L2C PhD Day Meeting

January 19th, 2016

« PhD day » Organizers :

Rahima Sidi-Boulenouar

Dafne Musino

Katarzyna Walczak

Christelle Eve

Christian Ligoure

Amphithéâtre de l'Institut de Botanique,
163, rue A. Broussonnet
Montpellier

Dear colleagues,

It is with great pleasure to invite you all to the 2016 edition of the « Phd Day meeting ».

The aim is to make young researchers to speak about their scientific project to the L2C staff.

It is a good opportunity to discuss about different topics and to connect the teams of the lab.

Your participation is essential, so we count on you to come and support the new generation of researchers.

Rahima, Dafne and Kasia

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MORNING SESSION 8H30-12H	
8H30-9H	**WELCOME**
9H-9H20	**STEFANO Aime** « Microscopic precursors of failure in colloidal gels »
9H20-9H30	**GROSS Isabell «** Nitrogen Vacancy scanning magnetometry for exploring exotic magnetic orders in thin film heterostructures. »
9H30-9H50	**KADYKOV Alexandr «** Terahertz excitations and phase transitions in HgCdTe heterostructures »
9H50-10H	**PINCEMAILLE Justine «** Interactions and assemblies wheat prolamins »
10H-10H20	**NINNARELLO Andrea «** Heterogeneous Glassy Dynamics near a Second Order Critical Point »
10H20-10H30	**ALEXEY Brodoline «** Digital holography applied to bio-imaging »
10H30-11H	**COFFEE BREAK**
11H-11H20	**SRISHTI Arora «** Interplay between viscosity and elasticity in freely expanding liquid »
11H20-11H30	**VUONG Thi Guynh Phuong «** Spectroscopy of boron nitride heterostructure »
11H30-11H50	**DOYEUX Pierre «** Quantum thermal machine acting on a many-body quantum system »
11H50-12H	**VILLA Stefano «** Interface-particle Interactions to Boost Water Treatment »
12H-12H20	**SAINT-MARTIN Guillaume** « Tissue alterations in spinal cord injured rodent: classic and diffusion magnetic resonance imaging as translational tool »
12H20-12H30	**PHIMPHACHAHN Anthony** « Synthesis and co-assembling of DHBC (double hydrophilic block copolymer) »
12H30-14H	**LUNCH**

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AFTERNOON SESSION 14H-17H	
14H-14H20	**MARCINKIEWICZ Michal «** Terahertz studies/probing of 2D and 3D topological transition**s »**
14H20-14H30	**TIALIN Wang «** Graphene on silicon carbide and copper: growth by chemical vapor deposition, structural analyses and potential applications **»**
14H30-14H50	**HUONG THI Ngo «** Power dependence of Internal Quantum Efficiency of Yellow Light Emitters based on InGaN-AlGaN-GaN Heterostructure**s »**
14H50-15H	**WALCZAK Katarzyna** « Novel high surface carbon-hybrid materials for enhanced hydrogen storage **»**
15H-15H20	**MUSINO Dafne «** Impact of coating agents on multi-scale structure and dynamics in silica-styrene/butadiene nanocomposites **»**
15H20-15H30	**POIRIER Alexandre «** soft matter approach for thickening liquids oils **»**
15H30-16H	**COFFEE BREAK**
16H-16H20	**HEINZE Karstra «** The mechanical properties of wheat grain biopolymers**»**
16H20-16H30	**MOHAMMED Ali «** Anisotropic Optical Properties of a Homoepitaxial **»**
16H30-16H50	**SIDI-BOULENOUAR Rahima** « A portable NMR device for the dynamic monitoring of water status in the fields of environmental stress plants: Sorghum application **»**
16H50-17H	**NAWACHATY Abi**r « Towards bottom-gated graphene p-n junctions on a Silicon Carbide substrat**e »**
17H20-17H20	**MATTONAT Melody «** Morphology of silica mesoporous materials structured by electrostatic complexes: Role of water activity **»**

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Microscopic precursors of failure in colloidal gels

StefanoAime

The mechanical properties of amorphous solids are currently a topic of intense research, with implications in material science as well in fundamental condensed matter physics. Recent works focus on the interplay between irreversible rearrangements at the microscopic level, resulting from an applied deformation or stress, and the macroscopic mechanical behavior. At the macroscopic scale, in fact, a distinctive feature of these materials is the slow plastic deformation that is observed when they are subject to a step stress. Remarkably, this slow creep regime is often interrupted by the sudden rupture of the material, with no macroscopic precursors.

