MINA-NEWS
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TOP NEWS

Avalun Covid-19 antigen test now on market

Startup Avalun, which calls the MINATEC High-Tech Building its home, released its Covid-19 antigen test a few days ago. This powerful growth driver will also help speed up the rollout of Avalun's portable lab, LabPad® Evolution.

At the start of 2020, Avalun had plans to roll out its LabPad® INR in six regions across France to monitor 10,000 patients on blood thinners. But that was before Covid. The test rollout (a project called Di@pason) was postponed when participating medical biology labs were overwhelmed by the testing demands of the pandemic. Avalun rapidly switched gears, focusing its R&D on a Covid-19 antigen test and on the release of its new portable lab, the LabPad® Evolution. The company started working on the antigen test in August, and obtained CE marking in late November.

RESULTS IN 20 MINUTES OR LESS

"Positive" patients with a high viral load can expect a result in just a few minutes, while a negative result can take up to 20 minutes. Compared to the conventional in-lab PCR test, Avalun's antigen test is 92.5% effective. A nasal swab is required for the new test. Avalun's LabPad® Evolution automatically reads the results and sends the information to secure public health data monitoring platforms.

Orders are flowing in and demand on this global market far surpasses what the company can manufacture. The LabPad® Evolution will make inroads into markets around the world—and not just in France—much faster than anticipated. Once the pandemic is behind us, Avalun will have a substantial installed base of products and will then be able to offer other kinds of tests. The company's R&D department is already working on them!

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TOP NEWS

Spintronics and optronics, better together

In research conducted for the EU Spice project, Spintec demonstrated an optical magnetic tunnel junction that is 1,000 times faster than magnetic tunnel junctions that use an electric write current. This breakthrough could lead to non-volatile MRAM with unprecedented levels of performance.

Earlier in this project, Spintec had shown that a femtosecond laser could effectively reverse the magnetization of a termium cobalt layer. Here, the gap with an electrical current—which maxes out at around 100 picoseconds—was already substantial. At this stage, however, the demonstration was on the material, not on a functional MTJ.

THE PATH TOWARD MEMORY POINTS OF 30 NM AND POSSIBLY EVEN 20 NM

The researchers recently reached this milestone, by replacing the MTJ's top metal contact (usually aluminum and tantalum) with a transparent material the laser light could pass through. They settled on indium tin oxide, widely used in LCD displays. Memory points measuring 80 nm in diameter were fabricated using standard deposition and etching processes. Ultimately, the researchers hope to come down to 30 nm, and possibly even 20 nm.

MRAM memory could benefit from smaller MTJs that enable faster write speeds while consuming less energy due to the use of the energy-efficient laser. Only the read phase would remain electrical, at least in the near term. This will ensure that each memory point can be read individually. The laser wavelength of 800 nm cannot be focused on MTJs this small in diameter.

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INNOVATION

No virus can escape the optomechanical resonator

CEA-Leti and Irig are developing a mass spectrometry-based technique to "nanoweigh" viruses. And extremely accurate nanoresonators could expand the potential uses for the technique. CEA-Leti and Irig researchers were able to detect and weigh individual biological particles (from several megadaltons to a gigadalton). The technique was effective on bullet-shaped viruses like rabies and Ebola and on the amyloid fibrils that play a role in some neurological disorders. These non-spherical particles were almost impossible to analyze using the previous generation of resonators.

This new technique also works on very low concentrations of particles. The next step will be to test it on airborne viruses. The research, conducted in partnership with the CNRS, was published in the journal *Nature Communications*.

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A new wrinkle sure to foil counterfeiters' plans

In research published in *Advanced Materials*, CEA-Leti and Bordeaux-based CELIA* developed a process to generate random micrometric patterns. A pulsed laser is used to melt thin layers of an amorphous germanium chalcogenide. This causes tiny wrinkles that are micrometers wide and tens of nanometers deep to form, creating the pattern. They are impossible to reproduce identically and, therefore, unique—perfect for authenticating items of value that are often counterfeited, from computer chips to fine timepieces and jewelery.

And, at just 50 microns, the entire pattern is tiny enough to be discreet, yet large enough to be read using a smartphone equipped with a lens. Talks with manufacturers interested in the technology are in progress.

