jonathan Freundlich

Pronouns : He
PhD year: 2nd
Institute: Astronomical observatory of Strasbourg

Brief presentation

I am Srikanth T. Nagesh, a PhD student at Observatoire Astronomique de Strasbourg. I was born and raised in Bengaluru, India. I completed my Bachelors in India and moved to Bonn, Germany to pursue a master degree in astrophysics. My PhD supervisors at the Observatoire were kind enough to host me and offer me a PhD position, and voila, here I am since 2022.

Abstract

Gravity is the least understood among the four forces of nature. The Lambda Cold Dark Matter (LCDM) paradigm tells us that the Universe is made up of baryons (visible component), dark matter, and dark energy, with dark matter driving the structure formation on large scales. Galaxy clusters are the biggest self-gravitating structures in the Universe. They are made up of hot ionized gas and thousands of different types of galaxies, embedded in a massive dark matter halo.

In this work, we investigate ultra diffuse galaxies (UDGs) observed in the Coma galaxy cluster. UDGs are low-surface brightness objects with large half-mass radii. The keyword "diffuse" is an indicator that the internal gravity of these objects is relatively weak. The UDGs weak internal gravity combined with the strong gravity from the galaxy cluster renders them to be ideal candidates test gravity theories such as Modified Newtonian Dynamics (MOND). MOND was proposed as a alternative to dark matter paradigm in 1983 by Mordehai Milgrom. It has been successful in explaining many galactic scale phenomena without the need of dark matter.

Spectroscopic observations provide velocity dispersion profiles of UDGs in the Coma cluster, and using these measurements to model UDGs in context of MOND has revealed some discrepancies between theory and observations. In this presentation, I will be presenting results of numerical simulations of UDGs orbiting around the Coma cluster, in MOND. We look at some of their dynamical properties and compare them with observations and subsequently try to explain whether the UDGs are within the realm of reconciliation or beyond.

Image credits: NASA

Speaker 12

Ultrafast spectroscopy of TB dyes for Dye-Sensitized Solar Cells

Author: **Simon Ali Rincon Celis**
E-mail: simon.rinconcelis@ipcms.unistra.fr
Supervisor: Prof. Stefan Haacke

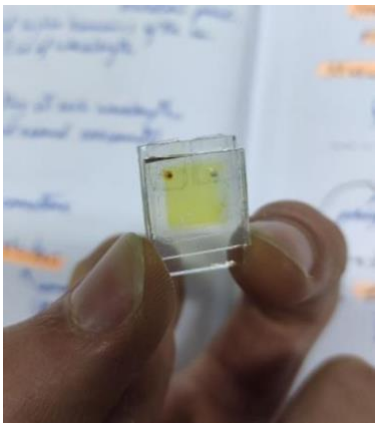
Pronouns: He
PhD year: 1st
Institute: IPCMS

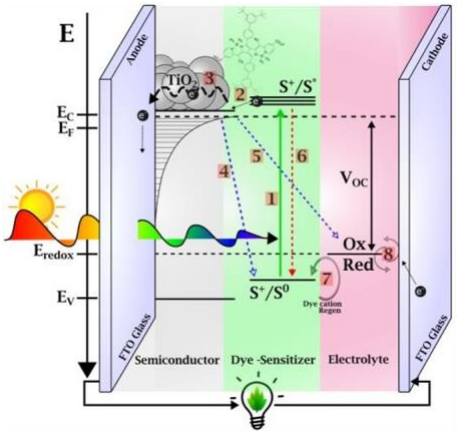
Brief presentation

Hello! My name is Simon Ali Rincon Celis. I am a Venezuelan physicist doing my Ph.D. at the Institut dePhysique et Chimie des Matériaux de Strasbourg (IPCMS). I finished my master's in physics at UNISTRA, where I followed the M1 and the EFEQT program, and the M2-MCN track during the last academic year. I am interested in quantum technologies as well as clean energy production. My Ph.D. is focused on the understanding of the competing ultrafast processes happening in transparent dye-sensitized solar cells.

