

## Editorial

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Dear Colleagues,

The IRIG's scientific newsletter allows us to end the year 2020 by putting Science in the spotlight, which is very fortunate. The results described in it come to show us, if needed, that the Institute's teams held the lead during the "COVID storm". As we have become accustomed to, we discover through this letter the advances in such varied fields that we have the opportunity to surf with ease from skyrmions to viruses through plants and ultra-low temperatures. Delight yourself!!!

COVID will have marked the year 2020 by sustainably transforming our professional and family lives. In order to avoid an even more serious health crisis, our laboratories and equipment have been forced to operate in slow motion or even to close. While waiting for the benefit of a massive vaccination to be felt, we remain deprived of the spontaneous and daily gestures that were so many expressions of attention or affection. Our social life obviously suffers from such a situation. Even if everyone has been able to adapt, this turmoil is anything but insignificant for our personal lives and for the life of our research structures. The impact has been significant for the IRIG which is a young institute. The strengthening of the institute requires increased exchanges, both spontaneous and initiated, in order to allow each UMR to go beyond its own strategy by seizing opportunities that arise to develop interdisciplinary projects for which IRIG is particularly well equipped. Initiatives will be rapidly proposed in 2021 by the Institute's management in order to create such opportunities, notably within the framework of the adjustments that have been put in place by the CEA in 2019 in the fields of quantum, the circular carbon economy, batteries, organ-on-chip and health innovations in the fields of diagnostics and therapeutic approaches.

The beginning of the year 2021 will be marked by the arbitrations which will be rendered within the framework of the CPER and the EQUIPEX+. The expected funding should support innovation and the further development of leading-edge instrumental platforms in Spintronics, Structural Biology, Proteomics, NMR and in the fields of materials characterization and data management and analysis. It is therefore an important opportunity for the IRIG given the place occupied by these platforms in our research programs. The renovation of the buildings will also be a strong priority in 2021. Although the amount of investment required is considerable, new projects will be launched. These are long-term projects for which the management of the DRF and the CEA's Heritage Department are working with us; I would like to thank them for their support.

The year 2021 is almost here; it will allow us to gradually see the fading away of everything that may have made the period we have gone through difficult. I hope that this new year will be synonymous with hope and envy for all of us, that it will bring new promises and success in the work that you will carry out.

I wish you a Merry Christmas and a Happy New Year!



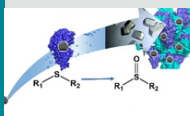
Jérôme Garin, Head of the Interdisciplinary  
Research Institute of Grenoble

# At the front page of IRIG

## Design of crystalline artificial enzymes

Artificial metalloenzymes consisting of an inorganic catalytic site and a protein stabilized by cross-linking are more effective than their soluble counterparts in the sulfoxidation of thioglycolamide derivatives.

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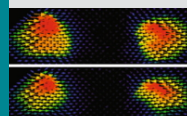
**C. Marchi-Delapierre  
LCBM**

*Chemistry, A European Journal*, 2020

## A new model of cell mechanics

The mechanical forces produced by the cells play a fundamental role: they influence the shape, movement, divisions and differentiation of the cells. The mechanism by which they are generated and distributed throughout the cell remains unknown.

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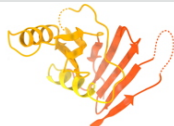
**Laëtitia Kurzawa  
LPCV**

*Nature Materials*, 2020

## Structure of a key enzyme of the replication of a human pathogenic virus

Evidence at the structural level of conformational changes necessary for the formation of a double-stranded RNA in a potentially fatal human RNA virus against which there is no treatment.

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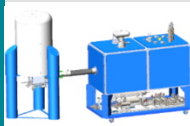
**Hélène Malet  
IBS**

*Nature Communications*, 2020

## High-resolution DNP-NMR accesses ultra-low temperatures

The thermal and fluidic performance of this innovative instrumentation for DNP and high-resolution solid-state NMR at very low temperatures places this instrument at the forefront of worldwide prototyping.

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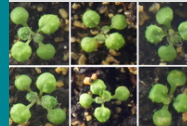


**Éric Bouleau - DSBT  
&  
Gaël de Paëpe - MEM**

## PAP8, a double agent of greening in Angiosperms

In chloroplasts, the construction of the photosynthetic apparatus depends on the coordination of nuclear and plastid gene expression for which the molecular and genetic mechanisms remain partly mysterious.

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**Robert Blanvillain  
LPCV**

*EMBO Journal*, 2020

## A new resistance strategy in pathogenic bacteria

A subpopulation of rare bacteria genetically identical to those resistant to the lytic action of complement has developed a strategy enabling it to spread throughout the body.

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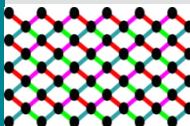
**François Cretin  
BCI**

*PLOS Pathogens*, 2020

## Towards quantum supremacy on a laptop

To increase the power of quantum computers, algorithms realized and executed on classical computers show that it is useless to increase their number of qubits, but on the contrary to improve their fidelity.