**Center for intense lasers and applications - University of Bordeaux CEA CNRS joint research unit 5107*

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Innovative thermometer helps keeps power components from overheating

Researchers from CEA-Leti and CEA-Liten built and tested innovative thermal sensors to monitor the temperature of gallium nitride (GaN) HEMT* power components. The sensors are fabricated at the same time and on the same substrate as the components and do not require additional process steps (masks). They utilize the Seebeck effect to predict overheating that could lower circuit performance. Plus, they do not require their own power supply and generate a response in the tens to the hundreds of millivolts.

This approach appears to offer greater potential than conventional thermal sensors, which are located near the circuit but are more expensive. Finally, this new breed of sensor could support the expansion of HEMT components, currently used in smartphone-type scenarios, into other applications like electric vehicles. Two patents have been filed to protect the innovation.

**High Electron Mobility Transistor*

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LiteBIRD deep-freezes telescopes to probe the genesis of our universe

Researchers from Irig are working on the international LiteBIRD space observation satellite project. They have been tasked with developing a cold machine that can deliver 2 microwatts at 100 mK—a level of performance never before achieved in space. The cold machine will be used on the two telescopes in the payload.

The researchers have opted for a four-stage magnetic refrigeration machine that is well-suited to the demands of space. Variations in a magnetic field are applied to a magnetocaloric material to produce cold. The researchers developed and patented a new magnetocaloric material, ytterbium gallium garnet, which offers unparalleled energy density. The design phase should be completed by the end of 2021.

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CEA-Leti expands 300 mm line with new contact fabrication capabilities

CEA-Leti has added even more new 300 mm equipment this year. The institute's clean rooms can now fabricate their own low-resistance ohmic contacts—a BEOL process where the electrical junctions that link the active components of a circuit to the circuit's connectors are made. The contacts fabricated at CEA-Leti offer resistances close to those made in industrial fabrication environments. This new capability will give even more weight to the R&D services CEA-Leti offers semiconductor-industry partners.

The new contactor fabrication process took two years to perfect. A set of masks—representing an investment of €50,000—was produced and a stable production process was finalized. CEA-Leti, which had previously outsourced certain 300 mm contact fabrication process steps to STMicroelectronics, can now complete these steps in house, shortening lead times on R&D projects for partners.

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An innovative lithium-ion battery anode

In research conducted for the EU Sinbat project, Irig is pulling out all the stops—electron microscopy, MRI, X-ray diffraction, synchrotron, and neutron scattering techniques—to characterize an innovative lithium-ion battery anode. The anode's revolutionary composition includes active domains of amorphous silicon and FeSi2 nanoparticles in a graphite matrix.

The silicon increases the anode's capacity to incorporate lithium and, as a result, the energy storage density. But it also triples in volume during charging, which can cause more rapid anode degradation. The anode developed by CEA-Liten and Varta, also a partner on the project, is made from a nanostructured material developed by 3M. This material effectively limits degradation. After 700 cycles, the anode still has 70% of its original capacity.

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ERC Proof of Concept grant for SOT-MRAM fabrication process

Researchers at Spintec won an ERC Proof of Concept grant for a SOT-MRAM memory fabrication process developed under an earlier ERC grant. The challenge here is the unusual profile of the memory's free magnetic layer. Rather than being round, it has a number of angles. This unique geometry eliminates the need to use micromagnets, which would normally be required for the system to operate in a reproducible manner. The downside is that standard UV lithography machines are not suitable for this type of SOT-MRAM fabrication.

Ionic irradiation—provided by startup Spin Ion—offers a potential solution. If it works, the researchers will have made a major advance toward ultra-fast, compact, energy-efficient SOT-MRAM, a potential replacement for SRAM memory.

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Bioresources enable antimicrobial bandages

Could all-natural materials be used to make antimicrobial dressings for open, infected wounds? A PhD research project conducted at CEA-Leti, CERMAV, and LGP2 investigated precisely this kind of environmentally-friendly dressing for inpatient care scenarios, and the findings were encouraging.

The dressings studied here were made from nanocellulose obtained from wood. The material can take the form of an aerogel, a cryogel, or a thin membrane. It was impregnated with an active ingredient in supercritical CO_2 at 31 °C and 74 bar, eliminating the need to use organic solvents. The researchers functionalized three structures: one with an antibiotic, one with an antimicrobial amino silane, and one with thymol from essential oils. They all demonstrated good antibacterial properties. The researchers will now dig deeper into their findings with an industrial R&D partner.

