

Top news

DNA could bring new innovations to micro-electronics

Recent advances in research being conducted by Leti and INAC scientists under CEA project A3DN could help overcome one of the major technological hurdles facing microelectronics R&D.

So, what does DNA have to do with micro-electronics? DNA strings measure around a nanometer—as do the pattern geometries the researchers are working on. And DNA's base-pairing capacities can ensure more accurate pattern alignment than the most powerful microelectronics technologies currently available.

Pattern alignment—between active circuit components or levels—has to be perfect for the electronic signals to be transmitted. The smaller the geometries, the more difficult it is to align the patterns.

Cost-competitive custom designs

In other good news, DNA strings can be used to create custom designs at very competitive costs.

The Leti and INAC researchers working on the A3DN project made suspended conductive nanowires from metal-coated DNA fragments. The nanowires could be used in NEMS.

The researchers also deposited high-density nanometric origami-like DNA structures (period values less than 15 nm) onto a substrate, and then transferred the patterns using traditional lithography.

These very encouraging research results could open up a wide range of opportunities in nanoelectronics, micro and nanosystems, biochemistry, nanocharacterization, and more.

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Innovation

Diamonds are a 3-D micro-supercapacitor's best friend

Silicon nanowires covered with a diamond film deposited by microwave CVD and an electroactive (PEDOT) polymer layer were used to create innovative electrodes under the EU-backed NEST research project. Two teams of researchers from INAC participating in this project achieved substantial improvements in 3D micro-supercapacitor performance. The results were confirmed on a demonstrator system. The electrodes' energy density, at 26 mJ/cm², was increased threefold compared to silicon nanowires functionalized with the polymer alone. Furthermore, the micro-supercapacitor developed offered excellent stability, with losses of just 20% after 15,000 charge-discharge cycles.

These advances put the new technology comfortably ahead of the pack in terms of energy density, the main challenge when it comes to supercapacitors. The primary application for the technology will be embedded electronics for biomedicine.

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Satellite operators hungry for 5G communications

Satellite operators are actively seeking to determine which type of waves they should focus on to secure a slice of the future 5G market. Research conducted by France's national space agency CNES at Leti set out to answer this question. The study is assessing four potential types of waves: OFDM, EW-OFDM, PS-OFDM, and FBMC. The type of wave selected must enable interference-free sharing between land and satellite frequency bands dedicated to 5G communications. The research will look at emissions in adjacent frequency bands, spectral efficiency, and the peak to average power ratio.

The research, to be completed next March, is focusing on a high-stakes topic: 5G communications. A 5G standard is under development. 5G will offer very high speeds and will be the top pick for the Internet of Things, connected vehicles, and other emerging applications.

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Intensity- and sign-tunable spin-charge conversion

A joint INAC-CNRS-Thales research team achieved record intensity- and sign-tunable spin-charge conversion in the two-dimensional electron gas at the interface between a layer of strontium titanate and another layer of lanthanum aluminate. The conversion rate was five to ten times higher than with the materials currently used. The researchers worked at 7 K, injecting a spin current through a material's magnetic tunnel contact to obtain a powerful transverse current, which can then be tuned by adjusting grid voltage.

The research shows that 2D electronic systems could be just as useful to spintronics as topological insulators. The research was published in *Nature Materials*.

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Innovation

High-performance computing gets more energy-efficient data transfer

The 3D-NoC network-on-chip developed by Leti, STMicroelectronics, and Mentor Graphics under a project coordinated by IRT Nanoelec offers 20% to 40% less energy consumption and higher speeds than other NoCs. The NoC developed is built on two 28 nm FDSOI stacked circuits, each with 96 processor cores. The cores are integrated on a 65 nm CMOS active interposer layer, which ensures communication between the cores and electrical conversion, reducing the distance between cores to just a few hundred microns. For discrete components on an electronic circuit board, the distance can be several centimeters.

A circuit is currently in fabrication and should be delivered in early 2017. Given the maturity of the technology, it could be transferred to a manufacturer very rapidly.

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Quantum dots perform well under mechanical constraints

Over the past several years, the application of mechanical constraints to semiconducting quantum dots has been broadly used to fine-tune the dots' emission wavelength to create single-photon sources, for example.

Researchers at INAC integrated several InAs quantum dots into a GaAs nanowire coated with an amorphous silicon shell to create quantum dots deformed along their growth axis. This heretofore-unexplored configuration resulted in significant emission gaps that were very similar from one emitter to another. Reproducibility is a key benefit for designing and building complex photonic circuits that integrate several tunable quantum emitters.

