

MINA-NEWS

MINATEC
NEWSLETTER
OCTOBER 2020

TOP NEWS

Unprecedented start to 2020-2021 school year at Phelma

Phelma was able to physically welcome first-year students to school on campus on September 11. With social distancing and other Covid-19 measures in effect, the first day of school was unlike any other.

Three auditoriums were prepared (with every other seat left open) to welcome the incoming first-year class. The students may have missed out on the usual "first day" excitement, but they did get a chance to meet other new students like them and see what the coming year will be like.

Because the entrance exams were disrupted by the pandemic, admissions were not completed until early September, almost four weeks later than usual. Despite the reigning uncertainty, 360 new students enrolled, similar to previous years.

SOME INTERNATIONAL STUDENTS STILL STUCK IN THEIR HOME COUNTRIES

Around 50 international students from all classes and majors are still stuck in their home countries due to border closings and have not yet made it to Grenoble.

And, with classroom capacity cut in half, managing student schedules and classroom occupancy is a conundrum. School officials will have to continue to think on their feet to ensure that students keep learning and that everyone stays safe.

Most of the new student orientation activities have been cancelled. A few outdoor activities, including a trip in very small groups up to the Bastille overlooking Grenoble, will be maintained. Back at the school, activities like futsal are prohibited and the Foyer cafeteria is closed until further notice. Student club offices are also closed.

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INNOVATION

Microneedles could improve treatment of skin cancer

CEA-Leti and Inserm* researchers developed a polymer microneedle patch to treat sun-related skin cancer without surgery. The hundreds of tiny needles are applied to the lesion. They dissolve in less than an hour and, in the process, deliver a drug, which, when exposed to light, is activated and destroys malignant cells.

The researchers determined the optimal needle size and spacing and developed a chemical-free fabrication process. The needles' length can be adjusted from 400 microns to 750 microns, making treatment pain free, yet still deep enough to reach lesions at the interface between the epidermis and dermis. A patent has been filed to protect the innovation and clinical trials are slated to begin. The microneedle patch could reach the market within three to five years.

*Inserm's OncoThAI unit, affiliated with Lille University and the Lille University Medical Center

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Tomorrow's window glass could be photochromic and photovoltaic

Imagine window glass that changes in tint depending on sun exposure and produces electricity, too. Researchers at Irig and two international partners* are trying to develop just such a glass. A specially developed and patented naphthopyrone pigment was placed between two sheets of glass, allowing the researchers to obtain photochromic and photovoltaic effects on a 23 sq. cm piece of glass in the lab.

In terms of scaling up the technology, the partners are working on improving the colorant's long-term stability and the speed at which it returns to its clear state when ambient light fades. They would also like to improve the PV conversion yield, currently at 4.2%. Prototypes measuring 1,000 sq. cm should be available by 2024.

*Pablo de Olavide University (Seville) and Solaronix (Switzerland)

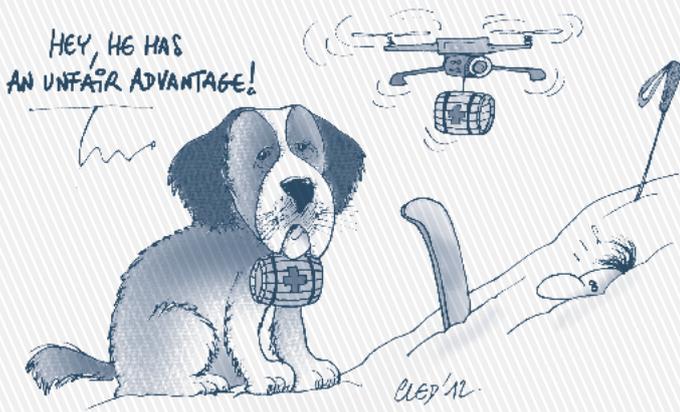
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Stabilizing skyrmions without a magnetic field now possible

The tiny magnetic bubbles known as skyrmions—potential candidates for tomorrow's memory bits—can now be stabilized at ambient temperature without a magnetic field. Researchers at Spintec just demonstrated this new capability using an exchange coupler already used in MRAM. Specifically, an anti-ferromagnetic layer is combined with the ultra-thin ferromagnetic layer that holds the skyrmions.