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Advance gives new hope for lasers without III-V materials

III-V semiconductor materials are expensive and increasingly rare. Their replacement as the go-to material for lasers is inevitable. CEA-Leti researchers were part of an international team* that recently published a notable advance in *Nature Photonics*. They developed an optically-pumped IV-IV semiconductor device capable of producing a 2.5 micron laser beam with an ultra-low threshold at temperatures of 100 K.

The device was made by depositing germanium and then germanium-tin onto a silicon substrate. The resulting disk was then encapsulated in silicon nitride and voltage was applied to introduce mechanical strain before transferring the disk to aluminum pillars for heat dissipation. At this stage, the device is a laboratory prototype. However, it does confirm that lasers can be made without III-V materials.

**STMicroelectronics, C2N-CNRS, Forschung Zentrum Juelich*

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Two Irig scientists now members of prestigious French learned society

Two Université Grenoble Alpes faculty members, also scientists at Irig, became members of the learned society *Institut universitaire de France* on October 1, 2020 for a five-year term. They were selected for their excellence in research and for the international recognition they have earned.

Junior Member Hélène Malet works at the IBS Electron Microscopy and Methods Group. She conducts research on the structural and functional analysis and replication of bunyaviruses, an order of viruses that affects humans and for which there is currently no treatment.

Senior Member Mairbek Chshiev works at Spintec. His research to determine the best combination of materials for sustainable electronics using spin orbitronics and 2D spintronics won over the selection committee.

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Hardware security expert Brice Colombier joins Grenoble INP-Phelma faculty

Grenoble INP-Phelma's newest faculty member is an expert in hardware security. Brice Colombier joined the TIMA lab's AMfoRS* group in September. His research focuses on attacks targeting integrated circuits and the associated countermeasures. Some attacks measure a circuit's electrical consumption to extract data, for example. And the most sophisticated attacks use laser injection devices whose sole purpose is to hack into circuits.

Colombier will also be teaching a 20-hour lab class to third-year embedded systems and connected devices majors. Students in this emerging field, which is about where the smart card was 20 years ago in terms of security, will need to explore vulnerabilities and learn to protect them.

**Architectures and Methods for Resilient Systems*

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What's new in the AMIS Masters program

EIT* Raw Materials recently renewed the EIT seal for the five-partner international AMIS (Advanced Materials for Innovation and Sustainability) Masters program coordinated by Grenoble INP-Phelma. And there are several notable additions to the curriculum.

The program now includes classes on the materials lifecycle and on electric vehicles. These totally new classes will provide students with both theoretical and practical knowledge of sustainable design and approaches that factor in supply chain issues and critical materials. And, while the classes and special sessions on innovation and entrepreneurship are not new, they have been substantially enriched by contributions from the industrial companies partnering with the program.

**European Institute of Innovation and Technology*

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RONALD PHLYPO
Dean, Masters in Data Analysis: Linking Experiments and Theory, Phelma

"Students have to learn scientific method and experimentation"

MINA-NEWS: What motivated you to set up this Masters program focused on scientific method and experimentation?
Ronald Phlypo: We feel that these are fundamental skills. And not only for scientists. Students planning careers in industrial R&D need them, too. Experimentation is vital to testing and development cycles. What we are seeing with our students' culminating projects is that they apply experimental protocols in a rote fashion without demonstrating the necessary critical thinking skills. We want them to take ownership of the protocols they are using.

MINA-NEWS: What is in the curriculum?
RP: The first semester of the program focuses on formulating hypotheses for a research project and determining experimental protocols. In the second semester, students will implement measurement and data analysis methods and learn to write their conclusions. The curriculum prepares students for the second year of their Masters program, where they can choose between cognitive science and signal and image processing at Phelma, or nanomedicine and structural biology at Grenoble-Alpes University.

MINA-NEWS: How many students are enrolled?
RP: This is the first year of the program and we are in the middle of a pandemic. So, the number of students is much lower than it would normally be. Starting next year, we plan to leverage two strengths. The first is that this is the only program of its kind in France. Second, all classes are taught in English, which makes the program ideal for international students. Ultimately, we plan to accept 25 to 30 students per year.

Learn more: https://bit.ly/3mdEua1
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FMNT backs four new equipment purchases

Three FMNT (Foundation for Micro and Nano Technology) partner labs had four equipment purchase requests, endorsed by FMNT, approved for funding by Grenoble INP. The equipment will be installed in the labs in 2021 and will be made available to other users through the OPE)N(RA characterization platform.