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MEMS RF switches made in Grenoble ready for space

MEMS radio-frequency micro-switches developed by Leti could be chosen by the European Space Agency for tomorrow's space applications. While it is still too early to tell, Leti is doing everything it can to increase its chances of success! First, Leti researchers have integrated the switches into a collective thin-layer packaging—a key advantage over individually packaged competing solutions. The switches are smaller and cheaper to manufacture, and offer state-of-the-art electrical performance.

The thin-layer packaging, which protects the switch from contamination and ensures reliability, does not alter component performance compared to an unpackaged switch tested under a controlled atmosphere. ESA, which is currently testing European MEMS RF switch technologies, ordered 150 packaged units.

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Could sugar make treating liver disease easier?

Wilson's disease, a genetic disorder that causes copper to build up in the liver, is treated using chelating agents to remove the metal. Research conducted by INAC, BIG*, and DCM** looked at two chelating agents that could ultimately offer improved penetration into liver cells. The chelating agents were functionalized with N-Acetylgalactosamine, a sugar that interacts specifically with liver cell membranes' biological receptors. Penetration is improved as the number of units of the sugar is increased. For example, with three to four units per molecule, the optimal value, efficiency was 1,000 to 10,000 times better than with a single unit.

The researchers are now working on further improving liver-cell targeting. At the level currently attained, the chelating agent's affinity for the biological receptor is close to that of proteins used *in vivo*.

*Formerly iRTSV

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Wireless pacemaker could be just over the horizon

Grenoble's TIMA lab and a consortium of partners are working on a project backed by the ANR, France's national research agency, to develop a wireless pacemaker. TIMA's energy-harvesting system, which is built on a multilayer piezoelectric blade, has already brought in some excellent results, operating in a simulated environment for 109 cycles (which corresponds to around three years of use), delivering the 10 microwatts required to run a miniature wireless pacemaker.

The energy-harvesting system would be activated by the heart muscle's mechanical activity and would be integrated directly into the pacemaker unit (20 mm long and 6 mm in diameter) implanted inside the right ventricle. Currently, traditional wired pacemakers are powered by a battery implanted near the collarbone, requiring surgery to change the battery approximately every eight years.

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Power conversion: GaN components show promise

The aeronautics and automotive industries are looking for more compact, efficient power converters. Leti's latest research on a converter built on gallium-nitride-on-silicon components is producing some results sure to please these demanding industries. When tested on a demonstrator system, the converters displayed low losses and high switching speeds enabling frequencies up to 30 MHz. The best converters currently available are limited to 100 kHz.

GaN components are also bidirectional, which means that they can switch on alternating current without the need for a conversion stage, eliminating a number of passive elements. The components are also compatible with CMOS technology, which offers low fabrication costs. Leti will test a new batch of the converters that just came out of the institute's clean rooms on a demonstrator system in the first half of 2017.

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Day by day

Nanoelectronic Devices, an open-source scientific journal

Publisher ISTE recently released *Nanoelectronic Devices*, a scientific journal available in English and French free of charge for both authors and readers. The journal will be published several times per year and the peer review committee members—including experts from the CNRS, Leti, and Soitec—are all Grenoble-based. Francis Balestra of IMEP-LaHC is the Editor-in-Chief.

Nanoelectronic Devices publishes articles from 5 to 20 pages in length. Possible article formats include research results, literature reviews, and state-of-the-art review articles on topics like FD-SOI, multigrid, and ultra-low-power components; nanowires; 2D technology; non-volatile memory; DRAM; SRAM; PCRAM; RRAM; MRAM; and nanoelectronics circuit and system design, technology, modelling, and characterization.

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Read the journal here: <https://www.openscience.fr/Nanoelectronic-Devices>

Day by day

RF and millimeter wave integrated circuits and systems meeting on March 10

MEP-LaHC and Leti will host a meeting on March 10, 2017 on RF and millimeter wave integrated circuits and systems, which have direct applications in radar, sensor networks, and the Internet of Things. The meeting will focus on reliability, ultra-low-power, achieving frequencies up to 150 GHz and beyond, and embedded and in situ characterization. The purpose of the meeting is to provide a forum for discussion and identify topics for possible future research projects.

The Antenna and Circuit Unit of the GDR Ondes consortium (of around 20 laboratories across France) is supporting the meeting, which is open to scientific researchers, industrial R&D professionals, and graduate and post-graduate students. While the event is free of charge, advance registration is required.

