

Top news

International Space Station: Germs be gone!

Long space missions present such a high risk of bacterial infection that astronauts spend 10% of their time cleaning!

One of the objectives of the ISS Proxima mission (in which ESA astronaut Thomas Pesquet is participating) is to study five advanced antibacterial materials on board. Because the bacteria cannot adhere to the materials, they simply end up elsewhere—like in active filters that eliminate them.

Three of the materials were developed at Leti, which possesses unrivalled knowledge of these types of surface deposits. The institute is working alongside ENS Lyon, CNRS, Saint-Gobain, and CNES on the experiment. The materials were placed in racks to protect them from vibration during launches and from accidental impacts during handling and exposure.

A fluorinated thin layer, organic silicon, and a biopolymer

The first material developed by Leti is a fluorinated thin layer, originally created for microfluidics channels and resin deposition for optical components. The second material is a very hydrophobic organic silicon used to deposit nanodroplets by electrowetting (the material has already been transferred to an industrial partner). The third material is a biopolymer for implantable medical devices for human and animal health applications.

When the materials come back to Earth this spring, they will be quarantined and then characterized. Antibacterial surfaces are not uncommon. However, what is uncommon is experimenting with the surfaces in space. The results of the experiment could give Leti inroads into new applications, from elevator buttons to grab handles for public transportation.

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Innovation

World-first: 300 mm CMOS qubits

Leti and NAC recently achieved a world-first, successfully demonstrating that a quantum bit, or qubit, made using 300 mm CMOS FDSOI, works! The qubit—the basic building block for quantum computing—was measured at 10 mK. This groundbreaking lab experiment proved that, despite the fact that the lab qubit's geometry is not compatible with the scales required of quantum computing, CMOS technology is a good candidate for tomorrow's quantum computers.

The qubit was inspired by a system that closely resembles a traditional transistor. It is made of two 30-nm-long grids connected in series and placed just 35 nm apart. It is based on holes, not electrons, and is controlled by applying radiofrequency electrical fields to the grids. The results were published in *Nature Communications*.

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RRAM memory emulates synaptic plasticity

The human brain's synapses—which send signals between neurons—can strengthen or weaken due to increases or decreases in activity. In the future, it may be possible to reproduce synaptic plasticity with RRAM memory run by specific coding schemes. A team of researchers from Leti, List, Clinatex, and Inserm investigated the topic, presenting a paper at IEDM 2016 in San Francisco.

The system could adapt to a range of plasticity mechanisms on time scales from several milliseconds to several months. In biology, where signals are very noisy, for example, short-term plasticity could ensure robustness in noisy environments; long-term plasticity could help monitor the progress of physiological processes. The innovation could aid in the development of smart implantable prosthetics.

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STT-MRAM memory gets higher write speeds

Researchers at Spintec have achieved higher STT-MRAM write speeds with lower electrical write voltage. They did it by introducing easy cone anisotropy into the storage layer; this causes a 10° to 15° misalignment between the initial magnetism of the storage layer (switchable) and the reference layer. This initial angle makes reversing magnetism faster and easier when writing the memory point. Usually, intrinsically-random (and therefore uncontrollable) heat fluctuations determine the initial angle required for reversing magnetism.

Easy cone anisotropy is obtained using special magnetic materials and annealing conditions.

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Innovation

When transistors become very sensitive to light

What do you get when you place a photodiode under the buried oxide of a FDSOI transistor? A transistor that is very sensitive to visible light! The transistor, developed and tested in laboratory conditions, was presented by Leti at the IEDM 2016 conference, where it garnered substantial interest. Because energy is transferred by capacitive coupling, the transistor can operate without an electrical connection between the diode and the transistor. At seven orders of magnitude, the transistor's dynamics rival those of the best CMOS imagers. Plus, it enables very small pixels of less than a square micron.

The researchers pointed out that, for now, there is only one of the transistors. Much research remains to be completed to model the transistor's effects, produce it at matrix-scale, and determine future applications. A Ph.D. candidate working on the topic will have her work cut out for her! The invention was inspired by a patent filed in 2011.

