MINATEC® NEWSLETTER

MINA-NEWS

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Top news

Germanium: spin transistors just over the horizon

INAC recently made a significant advance toward using spin-orbit coupling in transistors as the result of research conducted in conjunction with CNRS Palaiseau and Jülich Research Center of Germany.

As its name indicates, spin-orbit coupling "couples" an electron's momentum and spin. A new type of MRAM (magnetoresistive RAM) memory potentially capable of pushing back current limits could leverage spin-orbit coupling to multiply the pathways the electrical current can follow during the read and write cycles. Unfortunately, spin-orbit coupling, which makes it possible to manipulate spin, is virtually nonexistent in silicon and germanium, the materials used in today's microelectronics. One solution is to add a metal layer to the materials to generate what is known as the Rashba effect to cause spin-orbit coupling.

Low-temperature molecular beam epitaxy was used at INAC to obtain very clean, defectless interfaces between the iron and germanium resulting in a strong Rashba effect. When a spin current is introduced, it is converted by the Rashba effect into a charge current at the interface between the materials. And, according to the reciprocity theorem, the reverse is also possible, which means that spin current could be generated, detected, and manipulated using current CMOS technology.

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Innovation

P-SCAN pinpoints industrial systems' vulnerabilities

As part of a partnership with international certification agency Bureau Veritas, Leti developed a test bench to verify the security of connected objects for industry, healthcare, transportation, and more generally, the Internet of Things.

The P-SCAN test bench is the world's first automated system that can detect potential vulnerabilities at the physical interfaces of industrial equipment and ensure fast, reproducible results. Once the security target—what to protect and how—has been determined according to an evaluation grid, P-SCAN builds a testing plan from a library of security tests. A prototype will be transferred to Bureau Veritas in October 2017. Bureau Veritas plans to use P-SCAN to develop new cybersecurity testing services.

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5G network prototype at Pyeongchang Olympics

The 5G Champion project, in which Leti is participating alongside the Korean Electronics and Telecommunications Research Institute (ETRI), will develop a 5G network prototype for the 28 GHz frequency band that will be rolled out during the Pyeongchang Olympics in February 2018, two years before the official launch of 5G. The proof-of-concept prototype will combine state-of-the-art millimeter-wave terrestrial radio communications and new satellite technologies for the first time ever.

The project partners have set the ambitious objectives of reducing latency, delivering high transmission speeds in very dense user environments, improving service quality for highly-mobile use scenarios (like on buses), ensuring precision geolocation, and lowering network management costs.

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Mechanical constraint helps locate quantum light sources

New optoelectronic components like single-photon sources leverage semiconducting quantum dots integrated into a photonic structure. The sources are generally randomly distributed across a surface within the structure. Knowing the sources' positions, however, is important to understanding and improving component performance.

Researchers at INAC and Institut Néel developed a novel technique to map the sources. They introduced oscillation into the photonic structure to generate a very irregular mechanical constraint that causes a shift in the spectrum of light emitted by each quantum dot. Optical spectroscopy can then be used to measure the difference between the sources and determine the position of each source to within a nanometer.

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Innovation

Large-scale two-dimensional $MoSe_2$ production with no tape!

Researchers at INAC recently synthesized homogeneous three-atomic-layer $MoSe_2$ on a large scale using molecular beam epitaxy. Like other transition metal dichalcogenides (TMDs), $MoSe_2$ is a two-dimensional semiconductor that offers vast potential for applications in electronics, spintronics, and optoelectronics. Producing the material by exfoliation from bulk crystal using adhesive tape does not deliver consistent enough quality and the technique cannot be used for volume production.

INAC's technique delivers fine control of the number of layers deposited and complete coverage of the substrate, resulting in desirable structural and electrical properties and homogeneous 2D layers that were verified using several characterization techniques.