Even though material failure is ubiquitous in our everyday life, the underlying microscopic mechanisms are still not well understood, mainly because the direct observation of its precursors at the particle level is experimentally very challenging in atomic or molecular materials. Therefore, in this work we study the microscopic dynamics of a colloidal system under load, as a model system to investigate material failure. In particular, we measure the internal dynamics of colloidal gels during the creep regime, using a custom-made Mid-Angle Light Scattering apparatus coupled to a stress-controlled shear cell that I have developed.

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Nitrogen Vacancy scanning magnetometry for exploring exotic magnetic orders in thin film heterostructures

Gross[1,2], L.J. Martínez[2], V. Jacques[2]

[1]ENS Cachan [2]Laboratoire Charles Coulomb

The Nitrogen-vacancy (NV) centre is a color centre in diamond, which exhibits the quantum properties of a single atom, but in the solid state. By performing optically detected magnetic resonance it is possible to retrieve the Zeeman splitting of the NV centre's spin states and thus detect a local magnetic field. A NV-hosting atomic force microscope tip was combined with a confocal microscope to perform nanoscale magnetic field mapping. This set-up is used to explore thin film magnetic samples, in which the Dzyaloshinskii–Moriya interaction plays a crucial role in defining the magnetisation order. Domain walls in magnetic heterostructures, the magnetic structure of multiferromagnetic materials and magnetic Skyrmions will be the main focus of the thesis.

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Terahertz excitations and phase transitions in HgCdTe heterostructures

A. M. Kadykov,[1,2] F. Teppe,[1] C. Consejo,[1] L. Viti,[3] M. S. Vitiello,[3] S. S. Krishtopenko,[2,4], S. Ruffenach,[1] S. V. Morozov,[2,4] M. Marcinkiewicz,[1] W. Desrat,[1] N. Dyakonova,[1] W. Knap,[1] V. I. Gavrilenko,[2,4] N. N. Mikhailov,[5] and S. A. Dvoretsky[5]

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We report on terahertz photoconductivity under magnetic field up to 16 T of field effect transistor based on HgTe quantum well (QW) with an inverted band structure. We observe pronounced cyclotron resonance and Shubnikov-de Haas-like oscillations, indicating a high mobility electron gas in the transistor channel. We discover that nonlinearity of the transistor channel allows for observation of characteristic features in photoconductivity at critical magnetic field corresponding to the phase transition between topological quantum spin Hall and trivial quantum Hall states in HgTe QW.

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Interactions and assemblies wheat prolamins

Justine Pincemaille, L2C, IATE

The object of this work is the comprehension of the complex protein network in the wheat grain as well as the challenge to extract proteins in an appropriate way in order to study their structure-function properties. Results will be obtained by variations of the protein concentration and composition, and environmental parameters as Ionic strength, temperature, nature of the solvent, allowing to finely tune the interaction potential. The structures will be characterized by a combination of techniques like rheology, infrared spectroscopy, light scattering and large scale facilities (for SAXS and SANS studies).

Heterogeneous Glassy Dynamics near a Second Order Critical Point

Andrea Ninarello ,Université de Montpellier - L2C

The study of metastable states and the search for growing structural correlations are challenging tasks in glass science, which can be attacked using suitably coupled replicated systems in real glass models.

In this context, some interesting properties of this systems have recently been revealed. The most important one is the existence of a first-order liquid-to-glass phase transition at equilibrium, ending at a second order critical point.

In this contribution we perform Monte-Carlo simulations in order to characterize the dynamical behaviour and its glassy features in equilibrium conditions in the vicinity of the phase transition. We study in particular the dynamical slowing down related to the approach of the second order critical point, where we find a sudden growth of dynamic heterogeneity.

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Digital holography applied to bio-imaging

Alexey Brodoline, Dario Donnarumma, Daniel Alexandre, Gladys Massiera, Michel Gross.