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Slashing LED costs fourfold now possible

LEDs developed under a joint research project between Leti and INAC could cost four times less to produce than competing products while generating three times more light. Ikea and Valeo are banking on it! The LEDs have not yet hit the market, but the two companies have purchased stakes in Aledia, the Grenoble-based startup that will produce the LEDs. The LEDs meet the needs of the lighting and microdisplay markets. The huge reduction in costs comes from substrates—silicon instead of sapphire—that are twice as large and much less expensive, gallium nitride used in 3D bumps instead of 2D layers, and fabrication in 200 mm silicon foundries with no additional investment in production equipment.

The LEDs should also be able to emit a broader range of colors and shades of white. The innovation earned Leti and INAC an EARTO* Innovation Award in 2016.

*European Association of Research and Technology Organizations

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Perpendicular anisotropy: graphene and cobalt go hand in hand

When you stack several monolayers of cobalt to obtain perpendicular anisotropy the effect is diminished as the number of layers increases. However, when a layer of graphene is added to the stack the perpendicular anisotropy increases up to two times for twelve to thirteen monolayers.*

INAC completed the calculations, which were confirmed by lab experiments at Institut Néel and UC Berkeley. The results could pave the way to high-density, low-power magnetic memory, two of the benefits of perpendicular anisotropy. Another potential application is spintronic oscillators for radiofrequency components. The researchers also plan to investigate other structures made from cobalt monolayers plus a graphene layer, which, when stacked several layers high, could produce record levels of anisotropy.

*Research conducted under the EU Graphene Flagship project

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Thin-layer nanocomposites deliver unrivalled properties

Leti and LTM have developed a new class of thin-layer composites for microelectronics. The composites are made by dispersing a very high load—more than 50% of the total volume—of nanoparticles in a polymer matrix. The resulting composite delivers unrivalled properties: virtually loss-free magnetic materials up to 20 GHz, a frequency 20 times higher than the norm.

Individual nanometric graphene shells protect the nanoparticles from oxidation. The distance between particles (and, therefore, the desired properties) is controlled by a second nanometric polymer shell. Nanocomposites were successfully implemented in layers up to 20 microns thick on 200 mm wafers in the clean room.

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Bike pedal power sensor costs reduced tenfold

The power sensors that professional cyclists use cost more than \$1,000 per unit. Leti presented a demonstrator system at CES 2017 that costs less than \$100! The power sensor does not require any calibration, making it easy to use. Plus, it is compatible with all types of bicycles and is accurate to within around 8%, which is excellent. Finally, it offers twice the battery life of the sensors used by the pros.

The breakthroughs in cost and performance were achieved by using standard strain gauges, an ingenious method for integrating the sensor into the pedal, and a powerful algorithm based on the fusion of data from the sensors. Several patents have been filed to protect the innovation and several companies have expressed interest in scaling up the technology for manufacturing. The sensors can be used by professional athletes, hobby cyclists, and people who want to monitor their health.

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PEDALS WITH POWER SENSORS, GREAT!

PEDAL FASTER ...
WE'RE STILL NOT PICKING ANYTHING UP!



Why are lithium battery losses so high on the first cycle?

Mn-Ni lithium batteries lose around 40% of the high capacities for which they are known on the first charge-discharge cycle. Scientists have been trying to find out why for years. A team of researchers from INAC and Leti, in conjunction with a researcher from Russia, have made two major contributions to elucidating the mystery. They did it by combining the precision of RMN spectroscopy and a very sophisticated model.

The researchers worked on an industrial-grade material with a Ni-to-Mn ratio of 30%. The first thing they learned was that the nickel is evenly distributed before cycling, with segregation of the nickel-rich and nickel-poor areas. They also discovered that during cycling, the delithiation that occurs during the first charge causes irreversible damage to the nickel-poor areas of the material, where the loss of capacity is concentrated. The results were published in *The Journal of Physical Chemistry C*.

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Day by day

Phelma and Ensimag join forces on embedded systems and connected objects

Students entering their second year at Grenoble Institute of Technology's Phelma and Ensimag schools in the fall of 2017 will have a new program available: Embedded Systems and Connected Objects (SEOC). The two schools merged their common Internet and Connected Systems and Services and Embedded Software and Systems programs to form this original new offering!

Students who complete the new program will be prepared for careers in network design and operation; communications systems development and security; hardware and software systems architecture; and embedded systems.