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First-ever 600 V/100 A GaN demonstrator transistor for power electronics

Power components now have their own transistor. Researchers at Leti completed the first-ever 600 V/100 A normally-off MIS-HEMT (metal-insulator-semiconductor high-electron-mobility transistor) offering performance compatible with the requirements of power electronics. In addition, the transistor can operate at 200 °C and can be manufactured at a reasonable cost.

A 3 micron–4 micron GaN layer was deposited onto a 200 mm silicon wafer to boost voltage to 600 V. The GaN layer was used successfully thanks to a specific interface between the silicon and GaN layers. The transistor also offers higher operating frequencies than today's power components, making it a prime candidate for energy conversion applications.

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Day by day

SensiNact released as open source

The sensiNact IoT peripherals integration and management platform developed by Leti facilitates the interoperability and processing of data from heterogeneous sensors installed in urban environments. Leti announced that the software would be released as open source at the Embedded World 2017 trade show. The software has already been used in a Franco-Japanese research project on smart cities, ClouT (Cloud of Things), which kicked off in 2013 and which won a "Stars of Europe" award.

Access to the core features of sensiNact will give users—especially cities—an opportunity to develop their own applications without the risk of vendor lock-in. In addition, easier access to the platform will encourage users to share their experiences and compile use cases for the benefit of the entire community.

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Nanosafety Workshop: a uniquely interactive opportunity

The Nanosafety Platform will hold a day-long workshop on November 16, 2017 at the CEA's Grenoble campus for all professionals concerned by the use and responsible development of nanomaterials. A total of 120 attendees—scientific researchers, occupational physicians, occupational HSE and other professionals from industry, and representatives of relevant institutions—are expected at the event.

The workshop is intended to round out the NanoSafe conference, held every two years, which provides an overview of the state-of-the art in nanosafety. It will also be more hands-on and interactive. . The first edition will include testimonials from professionals, business networking sessions, and six hands-on workshops on topics like handling nanomaterials, worker monitoring, and the Safer by Design approach.

Register online at www.ateliers2017.insight-outside.fr
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Day by day

Photonics platform ready after a six-month delay

The photonics platform, originally slated for delivery in November 2016—later pushed back to January 2017—, finally opened on May 2, 2017. In all, it took the builder six months to resolve the variety of issues plaguing the project and deliver a building compliant with the original specifications. One of the major problems observed was excessive vibration caused by malfunctioning acid-base extraction equipment.

The move, which concerns 260 Leti Optics and Photonics Department employees and 360 pieces of lab equipment, will take place gradually from June 2017 to June 2018 to keep disruptions to a minimum. According to the calendar, the characterization facilities will be operational in September; the metallurgy labs will follow and the clean rooms will be last.

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Building an emergency shelter prototype in three days

A cohort of around fifteen college-level students from France and the United States will take part in a creativity workshop on June 13–15 where they will be tasked with creating an innovative emergency shelter prototype. The workshop is part of the REACT* research project with which the GIANT International Internship Programme is associated. The students will meet at MINATEC and will work with a team of researchers from the CEA to come up with their prototype, use scenarios, and a concept for an associated mobile app. Before the workshop, participating students will meet with a representative of ShelterBox, an international organization that provides emergency shelter units to disaster victims.

Also related to the REACT research project, six students from Grenoble, including several from Phelma, will go to the University of Pennsylvania and GIANT will welcome nine American students.

**Research and Education in Active Coatings Technologies for the Human Habitat*

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Leti stands out at EuCAP conference

Millimeter-wave communications, which offer substantial bandwidth for higher transmission speeds, are garnering interest as a solution for tomorrow's 5G networks. Leti is paying close attention, with a number of research projects on the topic, one of which won Best Paper at EuCAP in March.

In work conducted under the mmMAGIC project, Leti researchers compared two potential 5G frequency bands (around 60 GHz and 80 GHz). They characterized and analyzed signal propagation for each band, observing attenuation and multipath distortion for various indoor scenarios. A model for evaluating 5G communications system performance was developed using the data generated in the study.