Soft Matter (MATM), L2C

To understand the formation of the vascular system and the blood circulation in a zebrafish embryo, the observation has to be developed in vivo. Moreover, in microscopy the observation of biological systems is often characterized by a weak contrast in amplitude and an important contrast in phase. Digital holography is a suitable tool, for the study of this kind of systems; it constitutes a simple and non-invasive method.By recording the interference pattern between the light scattered by the object and a reference beam, the entire optical field can be reconstructed by numeric process. By shifting the frequency of the reference beam, it's possible to follow moving objects, like red blood cells. The use of a double illumination enables to reconstruct a 3D picture of the vascular system. Holography would as well be applied to the observation of chicken embryos, vesicles and also to the study of open channels of electromagnetic field in random media.

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Interplay between viscosity and elasticity in freely expanding liquid

S. Arora, L. Ramos and C. Ligoure,

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Montpellier Cedex 05, France

The mechanical behaviour of viscoelastic fluid can be probed by impacting the drop of a viscoelastic fluid on a small target and visualising it with high speed camera. The collision of a low viscosity liquid drop against the small target results in freely expanding liquid sheet. We use various self-assembled transient networks made of surfactant micelles or oil droplets reversibly linked by telechelic polymers. These networks behave as Maxwell fluids, whose characteristic relaxation time and elastic plateau modulus can be tuned by the sample composition and the nature of telechelic polymer. Our data are quantitatively compared with results obtained from viscous liquids of viscosities comparable to the zero-shear viscosities of the viscoelastic networks in order to elucidate the viscous and elastic contributions in the process of sheet formation and destabilization. We will discuss how the relaxation time of the viscoelastic network system plays a crucial role in the destabilisation of the sheet. In particular, we will show that networks with high relaxation time, of the order of a few seconds, lead to peculiar features in the sheet, such as cracks, due to the interplay of viscous and elastic effects. However, for low Deborah number purely viscous effects dominates.

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Spectroscopy of boron nitride heterostructure

Thi Guynh Phuong VUONG

In the recent years, nitride semiconductors gained more interest from scientists. Among them, hexagonal boron nitride (hBN) with unique electronic properties such as a wide bandgap (6eV), low dielectric constant, high thermal conductivity is a promising material for deep-UV light emitting devices. This PhD project consists in optical spectroscopy in hBN by means of time-resolved photoluminescence experiments under excitation down to 195 nm from 10 to 300K. I will first perform measurement in hBN bulk and hBN nanotubes and then in a hBN monolayer, monolayer of hBN on graphene and graphene-hBN superlattices with the goal to identify the difference in the excitonic recombination dynamics compared with bulk hBN and to study the influence of the graphene/hBN interface on the optical properties of hBN and on the transport properties of graphene.

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Quantum thermal machine acting on a many-body quantum system

Pierre DOYEUX

Recent results on quantum systems embedded in an out-of-thermal-equilibrium electromagnetic field have provided a useful framework to the study of quantum thermal machines [1]. Thanks to this configuration, the cooling (or heating) of a single two level atom (a qubit) has been studied, and the role of quantum discord has been investigated [2]. Recently, we have pushed further the study of such systems by increasing the number of qubits composing the target body. We have demonstrated the essential role of correlations in the delivery of the task. In particular, we have pointed out specific configurations in which qubits that are not interacting with the machine can still be strongly heated up (cooled down) thanks to qubit-qubit interactions. Besides, we have shown that modifying geometric parameters may result in a drastic change in the delivery of the task, thus providing the possibility of tuning the temperature of each qubit on a remarkably broad range [3]. I will start the talk by briefly explaining the functionning of the machine and then I will detail the two main results mentioned above.

[1] B. Bellomo, R. Messina, and M. Antezza, Europhys. Lett. 100, 20006 (2012).

[2] B. Leggio, B. Bellomo, and M. Antezza, Phys. Rev. A 91, 012117 (2015).

[3] B. Leggio, P. Doyeux, R. Messina and M. Antezza, Europhysics Letters (Epl), vol. 112 p. 40004 (2015) .

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Interface-particle Interactions to Boost Water Treatment

Stefano Villa

Predicting the physical behavior of particles at fluid interfaces is crucial for the design and optimization of many industrial processes ranging from the stabilization of emulsions in the food and pharmaceutical industries to the flotation techniques applied in wastewater treatment and mining. The central point of our work is the study of the micrometric particle's dynamic near an air-water interface, within a pending-drop geometry. In particular the focus is on the forces acting on the particle before the de-wetting. The study is made measuring the interface-particle distance during time with optical microscopy combined with an interferometric setup.