The curriculum covers a wide range of know-how and graduates will be well-rounded engineers with the skills companies—and, especially, startups—in the IoT industry are seeking.

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Phelma does well in L'Étudiant magazine engineering school ranking

Grenoble Institute of Technology's Phelma engineering school is still near the top of the L'Étudiant magazine engineering school ranking, coming in 5th out of 168 schools for academic excellence. And the school moved from 31st to 7th place from 2016 to 2017 for its international programs! The huge improvement can be attributed to stronger, more active relationships between the school and its many international partners. In other news, Phelma also entered the top ten for international dual-degree programs for the first time ever.

In terms of career placement, Phelma came in 3rd place in the "Making a Living in IT" category. Last but not least, a new general ranking that takes into account academic excellence, international programs, and corporate relations was created, with Phelma coming in 24th.

See the ranking: <https://goo.gl/bnsl45>
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Challenge First Step 2016 gives more than €700K to startups

The Challenge First Step selection committee made their choice at the end of November. A total of eight startups will receive support and €734K has already been earmarked for the projects. Depending on the progress the founders make toward their stated goals, they could be eligible for additional support in six months.

Liten spawned two of the projects: one is developing custom industrial battery systems and the other is working on complex-energy-system dimensioning and management software. Another four projects come from Leti; they are focusing on: an instrumented glove for a boxing and fitness platform; rollerblades with an intuitive brake system; micro-LEDs for displays; and chemical sensors for systems integrators. The two CTReg* projects are developing a system to detect contamination in industrial fluids and a buried utility network geolocation system.

*CEA Tech Regional technology platforms

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Nanosafety Platform website now online

The Nanosafety Platform (PNS) released the French version of its website last fall. And now the English version is also online. The Nanosafety Platform website, linked to the CEA Tech website, was created to inform businesses of the Platform's services and technical and scientific resources. The general public will also find valuable information about nanomaterials, including definitions, characteristics, and industrial uses, and nanosafety—all spelled out in layman's terms.

The Nanosafety platform is now also publishing a quarterly newsletter, *PNS News*, in English to support its communication strategy. The first issue was published in November and readers can subscribe on the website.

Visit the website: www.nanosafety-platform.com
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White paper on atomic layer deposition

A new white paper on atomic layer deposition is available free of charge on the website of French publisher *Techniques de l'ingénieur*. The 225-page white paper, in French, is titled *Principes et applications de la technique ALD* and provides an overview of the basics of the process. It was authored by around 20 scientists in France's national ALD network, RAFALD, including several researchers from LMGP, LTM, and the CEA.

The first several chapters address the fundamentals of atomic layer deposition, a process used to obtain homogeneous ultra-thin layers (just a few nm thick) whose surface states can be precision-controlled. The white paper continues with a review of the major applications of ALD: microelectronics, fuel cells, healthcare, textiles, optics, photonics, and MEMS. The target readership is technicians, engineers, and scientists.

Download the white paper: goo.gl/WH8k21
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NanoArt photo contest really zooms in!

Who could forget Maxime Legallais' 2015 NanoArt-award-winning photo of a red silicon nanowire in the shape of the red AIDS-awareness ribbon? After a hiatus in 2016, NanoArt is back this year and Maxime's title is up for grabs! The photo contest is organized by Fondation Nanosciences under the aegis of the Grenoble-Alpes University Foundation. Ph.D. and postdoc candidates affiliated with one of the 33 labs in the UGA, CNRS, CEA, Grenoble Institute of Technology, and INRIA network are eligible to compete.

Every month throughout 2017, entrants can send in a "nano" (≤ 100 nm) photo with a particular aesthetic appeal, and every month one winner will take home prize money of €150. In January 2018, the year's twelve winning photos will be put to a vote online, with first, second, and third prizes of €800, €400, and €300.

Learn more at www.fondation-nanosciences.fr
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Micro- and Nanotech Observatory 2016 year in review

The Micro- and Nanotechnology Observatory (OMNT) has released its annual year in review report. The report, which covers thirteen topics, is a prime source of information on the advances, trends, and outlook for micro- and nanotechnologies. It is also a valuable aid in decision making. The 250-page document, written by OMNT experts in both basic and applied research, covers the notable events of the past year in language that lets non-specialists gain a better understanding of the broad range of micro- and nano-related technologies, their many potential applications, and potential risks.

