MINA-NEWS

MINATEC
NEWSLETTER
FEB'22
#68

TOP NEWS

Clinatec Endowment Fund investigating new treatments for Parkinson's

Deep brain stimulation and infrared illumination appear to be effective at treating Parkinson's disease. But why? The Clinatec Endowment Fund, through a new research project called Astropark, is looking for insights into the cellular mechanisms at play in neurons and astrocytes.

Deep brain stimulation, shown to significantly reduce the symptoms of Parkinson's disease, has been used on tens of thousands of Parkinson's patients since it was invented 30 years ago by Professor Alim-Louis Benabid.

Another more recently developed Parkinson's treatment—infrared illumination—effectively slowed neurodegeneration in a preclinical trial at Clinatec that paved the way toward the world's first clinical trial of the treatment.

Two patients have been implanted with the infrared illumination device at Clinatec since the trial started in 2021.

ASTROPARK PROJECT BACKED BY THREE DONORS

The Astropark project, backed by donors AG2R La Mondiale, Fondation Neurona, and Apicil, is probing the currently unexplained biological phenomena at work in the two treatments.

Specifically, the researchers are studying neurons and astrocytes (glial cells). The role these cells play in the brain is unclear but could be major in the case of neurodegenerative diseases.

CEA-Leti and Clinatec will contribute their know-how, supporting the Astropark project team on the study of the effects of infrared illumination at various wavelengths and enhancements to the illumination strategies used.

Other diseases, such as Alzheimer's, will also be addressed.

lisa.carvello@clinatec.fr
thierry.bosc@cea.fr

INNOVATION

IMEP-LaHC fine-tunes nanocircuit noise simulation

Verilor, a current fluctuation (noise) simulation software module that faithfully reproduces the phenomenon for nano-scale circuits, was developed by a PhD candidate at IMEP-LaHC.

When circuits are miniaturized, low frequency noise, detrimental to performance and reliability, increases.

The "flicker noise" models currently used for larger circuits are not very representative of noise measured on nanocircuits in the lab.

Verilor breaks low-frequency noise down into a superposition of Lorentzian spectral noises.

The results of the simulation correspond to the variability of the measured signal and the total signal strength.

Verilor is now available to the scientific community.

Angeliki Tataridou, the PhD student who developed Verilor, won a Best Student Paper award at the Essderc 2021 conference.

angeliki.tataridou@grenoble-inp.fr

Turbulence in superfluid helium-4

Physicists at Irig recently looked at how to measure turbulence flow velocity in superfluid helium-4, experimenting with two techniques used for "normal" fluids.

In the first, they used a hot wire 1.3 microns in diameter as an anemometer fixed in the flow and came up with models for interpreting the signals collected.

In the second, they employed a fixed camera to measure the speed of hollow glass microbeads immersed in the flow.

This research is part of a wider investigation of how superfluid helium-4, with zero viscosity, dissipates mechanical energy as heat.

The findings could also be useful in the interpretation of astronomical observations of bodies like neutron stars.

pantxo.diribarne@cea.fr

Tenfold reduction in ReRAM cell variability

A solution to the problem of excessive variability in ReRAM (resistive memory) could be found in Mott insulators, metals that conduct electricity in theory, but that turn out to be insulators.

To test their theory, researchers working on a joint project by CEA-Leti, LTM, and CNRS fabricated 15 x 300 nm^2 memory cells, replacing the usual metal oxide with a Mott insulator.

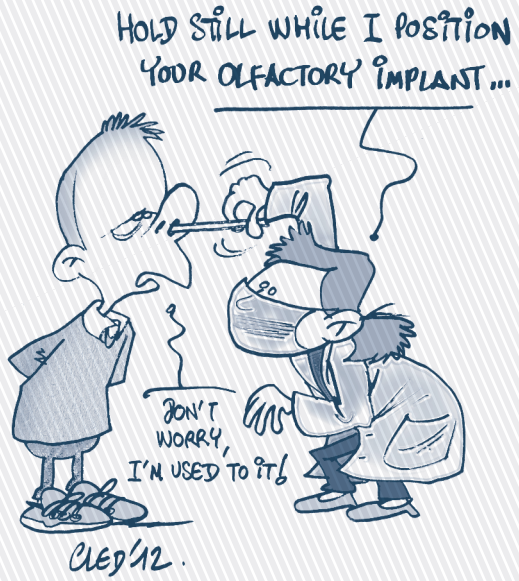
The variability of their cells was ten times less than that of conventional cells—and low enough for particularly demanding use cases like data storage.

When a Mott insulator transitions from conductor to insulator, there is no displacement of atoms or change in the crystal structure, two of the culprits responsible for cell variability, which explains the improvement.

