irig

# Scientific Newsletter

## SUMMER 2025

### When the sun strikes, photosynthetic organisms raise their shield bio-hybride

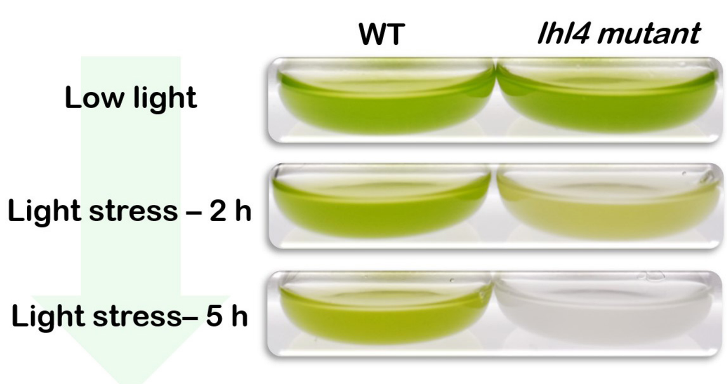
Guillaume Allorent - Cell & Plant Physiology Laboratory

Photosynthetic organisms produce organic matter from light energy through photosynthesis. This process also releases oxygen ($O_2$) through a photochemical reaction catalyzed by a dimeric protein complex called photosystem II (**PSII**). However, when light intensity exceeds the absorption capacity of PSII, it can be damaged or even destroyed. It must then be repaired by switching to a monomeric intermediate form, which is itself vulnerable to light stress but whose protective mechanisms have remained poorly understood until now.

Using **crosslinking*** approaches coupled with mass spectrometry, the researchers showed that a protein called «Light Harvesting complex-Like 4» (LHL4), induced in the presence of UV-B and under light stress, specifically binds to monomeric PSII during assembly. By combining different approaches (photophysiological and genetic analyses), they were able to demonstrate that this protein plays a crucial role in protecting this intermediate form under light stress and that its absence limits the synthesis of new functional PSII, ultimately leading to cell death.

This discovery highlights a new key player in photosystem protection, opening the way for strategies to enhance the efficiency and resilience of photosynthetic organisms in regard to the light stress. Research is underway to elucidate the precise mechanisms of this protection.

**Crosslinking*** : process of forming covalent bonds between molecules.




**Photograph of liquid cultures of the wild-type (WT) and lhl4 mutant strains of the microalga *Chlamydomonas reinhardtii*.** Under low light conditions, both cultures exhibit the characteristic green coloration. However, under high light stress, the lhl4 mutant rapidly dies, being unable to activate protective mechanisms against light-induced damage. As a result, the culture progressively becomes transparent.

**Collaboration**
- IRIG/BGE/EdYP
- University of Geneva (Switzerland)

**Fundings**
- IDEX Université Grenoble Alpes International Strategic Partnership grant (project Signalling UV-B to protect Photosynthesis)
- CNRS Momentum
- University of Geneva (Switzerland)

**REFERENCE**
Dannay M, Bertin C, Cavallari E, Albanese P, Tolleter D, Giustini C, Menneteau M, Brugière S, Couté Y, Finazzi G, Demarsy E, Ulm R and Allorent G.
**Photoreceptor-induced LHL4 protects the photosystem II monomer in *Chlamydomonas reinhardtii***
*Proc. Natl. Acad. Sci. U.S.A.* 2025

# Biohydrid systems for green fuel synthesis

Christine Cavazza - Chemistry and Biology of Metals Laboratory

Today, the development of new catalysts that are both high-performing and environmentally friendly is essential as sustainable alternatives to certain industrial processes. A notable example is the water-gas shift reaction (WGSR): $CO + H_2O \leftrightarrow CO_2 + H_2$ which traditionally relies on industrial catalysts operating under high pressure and temperature. This reaction, used to enrich syngas (produced from petrochemical processes) in hydrogen for the synthesis of liquid fuels, also occurs naturally in certain bacteria. In these microorganisms, the reaction is catalyzed under mild conditions by two enzymes: a carbon monoxide dehydrogenase (CODH) and a hydrogenase. The objective of the **CEA-IRIG/LCBM** Team is thus to develop efficient and innovative enzymatic systems.

Syngas, composed primarily of CO, $H_2$ and $CO_2$ holds significant potential for the production of liquid fuels and chemical intermediates. It serves as a versatile feedstock in processes such as Fischer–Tropsch synthesis, where the $H_2$/CO ratio plays a critical role in determining the efficiency and selectivity of the reactions. The WGSR enables adjustment of this ratio by converting CO and water into $CO_2$ and $H_2$, thereby optimizing syngas composition for specific applications. For instance, methanol synthesis requires a 1:2 CO/$H_2$ ratio, while the typical ratio in raw syngas is approximately 0.3. The WGSR proceeds via two half-reactions: oxidation of CO ($CO + H_2O \rightarrow CO_2 + 2e^- + 2H_2$) and proton reduction to $H_2$ ($2e^- + 2H^+ \rightarrow H_2$).