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Tissue alterations in spinal cord injured rodent: classic and diffusion magnetic resonance imaging as translational tool.

Guillaume P. Saint-Martin[1,4], Harun N. Noristani[1†], Nicolas Lonjon[1,2†], Maïda Cardoso[1], Marine Le Corre[1,2], Alain Privat[1], Christophe Coillot[4], Rahima Sidiboulenouar[4], Eric Alibert[4], Eric Nativel[4], Christophe Goze-Bac[4†] and Florence E. Perrin[1,5*†]

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4.Charles Coulomb Laboratory (L2C-BioNanoNMRI team), UMR 5221 Centre National de la Recherche Scientifique -University, Montpellier, France

5.Department "Biologie-Mécanismes du Vivant," Faculty of Science, University of Montpellier, Montpellier, France

Spinal cord injury (SCI) is a debilitating neuropathology with no effective treatment. Magnetic Resonance Imaging (MRI) technology is the method of choice used to assess the impact of an injury on the structure and functions of the human spinal cord. Moreover, in pre-clinical SCI research, MRI is a non-invasive method with great translational potential since it provides accurate longitudinal assessment of anatomical and structural alterations induced by an injury. Only recently, MRI techniques have been effectively used for the follow-up of SCI in rodents. However, the vast majority of these studies have been carried out on rats and when conducted in mice, the contusion injury model was predominantly chosen. Due to the remarkable potential of transgenic mice for studying the pathophysiology of SCI, we investigated using booth *in* and *ex vivo* 1H-MRI (9.4 T) lesion evolution in two severities of the mouse SCI (hemisection and over-hemisection) and documented their correlation with histological assessments. We demonstrated that a clear distinction between the two injury severities is possible using both *in* and *ex vivo* 1H-MRI and that *ex vivo* MR images closely correlate with histology. Moreover, tissue modifications at a remote location from the lesion epicenter were identified by conventional *ex vivo* MRI analysis. Therefore, *in vivo* MRI has the potential to accurately identify in mice the progression of tissue alterations induced by SCI and is successfully implemented by *ex vivo* MRI examination. In addition, we report on diffusion-weighted MR imaging with the use of dedicated "homemade" probes designed for spinal cord in mouse. This allows not only to study the fibrous structures such as the white matter but also to characterize the structural integrity of axons bundles. This is of crucial importance in the context of SCI. We demonstrate that diffusion MRI allows a much better and accurate identification of lesion extension at the epicentre and along the rostro caudal axis. Therefore, combination of in and *ex vivo* studies using several MRI modalities and histopathological assessment provides a valuable approach to further assess therapeutic strategies following SCI.

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Synthesis and co-assembling of DHBC (double hydrophilic block copolymer)

Anthony Phimphachan

L2C/Laboratoire Charles Coulomb (CNRS-UM) – Matières Molles (Dr. Martin IN)

ICGM/Institut Charles Gerhardt Montpellier (CNRS-ENSCM-UM) – IAM/Ingénierie et Architecture Macromoléculaire (Dr. Patrick LACROIX-DESMAZES)

Double Hydrophilic Block Copolymer (DHBC) are copolymers comprising a neutral hydrophilic block and an ionic hydrophilic block. By adding a Homoelectrolyte (HE) of opposite charge (like Oligo Chitosan) and by raising the pH, DHBC and OC can co-assemble due to electrostatics interactions in reversible PIC (Poly Ion Complex) micelles. The main goal of the thesis is the synthesis by controlled radical polymerization RAFT (Reversible addition-fragmentation transfer) of DHBC : linear and comb P(EO)-b-P((M)AA) and P(AM)-b-P(AA) of different length in ICGM-IAM. Then, co-assembling in PIC Micelles will be studied in term of size, structure and composition in L2C-MM. Theses PIC Micelles are used as a template for the eco-design and synthesis of mesoporous silica materials for drug delivery application and catalysis.

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Terahertz studies/probing of 2D and 3D topological transitions

Michal Marcinkiewicz

L2C, UMR 5221 CNRS, Universite Montpellier, GIS Teralab, 34095 Montpellier, France

December 21, 2015

In the past years, the discovery of novel topological states of matter has attracted significant attention [1]. The most salient feature of such topological insulators (TIs) is that they are fully insulating in the bulk but they have gapless edge or surface states at boundaries. In such structures the electronic dispertion relation is linear - takes form of the Dirac cone, previously observed in graphene. Linear dispertion relation is a fingerprint of relativistic, massless particles, observed for the first time in solid state physics [2].