Abstract

Dye-sensitized solar cells (DSSCs) use molecules to harvest sunlight and initiate charge transport. Theircolor and transparency tunability allow more flexible uses and make them interesting for applicationslike integration in buildings, houses, and vehicles [1,2]. Transparent and colorless solar cells with selective absorption in the near-IR can be used for these purposes due to the higher flux of photons than in UV. Specifically, for near-IR dyes based on cyanines, molecular aggregates form upon adsorption in the TiO_2 surface, and it was shown that monomer-to-aggregate resonant energy transfer(RET) competes with carrier injection into the semiconductor since it occurs on the same time scale [3]. Within this project, TB dyes have been introduced and characterized using femtosecond transientabsorption spectroscopy (fs-TAS) and fluorescence up-conversion spectroscopy (FLUPS) [4,5]. These dyes show power conversion efficiency (PCE) values ranging between 3.8-4.1%. In this Ph.D. thesis, wewill study the temporal competition between RET from monomers to aggregates and the carrier injection in DSSCs with the best-performing TB dyes.





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ED 182

PhD student's Congress

2024 edition

POSTER CONTRIBUTIONS

Poster 1

Design and synthesis of new thermally-activated delayed fluorescence (TADF) polymers for optoelectronic applications.

Author: **Edoardo Bartolini**
E-mail address: edoardo.bartolini@etu.unistra.fr
PhD year: 1st
Supervisor: Nicolas Leclerc – Anthony D'Alèo
Institute: ICPEES - IPCMS

Brief presentation

Born in a small town in the east-central part of Italy, named Ascoli Piceno, after a scientific high- school degree I studied chemistry and material science in Bologna and Milan, between 2017 and 2023. During my academic path, I developed a deep interest and specialized in photochemistry, organic and polymer chemistry, and here in Strasbourg I have the opportunity to combine these fields within a single topic, which makes me extremely motivated and happy to be part of the ED182. Outside of my lab, I'm part of the Internationa Doctoral Programme of the University of Strasbourg.

Abstract

Organic light-emitting diodes (OLEDs) are a prominent technology for displays and illumination devices due to their lightweight, flexibility and higher optical properties compared to liquid crystal displays (LCD) and LED. The last decades have seen tremendous development in these innovative devices, whose commercial employment was led for the first time by SONY in 2008, followed byother big tech companies such as Samsung, Apple, and Nintendo, and arrived at its culmination in LG's OLEDs TV.

My thesis project involves the design, synthesis and characterization of new fluorescent materials belonging to the third and last generation of emitters for OLED. In fact, during the last ten years, a new bright technology has been developed, named "thermally-activated delayed fluorescence", or TADF. Compared to the first and second generation of OLED emitters, TADF dyes are way more efficient and avoid the use of precious metals like Iridium or Platinum, whose cost, environmental impact and shortage prevent a wide and cheap marketization of OLED devices [1]. At the same time, we will try to produce polymers out of these compounds, since polymeric materials can be processed with low-cost manufactury and have mechanical properties ideal for the production of flexible or stretchable devices.

Reference:
[1] Liu, Y., Li, C., Ren, Z. *et al.* All-organic thermally activated delayed fluorescence materials fororganic light-emitting diodes. *Nat Rev Mater* **3**, 18020 (2018).