The aim of this work was to design a bicatalytic system combining an enzyme and a molecular complex: a carbon monoxide dehydrogenase (CODH), capable of oxidizing CO to $CO_2$ coupled with a nickel-based bioinspired catalyst that efficiently reduces protons to $H_2$. The CODH was first characterized at the molecular level, then integrated into a biohybrid system in which both catalysts are immobilized on carbon nanotubes. These nanotubes play a key role by facilitating electron transfer between the two catalysts, thereby accelerating CO conversion to $CO_2$ and concurrent hydrogen production (see **figure**).

Thanks to the high CO tolerance of the nickel complex, this innovative biohybrid system demonstrates excellent performance. It achieves complete conversion (100%) and a maximum reaction rate of 30 $s^{-1}$ for the WGSR, under ambient temperature and pressure conditions, without any external energy input, whether using pure CO or synthetic gas as the substrate.

The system developed in this study represents a first proof of concept. One of the major challenges lies in the development of Power-to-Syngas processes, which aim to produce highly pure syngas from water, $CO_2$ and renewable energy by optimizing the reaction in the reverse direction. For example, water electrolysis can be coupled with the reverse water-gas shift reaction ($CO_2 + H_2 \leftrightarrow CO + H_2O$). In this context, optimizing the WGSR —whether in its forward or reverse direction — emerges as a promising research avenue in catalysis for sustainable chemistry.
It opens new perspectives for the development of $CO_2$, biomass, and waste valorization processes, aligned with the goals of a circular carbon economy.

**Fundings**
- Programme NTE CEA
- Programme ECC CEA
- PEPR SpleenProjet POWERCO2

**Collaborations**
- Département de Chimie Moléculaire, UGA, Grenoble
- Laboratoire de Bioénergétique et Ingénierie des protéines, CNRS Marseille

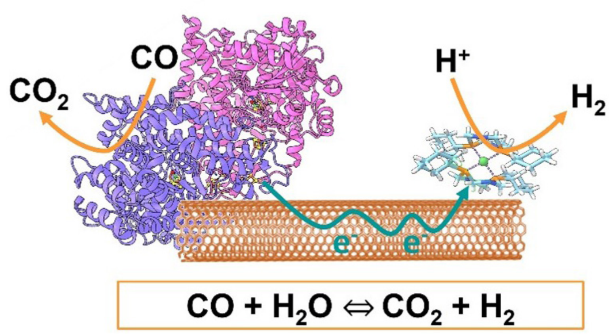



**Figure**: biohybrid system for the WGSR combining an enzyme, a bioinspired complex and carbon nanotubes. © CEA

**REFERENCES**
**[1]** PICHON T, RIGHETTI C, PERARD J, LE GOFF A and CAVAZZA C.
**From two-component enzyme complex to nanobiohybrid for energy-efficient water-gas shift reaction**
*Chemical science* 2025
**[2]** CONTALDO U, GUIGLARELLI B, PERARD J, PICHON T, LE GOFF A and CAVAZZA C.
**Insights into the role of the D-cluster in [NiFe]-CODH from Rhodospirillum rubrum chemistry**
*A European journal* 2025

# Thin film magnetic structure by neutron diffraction: challenge overcome

**Ketty Beauvois** - Modeling and Exploration of Materials laboratory

Manganese oxides have promising magnetic and electronic properties for spintronics, or spin electronics: in addition to charge state, electron spins are used as a further degree of freedom, with implications in the efficiency of data storage and transfer. The magnetic properties of these thin-film materials depend on the constraints of the substrate on which the layers are deposited. It is therefore essential to characterize their magnetic order precisely, in order to exploit them for applications such as magnetic MRAM memories and sensors. However, determining this structure on a nanometric scale remains a major technical challenge.

To overcome these obstacles, our research team combined:

- Macroscopic measurements (**SQUID***)
- diffraction on the **D10 neutron line*** (recently optimized at the Laue Langevin Institute, in Grenoble.

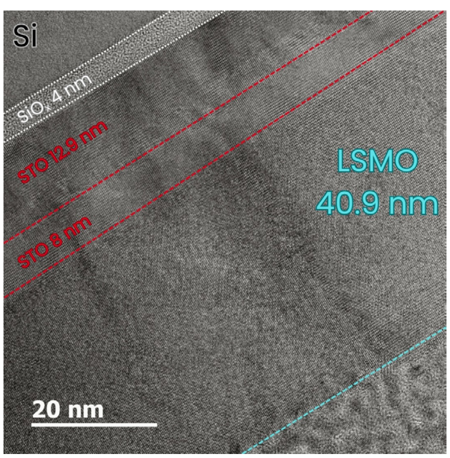



**Image 1:** Cross-section by electron microscopy of a thin LSMO film (40.9 nm) deposited on silicon with a $SrTiO_3$ (STO) buffer layer. © CEA

Thanks to its 4-circle configuration and its analyzer option, **D10 line** was able to isolate the magnetic signal from a thin LSMO film (40.9 nm thick, 5x5 mm square) deposited on silicon with a $SrTiO_3$ (STO) buffer layer (see image 1) despite the very small amount of material in the film and the background noise of the substrate (see **image 1**) despite the very small amount of material in the film and the background noise of the substrate.