The size of the skyrmions was also reduced, which could boost future memory storage densities. The smallest skyrmions measured 30 nm, five times smaller than anything obtained previously by Spintec. Also worth noting is that Spintec worked with the University of Montpellier to characterize the device using an innovative technique called nitrogen vacancy center magnetometry.

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A drone could speed up avalanche search and rescue

In an avalanche, every minute counts. The longer a victim is buried under the snow, the less chance they have of surviving. CEA-Leti researchers equipped a drone with a network of antennas run by a radio-frequency circuit to help speed up search and rescue operations. The system utilizes algorithms to estimate which directions Bluetooth and GSM signals are coming from. It can locate a smartphone to within a meter and inspect 10,000 sq. m of terrain in just minutes.

Ideally, the system would be used in conjunction with existing systems* or on its own if the victims are not equipped with another device. Initial lab tests have been encouraging. Field tests will be carried out this winter. The drone can be used year-round to search for victims in difficult-to-access areas. A patent was filed to protect the innovation.

*Avalanche transceivers, for example

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Reconstructing a SiC surface is all about order and disorder

How do you reconstruct the C-face of a silicon carbide (SiC) wafer after cutting? The issue has been the subject of great debate since an early observation that dates back to 1997.

An international team led by Irig simulated a novel approach to surface reconstruction never before used for semiconductors. The research was published in *Applied Physics Letters*.

The cutting process creates a strong disorder in the charge transfer between unpassivated dangling bonds. An all-silicon overlayer forms in an ordered network. Below this overlayer, disorder is observed to offset the dangling bonds of certain carbon atoms. This research will be of interest to any researcher working with SiC on topics related to power electronics or graphene growth, for example.

Learn more at: <https://bit.ly/3iapVkh>

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Nanowires: overcoming very large differences in lattice constant

Lattice constant is a measure of how structurally compatible two materials are. Researchers from Irig and Institut Néel recently reduced these differences for GaAs/InAs (gallium arsenide/indium arsenide) nanowires. Their approach was to form a 5 nm ternary (InGaAs) alloy interface between the materials. The alloy's composition transitions from a composition close to GaAs to one closer to that of InAs.

This gradient effect, achieved using epitaxial growth, is the work of a PhD candidate currently conducting research with the team. Characterization of the interface revealed no defects and minimal strain for an initial gap in lattice constant of 7%. The researchers feel that gaps of up to 11% would be acceptable, something that could open the door to new systems with advanced optoelectronic properties.

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Clinatec improves cerebral motor activity location technique

Clinatec has been trying to effectively determine the best location in the brain for its WIMAGINE[®] implant, which measures the brain activity of tetraplegic patients. The data is used to control an exoskeleton, restoring these patients' mobility and independence. Where to implant the device is a key challenge for Clinatec. Researchers at the center have been developing and improving on an original magnetoencephalography (MEG) method to position the implant since 2014. The researchers recently published a study of fourteen patients in the journal *Sensors*. The method proved to be both effective and robust.

Moving the implant by just a centimeter can drastically affect (for better or worse) its ability to detect the patient's intended movement and, therefore, control the exoskeleton. Clinatec is still engaged in clinical trials of its system under the Brain Computer Interface and Tetraplegia project, and a new patient joined the cohort a few months ago.

Read the article: <https://bit.ly/30gX8on>

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Postage-stamp-sized printed holograms

Researchers at CEA-Leti printed a pixelated hologram on a postage-stamp-sized component. The pixels, called "hoels", are distributed across the entire surface. When illuminated by micro-laser sources, they reconstitute a coherent image on the retina. The innovation is targeting augmented reality glasses, where the hologram would be superimposed on the scene the wearer is looking at.

The hoels, which measure just a few microns in diameter, are etched into a transparent photopolymer made up of around a hundred 200-nm-thick layers with angular disparities. The researchers now plan to test other materials. The holographic image obtained is static. However, PhD research projects* currently underway are exploring how to activate and deactivate the hoels to make the image dynamic. A patent was filed to protect the innovation.

*In conjunction with the University of Haute Alsace in Mulhouse, France

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Remote-control for micro-objects

Victor Vieille, a Phelma alum who did his PhD at G2Elab and who is now conducting post-doc research with CNRS, is making a name for himself with research to magnetically remote-control micro and nano-objects. He also won a Grenoble-Alpes University Best Dissertation Award in the innovation category in 2020, has filed two patents, and is planning to found a startup.