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Day by day

Nanocharacterization platform upgrades TEM equipment

Transmission electron microscopy (TEM) produces much more than just images. The TEM equipment at the CEA nanocharacterization platform (PFNC) provides detailed information on the chemistry of the materials analyzed. And, to make sure that the platform's equipment stays at the international state of the art, two transmission electron microscopes have been upgraded with advanced analysis systems.

The first was equipped with spectrometers to provide information on the chemical composition of the materials analyzed as well as on the materials' chemical bonds and optoelectronic properties down to the atomic scale. The second received a new ultra-fast CMOS camera to observe dynamic phenomena in samples. Applications for the upgraded equipment range from nanoscience to batteries, photovoltaics, microelectronics, and power electronics.

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Neutron detector helps predict the impacts of snow melt

LPSC* developed a neutron detector for French electric utility EDF to measure the snow water equivalent (SWE), or the amount of water in snowpack. The neutrons, which reach the Earth's surface in varying quantities depending on altitude and pressure, react with the water they pass through (they are slowed down or, in some cases, even completely absorbed). The number of neutrons that reach a sensor on the ground can be used to determine the amount of water above the sensor, regardless of how dense the snowpack is. A total of 40 of the sensors have been implemented at strategic points on specific drainage basins in France's main mountain ranges to determine the amount of snow melt water that will reach dams in the spring. A prototype new-generation sensor, which would cost less to produce, is currently being tested in the lab.

**Subatomic Physics and Cosmology Laboratory*

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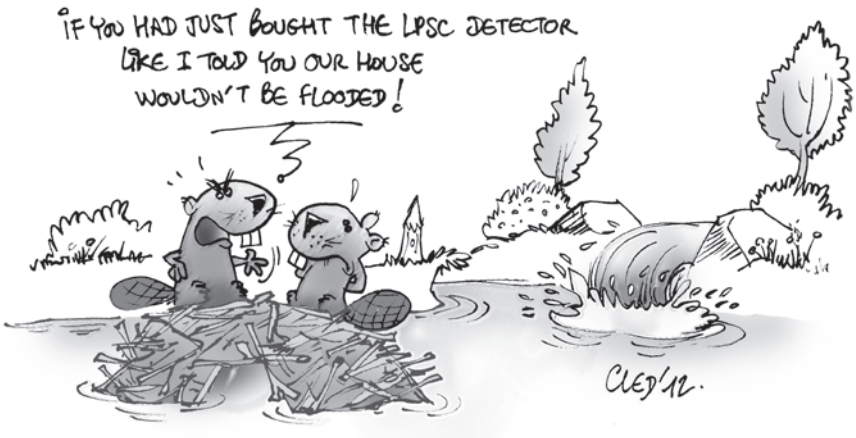

Horizons

DREAM project results published in six languages!

The European Commission recently published an article on the DREAM project, coordinated by Grenoble Institute of Technology from 2013–2016, in six languages on its web portal. Grenoble Institute of Technology's G2ELab, DRIVE*, and INP Grenoble Entreprise managed the project, which focused on innovative decentralized electricity grid management tools. The project's interdisciplinary approach at the intersection of IT and electrical engineering resulted in the development of management solutions that facilitate the integration of a larger portion of renewables into the grid while making operators' work easier through a non-hierarchical system. Two lab demonstrators were built, and an additional three are being tested in real-world conditions in Strasbourg, Milan, and Meltimi (Greece).

**DRIVE : Direction Recherche Innovation Valorisation Europe*

Read the article: https://goo.gl/DfksBc
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Horizons

NXP and Phelma form a new kind of partnership

On March 24 NXP and Grenoble Institute of Technology's Phelma engineering school signed a partnership agreement—the first of its kind—that included an equipment donation. NXP agreed to finance the equipment for a new teaching lab for the Embedded Systems and Connected Objects and Signal, Image, Communications, and Multimedia majors.

