



## RESUMES DES POSTERS

### Grazing incidence and anomalous x-ray scattering for in situ and real time probing of supported nano-objects

**Pascal Andreazza**  
*ICMM, Orléans*

### Domaines d'application des techniques synchrotron ultraviolet

**Mathieu Refregiers**  
*Synchrotron Soleil, Gif sur Yvette*

### Cultural Heritage at the ID21 beamline, ESRF

**Marine Cotte**  
*ESRF, Grenoble*

Recent applications and on-going refurbishment. Cultural heritage has represented an important research activity at the ID21 beamline, ESRF, for more than 15 years. The X-ray and infrared microscopes have been regularly used to study various ancient and artistic materials, such as fragments from paintings, glasses, ceramics, wood, papyrus...  $\mu$ XRF,  $\mu$ XRD,  $\mu$ XANES and  $\mu$ FTIR can be combined to reveal manufacturing processes or to understand degradation phenomena. Recent examples of applications to the study of artistic materials will be presented. The ESRF upgrade will significantly increase the brilliance and coherence of the X-rays beam. In this context, the ID21 instruments are being deeply refurbished. Hardware and software developments will be presented as well.

### La diffraction à haute énergie : un outil pour l'*in-situ*

**Guillaume Geandier**  
*Institut Jean Lamour, Nancy*

La diffraction des rayons X de haute énergie est un outil puissant pour suivre les évolutions des matériaux lors de l'application de chargement externes comme des traitements thermiques, mécaniques, thermo-mécaniques ou magnétiques. La haute énergie permet d'étudier des échantillons massifs de plusieurs mm<sup>3</sup> et d'obtenir des données avec une échelle de temps suffisantes pour explorer les phénomènes physiques qui ont lieu dans les matériaux massifs. Cet outil est particulièrement adapté à l'étude des matériaux métalliques dans les conditions proches de celles de formation ou leur utilisation dans les industries liés à la métallurgie.



## Setting up an In Vivo Crystallography Platform at SOLEIL

**Pierre Montaville**

*Synchrotron Soleil, Gif sur Yvette*

The combined use of modern microfocus synchrotron beamlines in conjunction with serial crystallography approaches allows the exploitation of a reasonably low number of micron-sized protein crystals for structure determination. This allows the exploration of the full potential of In vivo crystallography, i.e. the production of protein crystals within living cells, as an attractive alternative approach for structural biology. We propose a strategy to assess the possibility of turning eukaryotic cells into elaborated crystal screens within a synchrotron facility combining molecular and cell biology, microfluidics assisted SHG microscopy and synchrotron-based UV imaging, Soft X-ray tomography and serial X-ray crystallography.

## Utilisation du rayonnement ultraviolet en spectrométrie de masse

**Alexandre Giuliani**

*Synchrotron Soleil et INRA*

## X-ray absorption spectroscopy of cadmium in ultra-diluted plant samples

**Géraldine Sarret**

*ISTerre, Grenoble*

## PLEIADES: A VUV - soft x-ray beamline for studies of dilute matter

**John Bozek**

*Synchrotron Soleil, Gif sur Yvette*

## Essais mécaniques 4D pour caractériser les matériaux de structure

**Henry Proudhon**

*Centre des Matériaux MINES ParisTech*

Les matériaux de structure sont au coeur des défis liés aux futures mobilités. L'arrangement 3D de la microstructure des matériaux permet d'aspirer à plus de performance, d'efficacité, de fonctionnalité et de durabilité. Grâce à des sources de très haute brillance comme le synchrotron soleil, la tomographie aux rayons X nous permet de mettre en lumière les mécanismes clés de cette microstructure tridimensionnelle et complexe en quelques dizaines de secondes. Nous avons pour cela développé des essais mécaniques miniaturisés et automatiques nous permettant de travailler en quatre dimensions en intégrant l'effet du temps. Cela permet de mesurer les phénomènes physiques en jeu lors de la déformation de façon très précise et d'identifier les leviers de progrès.