Below 260 K:
The film undergoes a paramagnetic to ferromagnetic phase transition. The magnetic moments align predominantly in the (ab) plane, with a small out-of-plane component (see **Figure 2**). Neutron diffraction was used to determine precisely the values of the in-plane and out-of-plane components: m = (3.5, 0, 0.3) µB. The structure found is distinct from bulk LSMO (orientation [111]) and very thin films (mixed phases).

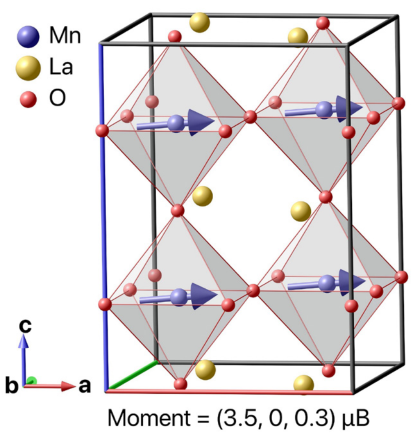



**Figure 2:** magnetic structure of LSMO determined in this study. Magnetic moments are carried by manganese (Mn) and represented by blue arrows.

The results show that the thickness controls the magnetic order (from nm up to bulk material). This is crucial for materials engineering and provides direct evidence that substrate stresses dictate the magnetic anisotropy of thin films. This opens the way to improve spintronic devices through precise control of moment orientation.

This study successfully demonstrates that neutron diffraction can resolve the magnetic structures of thin films. By overcoming this technical challenge, it offers a unique tool for spintronics, where precise knowledge of magnetic anisotropy is an industrial lock. The optimization of the D10 instrument now opens the way to exploring new nanostructured quantum materials.

**SQUID*** (Superconducting Quantum Interference Device). The SQUID magnetometer provides highly sensitive measurement of the magnetic moment of a sample as a function of magnetic field (static and/or alternating) and temperature.

**D10 neutron Line*** is unique in being the only four-circle diffractometer with optional energy analysis as on three-axis spectrometers. It also possesses a unique four circle dilution cryostat for temperatures down to 0.1K.

**REFERENCE**

H. Himanshu, E. Rebolini, K. Beauvois et al.
**Nuclear and magnetic structure of an epitaxial La0.67Sr0.33MnO3 film using diffraction methods**
*Thin solid film* 2024

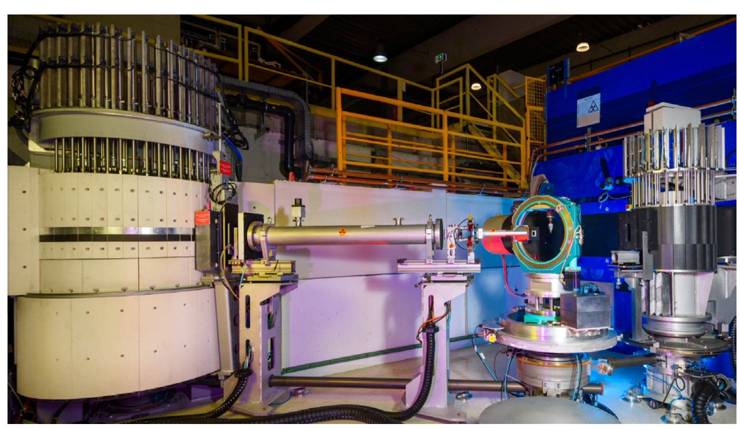


**Photo 3:** D10+ neutron line experimental set-up at ILL © L.Thion-ILL

## First step towards in vivo bio-detection

Elodie Engel - [Molecular Systems and nanoMaterials for Energy and Health laboratory](#)

To analyse injured biological tissue medicine uses biopsies but these procedures are invasive, painful and time-consuming. The researchers are aiming to replace biopsies by using optical fibers with remarkable optical properties, compactness and flexibility, which until now have only been used for in vivo tissues imaging.

A **CEA-IRIG/SyMMES/Creab** team has developed a biosensor based on functionalized optical fibers capable of detecting biological interactions remotely and in real time.