The solutions he is developing are simple, compact, and affordable. They consist of a magnet mounted on a motor with micro magnets. When the micro magnets are activated, they generate very localized magnetic fields used to move and deform nanobeads, a microlens, micro-tweezers, and a micro-pump. Victor helped develop the technology behind startup MagLA Diagnostics and is interested in other healthcare innovations like labs on chip and organs on chip.

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Startups continue to raise capital during the pandemic

The Covid-19 pandemic has not kept startups commercializing MINATEC technologies from raising funds. From June to September six MINATEC startups announced fundraising rounds for a total of €38 million in fresh capital.

MagLA Diagnostics (€3 million) is now positioned to scale up its portable HIV and hepatitis B and C screening device. Apix Analytics (€5 million) will ramp up business development efforts to expand sales of its multi-gas detectors. Elichens (€6 million) will begin volume manufacturing of its gas sensors. Aryballe Technologies (€7 million) will scale up its “smart nose” technology. Microoled (€8 million) is ramping up production of its miniature displays and developing a new augmented reality module. Antaios (€9 million) is entering into a partnership with Applied Materials (see article below).

In other startup news, Bespoon (ultra-wideband transmission) was acquired by STMicroelectronics.

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Phelma Partners Day to be 100% online

With no end to social distancing in sight, Grenoble Institute of Technology-Phelma is taking 2020 Partners Day online. The October 15 event will provide an opportunity for the school's 650 students (third-year undergrad and Master's) and recent graduates to participate in a day of online job dating. The goal is to match candidates with businesses on the lookout for interns and other new hires. Partner companies like NXP, Safran, MBDA, Soitec, Framatome, Assystem, Easii IC, and Dolphin Design have already RSVP'd.

Candidates can browse openings and submit an application. If selected, they will have an opportunity to meet employers at the job dating event. These remote interviews are sure to be both practical and constructive for all participants.

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Irig to assist with commissioning Japan's Tokamak reactor

The cryogenic system that cools the superconducting magnets on the Japanese Tokamak JT-60SA reactor has a refrigeration capacity of about 9 kW equivalent at 4.5 K, and the reactor's cyclical operation creates substantial variations in the heat loads the system must handle. From 2010 to 2016, when the CEA was designing the cryogenics for the JT-60SA, a team of researchers from Irig was working on how to smooth these loads. As commissioning draws near, they are taking their research into the field.

Assembly was completed in the spring, and qualification tests are underway. Next, the superconducting magnets will be cooled. Two researchers from Irig in Grenoble will be on hand (either physically or remotely) during this phase. If all goes well, the reactor will start up in the spring of 2021. The ITER reactor project has already benefited from some of these advances.

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DAMP probe available to industrial users

The DAMP (Device for Analysis of Moisture Profiles) probe invented by IMEP-LAHC entered a new phase in its development this summer. After a six-month project to bring the technology to maturity, tech transfer specialist Linksium is now actively seeking a partner to manufacture and commercialize the product under

license. DAMP addresses two markets: agricultural soil analysis and snow cover analysis.

The probe measures the amplitude of a stationary RF wave to simultaneously create a profile of several relevant parameters. For soil, the probe measures temperature, moisture, and fertilizer content. For snow cover, it measures total depth, liquid water content, and water equivalent—data useful for managing snowmaking at ski resorts and for predicting avalanches and water levels in reservoirs.

Discover DAMP in this two-minute video: <https://bit.ly/3i8f88j>

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Antaios raises \$11 million and partners with Applied Materials

Startup Antaios, a Spintec spinoff that holds patents to a SOT*-MRAM memory technology, has just raised \$11 million in fresh capital. The influx of funds will help scale the technology up from lab demonstrator to manufacturable system. Antaios is partnering with Applied Materials on the scaleup project.

Antaios was founded in 2017 in the wake of winning the grand prize in the 2016 i-Lab innovation competition. The company opted for a fabless business model and will partner with manufacturers to build an IP portfolio.

Specifically, Antaios is banking on non-volatile, fast, and high-endurance SOT-MRAM to replace embedded flash and SRAM memory in connected and mobile devices and for mass and, ultimately, long-term processor cache memory. The company continues to work with Spintec, and the partners are currently considering a joint lab.