The partnership was signed during the European qualifications of the NXP Cup at Phelma. Entrants in the international competition, organized by NXP, are tasked with building and programming a driverless vehicle and programming it to complete a circuit as quickly as possible. Phelma entered three teams, one of which made it to the finals. However, due to technical problems, the team's vehicle was unable to complete the circuit and was disqualified.

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New on the Micro- and Nanotech Observatory website

The new Micro- and Nanotechnology Observatory website went live in late 2016 and has been regularly updated with new publications ever since. Users can log on to their free account (for all CNRS, CEA, and affiliate staff) to access the most recent content, which includes more than ten presentation videos from the Memory for IoT and Neuromorphic Architectures workshop held at MINATEC in mid-March 2017. The corresponding PDFs are also available on the website. Two new in-depth reports (that give the state of the art and outlook for a given topic), one on personalized nanomedicine and the other on hybrid silicon solar cells, are also available.

www.omnt.fr
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Inno'Cup Junior 2017: teen innovators imagine the future

A total of ten projects will go head to head at the Inno'Cup Junior finals at MINATEC on July 11 and 12. Teen innovators (aged 15–18) will present a wide variety of product and service prototypes of their own design that include Eggyourt (an egg-based yogurt for the lactose intolerant), I-Zheimer (a connected bracelet to help lost Alzheimer's patients find their way), Safe Sea (an autonomous pollution clean-up catamaran), an environmentally-friendly floating power plant, and more.

The third edition of the competition, which is held every two years, is being run by science education organization La Casemate and is supported by founding partners The United States Embassy in France, the CEA, GIANT, Xerox Research Centre Europe, and *Phosphore* magazine, as well as Enedis, a new partner to the event this year.

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Interview

**Jean-Charles Guibert,
Director, MINATEC;
Advisor to the CEA Chairman
for International Innovation Projects**

"MINATEC's international reputation is what convinced the CEA to appoint me to this new position."

In April of this year, you were appointed Director, MINATEC, Advisor to the CEA Chairman for International Innovation Projects. What is your mandate?

The objective is to support the development of the CEA's international relations. The CEA's network of partners closely reflects the organization's traditional focus areas. My mandate as Director, MINATEC, Advisor to the CEA Chairman for International Innovation Projects is to expand the network to other fields like nanotechnology and renewable energy.

How will your experience at MINATEC help?

The MINATEC model works very well internationally. That is one of the reasons why the CEA appointed me to this position. The fact that the position was created should be considered the CEA's highest form of recognition for what we have accomplished at MINATEC. Of course, my experience at MINATEC and the network I helped to build here will be extremely helpful. I am in a strong position to offer countries where technological development is still emerging tailor-made support creating their own research-and-innovation models. We will see more of the kinds of things we are doing with MINATEC Nanolab® in Vietnam, North Africa, and South America, for example.

You are still the Director of MINATEC…

Yes. I will continue to promote MINATEC and build relationships on behalf of MINATEC both in France and internationally. Our innovation campus model has garnered interest from a wide variety of countries. Each year, MINATEC welcomes between 30 and 40 foreign delegations and sends delegations to around ten countries. These relationships are crucial to feeding our innovation pipeline with exciting, promising projects spanning research, education, and industry.

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Horizons

GIANT runs tours for *Presqu'île* residents

Residents of Grenoble's *Presqu'île* district will get a chance to tour Clinatec on July 3 and GreEn-ER (run by Grenoble Institute of Technology) on July 4. Visitors will be greeted by Heiko Buchholz, a performing artist from the "*Un euro ne fait pas le printemps*" theater troupe on special assignment for the Ministry of Happiness, the Insignificant, and Exploration of Small Worlds. The offbeat theatrical introduction will be followed by the most traditional of guided tours! The tours are free of charge for participants aged 18 and over; however, advance registration is required.