So far, TI have been discovered in 2D (i.e. GaSb/InAs broken gap quantum wells) and 3D (i.e. Bulk HgCdTe). For the 2D TIs, the 1D edge hosts gapless spin-helical edge channels linearly crossing at a Dirac point, as it was demon- strated experimentally in GaSb/InAs broken gap QWs [3], whereas a 3D TI has protected spin-helical surface states usually with a Dirac cone like dispersion.

References

[1] M. Z. Hasan and C. L. Kane, Rev. Mod. Phys. 82, 3045-3067, 2010

[2] M. Orlita et al., Nature Physics 10, 233238, 2014

[3] E. Halvorsen, Y. Galperin and K. A. Chao, Phys. Rev. B 61, 16743, 2000

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Graphene on silicon carbide and copper: growth by chemical vapor deposition, structural analyses and potential applications

Tianlin WANG[1]

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Eugène Bataillon, 34095 Montpellier Cedex 5, France

Graphene was identified as one of the emerging materials however a low cost synthesis method of homogeneous large graphene layers with excellent quality is still required. Graphene growth by Chemical vapor deposition (CVD) is well controlled on metals (copper [1], Nickel [2], Iridium[3]...). For some applications, it is necessary to add an additional transfer step on silicon wafer and this may be problematic. We have developed a procedure for transferring graphene to all types of substrates without the use of resin. However, this method needs to be studied and developed. On the other hand, graphene growth on silicon carbide (SiC) by sublimation of silicon atoms at high temperature[4] or by CVD[5] remains promising. A study through the parameters such as carbon source, pressure, temperature is required. The elaborate layers will be characterized by structural (AFM, SEM), optical (Raman spectroscopy, Reflectrometry) and electrical techniques.

[1] Li et al. Science 2009, vol324, 1312

[2] Chae et al. Adv. Mater. 2009, vol21, 2328

[3] Coraux et al. NanoLett 2008, vol8, 565

[4] Berger et al. J.Phys.Chem B 2004, 108, 19912 [5] Strupinski et al. NanoLett 2011, 11, 1786

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Power dependence of Internal Quantum Efficiency of Yellow Light Emitters based on InGaN-AlGaN-GaN Heterostructures

Thi Huong Ngo[1], Bernard Gil[1], Pierre Valvin[1], Benjamin Damilano[2], Kaddour Lekhal[2] and Philippe De Mierry[2]

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We investigate the evolution of the internal quantum efficiency (IQE) versus excitation power of yellow light emitters based on multiple quantum-well stacking of InGaN-AlGaN-GaN basic building blocks. In such stacking the indium composition is kept constant at 21 percents and the thickness of AlGaN layers are introduced to compensate the strain and to improve the material quality. Using time resolved photoluminescence measurements we measure that the IQE at low excitation condition increases when increasing the thickness of AlGaN layer in straightforward correlation with the improving of the crystal quality. Power dependent measurements were then carried out and an ABC modeling was used to estimate the contribution of difference recombination channels such as Shockley- Read-Hall non-radiative recombination, radiative recombination and non-radiative Auger recombination. We find that the Auger effect dominates for high excitation regime. We also obtained that intercalating an AlGaN strain compensating layer reduces the coefficient of the non-radiative recombination rates but it also reduces the onset of Auger recombination.

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Novel high surface carbon-hybrid materials for enhanced hydrogen storage

Katarzyna Walczak

Laboratoire Charles Coulomb

The hydrogen storage is one of the most important challenges in developing hydrogen-based, clean vehicles. Today the efficient method of on-board storage, allowing 500 km driving range does not exist. The goal of my thesis is to synthesise the carbon-based materials for hydrogen storage by physisorption, with optimized specific surfaces and hydrogen adsorption energy. The structures will be prepared by arc discharge technique and characterized by MEB, EELS (morphology), N2 adsorption, NMR (pore size distribution), IR and Raman (chemical structure), and calorimetry (energy of adsorption). Hydrogen adsorption will be evaluated at T = 77 K and 300 K and the reversibility of storage will be quantified. In addition, numerical simulations (GCMC) will be used to model the adsorption isotherms and orient the search for applicable structures.