Poster 2

Amylovis-grafted dendronized IONPs as tracers for the detection of neurodegenerative disease by MRI

Author: **Gabriel R. Guerrero Porras**
E-mail address: grgp40@gmail.com
Supervisor:
Prof. Sylvie Bégin-Colin
Prof. Marquiza Sablón CarrazanaProf. Alicia M. Díaz García

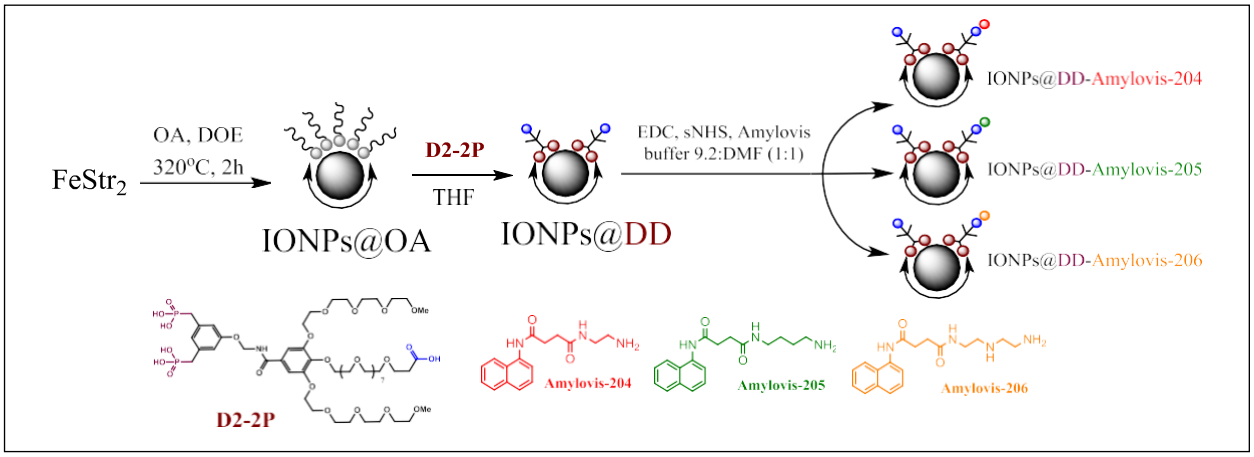
Pronouns: He
PhD year: 1st
Institute:
ICPEES-UNISTRA
CNEURO-BioCubaFarma, Havana, CubaLBI-FQ-UH, Havana, Cuba

Brief presentation

Hello, my name is Gabriel Guerrero and I'm a 1st year PhD student in Chemical Sciences between the University of Havana (Cuba) and the University of Strasbourg (France). I'm a 27-year-old Cuban whois very passionate about chemical sciences, especially those related to biochemical processes. My research topic is related to the synthesis of metal oxide nanoparticles as contrast agents for the early detection of neurodegenerative diseases, such as Alzheimer's disease. I am very grateful for the opportunity offered by this congress to share my work with you.

Abstract

For a precise Magnetic Resonance Imaging (MRI) detection of β-amyloid plaques (βA), structures thatare a hallmark of Alzheimer's disease (AD), contrast agents (CAs) that increase the sensitivity of MRI must be employed. Iron oxide nanoparticles (IONPs) are promising T2 CAs, but, to ensure a targeted diagnosis, it is necessary to couple at their surface targeting ligands able, after intravenous injection, to selectively accumulate into the structures under study (βA). In this work, three targeting ligands which are aminated derivatives of naphthalene (named Amylovis) and have been developed inCNEURO and related to βA, were conjugated to dendron-functionalized IONPs (ICPEES). The dendron is strongly anchored at the surface of IONPs by two phosphonate groups and display a peripheral terminal carboxyl group, on which the Amylovis targeting ligand is coupled through the formation of amide-like bonds. Such designed dendronized IONPs bearing Amylovis represent novel CAs that are promising for the detection of AD by MRI.