One of the main challenges is to be able to carry out several biological detections simultaneously. This is essential for *in vivo* detection, in order to have the replicas and negative controls needed to overcome non-specific phenomena (adsorption, temperature changes). To achieve multiplexed detection, we **functionalized*** the end of a rigid optical fiber assembly (diameter 1.6 mm) with two droplet arrays containing two different DNA strands. **Hybridization*** of the complementary strand was followed at the other end, in real time, using the interference phenomenon. The 2nd DNA was used as a negative control. (cf. **figure**).

This proof of concept is a first step towards in situ bio-detection. We now need to increase the multiplexing and sensitivity of smaller, flexible assemblies compatible with *in vivo* applications.

**Functionnalization***: grafting of molecules onto a surface to give it biodetection capabilities (=recognition of biological targets).

**Hybridization***: pairing that occurs when two DNA strands with complementary sequences meet

**Fundings**
- CNRS : CNRS: interdisciplinary exploratory research program MITI
- Université Grenoble Alpes: exploratory research program IRS et IRGA.
- CEA : thèse PHARE
- Labex LANEF
- Labex ARCANE
- European project HoliFAB
- FEDER European Regional Funds and French Région Occitanie as part of the MultiFAB project

**Collaboration**
- LAAS - Systems Analysis and Architecture Laboratory, Toulouse, France

**REFERENCE**
BRATASH O, COURSON R, MALAQUIN L, LEICHLE T, BUHOT A, LEROY L and ENGEL E.
**Multiplexed bio-detection on an interferometric optical waveguide assembly**
*[Advanced Materials Interfaces](#)* 2025

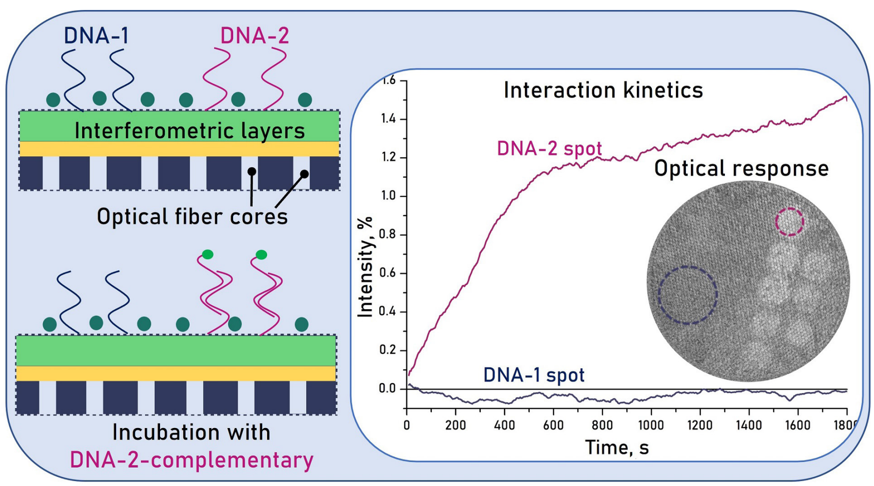



**Figure: Left (top):** schematic diagram of the functionalization of the end of the optical fiber assembly with strands DNA-1 and DNA-2.
**Left (bottom):** hybridization of DNA-2 with its complementary strand. Right: real-time monitoring of the signal in two spots: DNA-1 spot = negative control. DNA-2 spot = increase in signal due to hybridization with the complementary strand.
**Photo:** overview of the signal intensity after detection of the complementary strand (only the DNA-2 spots light up). © CEA

## Helical magnetic dichroism for ultra-fast magnetic vortex dynamics

Liliana Buda-Prejbeanu - Spintronics and Technology of Components laboratory

Various applications in spintronics, such as sensors or magnetic memories, exploit magnetic vortices, which consist of circular distributions of magnetization. Researchers are studying the ultra-fast dynamics of these vortices to manipulate and control magnetic states on the nanometric scale.

In a magnetic material, an infrared laser pulse causes a transient loss of magnetization, triggered by a redistribution of energy between electrons, phonons and spins. However, the magnetization response of complex magnetic structures such as vortices is difficult to characterize. Researchers have implemented an innovative method to probe the vorticity of magnetization on the picosecond scale using magnetic helicoidal dichroism (MHD).

In the experiment carried out at the FERMI laboratory in Trieste (Italy), an initial femtosecond infrared laser pulse is applied to a magnetic pillar placed on a silicon substrate. This thermally excites a magnetic vortex of micrometric diameter. After a controlled delay, a second, higher-energy laser pulse (extreme UV) carrying an orbital angular momentum probes the magnetic structure. The researchers have shown that it is possible to follow the evolution of the magnetic vortex through its interaction with light using magnetic helicoidal dichroism (MHD), by reversing the direction of rotation of the vortex and then comparing the scattering of the extreme UV light.