The researchers will now turn their attention to the synthesis and deposition of this unusual material, which remain tricky.

camille.giroud@cea.fr

MINATEC®
MINA-NEWS is published by MINATEC,
3 parvis Louis-Néel, 38054 Grenoble Cedex 9 France



Rose to develop artificial nose for patients suffering from loss of smell

Since September, CEA-Leti and startup Aryballe have been contributing to the European Rose project to design a miniaturized artificial nose.

The innovation will help the staggering 20% of the world's population who have lost or partially lost their sense of smell due to Covid-19 or other illnesses.

CEA-Leti is developing ultrasound transducers that contain silicon membranes that vibrate at their own frequency.

Aryballe will deposit biochemical material onto the membranes that will trap specific olfactory molecules, changing the vibration frequency.

Designed to make patients' lives better and safer (by alerting them to hazards like gas leaks and toxic substances), the miniaturized artificial nose will measure less than one square centimeter and detect 16 or 64 families of smells.

camille.giroud@cea.fr

Silver nanowire arrays not as unstable as previously thought

Silver nanowires, in the running to replace transparent indium tin oxide electrodes, are plagued by instability under electrical and/or thermal stress.

A PhD candidate at LMGP showed that silver nanowires encapsulated in transparent oxides deposited by spatial ALD are stable.

Other laboratories and companies also contributed to the project, helping integrate the reinforced silver nanowires into heating films for labs-on-chip, piezoelectric generators, X-ray sources, organic photovoltaics, and other devices.

Dorina Papanastasiou, the PhD student behind the research, received a C'Nano Aura thesis award.

She is now a postdoc at LMGP.

theodora.papanastasiou@grenoble-inp.fr

LEDs in the race against mercury for UV-C emission

A recent paper by researchers from Irig and Institut Néel presents a method for creating quantum wells in GaN/AlGaN core-shell structures on GaN for UV emission enhancement.

The secret of the structures lies in their very small number of cracks—which behave like non-radiative centers, trapping charge carriers.

Because of the difference between the two materials' mesh parameters, the cracks are created beyond a certain elastic energy per unit area threshold.

The researchers used an epitaxial growth process in which the aluminum content of the AlGaN increases gradually to avoid reaching this threshold.

The quantum wells, embedded in nanowires, are of interest to research due to their potential to improve UV LED efficiency and, possibly, replace mercury disinfection lamps.

joel.eymery@cea.fr

Wireless technology unleashes avalanche detonators

CEA-Leti will present an electronic detonator system with bidirectional radio modules at the Mountain Planet trade show in Grenoble in April.

Communicating via a special protocol, the system wirelessly and remotely controls several detonations synchronized to within a tenth of a second, with a success rate of 100%.

The technology was originally developed for Davey Bickford, the leading global provider of blasting solutions to the mining industry, and has been proven in several field tests by the company.

Ski resort operators are also interested in the solution as a way to set off the controlled avalanches frequently used to prevent real ones.

With some adaptations, the system could be used by ski patrols to remove excess snow load exactly where they need to, minus the hassle of wires and at a safe distance from the explosives.

camille.giroud@cea.fr

The physics of stacked graphene layers is both rich and unpredictable

When two layers of graphene are stacked, even the tiniest misalignment can slow electrons down or bring them to a halt altogether. The underlying physics is particularly rich, with the graphene behaving like a superconductor or, conversely, like an insulator!

A recent Irig meta-analysis of around ten studies shed new light on these phenomena. The researchers pointed out that the high variability in behavior from one two-layer stack to another is not only due to differences in alignment.

It can also be attributed to fabrication-process-induced deformations and residual strain in the layers. A relative stretch of just 1% can dramatically alter the layers' electronic properties.

The research was published in *Physical Review Letters*.

Read the abstract: https://bit.ly/3AIZCNg

vincent.renard@cea.fr

Greenhouse gases could soon be monitored using LiDAR

In research for the H2020 Holdon project, CEA-Leti developed a LiDAR for observing greenhouse gases CO_2 and methane from space.

Built with a III-V (HgCdTe) detector and CMOS read circuit, the device's operating range is between the UV and NIR spectra.

With single-photon sensitivity and a dynamic range of six to seven orders of magnitude, the LiDAR's performance is nothing short of exceptional.

It will be used for research purposes, providing data on greenhouse gas emissions, fluxes, and capture.

The companies participating in this European project will also have their needs in weather forecasting, biology, and materials science met. Project partners Airbus and École Polytechnique will soon receive their LiDAR demonstrators.

camille.giroud@cea.fr

Augmented reality through almost-normal glasses could soon be here

CEA-Leti outlined a bold vision for augmented reality glasses in three papers it presented at SPIE Photonics West in the United States, charting a course toward high-tech specs as lightweight and unobtrusive as regular prescription eyewear.