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Street art comes to CEA Grenoble campus

In July a 300 sq. m mural on the Avenue des Martyrs side of the CEA's 10.03 building was unveiled. The mural illustrates themes like science, innovation, athletics, disability, diversity, and movement. It also heralds in the 2021 Summer Games, a sporting event for research organizations across Europe. CEA Grenoble will co-host the Games with the CEA-ST Sports Club.

The mural was part of the Grenoble-Alpes 2020 Street Art Fest. Artists Srek and Killah One produced the mural under pressure, completing the initial line drawing with the aid of a videoprojector over an entire night. The eye-catching new artwork will draw attention to the campus as the surrounding neighborhood continues to evolve and welcome new residents as the major urban renewal project currently in progress advances.

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International Roadmap for Devices and Systems to include More than Moore technologies

IRDSTM (International Roadmap for Devices and Systems) has focused primarily on computing technologies—until now. The framework was recently broadened to include More than Moore micro and nanotechnologies, from smart sensors and power systems to energy harvesting and flexible and printable components. The EU H2020 Nereid project, led by Grenoble Institute of Technology, had resulted in a European nanotechnology roadmap. Francis Balestra, research director at IMEP-LAHC and coordinator of the Nereid project, recommended that the European roadmap be expanded to the rest of the world.

A 50-page executive summary of the 2020 roadmap is now available on the IRDSTM website. A more detailed version of

GIORGIO ANANIA
CEO, Aledia

“Our investment in this plant is a calculated risk”

MINA-NEWS: What spurred Aledia to build its new plant in Champagnier?*

Giorgio Anania: We wanted to be 100% ready to manufacture when our product hits the market in early 2022. Our micro-LED technology offers some very substantial benefits for augmented reality and smartphone and computer displays. But we are also competing with companies like Facebook and Apple. So, we can't afford to wait for our first orders to come in to build our manufacturing facility. It is a calculated risk.

MINA-NEWS: So, what is the outlook?

GA: Each of the markets we are addressing is worth hundreds of millions of euros. We also have the backing of some major partners. Intel acquired a stake in Aledia in 2018. Our other investors include a global smartphone leader and a GAFAM. Therefore, it is safe to say that the risks have been mitigated. Another factor is that the 52,000 sq. m facility, which includes 18,000 sq. m of cleanrooms, will be built in three phases as our sales ramp up.

MINA-NEWS: Was your plan always to build the plant in Grenoble?

GA: No. Initially we were looking for cleanrooms that were already built. Grenoble's tech ecosystem really got behind the project to find a local solution to meet our needs for a plant that could be up and running within our timeframe, that would allow us to limit our capital expenditures and spread them out over time, and that would give us access to a qualified local workforce. The added bonus is that the new plant will be just ten minutes from our R&D center in Echirolles and very close to CEA-Leti and our joint lab, which is ongoing.

*A total of €38 million will be invested in the plant. It will ultimately employ 500 people.

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the fifteen-year roadmap is expected in 2021. The information published to date indicates that Europe has a significant lead on the US and Asia on More than Moore technologies.

Download the executive summary of the 2020 roadmap:
<https://irds.ieee.org/>

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Grenoble Institute of Technology-Phelma grad invents travel guitar

Alexandre Albisser (Phelma class of 2020) loves music, design, and making instruments. He and two other Phelma grads founded startup Revehō in January to develop and commercialize a travel electric guitar concept that Alexandre came up with when he was a student entrepreneur.

The modular Slite guitar can be assembled and disassembled and has a built-in amplifier, making it a high-end, all-in-one product that comes with its own compact case. It is designed for on-the-go use and is easy to carry on public transportation, for example. With a retail price of €1,548, it is aligned with entry-level high-end instruments.

The company is running a Kickstarter campaign until October 9. The target of €100,000 will go towards completing development

work and scaling up the concept for manufacturing. Manufacturing is scheduled to start in early 2021.