The results reveal complex dynamics, with changes depending on the thickness of the vortex, and even a temporary inversion of the magnetization at surface. This time-resolved measurement sheds new light on the fundamental mechanisms of ultrafast dynamics, which are still poorly understood.

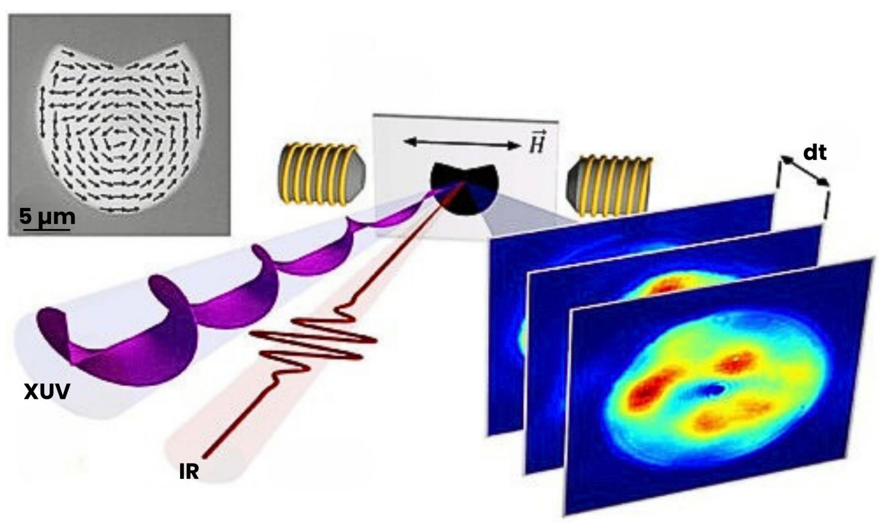
As part of this study, the **CEA-Irig/SPINTEC** laboratory developed the samples studied and jointly carried out micromagnetic simulations to corroborate the experimental results and provide a theoretical interpretation of the observed results.

**Collaboration**

- New Technologies Research Center, Université West Bohemia, Republique Tchèque
- Elettra-Sincrotrone Trieste, Trieste, Italie
- Department of Molecular Sciences and Nanosystems, Université de Venise, Italie
- Sorbonne Université, CNRS, Institut des NanoSciences de Paris, France
- Laboratory of Quantum Optics, Université Nova Gorica, Slovénie
- Center for Photon Science, Paul Scherrer Institute, Suisse
- Synchrotron SOLEIL, Gif-sur-Yvette, France


**REFERENCES**

M. Fanciulli, M. Pancaldi, A.-E. Stanciu, M. Guer, E. Pedersoli, D. De Angelis, P. R. Ribič, D. Bresteau, M. Luttmann, P. Carrara, A. Ravindran, B. Rösner, C. David, C. Spezzani, M. Manfredda, R. Sousa, L. Vila, I. L. Prejbeanu, L. D. Buda-Prejbeanu, B. Dieny, G. De Ninno, F. Capotondi, T. Ruchon and M. Sacchi
**Magnetic vortex dynamics probed by time-resolved magnetic helicoidal dichroism**
*Physical review Letters* 2025


**Expérimental set-up** : in the center, a first short IR pulse excites the magnetization of the magnetic vortex in a permalloy pillar (pacman shape, shown in gray). Then, a second XUV laser pulse with orbital angular momentum probes the system. Then, an applied H magnetic field reverses the direction of rotation of the vortex magnetization. Finally, light scattering images with zones of different color between the right and left magnetic orientations determine the magnetic helicoidal dichroism signal, enabling the magnetization dynamics to be tracked. © CEA

# Germanium-based superconducting transistor in phase and harmony

**François Lefloch -** Quantum Photonics, Electronics and Engineering laboratory

For several years, the **LaTEQS** team at **PHELIQS** has been dedicated to study the electronic properties of germanium layers a few nanometers thick embedded in a SiGe substrate. These layers exhibit exceptional qualities, with charge carrier mobilities (here, holes) reaching several hundred thousand cm²/V/s and an elastic mean free path in the order of microns. The layers are fabricated at CEA-LETI as 200 mm diameter wafers, then patterned using the PTA clean room facility for the design of quantum devices such as spin qubits and superconducting transistors.

Through a series of three recent publications and as many PhD thesis, we have developed the manufacturing processes for superconducting transistors, studied in detail the properties of the non-dissipative current induced by the field effect in the Ge channel, and fabricated our first superconducting qubit.

The superconducting transistors we design, consist of a germanium channel (a semiconductor material) a few hundred nm long and connected to two aluminum superconductors (source and drain). The device is completed by an electrostatic gate that covers the channel, allowing control of the current flowing through it. This operation is similar to the silicon transistors used in cell phones.