The technology hinges on transparent silicon nitride waveguides deposited on a glass substrate that project pixelated holograms directly onto the user's retina. The system itself is a huge technological challenge, and pixelated holograms have been the topic of three CEA-Leti patents. Current optical losses are too high for the system to work, but research is underway to reduce them.

The augmented reality glasses could also find opportunities on the health and defense markets.

camille.giroud@cea.fr

Spintec unveils high-potential memristor for neuromorphic computing

Spintec recently completed a proof-of-concept of a promising memristor that could be used as an artificial synapse in neuromorphic architectures.

This non-volatile memory's resistance can have multiple intermediate values between a minimum and a maximum.

Thanks to recent advances, the storage layer's magnetization can be oriented and stabilized in all directions of the layer plane, rather than just parallel or antiparallel to a reference layer.

The memristor stands out for its low power consumption, low variability, and write endurance, making it ideal for machine learning applications with their billions of potentially energy-intensive operations.

The next step is to implement the component in circuit architectures for testing.

bernard.dieny@cea.fr

DAY BY DAY

Grenoble INP, UGA engineering students for the energy transition

A cohort of 28 third-year students at Grenoble INP, UGA engineering schools—including three from Grenoble INP - Phelma, UGA—recently completed the first semester of a course called *Piste* to promote technologically-frugal and environmentally-responsible engineering*.

We will have to rethink our production systems to effectively address today's social and environmental challenges. This course does just that!

Students take a system-level approach to the issues, learning new concepts in class that they then implement in group projects addressing the needs of a business, nonprofit, or public service through a frugal solution that represents a shift away from the conventional growth model.

This semester, students completed projects on a summer cooling solution for existing homes and low-tech food preservation systems, for instance.

**course offered by Grenoble INP - Ense³, UGA; learn more at: https://ense3.grenoble-inp.fr/fr/formation/piste*

laurent.jossic@grenoble-inp.fr
fanny.poinsotte@grenoble-inp.fr

CEA-Leti ready to dive into even more European projects

The EU Horizon 2020 program turned out to be especially productive for CEA-Leti, with 184 projects securing €192 million in funding. The average EU project acceptance rate is 17%. CEA-Leti had 26% of its projects accepted—and served as coordinator on 34 of them!

CEA-Leti is more committed than ever to addressing major societal challenges—from the medicine of the future to frugal electronics, telecommunications, and cybersecurity—through the new Horizon Europe program. The institute is already leveraging new EU instruments like startup innovation funding, public-private partnerships in telecoms and microelectronics, cleanroom equipment purchase grants, and a defense research program.

camille.giroud@cea.fr

Primo1D raises €15 million in capital to ramp up production

Primo1D, a CEA-Leti spinoff founded in 2013, develops and manufactures RFID-enabled thread that, once integrated into textiles, cables, or other manufactured products, is both durable and invisible. The solution can be used to identify, authenticate, and track products throughout their lifecycle.

After seven years at MINATEC, Primo1D moved to its own facility nearby to begin manufacturing.

SPI (a Bpifrance investment fund), Innovacom, and Primo1D's existing investors injected €15 million in fresh capital into the startup in November 2021—funds Primo1D will use to ramp up production significantly.

The company will install a new piece of manufacturing equipment and hire ten people this year. Production will continue to ramp up from today's 1 million units to 100 million units per year by 2024.

emmanuel.arene@primo1d.com

LÉA DI CIOCCIO
head of the eco-innovation program at CEA-Leti

"We are supporting the development of more sustainable technologies"

MINA-NEWS: CEA-Leti offers eco-innovation studies to some of its R&D partners. Why?
Léa Di Cioccio: Environmental regulations–both in France and across Europe–are one of the factors driving demand for this kind of study among our R&D partners SMEs have expressed a real need for support. Fabless manufacturers are seeking insights that will help them work more effectively with semiconductor foundries. And, while reducing carbon emissions is still their priority, corporations are also getting curious about leveraging design and R&D.

MINA-NEWS: What are you focusing on to make your technologies greener?
New economic models around repair, reuse, recycling, and renting rather than owning are starting to emerge. So, we will have to do R&D differently. There are at least three things we can focus on in terms of technology: reducing power consumption, something we have been working on for years, finding substitutes for rare and critical materials, and using those manufacturing processes that have the greatest impact on the environment as little as possible.

MINA-NEWS: Is this something you hope to do with all of your partners eventually?
It is up to policymakers to create the impetus for change. Our role is to raise awareness, make recommendations, and work with other stakeholders, starting here at home, where we are working together with institutes and departments across the CEA organization.