IMEP-LaHC will get a latest-generation semiconductor parameter analyzer and a fiber splicer for new "special" optical fibers. G2ELab will receive electrothermal characterization equipment for wide-gap semiconductor power component and multilayer component research. And LMGP will round out its protein production and purification equipment with a chromatography machine.

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Alain Sylvestre to head the Foundation for Micro and Nanotechnology effective January 1, 2021

Alain Sylvestre, a Université Grenoble Alpes faculty member and research scientist at G2ELab, will succeed Mireille Mouis as director of the FMNT on January 1, 2021. Sylvestre has served as deputy director for the past two years. Fellow Université Grenoble Alpes professor Skandar Basrour, who also conducts research at TIMA, will succeed Sylvestre as deputy director.

Sylvestre's priority will be to continue to support projects in five strategic fields: microelectronics, components and systems for telecommunications, integrated measurement devices, biology and health, and materials and components for energy. He will also complete the financial audit process for the OPE)N(RA platform. This will facilitate financial documentation for labs seeking to use the platform for publicly-funded research. He will also continue to promote the FMNT and the shared OPE)N(RA platform.

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Anne Kaminski-Cachopo appointed director of IMEP-LaHC

IMEP-LaHC has a new director. Current director Jean-Emmanuel Broquin will finish his second term at the end of the year; current deputy director Anne Kaminski-Cachopo will succeed him on January 1, 2021. Dr. Kaminski-Cachopo is a member of the Grenoble INP-Phelma faculty. She is an expert on photovoltaic components and also conducts research on photodetectors.

IMEP-LaHC employs around 130 people, including 60 permanent employees on two sites (in Grenoble and Le Bourget-du-Lac). The lab is home to three research groups on micro and nanoelectronic components, terahertz photonics and optoelectronics, and radio and millimeter-wave frequency. Cross-disciplinary research topics like sensors and optoelectronics are also gaining traction at the lab. A joint lab with an industrial R&D partner on these topics is expected to be finalized in early 2021.

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HORIZONS

UNITE! Grenoble INP-Phelma is crossing borders even during the Covid lockdown

The purpose of the UNITE! (University Network for Innovation, Technology and Engineering) program is to create a physical and virtual university network across Europe from Finland to Portugal. UNITE! was selected as one of the 17 European University Alliances to receive funding from the European Commission.

Grenoble INP-UGA, Institute of Engineering and Management is one of the seven members* of this university alliance that serves some 180,000 students. UNITE! will be rolled out gradually. In the first semester of the academic year, Grenoble INP schools Phelma and Ense^3 introduced thirteen new courses in the field of energy, which is one of the pillars of the UNITE! program. Six Grenoble-based students were able to enroll in elective courses offered by partner universities this year.

Amid the ongoing Covid pandemic, the UNITE! program partners will continue to help to raise Europe's international profile as a center for scientific research and business—even if they have to do it from home!

https://www.unite-university.eu/

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Women in engineering 2020: Grenoble INP earns kudos for its commitment to gender representation

On October 1, 2020 Grenoble INP won the "Most Committed School Award" for its *Genre INP'lication* project at the CDEFI* 10th annual *Ingénieuses* women in engineering competition.

The award-winning project to improve gender representation is led by Céline Ternon, who heads gender equity programs at Grenoble INP. Genre *INP'lication* encompassed awareness-raising activities at several Grenoble INP schools. The goal is to get students thinking about gender stereotypes. Although progress is being made at engineering schools, deep-rooted inequalities persist in the workplace.

At Phelma, students gathered to share and discuss their experiences. Second-year students came together in February for an event that included a lecture on the benefits of diversity and inclusion and five workshops on a variety of topics, including gender equity.

**France's conference of engineering school deans*

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SafeHear could make conversations in noisy environments safer and more comfortable

Imagine earplugs that filter out noises, not voices! Startup SafeHear, founded in early 2020 by Grenoble INP-Phelma student Antoine Kuhnast and Grenoble IAE graduate Héléna Jérôme, is developing just such a product. The founders have some heavyweights behind them: They are already working on several R&D projects with STMicroelectronics and Inria.