The report is free of charge to subscribers. A PDF version of the 2017 report will be available on the OMNT website www.omnt.fr in February.

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Interview

Thierry Bosc,
Clinatec

€10 million in donations to invent tomorrow's medicine

Your matching gift campaign brought in €10 million in donations. Were you surprised?

The matching gift concept is still very uncommon in France, and it had never been used for such a large fundraising campaign. We didn't think we would get there this fast! Our sponsors, working under the watchful eye of Alain Mérieux, helped us reach our goal of €5 million in just six months. The Edmond J. Safra Foundation matched the amount. All of our donors—corporate (Biomerieux, Servier, ARaymond, Altran), foundations (France Parkinson, EDF), and individual—told us how proud they were to have contributed to the campaign's success.

How will the funds be used?

To pursue our work inventing tomorrow's medicine. The matching gift campaign is over. But we still need another €15 million by 2018. The €10 million we raised will primarily fund two projects that are already well underway. The Brain-Computer Interface (BCI) project, which started in 2007, will restore mobility to people suffering from spinal-cord injuries. And the Near-Infrared (NIR) project, which started in 2010, will find a curative treatment for Parkinson's disease. The funds will also support new programs on epilepsy and obsessive-compulsive disorder.

What milestones will you reach in 2017?

For the BCI project, we will be testing the feasibility of operating an exoskeleton capable of providing maximum freedom of movement. For the NIR project, we will file for approval to begin clinical testing to confirm the encouraging results of the preclinical testing completed at Clinatec.

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Day by day

72 local high-school students to attend Inn.Otech 2017

The second Inn.Otech program, run by STMicroelectronics, Soitec, and Grenoble Institute of Technology will give 72 local high-school sophomores a chance to immerse themselves in the world of microelectronics and semiconductors. The program was set up to bust some myths about careers in science and industry and spark interest in careers in these fields.

Each of the sessions, to be held in March and April, will enroll 36 students. The groups will spend a day at STMicroelectronics, a day at Soitec, and a day at Grenoble Institute of Technology's Phelma engineering school. They will tour the MINATEC showroom, participate in CAD and cleanroom workshops at CIME Nanotech, make meringue using liquid nitrogen at LMGP, and discover holograms at IMEP-LaHC. Phelma faculty members will present the school's science programs to aid the students in their future academic and career choices.

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Horizons

Phelma introduces international materials-focused Master's

Next September Grenoble Institute of Technology's Phelma engineering school will welcome a cohort of fifteen students to its new international Master's in Advanced Materials for Innovation and Sustainability (AMIS). The curriculum covers the entire materials value chain, with a focus on integrating materials into a sustainable economy, and includes classes on innovation and entrepreneurship. All classes are taught in English and students are expected to spend one year at a partner university in Finland, Germany, or Belgium. Students are also encouraged to complete their internships at partner organizations CEA, IMEC, or Fraunhofer-Gesellschaft, or at Arkema or ArcelorMittal, companies affiliated with the program.

The program is certified by the European Institute of Innovation & Technology and was created under Raw Materials KIC*, of which Grenoble Institute of Technology is a partner.

*Knowledge and Innovation Communities

Learn more: amis-master.eitrawmaterials.eu
Contact: contact@amis-master.eu

Bag-Era makes the IoT more reliable

Bag-Era, which was founded in 2016 and is based in Montbonnot, near Grenoble, is developing the fruits of six years of research at Leti on synchronizing connected objects and services. Everybody is talking about the Internet of Things, but for it to become a reality, sensors and switches must be more coherent and internet connections more reliable. The company's LINC software environment includes around a hundred reusable components developed for industrial IoT applications. The components ensure that the actual state of a system (whether a valve is open or closed, for instance) is coherent with the state assumed by the software.

In other words, Bag-Era is the bridge between internet giants like Google, Orange, and Apple, and industrial systems designers for facilities that range from parking garages and elevators to energy and building management systems.