In 2022 we would like to integrate eco-innovation into all our research. This would be a first step toward developing more sustainable technology. ■

camille.giroud@cea.fr

CEA-Leti will run an eco-innovation workshop featuring outside speakers on March 9 and 10. Anyone can attend. Learn more and sign up at: https://workshop-CEALeti-ecoinnovation.insight-outside.fr

LIVE FROM MINATEC

Y.Spot Partners full to capacity on opening day

Virtually all of the Y.Spot Partners building had been leased before it opened.

The main tenants are HP France (600 employees), moving from their old site in Eybens, near Grenoble; The Village by CA startup accelerator* (with 20 startups); and four CEA tech transfer and scientific outreach departments.

Y.Spot Partners is located near Y.Spot Labs, which runs innovation projects organized around ecosystems, making it the perfect neighbor.

A total of 800 people will work in the 10,000 sq. m building. A lunar habitat designed by future CEA Grenoble partner, startup Spartan Space, will be on display at the March 11 ribbon-cutting ceremony.

Attendees will also have a chance to explore the Atelier Arts Sciences, Ideas Lab, an outdoor sports exhibit by Isère Attractivité, and the GIANT pavilion.

**offering mentoring, training, and other support services.*

philippe.watteau@cea.fr

HORIZONS

Alten the latest Phelma partner

Grenoble INP - Phelma, UGA signed a one-year partnership agreement with global engineering and information systems strategy and development consulting firm Alten a few months ago.

Students in the school's Physics Engineering for Photonics and Microelectronics (IPhy), Signal, Image, Communication, and Multimedia (SICOM), and International Advanced Materials (AM) programs, and any other students interested in consulting careers, will benefit from this new partnership.

Since 2008, Alten has hosted interns and hired around 20 graduates.

Although the partnership is with Alten France, the school had a particularly close relationship with Alten's Grenoble office, which is managed by a Phelma alumna!

aurelie.dinola@grenoble-inp.fr

Grenoble INP - UGA on the race to zero emissions

Grenoble INP - UGA has joined the Race to Zero for Universities and Colleges alongside more than 1,000 institutions around the globe.

This UN-backed initiative encourages institutions to "pledge, plan, proceed, and publish" their path to net-zero greenhouse gas emissions.

All of Grenoble INP – UGA's activities this fall produced 1.8 tons CO_2 equivalent per person*.

The items responsible for the most emissions were energy consumption, mobility, and equipment purchases.

Now that the school has pledged, it will write up a plan consolidating all of the measures implemented campus-wide, with a target of reducing overall carbon emissions by 75% by 2030.

**For a person in France, the average carbon footprint is 8 t CO_2 e/person (source: https://www.citepa.org/fr/2021_11_a28)*

durable.vp@grenoble-inp.fr

AGENDA

February 27 to March 4
[2022 Physics School, Les Houches]
https://smbleshouches.com/

March 5
[parvis Louis Néel, Grenoble]
PHELMA OPEN HOUSE
https://ecole-ingenieur-phelma.com/journee-portes-ouvertes-grenoble-inp-phelma

March 9 and 10 [Grenoble]
CEA-LETI
ECO-INNOVATION WORKSHOP
https://workshop-CEALeti-ecoinnovation.insight-outside.fr

March 10 and 1 [Grenoble]
MINAPAD FORUM 2022
https://imapseurope.org/event/minapad-2022/

March 17 [Maison MINATEC]
JSIAM - JUNIOR SCIENTIST AND INDUSTRY ANNUAL MEETING
https://adobe.ly/3GcwxLg

April 1
[Grenoble (online)]
LETI HEALTHCARE WORKSHOP
Innovations in microtechnology for bioproduction and in vitro diagnostics.
Register at: https://bit.ly/3G6yOYj

April 12 [Maison MINATEC]
GIANT ORIENTATION DAY
Further information and registration:
https://adobe.ly/3Hbal5J

CONTACTS

MINA-NEWS is published by MINATEC 3, parvis Louis-Néel – 38054 Grenoble cedex 9, France
Head of Publication: Jean-Charles Guibert - **Editor-in-Chief:** Julie Spinelli
Contributors: Camille Giroud, CEA-Leti, *camille.giroud@cea.fr*
Nathalie Mathieu, Phelma, FMNT, *nathalie.mathieu@phelma.grenoble-inp.fr*
Patrick Warin, IRIG *patrick.warin@cea.fr,* Julie Spinelli, MINATEC, *julie.spinelli@cea.fr*
Alexis Sableaux, Grenoble INP – Phelma UGA *alexis.sableaux@phelma.grenoble-inp.fr*
Editing: Benoît Playoust and Bénédicte Magne | **Graphic design:** studio Bambam [Grenoble]
English translation: SFM Traduction