Poster 3

Quantum Spintronic Energy Harvester

Author: **Mathieu Lamblin**
E-mail address:
mathieu.lamblin@ipcms.unistra.fr
Supervisor: Martin Bowen

Pronouns: It
PhD year: 3rd
Institute: IPCMS - DMONS

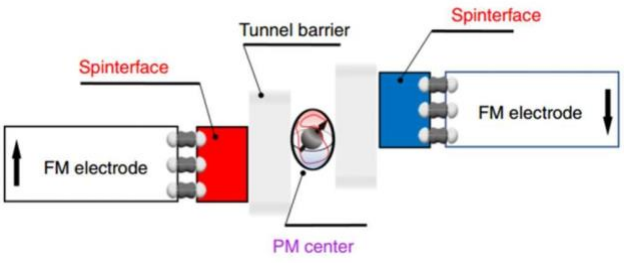
Brief presentation

After a preparatory class in Mathematics, I obtained an engineering degree from Ecole Polytechnique and a master degree in Condensed Matter Physics from Ecole Normale Superieure. I have an utmost concern for environmental issues as I am convinced that the biggest challenge of this millennium is climate change along with the upcoming scarcity of resources and the destruction of the ecosystems which will impact deeply our comfortable habits. Facing these concerning problems, I have made my life goal the quest of finding innovative and resilient ways to deal with energy. These aspirations, alongwith my profound wish to explore the mysteries of the quantum world led me to this project which is perfectly in line with my moral values and allows me to design real devices which might be at the center of an upcoming industrial revolution.

Abstract

Quantum heat engines have attracted extensive research as they give us hope towards abundant, continuous, microscopic and environmentally-friendly power sources. Recent experimentations carried out by my team have showcased a quantum heat engine that harvests the energy provided bythe magnetic fluctuations of trapped atomic complexes between two ferromagnetic electrodes.

This poster aims at introducing the spintronic engine and give insight towards its description in terms of transport, spin and thermodynamics. The design of our device will be presented along withmagneto-transport experimental results proving its efficiency. Insights into the ongoing theoretical research that aim at explaining this strange energy-generative behavior will be given using the phenomenological framework of mesoscopic spintronics applied to a non-linear spin-diode material. This model will finally be put in resonance with a macroscopic fully-electronic description of an equivalent circuit representing the device.



	Source	Typ. Pd (mW/cm²)	Constraint
Natural	Paramagnetic fluctuators in a MTJ	30000	R&D / Engineering...
Artificial	Solar	50	Not 24/7
	Thermoelectric	30	T gradient
	RF power	1	Distance/ Harmonics
	Vibration/PZT	0.2	Vibration frequency
	Vibration/EM	10	AC/DC conversion

Poster 4

Why Weren't We Made of Antimatter? Search forCharge Parity Violation in Higgs Decays into Tau Leptons with CMS

Author: **Poncet Océane**
E-mail address:
oceane.poncet@iphc.cnrs.fr
Supervisor: Anne-Catherine Le Bihan, SaskiaFalke

Pronouns: She

PhD year: 2nd

Institute : Insititut Pluridisciplinaire HubertCurien

Brief presentation

Hello, I'm Océane Poncet, a particle physics PhD student at IPHC, specializing in the search for ChargeParity violation in Higgs to tau leptons decays within the CMS experiment. As QMAT member, I contribute to the academic community by teaching at the Faculty of Physics and Engineering of Strasbourg, where I also completed my bachelors and master studies. Having participated in the CERN summer student program, I am now an active member of the CMS collaboration. Outside academia, I enjoy outdoor sports like hiking, climbing, and running as well as photography.

Abstract

At the universe's origin, matter and antimatter were presumably equally present. However, today's matter prevalence implies early universe Charge Parity (CP) symmetry violations. The Standard Model of particle physics (SM) predicts CP violation but not sufficiently to justify the current matter- antimatter asymmetry of the Universe. On July 4th, 2012, CERN's ATLAS[1] and CMS[2] collaborations completed the Standard Model with the Higgs boson discovery. While studies confirm CP-invariant couplings of the Higgs boson to vector bosons, potential CP violation in Higgs-fermions couplings are not yet excluded. My research focuses on the Higgs boson's decay into tau leptons, using data collected by the CMS detector at the Large Hadron Collider. The CP-sensitive variables are reconstructed using the tau spin information preserved in the Higgs decay into tau leptons. My initial work focused on the calibration of the hadronically decaying tau leptons, especially on the development of a new method to measure the identification efficiency and energy scale. Ongoing work includes the development of an analysis framework to add the delicate di-tau lepton invariant mass reconstruction as a crucial background reducing discriminating variable.