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Apios sets out to repair large bone defects

The purpose of the Apios project, backed by LMGP*, is to mature a technology for repairing large (5 mm or more) bone defects—such as those due to maxillofacial or orthopedic injuries. The project leverages eight years of research and focuses on trapping active proteins in a biomimetic film placed on an implant to trigger a response from the body's stem cells, reactivating bone tissue reconstruction.

The research has already resulted in patents as well as an article in the journal *Biomaterials* in 2016. A team of five researchers and one clinical practitioner (from Annecy) are working on Apios with the hope of partnering with hospitals, conducting market research with implant manufacturers, and building relationships with active protein producers.

*with ESRF and Institut Albert-Bonniot

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Horizons

Phelma: 2017 admissions open to graduates of additional science prep programs

Grenoble Institute of Technology's Phelma engineering school will be saving two slots next fall for students coming out of preparatory classes in Biology, Chemistry, Physics, and Earth Science (formed when the Biology and Veterinary prep programs merged). This is the first time the school's admissions policy allows students from these programs to apply. The goal is to see how broadening admissions to chemistry students works out, given that the entrance exam is more physics-oriented. If it is a success, it could be expanded to a larger scale, similar to what was done in 2015 for applicants from the Technology and Industrial Sciences prep program. In 2016, six students from this prep program were admitted.

The longer-term objectives for the school are to foster a more diverse student body and to balance out the number of students enrolled in the different majors starting in their second year.

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Startup EnWires sets up shop at LMGP

In November startup EnWires moved from INAC (of which it is a spinoff) to engineering physics and materials lab LMGP. EnWires continues to conduct its basic research with INAC, but will now be able to use the process it has developed at a larger scale at LMGP. The startup's contract allows it to use LMGP's facilities to make and test innovative composites for lithium-ion batteries.

This year EnWires hopes to produce in the tens of grams of its materials per day while continuing to work on battery performance enhancements (cyclability, charge speed). In addition, EnWires has signed an R&D contract with the CEA and plans to sign another with LMGP on materials production and characterization.

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Grenoble Institute of Technology 2017 adventure race to take place in Vercors

The 22nd annual Grenoble Institute of Technology adventure race will take place on May 6 and 7 in the Vercors mountains. The team event, organized by the students, is open to all: working professionals, women, men, the disabled... everyone is welcome! A qualification race will be held on March 25 on a completely new route in Jarrie. Just 150 of the expected 300 entrants will qualify for the big race. The rules of the race have also changed: in addition to the standard route, teams will have to choose from a selection of other activities from mountain biking to trail running to maximize their chances of winning!

Event security will also be ramped up due to the government's counter-terrorism security measures in place, and individual participants will be equipped with GPS beacons.

Register until March 18 at <http://raid.grenoble-inp.fr>
Contact: inscription.raid@grenoble-inp.fr

Live from MINATEC

1967–2017: Leti celebrates 50 years

Leti's 50th anniversary celebrations kicked off on February 2 with a party on the ground floor of Maison MINATEC. The entire local innovation community was invited to come and celebrate with Leti and visit a special 50th-anniversary exhibit "Leti, pioneering micro- and nanotechnology." The second major event to mark Leti's 50th year will be Leti Innovation Days at the end of June. This year, the event will be more exciting than ever, with theme-based group tours on June 29 that will include stops at major points of interest, presentations of demonstrator systems, and plenty of opportunities for questions and answers.

On September 30, Leti employees and their families will gather at the Château de Sassenage near Grenoble for a day of games and other activities. In October, just a few days from Leti's actual anniversary, a special Midi MINATEC brown-bag lunch lecture dedicated to Leti's 50 years in operation will close out the year.

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Live from MINATEC

Innov@School gets high-schoolers thinking about the homes of the future

What kind of homes will we live in tomorrow? Will they be mobile or stationary? What kind of energy will we use? Around 100 local high-school juniors enrolled in science tracks will try to answer these and other questions during the Innov@school 2017 program. This CEA Tech-Grenoble School District initiative kicked off in 2013 with the purpose of raising students' awareness of the challenges of innovation and careers in the field.

Groups of fifteen students will spend a day at MINATEC with their teachers learning about the technologies on display in the showroom from the scientists and engineers that developed them. A creativity workshop facilitated by the Ideas Laboratory will follow. Students will be asked to come up with a list of ideas they can use either for the Inno'cup Junior competition or for their graduation projects next year.