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LIVE FROM MINATEC

Grenoble-based project wins i-Lab competition

Mag4Health, a future startup and CEA-Leti spinoff, won an award at the i-Lab 2020 competition. The project aims to develop a helmet-sized magnetoencephalography (MEG) system that represents a major advance with regard to today's bulky machines. The core technology, protected by ten patents, does not require cryogenic cooling. Instead, it boasts a simple magnetic shielding system that weighs just a few hundred kilograms (instead of ten tons). The key to the breakthrough? Optically pumped magnetometers with an enhanced size-to-sensitivity ratio.

MEG is widely accepted as superior in accuracy and resolution to EEG* neuro-imaging. Mag4Health has set the ambitious target of cutting the cost of the system tenfold so that a greater number of systems (just 150 worldwide currently) can be made available. Clinical trials started in September. The startup will be officially founded in early 2021.

*Electroencephalogram

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New energy technologies gain traction at INSTN, France's national institute for nuclear science and technology

Operating under the aegis of the CEA, INSTN provides highly-specialized science and technology education and training for the nuclear industry. But INSTN has another side you might not know about! The institute is also actively developing continuing professional development courses to support the CEA's broader strategy. Specifically, the new offering will address new energy technology and renewable energy with courses from one to three days, depending on the topic.

A one-day training course entitled “The Energy and Environmental Transitions: Challenges and Opportunities,” which had been offered previously under a different name, is on the new program, along with courses on solar photovoltaic, hydrogen energy, and fuel cells. Additional short courses on lithium-ion batteries will be added in 2021. Complete course descriptions are available online.

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High Level Forum introduces calendar of online events

The High Level Forum (HLF) was created to bolster cooperation between the world's leading innovation ecosystems, one of which is Grenoble's own GIANT campus. The traditional annual summit planned for the fall in Grenoble has been postponed to 2021. Key HLF stakeholders have adapted to this changing context by rolling out a year-long calendar of online events to replace the traditional once-a-year meeting.

International working groups will tackle several strategic topics and will meet regularly at new online HLF Connect Briefing meetings. The first HLF Connect Briefing will be streamed from Grenoble to international stakeholders on December 1. Participants from ten regions around the world will address issues like how

to make innovation ecosystems more resilient, new and inclusive alliance strategies, and winning technologies for times of crisis.

Registrations will open in early November online at

<http://hlf-giant-grenoble.org/>

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Science Impulse innovates in researcher recruitment

What if up-and-coming scientists from around the globe were given opportunities to bring their novel ideas to three-year technology research projects? The Science Impulse program, which was introduced by the CEA Technology Research Division in September, aims to do just that! This year the program is offering candidates four challenges: smart fuel-cell management, exposome* measurement, 6G technology bricks, and architectures for the quantum processor of the future.

Scientists must have between two and seven years of experience (not including their PhD) to apply. The winners will contribute to developing the project with CEA experts. Science Impulse will cover the scientists' compensation and benefits, at least one two-year post-doc position, and access to technology platforms and other research facilities. This kind of project-based recruitment is already in use at INSERM (a leading human-health research organization in France).

*All of a human being's environmental exposures throughout his or her lifetime.

Learn more: www.science-impulse.com

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Point-of-care testing: Horiba Medical and CEA-Leti extend partnership

The Point-of-Care Testing (POCT) project run by Hemacount (a joint laboratory of Horiba Medical* and CEA-Leti) since 2014 is investigating ways to replace bulky, complex medical analysis systems with compact, easy-to-use point-of-care devices. The partners recently announced that they would be extending the joint lab, which has already produced a dozen patents.

The focus of the partners' research is to combine a microfluidic circuit with a lensless imager to form a portable complete blood count (CBC) testing device. The objective is to obtain a device that offers the same level of performance as today's lab tests. The research will also pave the way toward other automated point-of-care biological analyses.

*A subsidiary of Japan-based Horiba, a manufacturer of precision instruments for analysis and measurement

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HORIZONS

Cystic fibrosis in the crosshairs at iGEM

The iGEM (International Genetically Engineered Machine) synthetic biology competition will not be able to take place in person in Boston this year. Instead, teams will compete online and through videos. The Grenoble team, made up of four Grenoble Institute of Technology-Phelma students, is entering PyroBusters, its weapon against *P.aeruginosa*, a bacteria responsible for many secondary lung infections in patients suffering from cystic fibrosis and, more generally, for hospital-acquired infections.