The human voice is situated between 300 Hz and 3,000 Hz—just a small portion of the entire audible spectrum, which goes up to 20,000 Hz. SafeHear earplugs would be built on two acquisition microphones, a signal processing stage, and Bluetooth transmission to other users. The earplugs would have an operating range of around 10 meters. The company plans to address two main markets initially: industrial and consumer PPE, with uses ranging from noisy factories to concerts and sporting events.

Learn more: www.safehear.fr

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Minalogic helps its members pivot to online communications

Cluster Minalogic and its members rely heavily on in-person events to promote their businesses. With live events cancelled this year, Minalogic rapidly created a series of workshops to help its members shift to business online. Among the offerings are workshops on effective online meetings and a Pitching for Success program designed to help participants craft an impactful pitch and deliver it online.

And for members participating in international trade shows, Minalogic can share the business intelligence services of fellow Minalogic member Aprobase. The company offers a search engine that can query databases in more than 70 languages and provide the relevant information in French. The tool can collect up to five times more information than manual searches.

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Alternative mobility gains ground at CEA

CEA continues to roll out alternative mobility solutions to help employees get around its 70-hectare campus. Soon, 100 of the 1,000 bikes in the campus fleet will be equipped with connected locks that can be controlled with a regular ID badge or special app. The 30 free-floating Twizy electric vehicles will be findable at all times via the Totem geolocation app.

CEA is also helping raise all campus users' awareness (including pedestrians) about safety through an informational campaign and safety kits for all employees who commute by bike or scooter. And, last but not least, employees can have their bicycle maintenance needs taken care of at the repair shop for free (not including the cost of parts).

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100% online CSR day on December 4

Grenoble INP-Phelma will organize a CSR* day for its 300 second-year students on December 4. The event, which was supposed to be held on site, will now be held online. The morning program—on the social issues inherent to CSR—will include a lecture by social scientist Thomas Reverdy and a panel talk. The afternoon will be devoted to eight breakout sessions facilitated by students on topics like gender equity, sustainable development, and the digital footprint.

Phelma continues to confirm its commitment to including CSR in the curriculum with this second CSR day. The first was held in February for last year's second-year students. And, if Covid restrictions allow, the event could be extended with tours of Phelma partner companies that would like to show students their exemplary CSR initiatives.

**Corporate Social Responsibility*

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Y.SPOT Partners building to be delivered in a year

Construction on the Y.SPOT Partners building, which began in December 2019, is slated for completion by the end of 2021 so that the tenants, which include CEA, can build their interior workspaces and move in in early 2022.

The 10,000 sq. m building, dedicated to collaborative and multi-partner innovation projects, is located on Place Nelson-Mandela in the center of the GIANT campus. It is the second part of the Y.SPOT center. The first, Y.SPOT Labs, opened in January 2020. Located on the CEA campus, Y.SPOT Labs hosts tech-oriented projects. The doors of Y.SPOT Partners will be open to companies, students, artists, startups, and other stakeholders.

CEA will occupy 2,000 sq. m of the new building—space that will house the open labs as well as tech-transfer, spinoffs, and industrial R&D partnership activities. GIANT will have reception and workspaces in the building.

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AGENDA

December 3 and 9 [online]
MINALOGIC PITCHING FOR SUCCESS WORKSHOPS
Registrations: *https://bit.ly/3fxoLQv*

December 4 [Phelma — online]
CSR DAY FOR SECOND-YEAR STUDENTS
Contact: *jean-christophe.klein@phelma.grenoble-inp.fr*

December 8 [online]
MINALOGIC EXTRAORDINARY GENERAL MEETING
https://bit.ly/39aaMiq

December 10 [online]
COVID-19: CURRENT RESEARCH ON THE LOCAL AND NATIONAL SCENE
Organized by IBS in conjunction with Université Grenoble Alpes Medical Center and IAB
https://hostpathogen.fr/meetings/

December 10 [online]
LETI DEVICES WORKSHOP
Information and registration:
https://bit.ly/2UPJXrz

February 2 and 3 [World Trade Center Grenoble]
MINAPAD FORUM
Conference on microelectronics packaging and assembly
https://bit.ly/3maiywc

February 14 to 19 [Chamonix]
PHYSICS SCHOOL – LES HOUCHES
Organized by Grenoble INP, ILL, LSPC, and Grenoble-Alpes University
https://bit.ly/2UWMT5q

February 27 [online]
PHELMA OPEN HOUSE
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