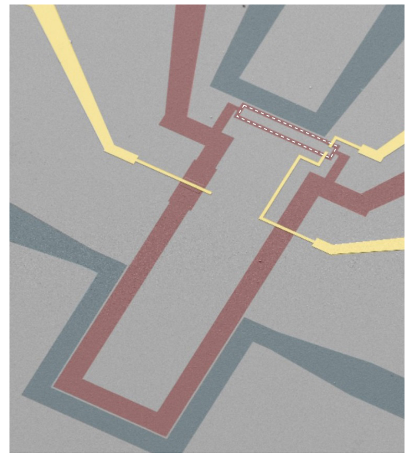
We exploit the properties of germanium at very low temperatures (T < 1 K) when the aluminum contacts become superconducting. Thanks to the exceptional quality of the electrical contact between the aluminum and germanium, it becomes possible to induce superconducting correlations in the channel, thus making it itself "superconducting," *i.e.*, without energy dissipation. We have thus developed a "perfect" transistor which, in its OFF state (positive gate voltage), does not conduct, and which, in its ON state (negative gate voltage), conducts without resistance. This transistor therefore generates no electrical heat dissipation (Joule effect).

**The main objective of our work is to deepen our understanding of the properties of this non-dissipative current (supercurrent) and to create our first quantum circuit based on this type of transistor.**

Quantum mechanics applied to this type of circuit tells us that there is a relationship between the macroscopic phases of the two superconducting contacts and the supercurrent amplitude (first Josephson relation). When the link between the two contacts is a tunnel barrier, this relationship takes the form of a pure sinusoidal function.
This phenomenon (the Josephson effect) forms the basis of superconducting quantum circuits such as those developed by companies like Google, IBM, Rigetti, in France within the start-ups Alice&Bob and SilentWave, and in numerous academic laboratories.

We recently demonstrated that, in the case of our devices called JoFETs (Josephson Field Effect Transistors), this relationship is more complex and involves higher harmonics [**1**]. This phenomenon demonstrates the very good electrical quality of the source-drain interfaces with germanium. We then developed a first device composed of two JoFETs integrated in a small superconducting loop (SQUID) [**2**]. Through interference effects obtained by modulating the magnetic flux through this loop, it is possible to control the amplitude of the supercurrent and manipulate its different harmonics. We thus developed the equivalent of a JoFET whose first harmonic can be reduced by 95% (see **figure 2**).

This phenomenon indicates that the non-dissipative current is no longer carried by Cooper pairs but by pairs of pairs, opening the way to new types of superconducting qubits, potentially better protected than those based on tunnel junctions.



**Scanning electron microscopy image** of the double SQUID allowing the measurement of the harmonics of the current-phase relationship of the device consisting of a superconducting loop and two Ge superconducting transistors (dotted lines).

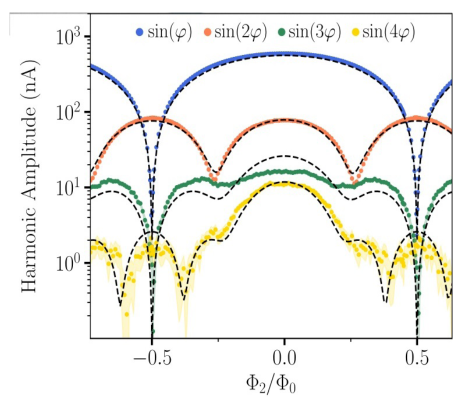



**Figure 2:** The experimental curves show the harmonic decomposition as well as the model adjustment as a function of the magnetic flux through the loop.

To this end, we have produced a first superconducting qubit from a single JoFET [3]. The geometry of this qubit is inspired by superconducting qubits based on tunnel junctions (transmon), composed of a superconducting island connected to a JoFET, itself coupled to a microwave resonator for reading the qubit state. Using circuit quantum electrodynamics (cQED) techniques, we demonstrated the coherent control of the qubit's quantum states using microwave signals. We also measured the impact of gate control on the qubit states, by evaluating its coherence times. Although these times are still modest (in the order of a few tens of nanoseconds), this advance paves the way for qubits whose protection and coherence times should be considerably improved.

**Fundings**
These studies were partly funded by the ANR SUNISIDEuP project, the PEPR RobustSuperQ and Labex LANEF.

**REFERENCES**

**1** - A. Leblanc et al.
**From nonreciprocal to charge-4e supercurrent in Ge-based Josephson devices with tunable harmonic content**
*Phys. Rev. Research* 2024

**2** - A. Leblanc et al.
**Gate- and flux-tunable sin(2ϕ) Josephson element with planar-Ge junctions**
*Nature Communications* 2025

**3** - E. Kiyooka et al.
**Gatemon Qubit on a Germanium Quantum-Well Heterostructure**
*Nano Letters* 2025

## On the improvement of missing value imputation in proteomics

**Thomas Burger** - Biosciences and bioengineering for health Laboratory

In experimental science, data collections can be affected by missing values (defined by an absence of measure for a given observation). As too much missing values may jeopardize the data analysis, imputation (i.e., the completion of the data by estimating the measures which should have been observed) is often both a necessity and a lesser evil. However, this task is particularly difficult in **proteomics***, because of the rate of missing values, but also because of their multiple origins.