The event illustrates GIANT's strong commitment to Grenoble and its residents and the original format was selected to bring people who work in the neighborhood and those who live there closer together and provide a better understanding of the work that goes on at GIANT.

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Nuclear: Phelma signs partnership with the University of Bristol

Grenoble Institute of Technology's Phelma engineering school and the University of Bristol (England) recently signed a nuclear energy partnership. The two institutions had previously been ERASMUS partners for several years. Nuclear energy is a high-growth field in southwestern England, where French electric utility EDF is building two EPR™ pressurized-water-type reactors that will be commissioned in 2025.

The partnership provides for Phelma students to complete three-month research projects at Bristol labs. There will also be a common Nuclear Fuel lecture course taught in Grenoble starting the first semester of 2017–2018 and available by videoconference to students on the Bristol campus. Each campus will hold its own lab classes on the topic and students will complete group projects in blended French-English groups. This original teaching experiment will be evaluated so that it can be improved upon and so that the format can be expanded to other courses.

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MT 180: Grenoble's Sabrina Fadloun in the running at nationals

Imagine an electron as fast as Usain Bolt! Sabrina Fadloun had the jury—and the entire audience—hanging on her every word at the Grenoble-Alpes University finals of the MT 180 (My Thesis in 180 Seconds, inspired by the Three Minute Thesis®) competition held at MINATEC on April 13. Two other PhD candidates from Grenoble Institute of Technology joint labs, Hippolyte Durand and Lisa Guigue, came in second and third!

A second-year PhD candidate conducting research at SIMap and Leti, Sabrina is studying a MOCVD copper-deposition process to make high-form-factor through vias for 3D integration. Next up for Sabrina: the national semifinals in Paris on June 13 and—fingers crossed—the finals the next day.

Watch video at https:// goo.gl/2eJyX4
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Open labs: Atelier Arts-Sciences and Ideas Lab expand circle of partners

The Isère General Council, already a partner of the Ideas Laboratory®, recently signed a new partnership, this time with the Experimenta expo, which will now be held once every two years. The next edition will take place in February 2018 at MINATEC, with activities spread out at sites across the Greater Grenoble area.

Ideas Laboratory® also has a new partner, insurance company MAIF, evidence of the insurance industry's growing interest in innovation in the era of Big Data and the major changes it will bring. MAIF has assigned a full-time innovation project manager, Patrick Delannoy, to Ideas Laboratory®, where he will liaise with the partners and keep a watchful eye on open labs projects, especially those focusing on new forms of mobility.

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Live from MINATEC

Grenoble Institute of Technology moves up in 2017 QS World University Rankings by Subject

This year, Grenoble Institute of Technology, Grenoble-Alpes University's Engineering School, moved up 22 slots in the 2017 QS World University Rankings by Subject released in March. Grenoble Institute of Technology came in 177th out of 900 in the Engineering and Technology category.

The school was in the top 100 for Natural Sciences as well as for Materials Science, one of Phelma's flagship disciplines. Grenoble Institute of Technology is the only university in France in the top 100, followed by Polytechnique and Pierre et Marie Curie University, which were in the top 150.

www.topuniversities.com/university-rankings
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Sylfen wins international innovation award from French newspaper *Le Monde*

Sylfen won the *Le Monde* Smart Cities competition International Award in Singapore on June 2, shortly after receiving the European Innovation Award for the Energy Category of the same competition in April. The awards will help raise the growing company's profile.

Based in Grenoble at the MINATEC High-tech Building, the startup, which holds licenses to 22 Liten patents, has developed a system to store energy as hydrogen and make it available on demand. The company is currently working on a prototype of its Smart Energy Hub; Liten is working on the reversible electrolyzer and Sylfen is handling the rest (the battery, power electronics, integration, hydrogen compression, and management software). Sylfen currently employs six people and plans to hire fifteen more to support growth.