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Jean-Claude Royer joins Cinatec's management team

Jean-Claude Royer was appointed to Cinatec in June 2016 to oversee implementation of the center's roadmap and supervise all projects at the facility. He succeeded Astrid Astier. Prior to joining Cinatec, the Edmond J. Safran Biomedical Research Center, Royer, a physicist with a Ph.D. in computer science, ran Leti's characterization department at the Nanocharacterization Platform (PFNC) on the MINATEC campus.

Cinatec was founded by the CEA, Grenoble University Medical Center, Grenoble-Alpes University, and Inserm. The center's 70-strong staff includes engineers in micro- and nanotechnology, electronics, and software, healthcare practitioners, and other medical professionals.

Cinatec's main missions are to treat Parkinson's and Alzheimer's, fight cancer, and restore mobility to spinal-cord injury patients.

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ESRF Colloquia a success

The ESRF Colloquia series, which kicked off in 2016, has now reached cruising speed. The past few quarterly talks, which are free of charge and open to the general public, have routinely brought in more than 150 people.

The topics addressed go far beyond issues directly related to the synchrotron's activities. And the speakers—from climatologist Jean Jouzel, who was Vice President of the IPCC when he won the Nobel Peace Prize in 2007, to Damir Buskalic, who helped detect gravitational waves, to Al Gore—are high-profile members of the international scientific community.

The next talk in the series, to be held on March 17 at 2:30 p.m., will feature British biochemist David Stuart, who will address his work on viruses observed at the atomic scale.

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Live from MINATEC

eVaderis gets influx of fresh capital

Grenoble-based startup eVaderis has raised funds from Starquest Capital, one of France's most active innovation-focused investment firms, and from CEA Investissement. Since eVaderis was founded in 2014, the company has been working closely with Spintec and has received financial support from Bpifrance.

eVaderis develops design attributes based on resistive non-volatile memory technologies (STT-MRAM, ReRAM) to achieve a balance between electronic component performance and ultra-low-power requirements. The solutions include eliminating sleep mode, storing data on button batteries, and energy-harvesting systems. The company is targeting the IoT, sensor network, smart card, security, mobile medical device, mobile telephone, and automotive markets.

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Agenda

February 11, Grenoble Institute of Technology - Pluriel (Campus)

Day-long informational meeting on studying engineering
For students enrolled programs eligible for admissions (high-school, preparatory, tech institute) or an equivalent diploma
<https://goo.gl/QwVtuK>

March 9, MINATEC Inn.Otech

introducing high-school sophomores to the world of microelectronics and semiconductors
Contact: nathalie.mathieu@phelma.grenoble-inp.fr

March 7, ESRF

ESRF Colloquia: British biochemist David Stuart
Contact: mengoni@esrf.fr

March 10, auditorium M001, Phelma RF and millimeter wave integrated circuits and systems day

florence.podevin@grenoble-inp.fr

March 13–18, les Houches Winter school: Biology at different scales, an interplay between physics and biology

<http://www.leshouches.strikingly.com>

March 17, Maison MINATEC 8th annual JSIam: Junior Scientist and Industry annual meeting

<http://www.jsiam-giant-grenoble.org/>

March 18–19, Alpes Congrès Grenoble Maker Faire Grenoble

The expo for DIY'ers, makers, remodelers, fixers, and inventors
<https://goo.gl/4jilLHR>

March 25, Jarrie Qualifying round for the Grenoble Institute of Technology 2017 adventure race

Contact: inscription.raid@grenoble-inp.fr

April 4, Maison MINATEC Atomic Scale Processing workshop Organizer: Oxford Instruments Plasma Technology

<https://goo.gl/y6BxGY>

April 13, Grenoble Institute of Technology - Phelma Inn.Otech

introducing high-school sophomores to the world of microelectronics and semiconductors
Contact: nathalie.mathieu@phelma.grenoble-inp.fr

April 26, Maison MINATEC Minalogic International Business Meetings

<https://goo.gl/qDoZXh>

June 7–9, Phelma Club EEA & EAEEIE colloquium

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MINA-NEWS >

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