Researchers with **CEA-IRIG/BGE** have therefore designed a new statistical model, which jointly characterizes two missing types of values: the censored ones, (i.e., when a protein fragment is not abundant enough to be detected), and those lacking randomly (i.e., resulting from the non-exhaustiveness of the instruments). In addition, they have shown that an imputation algorithm which maximizes the known correlations between biomolecules (proteins and their fragments, transcribed, etc.) can be derived from this model. Finally, in the absence of a formal solution to the associated maximization problem, they have implemented a numerical solver relying on a feed-forward neural network. .

**Proteomics*** : characterisation by identification and quantification of all the proteins present in a biological sample

**Fundings**
ANR projects:
- ProFI
- GRAL CBH
- SECRET
- DEAP
- MIAI @ Grenoble Alpes

**Collaboration**
Laboratoire Recherche Translationnelle et Innovation en Médecine et Complexité (TIMC) Univ. Grenoble Alpes, CNRS, Grenoble INP

**REFERENCE**
L. Etourneau, L. Fancello, S. Wieczorek, N. Varoquaux and T. Burger.
**Penalized likelihood optimization for censored missing value imputation in proteomics.**
*Biostatistics* 2025.

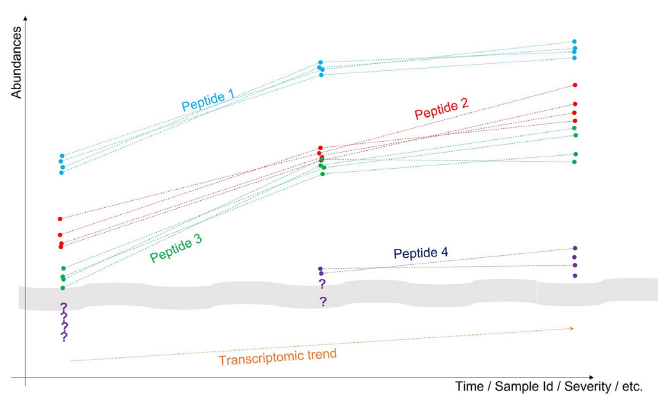



**Figure**: toy example of how to leverage biomolecules' correlations to improve missing value imputation: several peptides coming from the same protein (as well as possibly the transcript it was translated from) having measurement profiles that should be correlated. It is thus relevant to impute the missing values as to maximize it, as illustrated by the location of "?" For Peptide 4.

## Fluorescent proteins switch in all directions

**Dominique Bourgeois** - Institut de Biologie Structurale

In recent years, **super-resolution microscopy** (or nanoscopy), which uses optical microscopy to image biological samples at nanometric resolution, has undergone a real boom. Some nanoscopy methods use photo-convertible fluorescent proteins* (**PCFPs**) as markers. One of the most widespread of these methods is Single Molecule Localization Microscopy (**SMLM**). It is based on the principle that PCFPs are able to change their fluorescence emission from green to red under illumination at 405 nm. But beyond this photo-conversion, PCFPs tend to switch reversibly between fluorescent and non-fluorescent states, which can seriously impact the quality of the images obtained. The teams of D. Bourgeois (IBS/I2SR) and B. Brutscher (IBS/RMN) have revealed a new photo-switching mode for mEos4b, a widely-used PCFP.

After photo-conversion, mEos4b (red form) undergoes a "negative photo-commutation": it is switched off under light at 561 nm (which excites fluorescence) and reactivated under light at 405 nm. This property is due to a photo-induced conformational change in the chromophore (cis-trans isomerization), the cis conformation being the only one capable of fluorescence. The result is a marked blinking of single molecules during data collection.

Another, almost imperceptible, source of blinking was identified and elucidated in this study. Taking place over a shorter time scale (a few tens of ms versus several seconds for negative photo-commutation), a "positive photo-commutation" is observed: mEos4b in its red form is switched off under light at 405 nm and reactivated at 561 nm. The phenomenon can be explained using Nuclear Magnetic Resonance (NMR), which reveals conformational heterogeneity in mEos4b: a stable red fluorescent state (R1) predominates, but a second, much less bright red fluorescent state may appear (R2).

Light at 405 nm induces the transition from the R1 to the R2 state, while light at 561 nm restores the R1 conformation. The study also revealed that the coexistence of the two states R1 and R2 is strongly influenced by the physico-chemical conditions of the sample (pH, buffer medium, etc.).