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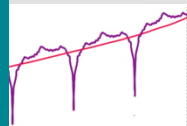
**Xavier Waintal  
Pheliqs**

*Physical Review X*, 2020

## Discovery of a new biological rhythm

Evidence, following lensless imaging of the dry mass measurements, of the existence of a new 4-hour cell biological rhythm that could have strong implications in the health field.

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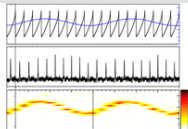
**Lamya Ghenim  
BGE**

*Scientific Reports*, in press, 2021

### Spin-torque nano-oscillators

Development of ultra-fast spectrum analyzers based on spin-torque nano-oscillators that allow for the first time, in an experimental way, to push the limits of scanning speeds on time scales below 100 ns.

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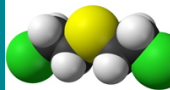
**Ursula Ebels  
Spintec**

*Nano Letters*, 2020

### Towards new mustard gas biomarkers

The use of a mustard gas analogue makes it possible to envisage the availability of biomarkers of exposure with long lifespans and which are detectable in a simple way via their detection in urine or plasma.

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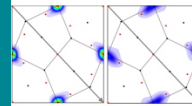
**Thierry Douki  
SyMMES**

*Analytical and Bio-analytical Chemistry*, 2020

### Magnetic frustration in a pentagonal network

Highlighting of new static and dynamic behaviors of certain materials exhibiting magnetic frustration connected to pentagonal geometry and hierarchical interactions.

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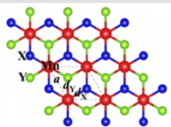
**Éric Ressouche  
MEM**

*Physical Review Letters*, 2020

### New magnetic multilayers for skyrmions

Skyrmions are promising magnetic quasiparticles for the development of future generation of magnetic memories. A new possibility to generate skyrmions as well as the conditions of their stability are predicted by calculation.

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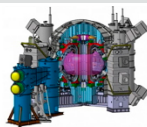
**Mairbek Chshiev  
Spintec**

*Physical Review B*, 2020

### Fusion: Finalizing the assembly of JT-60SA

The JT-60SA tokamak construction project has just been completed in Japan, the culmination of 15 years of effort. This collaborative project between Europe and Japan aims to build the largest tokamak in the world before ITER, using superconductivity technologies.

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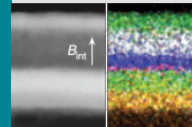


**DSBT**

### Nanometer scale magnetic skyrmions at zero field: A step closer to the applications

New magnetic structures make it possible to stabilize nano-sized skyrmions without an external magnetic field. A further step towards storage applications and information processing.

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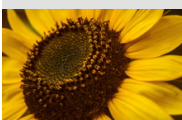


**Olivier Boulle  
Spintec**

*Physical Review Applied*, 2020

## Press releases - Prizes

### Nature-inspired solutions to sustainably increase crop yield



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### Maria Spies - C'Nano 2020 Thesis Award



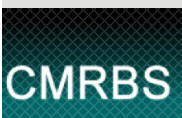
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### Solène Besson - Silab Corporate Foundation Award



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### ICMRBS Founders' Medal awarded to Paul Schanda



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### Jacques Joyard winner of the Georges Morel Prize of the French Academy of Sciences



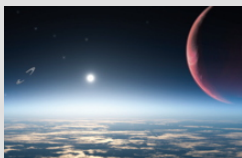
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### Paul Schanda receives the Varian Young Investigator Award



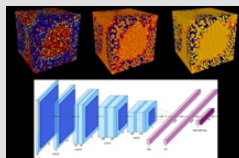
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# Other scientific news of the IRIG laboratories



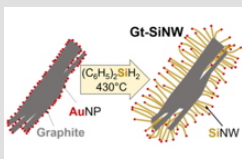
**Is photosynthesis viable outside the solar system?**

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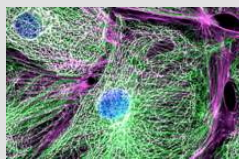
**From ionic surfactants to Nafion through convolutional neural networks**

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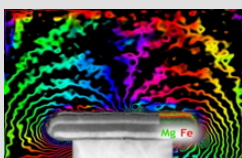
**Si nanowires on graphite for high-energy lithium batteries anode**

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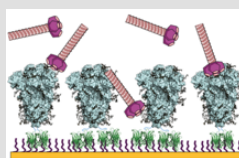
**Movie: Microtubule Mechano-Sensation**

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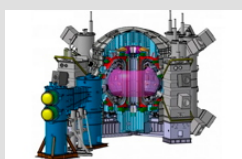
**Unveiling the heart of magnetic memory cells thanks to electron holography**

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**SARS-CoV-2: discovery of a novel transmission mechanism**

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**DSBT to assist with commissioning Japan's Tokamak reactor**

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**Cancer Biology and Infection**  
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