## **Solitons in CDW and new synchrotron sources**

**David Le Bolloc'h**

*LPS, Orsay*

## **Multimodal nano scanning of biological samples**

**Benoit Masquida**

*GMGM, Strasbourg*

## **Multi beamline approaches on lipid droplets from yeast to plant. The aim of this poster is to link contributions of four different Soleil beamlines to structural issues about lipid droplets**

**Yann Gohon**

*Institut Jean-Pierre Bourgin, INRA*

## **Correlating Super Resolution Microscopy with Synchrotron X-ray Fluorescence Imaging to Study Metal Functions in Neuron Synapses**

**Richard Ortega**

*CENBG, Grenoble*

We correlate stimulated emission depletion (STED) microscopy and synchrotron X-ray fluorescence (SXRF) both performed with 40 nm resolution to investigate the unknown distribution of trace metals in neuronal synapses. We achieve at ESRF beamline ID16A a zinc detection limit of 130 atoms per pixel. We reveal the nano-colocalization of zinc with tubulin and highlight the separate distribution of zinc and copper within F-actin protrusions indicating new functions for metals in the regulation of the synaptic cytoskeleton. This study emphasizes the need for synchrotron radiation X-ray nanoprobe with high spatial resolution (<30 nm) and high chemical element sensitivity (= high photon flux, typically > 10<sup>12</sup> ph/s) to answer fundamental questions in the neuro-biology of metals.

## **Hartmann wavefront sensor in the EUV and hard X-Ray range for easy metrology, alignment and Adaptive optics on X-Ray beamlines**

**Fabrice Harms**

*Imagine Optic, Orsay*

Synchrotron beamlines have opened the door to new, exciting experiments in physical, chemical and biological sciences. Many of these experiments require an optimum? or at least a properly defined ? wavefront (WF) quality. A number of WF sensing techniques have been proposed, including grating-based interferometry, speckle tracking, pencil beam deflectometry, or curvature sensors. Among these techniques, Hartmann WF sensing provides many advantages, such as insensitivity to vibrations, achromaticity, huge dynamic range. Hartmann sensors in the X-EUV range are now available off the shelf, and provide great help for complex experiments such



as HHG. In this context, we propose a Hartmann sensor in the 5-25keV hard X-Ray range, as a standard metrology tool for hard X-Ray beamlines. The device is based on a custom scintillator-to-detector optical relay system, as well as on an optimal Hartmann array geometry, providing 20 $\mu$ m spatial WF sampling, over a 3x3 mm<sup>2</sup> pupil. We show first results at 10 keV, achieving 4pm WF repeatability. We also present the results of use of the sensor for easy alignment and optimization of beam quality.

## Studying the formation of mesostructured particles via multi-scale scattering techniques

**Julien Schmitt**

*Laboratoire de Synthèse et Fonctionnalisation des Céramiques, Cavaillon*

Mesoporous materials formed in aqueous solution via cooperative mechanisms between a surfactant and inorganic species is a fascinating system to study both for fundamental and applicative aspects (as catalyst, species separator or sensor). The material can be synthesized as sub-micrometer sized grains with a well-defined morphology and an inner nanometer-sized porosity. It is then crucial to study the formation mechanisms both at the nanometer scale to understand the self-assembly process driving the mesophase formation and at the micrometer scale to monitor the overall particle nucleation and growth. Scattering techniques at large scale facilities allow such multi-length scales studies: via a combination of USAXS and SAXS, or by simultaneous SANS and spin-echo modulated neutron scattering (SEMSANS) measurements. Results from various examples will allow discussing advantages and challenges associated with each methods and help design novel anisotropic and porous particles.

## Le futur des conditions extrêmes et dynamiques sur les sources de 4ème génération

**Guillaume Morard**

*ISTerre, Grenoble*

## Ductile damage study for complex loading paths and low stress triaxiality via 3D synchrotron imaging and FE simulations

**Xiang Kong**

*Centre des Matériaux MINES ParisTech*

## Quantifying water ionization by soft X-rays using a microfluidic device

**Lucie Huart**

*NIMBE-CEA, Saclay*

Combining microfluidic, that offers an adaptable and well-defined sample environment, and sodium-benzoate, as a fluorescent dosimeter, the study propose an high and sensitive way to measure radical production upon soft X-rays exposure (1keV range). Yields of OH radicals determined in the microfluidic cell are in good agreement with the literature and previous results obtained in a static cell. Characterisation with flow measurement and vertical



interferometry provide an accurate description of the device. The soft X-rays chosen, in this study, constitute the most constraining conditions due to their low penetration in matter (micrometer range in condensed phase). However the present methodology can be easily be transposed to more energetic (up to hard X-rays) radiations.