PyroBusters will detect and destroy the biofilm (a community of microorganisms that adhere to surfaces like the respiratory tract) utilizing a novel drug delivery method. The team designed

an automated test bench that reproduces the pulmonary environment's temperature, moisture, and movement and that includes fluorescence imaging to visualize the treatment.

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Midi MINATEC brown bag lunch talks back after a seven-month hiatus

MINATEC's legendary Midi MINATEC Friday brown bag lunch talks, put on hold in mid-March, started up again on Friday, October 2. The next talk, scheduled for Friday, October 9, will be given by Grenoble's contenders in the iGEM synthetic biology competition (see article [this page](#)).

To ensure compliance with Covid-19 prevention measures, the number of open seats in the auditorium will be limited and, at the time this newsletter was printed, there will be no lunch. In addition, attendees, who must register in advance, are required to wear masks and to use social distancing.

The online Midi MINATEC on June 19 brought in 350 remote attendees, a success that sparked the new phygital format. If you would like to watch the live webcast, sign up today!

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IEDM 2020 online conference now has its own online workshop

Leading international integrated circuit conference IEDM is going 100% online from December 13 to 15. CEA-Leti usually holds its traditional workshop at the same time and the popular event generally brings in 200 international participants. Since that won't be possible this year, the organizers in Grenoble are taking the workshop online.

The workshop will cover the data lifecycle (secure capture, storage, analysis, transmission, and display); the length was voluntarily scaled back to one hour. Webcasts at three different times (during working hours in Asia, Europe, and the Americas) will be broadcast on Thursday, December 10. All content will be prerecorded to avoid any quality issues. CEA-Leti speakers will answer questions live, however.

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CEA-led QLSI project rallies Europe's quantum CMOS community

Effective September 1, the CEA is coordinating the €15 million EU QLSI project. The goal is to lay the groundwork for the scaleup of tomorrow's CMOS quantum computing technologies. An impressive nineteen stakeholders are engaged in this project. They include France's CNRS, Bull, STMicroelectronics, and Soitec and European research organizations TUDelft and IMEC.

Other technologies—optics, superconductors, and trapped ions—have been used to demonstrate the concepts. While CMOS is far behind on a key parameter, fidelity, the technology does enable high integration densities and promising physical characteristics. QLSI will fabricate sixteen operational qubits to validate the feasibility and potential of CMOS for quantum.

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Bernard Diény and Spintec make it into the Computer History Museum

S Spintec Chief Scientist Bernard Diény is now a part of the Computer History Museum (Mountain View, California) oral history project. Diény is best-known for his discovery of the spin valve and new magnetoresistive materials—the fruits of an 18-month visiting scientist position at IBM back in 1989. Today, his innovations are present in the read/write heads of billions of hard drives sold around the world each year.

In an oral history interview with three of his colleagues from back then, Diény also talks about the genesis of Spintec and the lab's major advances in MRAM. Spintec's innovations in this field are now in mass production with Samsung, TSMC, Global Foundries, and other electronics and semiconductor-industry giants. Diény's place among other pioneers in the Computer History Museum's oral history archives will raise the international profile of these French-born technologies.

Watch the complete oral history interview: <https://bit.ly/3mSKtSp>

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AGENDA

October 8 [Grenoble]

ATELIER ARTS SCIENCES OPEN HOUSE

To register (required):
+33 4 76 90 00 45

October 14 [online event]

LETI INNOVATION DAYS

A three-hour seminar on sensors and data transmission and processing. With Yann Le Cun, 2019 Turing Award winner.
<http://www.leti-innovation-days.com/>

October 15 [online event]

PHELMA PARTNERS DAY

Online speed interviews for internships and jobs
aurelie.dinola@grenoble-inp.fr

October 16 [MINATEC Auditorium]

DAY-LONG MEETING ON QUANTUM COMPUTING

To register (required):
<https://bit.ly/2S73UZu>

October 19 to 22 [online event]

GRAPHÈNE 2020

<http://www.grapheneconf.com/2020/>

November 16 to 20 [online event]

NANOSAFE 2020

This seventh edition of NanoSAFE is 100% online. Advance registration required
Contact: nanosafe2020@cea.fr

December 1 [online event]

HLF CONNECT BRIEFING

First online event for the international working groups of the High Level Forum
<https://bit.ly/3jaPWS1>

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