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Testing antibiotic efficacy in just one hour

MIT used Leti's suspended micro-resonators to develop a new microchip for fast drug testing. The chip measures cell culture growth by weighing the culture with accuracy to within a femtogram. The measurement provides an indication of the culture's response to a drug such as an antibiotic. The results of the research were published in *Nature Biotechnology*.

The test takes just one hour; traditional techniques take an entire day. And, over longer timespans, the microchip can also be used to assess the efficacy of anti-cancer drugs.

Leti took advantage of this new project with MIT to make further improvements to process yields; the institute recently delivered another 800 of the micro-resonators to MIT. The technology is now robust enough for industrial scale-up.

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PX'Therapeutics focuses on new drug candidate

In the future, diabetics suffering from neuropathy (in their hands and feet, for example) could benefit from a new drug called atexakin, which regenerates damaged nerve fibers. Switzerland's Relief Therapeutics Holding AG recently signed an agreement with Merck to develop, manufacture, and commercialize the drug. Merck then turned to Grenoble's PX'Therapeutics to develop an efficient manufacturing process and to supply test batches of the drug for clinical trials.

This is a major contract for PX'Therapeutics, and will keep more than a third of the company's employees busy for some time to come. An initial evaluation of the process has been completed, and development work is expected to commence in the coming days. Atexakin is a human protein made up of 185 amino acids—specifications that align perfectly with PX'Therapeutics' know-how.

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GreEn-ER open for business, ribbon-cutting in December

The GreEn-ER center for innovation in renewable resources and energy has been up and running for a year now. The ribbon-cutting ceremony will be held on December 5. Every day, some 1,500 people—students enrolled at Ense³ and in Masters programs like Grenoble-Alps University's UFR Phitem and researchers from G2ELAB* and the Institut Carnot Énergies du Futur—use GreEn-ER's facilities.

Over the past year, GreEn-ER has also hosted a full calendar of events, including the Hydro 21 meeting and AFIG Days. This fall, Ense³ is holding a six-lecture series on interculturality at the facility.

In other notable GreEn-ER news, a weather station equipped with state-of-the-art sensors to measure solar irradiance was recently installed on the building's roof. The data collected will be used to manage building systems and will also be available for use by students and research scientists.

*Electrical Engineering Lab

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Fluoptics in the spotlight

Fluoptics has carved out the top slot on Europe's real-time fluorescence imaging solutions market. The company has implemented more than 100 of its Fluobeam® non-invasive surgical-assistance systems in sixteen countries. Fluoptics' technology is currently the only one in the world capable of generating images of parathyroid glands using light during tricky thyroid surgery—ultimately improving patient outcomes.

The company, founded in 2009, is located on the MINATEC campus. Fluoptics reported revenue growth of 80% last year and is pursuing its international business development strategy. With a Boston, MA (United States) office already open, the company is now setting its sights on Asia, with recent distribution agreements signed with partners in Taiwan and Thailand.

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Enerbee takes to the air

Enerbee, a two-year-old startup specializing in micro-generators that harvest energy from movement, has turned a corner in its development. The company will now leverage its proprietary technology to develop self-powering connected ventilation systems, ultimately carving out a position on a high-added-value, IoT-related market. Enerbee will present a prototype at CES* Las Vegas in January.

The system is equipped with sensors to measure indoor air quality at the air vent and send the data collected in real time to regulate air flow and maintain optimal air quality.

Jocelyne Wasselin, formerly Enerbee's head of engineering, was recently appointed COO and will orchestrate the company's new strategy.

*Consumer Electronics Show

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Interview

Anna Choulier Renström,
Leti

**We are going
to CES 2017
to raise
our profile**

What is Leti's strategy for CES 2017?

Our booth will be twice as big as last year's. We will showcase three interactive demonstrator systems that will let visitors experience and test our technologies and understand the technologies' features.

Three startups will be coming with us: e-Lichens, with us in 2016; Moovlab, which was just created; and Sublimed, a Liten startup that illustrates Grenoble's innovation model very well.

Leti is exhibiting for the second time. What are your goals?

We really want to raise our profile and let the world know about what we do. We will sell our strengths, both to potential corporate R&D partners and to investors. We are positioning ourselves as a source for world-class technological innovation and a startup accelerator. We also have a PR strategy in place. We will be on-site two days before the event opens to meet with journalists from around the world.

Do you expect to bring home any new R&D contracts?

It takes years to make a name for yourself. Then you have to prove your worth. The first step is to pursue the communications strategy we rolled out last year and that our representatives in the United States have been hard at work on.