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[2] CMS. (2012) "Observation of a New Boson at a Mass of 125 GeV with the CMS Experiment at the LHC", *Physics Letters B*, *716*, 30-61doi:10.1016/j.physletb.2012.08.021

Poster 5

Polymorphism drives thermoelectric properties in oriented PBTTT films

Author: **Said Oummouch**
E-mail address:
said.oummouch@ics-cnrs.unistra.fr
Supervisor: Martin Brinkmann

Pronouns: He

PhD year: 1st

Institute: Institut Charles Sadron

Brief presentation

My name is Said Oummouch, a 24-year-old from Morocco. After obtaining my baccalaureate in physical sciences, I decided to pursue a bachelor's degree in chemical engineering and a master's degree in materials science engineering. My fervent interest in scientific inquiry propelled me to pursue a doctoral degree, during which I am conducting a thesis under the esteemed guidance of Dr. Martin Brinkmann. My research primarily revolves around the fabrication of anisotropic n-type polymer thin films.

Abstract

Polymorphism is a common feature of polymer semiconductors such as polythiophenes and determines their optical and electronic properties. Controlling polymorphism is thus an elegant means to probe structure-property correlations for this class of materials. In this contribution, we focus on a PBTTT bearing single-ether side chains, namely PBTTT8O. This polymer forms two distinct structures under controlled growth conditions: a crystalline phase with highly ordered side chains and a liquid crystalline phase with disordered side chains. Methods to grow and interconvert the pure phases are uncovered. Highly oriented films of both polymorphs have been prepared using high-temperature rubbing and a model for the structure of the crystalline polymorph is proposed. Upon doping with the strong acceptor F6TCNNQ, the aligned polymorphs show substantially different transport and thermoelectric properties, the best thermoelectric properties are observed for the LC phase with power factors of 1382.4 µW/mK2 at [F6TCNNQ] = 2 g/l versus 428.7 µW/mK2 for the crystalline phase at [F6TCNNQ] = 5 g/l. More interesting, TE properties are further improved for aligned films showing a coexistence of the two polymorphs.

Poster 6

Supercrystals of noble metal nanoparticles: latticepacking and plasmonic properties

Author: **Sébastien Boukhris**
E-mail address:
sebastien.boukhris@etu.unistra.fr
Supervisor: Doru Constantin

Pronouns: He
PhD year: 1st
Institute: Institut Charles Sadron

Brief presentation

My name is Sébastien Boukhris and I'm a first year PhD student working at the Charles Sadron Institut. I did all my studies in Strasbourg. I first obtained à License in physics and I then obtained a Master's degree in materials engineering in which I specialized in Polymer engineering during the second year. During my M2 internship, I had the opportunity to discover and use X-ray scattering techniques to understand the behavior of the chains of a polymer network under stretching. It is because of that experience that I choose to do my thesis on a subject that uses the same primary characterization technic.

Abstract

Since Ancient Greece, natural scientists have been fascinated by the way identical bodies pack together in regular assemblies. The vast majority of their efforts has concerned isometric objects (with a similar size along the three space directions), such as spheres and Platonic or Archimedean solids (full or truncated regular polyhedra, respectively). However, much less work has been done onelongated particles, such as ellipsoids or spindles. In this context, the assembly of nanoparticles (NPs) in supercrystals (SCs) has both fundamental and practical significance. On one hand, their excellent shape regularity and large density make them ideal candidates for achieving compact and ordered packings; on the other hand, small changes in the SC structure can lead to large variations intheir optical properties. Our goal is to study the different packing and optical properties obtained using NPs of different shapes (ranging from bipyramidal to ellipsoid and shapes in between). To achieve that, several state-of-the-art techniques are being used such as scanning electron microscopy (SEM), X-ray scattering, and spectroscopy.