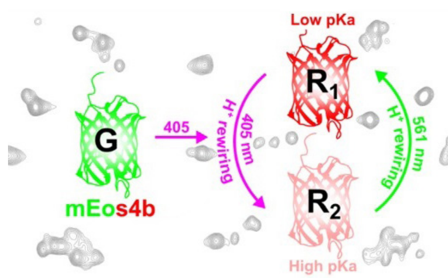



**Image 1**: mEos4b's positive photo-switching mechanism..

Thanks to numerous developments, SMLM microscopy is now a key technique for integrative biology, making it possible to go from the cell to the single molecule.

Although numerous methodological obstacles have been overcome to improve the resolution of the images obtained, the study reveals that the great complexity of the photo-physical properties of fluorescent proteins is a limitation to the quantitative analysis of these images. However, there are still a number of solutions open to optimize experimental conditions and overcome this new lock.

**photo-convertible fluorescent proteins***: fluorescent proteins whose fluorescence properties change irreversibly under illumination conditions.

**Fundings**
- iNEXT-Discovery Horizon 2020 program of the European Commission,
- Agence Nationale de la Recherche (grants no. ANR-20-CE11-0013-01, ANR-22-CE13-0046 and ANR-22-CE11-0011-01),
- IR INFRANALYTICS (FR2054) FRISBI (ANR-10-INBS-0005-02) and GRAL, CBH-EUR-GS (ANR- 17-EURE-0003)

**Collaboration**
Irig/SyMMES/Conception d'Architectures Moléculaires et Processus Electroniques (CAMPE)

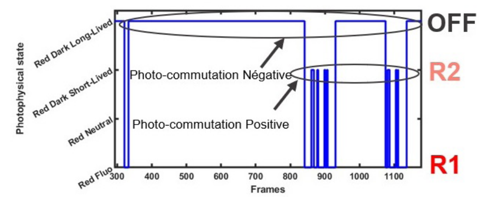



**Image 2:** example of the evolution of the photo-physical state of a single mEos4b, molecule over time, showing transitions between the R1, R2 and OFF states. (D. Bourgeois / IBS)

**REFERENCE**
Wulffelé J, Maity A, Ayala I, Gambarelli S, Brutscher B and Bourgeois D.
**Light-Induced Conformational Heterogeneity Induces Positive Photoswitching in Photoconvertible Fluorescent Proteins of the EosFP Family**
*Journal of the American chemical Society* 2025

# Press releases - Prizes - Others

Inauguration de la ligne pilote SPINfab au laboratoire SPINTEC

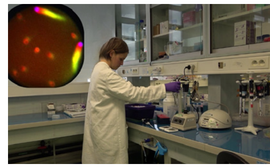
IRIG website

Renaud Demadrille's team awarded by « Materials Chemistry Horizon Prize » 2025 of the Royal Society of Chemistry

IRIG website

ERC awards Marie-Ingrid Richard with Advanced Grant to study catalysis at near-industrial conditions

IRIG website



Alexandra Colin awarded CNRS Bronze medal 2025

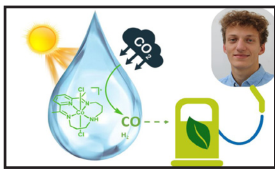
IRIG website

Lionel Imbert awarded CNRS Crystal Medal 2025

IRIG website

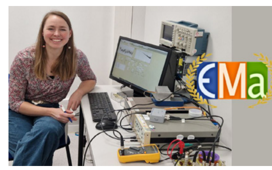
Alicia Vallet awarded CRNS Crystal medal 2025

IRIG website



Matthieu HAAKE academic thesis prize 2025

IRIG website



Johanna Fischer EMA Young Scientist 2025

IRIG website

Les Laboratoires Pierre Fabre et l'Irig célèbrent 25 ans de partenariat au service de la photoprotection

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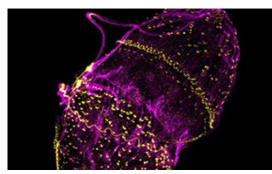
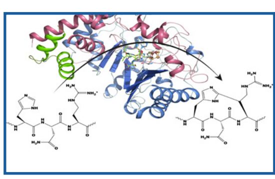


Neither prey nor partner: the plankton that blurs the line between predation and symbiosis

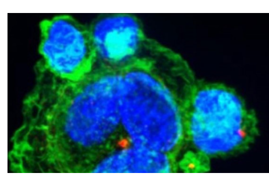
IRIG website

# Other scientific news of the laboratories



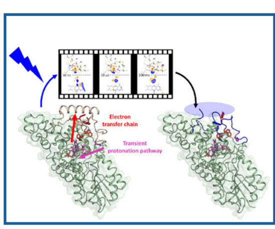
Uncovering the structure of a radical SAM enzyme in complex with its precursor peptide...

IBS website



Leukemia cells lose their way

LPCV website



A molecular movie sheds light on cryptochrome photoreception

IBS website

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