Our startups, however, can expect faster returns on the event. At CES 2016, for example, e-Lichens and Aryballe Technologies met with high-level decision makers. Since then, both companies have entered into advanced talks with potential corporate partners and investors.

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Horizons

Leti working with GlobalFoundries on 22 nm FD-SOI

FinFET and FD-SOI are currently neck-and-neck in the race to further miniaturize CMOS circuits beyond the 28 nm node. And major market players will play a key role in determining which technology wins. Leti, which has been betting on FD-SOI for years now, recently joined the 22FDX Accelerator ecosystem created by GlobalFoundries, the world's second-largest foundry.

The consortium, which brings together around 20 manufacturers and research institutes, promotes FD-SOI's benefits: ultra-low power consumption, low cost, and better RF performance than FinFET. 22FDX Accelerator also develops enabling technologies and files patents to encourage manufacturers to switch to FD-SOI technology.

And certain pioneers have already made the shift: NXP for its new automotive platform and Sony for its next generation of GPS products.

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Micro-nano observatory reports now online

The Micro and Nanotechnology Observatory (OMNT) now publishes its reports and comments from the observatory's network of experts online. The content available includes regular news updates, one-page executive summaries of current issues, and in-depth reports. All publications are available by email or can be downloaded online. An annual overview is also available as a download.

Access is free of charge for all CNRS and CEA employees and employees of research units affiliated with these organizations. Corporate customers can subscribe. The OMNT now also offers a monthly newsletter. Subscribers can choose which topics to follow by selecting their newsletter preferences.

Learn more at www.omnt.fr
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Grenoble reaches out to Taiwan and South Korea

Leti recently signed two new partnership agreements with research institutes in Asia, following the partnership with Shanghai Industrial Technology Research Institute (SITRI) signed last spring.

The first is with the Korea Institute of Science and Technology (KIST), a multidisciplinary research institute, and covers early-stage research on monolithic 3D technology, neuromorphic architectures, 3D non-volatile memory, and other topics. The partnership anchors a preexisting relationship between Leti and KIST.

The second agreement, with the Institute for Information Industry (III) of Taiwan, establishes a new relationship. III is tasked with making new technologies available to businesses, most notably to help them prepare for a post-Moore's-law future. Joint R&D will focus on IoT and 5G.

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Emmanuelle Gourieux, active in student life

Emmanuelle Gourieux, a third-year student at Grenoble Institute of Technology's Phelma engineering school, has been elected Student Vice President. She will represent her cohort to Grenoble Institute of Technology and sit on several commissions, including CSIE*, which she co-chairs and which provides financial support for student non-profit initiatives. Emmanuelle also represents her classmates to the Grenoble-Alpes University community. As she will be spending up to fifteen hours per week on these new responsibilities, she has decided to relinquish her seat on Phelma's student government—a position she was fully committed to last year. In September she also stepped down as secretary of student volunteer group *Cheer Up! Phelma*, a position she had held since 2014. However, she remains involved with the group, visiting young cancer patients in the hospital each week.

*Committee to support student initiatives

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Horizons

Planet Makers gets kids into robotics

Planet Makers, a non-profit organization created this fall, has set up shop at Grenoble Institute of Technology's Phelma engineering school, thanks to the support of the Fondation Grenoble INP. Planet Makers was founded by two self-proclaimed Phelma engineering geeks, Jérôme Martin and Andréa Battistella, who both share a passion for teaching. Their goal: to get kids into robotics by letting them use a "DIY" approach to technology. Planet Makers is already active at the FabLab at science-education center La Casemate and at public youth outreach centers. Kids can come and make their own robots by assembling electronic and mechanical modules with sensors, motors, etc., and program them using a dedicated web app.

Planet Makers uses tools developed and commercialized by IziMakers, the company that Jérôme Martin and Andréa Battistella founded in October 2016.

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Live from MINATEC

Photonics platform delivery date pushed back

Delivery of the six-level, 12,800 sq. m photonics platform was originally scheduled for early November, but has been pushed back to January due to construction delays and the results of certain tests. The contractor that won the bid will have to put additional resources on the job to complete construction. The CEA has set up a dedicated team to keep a very close eye on the construction project on a day-to-day basis to ensure that the building will meet all specifications.

The unforeseen issues on the project will push back the opening of the platform by at least two months. The 230 Leti-DOPT employees to be assigned to the platform will have to wait until early March to start moving in. These employees are currently spread out over five different locations and use around 360 pieces of equipment for their research. These resources will still be transferred to the new platform in 2017, but the schedule is currently being revised in light of the construction delays.