## **BM02 - D2AM a French CRG at the ESRF dedicated to Anomalous Diffraction and Scattering in Materials Science**

**Nathalie Boudet**

*Institut Néel, Grenoble*

## **Les lignes CRG-FAME et CRG-FAME-UHD dans le contexte de la jouvence de la source de l'ESRF: conséquences et perspectives**

**Olivier Proux**

*Observatoire des Sciences de l'Univers de Grenoble*

## **Hétéro-structures coeur-coquille combinant photo et magnétostriction : identification des principaux leviers contrôlant le couplage élastique**

**Isabelle Maurin**

*Laboratoire de Physique de la Matière Condensée, Palaiseau*

Nous étudions la conception de structures photo-magnétiques artificielles dans le but de manipuler les propriétés électroniques d'un matériau via l'application de contraintes dynamiques. Nous explorons deux configurations de couplage au sein de particules cœur-coquille ou de bicouches impliquant un composé à transfert de charge photo-déformable, associé à un composé magnétique dont la réponse peut être modulée sous éclairage par un effet de magnétostriction inverse. Nous avons réussi à synthétiser plusieurs séries d'échantillons cœur-coquille de façon à adresser une question spécifique : (i) influence du rapport volumique entre cœur et coquille, (ii) impact de la microstructure de la coquille, granulaire ou lisse et continue, (iii) rôle de l'épitaxie en comparant au cas d'une coquille amorphe. Nous avons suivi les changements photo-induits dans chaque série par diffraction des rayons X in situ (ligne BM1a, ESRF) et spectroscopie XAFS (FAME/BM30B) de façon à quantifier le transfert de charge. Comme il reste difficile de remonter à la cartographie des champs de déplacements, ces données sont mises en regard de simulations. Nous avons aussi étudié l'influence du désaccord paramétrique qui va contrôler l'amplitude des déformations, mais aussi les temps caractéristiques de transformation.

## **Les conditions extrêmes à SOLEIL après l'upgrade**

**Jean-Paul Itié**

*Synchrotron Soleil, Gif sur Yvette*



## Segmentation of amyloid-plaques in three mouse models of Alzheimer's disease using X-ray phase contrast-computed tomography

**Fabien Chauveau**

*Centre de Recherche en Neurosciences, Lyon*

X-ray Phase Contrast Tomography (XPCT) uses highly coherent synchrotron radiation to image soft tissues. Ex vivo brain XPCT enables a virtual histology of cerebral structures, myelinated tracts, but also amyloid plaques. Previous reports on amyloid plaques detection have been mostly restricted to qualitative observations, owing to the difficulty to process the large amount of data arising from whole-brain imaging at a  $\mu\text{m}$  scale. The present work aims to develop a segmentation pipeline to extract relevant measurements on amyloid plaques across several Alzheimer's transgenic lines.

## High energy in situ synchrotron application to iron and alloyed carbides precipitation in low alloyed martensitic steel

**Steve Gaudes**

*Institut Jean Lamour, Nancy*

Tempering is a common heat treatment used to improve strength/ductility balance in martensitic steels thanks to the precipitation of carbides. High energy in situ synchrotron XRD is a powerful tool to investigate the microstructural transformations during the thermal treatment through a bulk sample. For the first time we, investigated quantitatively the sequence of carbides precipitation and dissolution (iron and alloyed carbides) during the tempering of martensite and advanced nano-bainitic microstructure. Resulting from the phase transformations, strong mechanical and chemical effects are observed in the matrix phases through the lattice parameters. The experimental results are compared to both nucleation and growth and micro-mechanical models.

## Calibration and characterization software framework for the high data rate soft X-rays PERCIVAL imager

**Fabienne Orsini**

*Synchrotron Soleil, Gif-sur-Yvette*

The PERCIVAL detector is a large Monolithic Active Pixel Sensor (MAPS) dedicated to soft X-rays experiments, in the primary energy range of 250 eV to 1 keV, for synchrotron and FEL facilities. A demonstrator of 2 million pixels is being developed. To cope with a large dynamic photon flux range detection (1 to  $5 \times 10^4$  photons at 250 eV), a dedicated pixel architecture is designed with a smart gain system able to adapt its photo-detection sensitivity.

A software framework is being developed for calibrating and characterizing the sensors. The modularity of the code, written in Python-3, will ensure that developers and/or users can plug and play with different analysis methods to perform a calibration or a characterization of the sensor, or to analyze corrected data acquired with the imager.



## Development of a new photon counting camera prototype for time resolved experiments at SOLEIL synchrotron

**Arkadiusz Dawiec**

*Synchrotron Soleil, Gif sur Yvette*

The single photon counting hybrid pixel detectors, due to their excellent imaging performances, became the major scientific instruments for many diffraction applications at synchrotron radiation facilities. In order to respond to current and future requirements at SOLEIL synchrotron, especially for time-resolved pump-probe experiments, the Detector Group have started the development of a new camera prototype based on the UFXC32k single photon counting readout circuit. In this work, the architecture, development status, and first results of the new 2-chip camera prototype is presented.