Poster 7

Hybrid Chiral Plasmonic Assemblies for Biosensing

Author: **Sevil Veysalova**
E-mail address: sevil.veysalova@ics-cnrs.unistra.fr
Supervisor: Matthias Pauly

Pronouns: They
PhD year: 1st
Institute: Institut Charles Sadron

Brief presentation

I am Sevil Veysalova from Azerbaijan. I completed my Bachelor's degree and the first year ofmy Master's degree in Baku, Azerbaijan, before continuing my studies in Strasbourg, France for the second year of my Master's degree. Last year, I completed an internship at the InstituteCharles Sadron, focusing on enhanced sensing of chiral biomolecules using chiral plasmonicmetasurfaces. Currently, I am continuing my PhD at the same institute, where my research focuses on "Hybrid Chiral Plasmonic Assemblies for Biosensing Applications". In my spare time I actively participate in a variety of sports as hobbies, including cycling, boxing, workout, yoga, pilates and hiking. These activities not only keep me physically fit, but also provide a welcome balance to my academic pursuits.

Abstract

Chirality is a long-standing area of research in the biosciences and chemistry because it determines important aspects of a molecule's interactions and reactivities with other chiral molecules. Circular dichroism (CD) spectroscopy is a key tool for detecting andcharacterizing chiral structures, which exhibit different optical responses to different circularlypolarized light. These natural responses are inherently weak and require large amounts of chiral material to achieve adequate signal-to-noise ratios. On the other hand, chiral noble metal nanoparticles exhibit strong CD due to their localized surface plasmon resonance. The ultimate goal of my research is to enhance the CD of molecules and the sensitivity of CD spectroscopy with the use of chiral plasmonic metasurfaces. In this study, we construct chiralplasmonic metasurfaces using Grazing Incidence Spraying (GIS) and Layer-by-Layer (LbL) self-assembly methods, with a flow cell integrated on top of the platform. GIS is used to deposit oriented silver nanowire arrays, while LbL is used to construct multilayer superstructures. The flow cells allows to bring various solutions in contact with the chiral plasmonic metasurfaces.

Poster 8

Ultrafast photoreactivity of bio-inspired moleculardevice

Author: **Thomas Meric**
E-mail address:
Thomas.meric@ipcms.unistra.fr
Supervisor: Jérémie Léonard

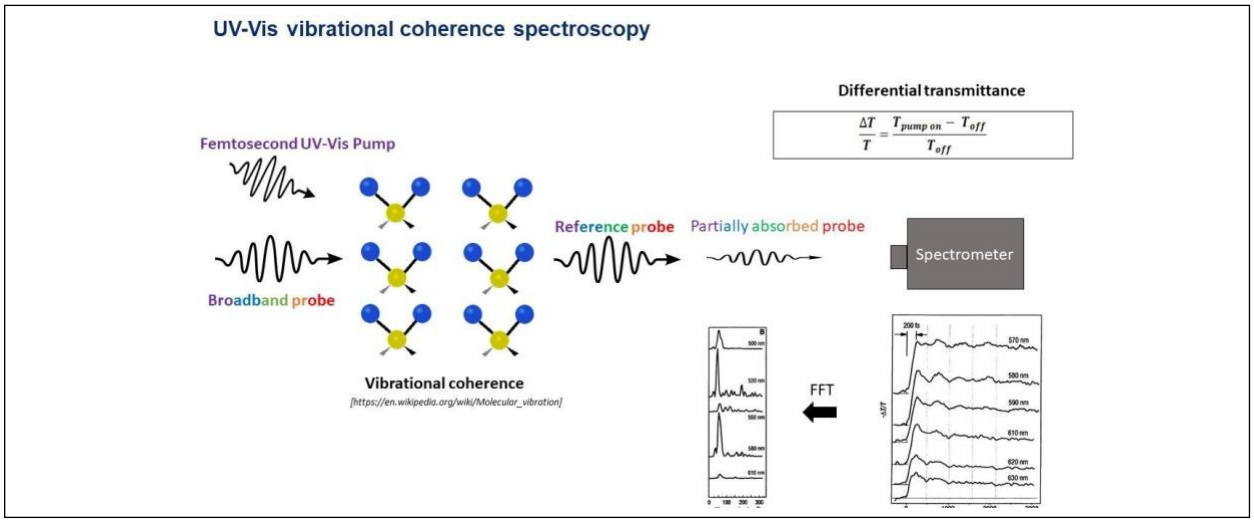
Pronouns: He
PhD year: 1st
Institute: IPCMS