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Morphosense precision structural-health monitoring

In the future, major structures like bridges, dams, tunnels, railroad tracks, oceangoing vessels, cooling towers, and wind-turbine blades could be instrumented with Morphosense's MEMS accelerometer networks. Morphosense is a Leti spinoff founded in mid-2016 to develop a precision structural-health monitoring system leveraging ten years of R&D. The system, which consists of sensors mounted at strategic points of the structure being monitored, is capable of measuring in real time structural deformations of 100 microns per meter and vibration—both good indicators of structural health.

The company has signed a joint R&D contract with Leti for an automated calibration method and is currently focusing its sales efforts on Canada and Asia. An initial round of fundraising is planned within the next year.

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Alps Design Lab, where technology meets design

Alps Design Lab, a CEA Tech Open Lab, has tackled the challenge of how to use a shipping-container-sized electrolyzer to create a "normal-sized" teaching demonstrator. In a few weeks, the lab will deliver to Liten a refrigerator-sized system that packs in a high-temperature furnace, heat exchanger, and steam generator—qualities sure to appeal to future users!

Design students, supervised by faculty, participate in Alps Design Lab projects to help R&D labs and startups to make their technologies easier to understand and share! The lab, founded around a year ago, produces use scenarios, 3D renderings, models, prototypes, and demonstrator systems. Projects generally run from six months to a year, depending on how complex they are.

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Live from MINATEC

Israeli teachers at CIME

As part of the EU EduNano project, eight Israeli high-school teachers will come to CIME Nanotech in mid-December to expand their knowledge and discuss teaching methods with the Nano@school team. The program includes nano-biotech, atomic force microscopy, and PV characterization lab classes and even classes taught right in the clean room!

In July, CIME hosted 25 students from Israel's top universities (partners of the EduNano project). The Masters and Ph.D. students worked with ten Grenoble Institute of Technology and Grenoble-Alpes University faculty members to make MOS transistors and attended nano-biotech lab classes. The session was a success and talks are underway to make it a regular event.

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Communication: High Level Forum innovates

The 5th High Level Forum (HLF) was held in Grenoble this fall. The event was attended by representatives of the world's main science and technology ecosystems, who came together to discuss the latest advances in innovation. For the first time ever, a report was published recapping the event. The magazine-style document is available on the HLF website, and features an overview of all of the sessions as well as interviews with several prestigious speakers.

The publication, recent website overhaul, and a new bimonthly newsletter are all part of the HLF's efforts to communicate more broadly to help make connections between innovation stakeholders from around the globe between HLF events and to facilitate partnerships and other concrete initiatives to support innovation.

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Startup UroMems raises €14 million

UroMems, a startup founded in 2011 and housed at the BHT, has just completed a very impressive round of fundraising, bringing in €14 million in fresh capital. The company's product—an artificial urinary sphincter implant that can be placed near the urethra—is a breakthrough innovation that could potentially help the 50 million people worldwide currently suffering from severe urinary incontinence.

The company's technology is a better alternative than surgery, which often comes with serious side effects. It also features microsensors and processing electronics to adapt the implant to the patient's physical activity in real time. UroMems tends to keep the details of its R&D under wraps, but does work closely with labs TIMC and TIMA.

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Agenda

**Until December 9,
Presqu'île Scientifique
Dautreppe Seminar 2016:
Tomorrow's Energy**

<http://dautreppe.energie.grenoble.cnrs.fr/>

**December 13,
Grenoble Institute of Technology
auditorium**

**Lecture: Satellite Environment
Testing**

Alexis.sableaux@phelma.grenoble-inp.fr
Inscriptions : <https://goo.gl/kKzmsT>

**December 15,
Phelma**

**Workshop on advanced materials
for energy and healthcare**

<http://goo.gl/P7Kg6f>

**December 16,
Maison MINATEC**

Special Christmas Midi MINATEC

brown bag lunch with the Polygone
Orchestra

<http://goo.gl/uMRYXO>

**January 5–8,
Las Vegas
Leti exhibits at the Consumer
Electronic Show 2017**

<https://www.ces.tech/>

**January 15–20,
Villard-de-Lans
Winter School: The New Frontiers
of 2D Materials**

<http://goo.gl/hxjiy6>

**March 10,
Phelma auditorium M001
RF-Millimeter Wave Circuits and
Integrated Systems Day**

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MINA-NEWS >

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