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MImpact of coating agents on multi-scale structure and dynamics in silica-styrene/ butadiene nanocomposites

D. Musino, A.C. Genix, J. Oberdisse (Laboratoire Charles Coulomb, Université Montpellier)

The study of nanocomposites (NCs) opens the road to an improvement of energetic/ climatic performances in tire applications, e.g. via the reduction of rolling resistance related to dissipative processes. Mechanical properties of silica-SB (styrene-butadiene) NCs are strongly influenced by structure and dynamics which are related to polymer chain-filler interactions. In this work, we investigate model (made of SB with colloidal nanoparticles) and simplified industrial NCs (obtained in a mixer, with a complex filler structure) by a multi-scale approach based on structural analysis by small angle scattering and on dynamics studied by dielectric spectroscopy. We are working on i) the influence of silica content (on sample structure, following the increase of repulsive interactions with increasing; ii) the effect of coating agents, which promote filler-polymer *compatibility*. It is shown that the length of silanizing agent has not a strong impact on structural properties. Finally, iii) the impact of crosslinking, which is found to influence aggregate size.

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Soft matter approach for thickening liquids oils

Poirier Alexandre

Laboratoire Charles Coulomb

Although many oils are used in the food industry, palm oil is the most used for its technical properties, being solid at room temperature and stable over time. These interesting properties are related to the content of saturated fatty acids, which are unfortunately bad for health.

The food industry requires solid oils to produce numerous products like spreads, margarine, mayonnaise, whipped cream… To introduce solid properties in liquid oils at room temperature it's common to use emulsions. Emulsion is a fine dispersion of droplets of one liquid in another in which it is immiscible. The stabilization of droplets can be ensured by surfactant molecules, proteins or colloidal particles.

The thesis, funded by the PIVERT institute, aims to investigate the mechanisms related to the stabilization of oil emulsions by plant proteins which are by-products from rapeseed and sunflower oils productions.

Bulk and interfacial properties of rapeseed and sunflower protein extracts will be studied and related to various properties of the emulsions generated including the emulsion stability and mechanical properties. The structure and self-assembly properties of proteins in aqueous solutions will be characterized by scattering and spectroscopic technics while ellipsometry and tensiometry will be used for interfaces. The rheology of solutions and interfacial layers will be also investigated.

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The mechanical properties of wheat grain biopolymers

Karsta Heinze a,b, Jean-Yves Delenne a, Matthieu George b, Valérie Lullien-Pellerin a

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The wheat grain is a compact biological structure consisting of two major biopolymers: starch and gluten. The starch granules embedded in the gluten matrix form a cemented granular material of high hardness. During the milling process the fractionation behavior of the grain material is of great importance for flour yield, flour end use and the required milling energy. This PhD project aims to help to better understand grain fractionation at the molecular level in order to explain and predict fractionation at the tissue and whole grain scale. To achieve this, we combine three approaches: milling experiments at the grain scale to determine whole grain behaviour, Atomic Force Microscopy to investigate the biopolymer's mechanical properties at the nanoscale and numerical modeling to analyze fractionation pathways at a mesoscale.

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Anisotropic Optical Properties of a Homoepitaxial

(Zn,Mg)O/ZnO Quantum Wells growth on A plane

Mohammed J. Mohammed Ali[1*], T. Bretagnon[1] and J.M. Chauveau[2] [1]Laboratoire Charles Coulomb, CNRS - Université Montpellier, F-34095 Montpellier, France

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In this communication, we report on the optical properties of homo-epitaxial non-polar (Zn,Mg)O/ZnO quantum wells (QWs) grown by molecular beam epitaxy (MBE) on A-plane (11-20) ZnO substrates. The optical properties of this quantum wells are investigated by using reflectance and continuous wave photoluminescence (CW-PL) spectroscopies.
The CW-PL and reflectivity spectra measured at low temperature reveal strong in-plane optical anisotropies and clear reflectance structures, as an evidence of good interface morphologies. The signatures of confined excitons analogous to C- exciton and (A, B) - excitons in bulk ZnO, are detected using light polarized respectively along the c-axis and perpendicular to this axis.