Brief presentation

My name is Thomas Meric, I'm a first-year PhD student and I joined the IPCMS in December. I come from the world of photonics, having completed the Europhotonics Master's program shared between the University of Aix-Marseille in France and the University of Tampere in Finland. I started a PhD in Germany at the Helmholtz-Zentrum Dresden-Rossendorf. I was working on the implementation of a contrast enhancement front-end for the PW laser PENELOPE, aimed at performing ion acceleration experiments for radiobiological applications. However, due to difficulties with my supervisor, I decided to change projects after the first year. I joined the IPCMS to work on bio-inspired molecular devices. In particular, controlling the ultrafast reactivity of these molecules requires the use of ultrashort laser pulses, which is the subject I want to specialize in.

Abstract

Nowadays, the physical properties of matter are controlled at the molecular level. Bio-inspired photoswitches and motors for example are synthetic molecules that rotate on themselves when a photon is absorbed, thereby modifying their physical and chemical properties. Unfortunately, current photoswitches are limited by their low efficiency. We want to study photoswitches to identify the parameters that determine the efficiency of photo-induced molecular rotation and see if we can improve it. To monitor ultrafast molecular dynamic processes, we are using a technique called UV- VIS vibrational coherence spectroscopy (VCS). An ultra-short pump is used to trigger a synchronized isomerization process. A probe is then used to measure the variation in absorption resulting from the molecular vibrations (transient absorption spectroscopy). With some Fourier transform analysis, we can obtain several informations, such as the reaction speed or coherency preservation and see which atomic bond is involved in the isomerization process. Pump duration is a key parameter for VCS, so I will also present my results on pulse characterization using ptychography, a method for measuring the spectrum and phase of ultrashort pulses.



Poster 9

X-Ray properties of Young Stellar Objects in Orion

Author: **Thomas Oliveira**
E-mail address:
thomas.oliveira@astro.unistra.fr

Supervisor: Laurent Cambrésy

PhD year: 1st

Institute: Observatoire astronomique de Strasbourg

Brief presentation

I'm Thomas Oliveira, born in Loraine near Metz. I like video games and sports like volleyball, bike,handball, swimming, etc...

Abstract

Context: The link between stellar formation and evolution with X-ray emission is still unclear. This ispartly due to the limitations on sensitivity, area coverage and positional accuracy of existing X-ray surveys, which make it difficult to identify optical counterparts.

Method: In this study, we initially focused on crossmatching X-ray measurments in the Orion Molecular Cloud with optical counterparts (from the Gaia telescope). We reached a limiting flux of1e-16 ergs/cm2/s and a mean positional error of 1.5 arc-seconds. Based on the X-ray to optical angular separation distribution we determined the false association rate. Using Gaia distances we derived X-ray luminosities. Comparing the observed Gaia colour magnitude diagram to that of PARSEC isochrones (Bressan et al. 2012) we derived the average age and extinction. We also investigated the possible correlation between the X-ray to optical luminosity ratio as a function of optical luminosity.