Temperature dependence of CW-PL has been investigated in the two polarizations. For electric field of the light perpendicular to the c-axis the total intensity of the PL lines decreases by about an order of magnitude when the temperature increases from 10 K to room temperature. At low temperature a line associated to an excitonic complex dominates the PL spectrum. When the temperature increases the intensity of this line decreases as the intensity of the line associated to the free exciton increases. In the other polarization at about 100 K a new line appears in the spectrum. Its intensity increases with temperature. This feature is associated to the C free exciton.

Keywords/ ZnO, quantum well, non-polar, optical properties

L2C PhD Day Meeting

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A portable NMR device for the dynamic monitoring of water status in the fields of environmental stress plants: Sorghum application

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Understand how plants respond to water stress is essential today to meet the challenge of developing new cultivars and new management cultures compatible with maintaining the productivity of plants, despite the climate change. Many teams at CIRAD are working on water-plant relations but paradoxically, there is no direct and noninvasive method for quantifying water in the plant and measure the water flow. In this thesis, we propose to construct a transportable NMR (Nuclear Magnetic Resonance) device to measure in fields the water in the plant and its mobility. The built equipment will be used to study the comparative response of different sorghum genotypes in normal and water stress conditions. The data will be compared with ecophysiological data acquired by other non-invasive methods (stomatal conductance, chlorophyll fluorescence, infrared thermography).

Keywords: NMR, water status, environmental stress, Precision Agriculture, climate change and developing new tools for monitoring water in the plant, "water status - monitoring"phenotyping in fields ecophysiology.

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Towards bottom-gated graphene p-n junctions on a Silicon Carbide substrate

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Graphene is a two-dimensional material. It attracts a great interest due to his distinctive band structure and the exceptionally robust quantum hall effect. Different growth techniques have been developed to produce graphene on different substrates. It seems that epitaxial graphene on silicon carbide (SiC) or chemical vapor deposition on SiC are favorable techniques to produce graphene for industrial applications. In this work we focus on chemical vapor deposition on SiC. The SiC is used because it is an insulating material, chemically very stable and no charge accumulates at the surface as in silicon dioxide. Even more interesting, the SiC substrate allows to produce graphene at large scale, over several centimeter squares. Nonetheless, the main disadvantage is the inability to control the carrier concentration. Therefore a bottom gate can help to modulate the carrier's type and to produce graphene p-n junctions. In my presentation, I will present the different methods which have been used by various groups to modulated the carrier density[1,2] by a bottom gate and I will present the method I propose to develop during my phD thesis.

[1]D.Waldmann et al,Bottom-gated epitaxial graphene, Nature Materials(2011),DOI: 10.1038

[2]B.Jabakhanji et al,Quantum Hall effect in bottom-gated epitaxial graphene grown on the C- face of SiC,Applied Physics Letters,100,052102(2012)

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Morphology of silica mesoporous materials structured by electrostatic complexes: Role of water activity.

Mélody Mathonat

L2C/Laboratoire Charles Coulomb (CNRS-UM) – Equipe Matière Molle (Dr. Martin IN)

ICGM/Institut Charles Gerhardt Montpellier (CNRS-ENSCM-UM) – MACS/Matériaux Avancés pour la Catalyse et la Santé (Dr. Corine Gérardin)

Polyions complex (PIC) micelles formed by electrostatic complexation between a double hydrophilic block copolymer (DHBC) and an oppositely charged homopolyelectrolyte are used as drug cargos and structuring agents for the synthesis of mesoporous silica materials [1]. The core of the PIC micelles is made of an electrostatic complex of oppositely charged polymers swelled by water (called a coacervate). The pore size and the structure of the mesoporous materials (hexagonal and lamellar) depend on the length of the polymer used, but also and more interesting economically, on the physico-chemical conditions (concentration, pH, temperature). The aim of the project is to understand to what extent the water activity in the reaction bath determines the swelling of the core of the PIC micelles which in turns determines the pore size and the structure of the mesoporous material.

[1] Drug-polymer electrostatic complexes as new structuring agents of drug-loaded ordered mesoporous silica; E. Molina, J. Warnant, M. Mathonnat, M. Bathfield, M. In, D. Laurencin, C. Jérôme, P. Lacroix-Desmazes, N. Marcotte and C. Gérardin, Langmuir 31, 12839-12844 (2015).

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