Results: We identified 1122 X-ray sources with statistically reliable optical counterparts and found sources have X-ray luminosities in the range 10^(28-32) erg/s. We estimated an average age of 15 million years and a mean Hydrogen column density of ~ 1.5 x 10^21 atoms/cm2. We found that low mass stars follow an approximate constant ratio of Lx/Lg ~ 10^-3, while massive stars display a muchlower X-ray to optical luminosity ratio going all the way down to 10^-7. These preliminary results provide the basis for a much broader study around the solar neighbourhood, which will be extended to the eROSITA data.

Poster 10

Can we decipher the dynamics of the Milky Way Disk from Gaia ?

Author: **Yassin Rany Khalil**
E-mail address: Yassin-rany.khalil@etu.unistra.fr
Supervisor: Benoit Famaey, CNRS
Pronouns: He
PhD year: 2nd
Institute: Astronomical Observatory of Strasbourg

Brief presentation

Hello, my name is Yassin. I am fascinated by the nature that surrounds us. My curiosity about our universe and a pious appreciation of mathematics and physics lead me to study our galaxy: the MilkyWay.

Abstract

Stars, planets, dust, gas, and dark matter are the main components found in our galaxy. The force ofgravity is what lets them in constant interaction. Further, we see many features in other galaxies.

Surprisingly, as we are inside the Milky Way, it is not easy to distinguish the structure therein. We could think of the analogy of someone trying to draw a plan for his city by looking at it from the 3rd floor of a building. We could then have other construction in front of them. Also, it could be foggy orrainy sometimes. These examples show how hard it would be to do so. After everything, we have many decades of astronomical observations of our galaxy and research supporting the existence of some structures in the Milky Way. Two of them being the bar and the spiral arms. The bar is sort of an assembly of stars looking like the pointers of a watch rotating accordingly. The spiral arms are more familiar to our imagination. Both have physical parameters, like their frequency of rotation.

Those parameters are not yet precisely determined, and tension exists between different values. Inmy work, I hope to share in my talk how exciting and adventurous is to study the physical characteristic of the bar and the spiral arms of our galaxy by studying the dynamics of the movements of the stars around the Sun.

Poster 11

Urea-containing supramolecular semiconductors based on diketopyrrolopyrrole systems

Author: **Id-boubrik Imrane**
E-mail address: Imrane.id-boubrik@ics-cnrs.unistra.fr
Supervisor: Amparo Ruiz-Carretero

Pronouns: He
PhD year: 3rd
Institute: Charles Sadron

Brief presentation

My name is Id-boubrik Imrane, 3rd PhD student in supramolecular/organic chemistry in Charles Sadron Institute. I graduated my master degree in molecular chemistry at Sorbonne University in 2021 and got an ANR financement at ICS with Dr Amparo Ruiz-Carretero as supervisor. I did a presentation for this event two years ago. For my last PhD year I will present a poster with datas updated.

Abstract

Hydrogen bonding interactions provide an efficient way to control the molecular packing and orientation of conjugated polymers and organic molecules leading to significant changes in their electrical and optical properties. In this work, we explore hydrogen-bonded systems based on diketopyrrolopyrrole (DPP) as a model. We have chosen DPP due to his extended π-conjugated structure, excellent stability, charge mobility and optoelectronic properties and explore the influence of H-bonding in electronic devices such as organic photovoltaics (OPVs), organic field-effect transistors (OFETs) get charge carrier properties, optoelectronic properties, an excellent stability, a low solubility and an intense red color. Their properties can be shaped by substitutions in many positions and allow tuning optoelectronic properties whereas H-bonding direct the self-assembly towards different supramolecular structures with different optoelectronic properties. We purpose to present H-bonding effect on DPP optoelectronics properties with DPP functionalized by urea chains in lactam and thiophene core thanks to different techniques (UV, XRD, photoconductivity).