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IRT Nanoelec: More than 300 SMBs have received services through the Easytech program

The Easytech program introduced by IRT Nanoelec in 2012 has provided digital innovation and technology transfer support services to more than 300 local SMBs to date. Participating SMBs can access IRT Nanoelec services developed to meet their unique needs, from an appointment with a consultant to get advice to an audit of a process in progress or R&D project support and financing of up to 50% of project costs. Support from the Auvergne-Rhône-Alpes regional government and several local municipalities have now made it possible for IRT Nanoelec to offer consulting appointments in Grenoble, Lyon, Valence, and Saint-Étienne.

This June IRT Nanoelec will publish a collection of success stories highlighting more than 50 businesses (Arnano, Avalun, Delta Drone, Isorg, and more) that have received support through Easytech.

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PUS improves energy yields at MINATEC

Engie Cofely subsidiary Pôle Utilités Services (PUS), which produces and distributes MINATEC's technical fluids, would like to reduce its energy spending by between 5% and 10% by the end of 2018—without affecting service quality and uptime, of course! In 2015 the company introduced a new energy management strategy inspired by ISO 50001, assigning an Energy Manager and operational staff to the project.

And, in the era of Big Data, the company has implemented Engie's Blu.e platform, which gathers, analyzes, and processes energy data to generate recommendations and forecasts. In 2016 PUS reduced its energy spending by more than €20,000 for cold water production and saved an additional €15,000 by negotiating better utility contracts.

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Exploring artificial intelligence at Ideas Days

Ideas Days 2017, to be held by and at the MINATEC Ideas Laboratory® on July 4 and 5, will explore "Man and his relationship to the world from the Paleolithic age to artificial intelligence." The program will include lectures, workshops (including arts workshops), and panel talks addressing the major shifts affecting our society, from work and mobility to food.

Markus Gabriel, philosopher and author of *Why the World Does Not Exist*, will speak. Paleoanthropologist Pascal Picq will share his take on how man's relationships to the world and technology have changed.

Ideas Days will address some serious topics. However, the format will be informal, with a concert, food trucks, and other fun activities. The purpose of the event is to break down the silos that traditionally separate different approaches to technology and shape a more positive future in which innovation is guided by people and uses rather than the reverse.

See the full program and register at www.ideas-days.com
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Cholera test kit designed in Grenoble in iGEM competition

This year Grenoble Institute of Technology's Phelma engineering school and Grenoble-Alpes University (UGA) will once again enter the iGEM synthetic biology competition held by Boston's MIT. The Grenoble team, which includes four students from Phelma and six from UGA's School of Pharmacy, will develop a portable, self-contained cholera test kit. A DNA sequence from the bacteria responsible for cholera will be integrated into a DNA sequence from a common E. coli bacteria to detect cholera in a stool sample and alert the user to a positive result via fluorescence.

The data gathered by the test kits will be sent to a server, facilitating epidemiological analyses by geographical area and, therefore, supporting more effective prevention. The Grenoble team will present a prototype and the results of their experiments at the finals in November.

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Agenda

June 8–9, Phelma-MINATEC
57th Congress of the EEA Club and EAEEIE European Conference
http://eea2017-iut1.univ-grenoble-alpes.fr

June 13, Eurexpo Lyon, Hall 4
Smart City
Organized by Minalogic and Tenerrdis as part of Onlylight
www.minalogic.com

June 14, Maison de la Radio, Paris
National Finals of the My Thesis in 180 Seconds competition
http://mt180.fr

June 22, 6 p.m., Maison MINATEC
MICE (Meetings, Incentives, Conferences, Exhibitions)
Club innovation evening
https://www.grenoble-congres.com/fr/club-mice/

June 22–23, Maison MINATEC
French-American Workshop
www.giant-grenoble.org/fr/faw2017-2/

June 26–29, Munich
Laser World of Photonics
International photonics trade show
www.world-of-photonics.com

June 28–29, Maison MINATEC
Leti Innovation Days
Leti Miniaturization Technologies: Innovations and Roadmaps. This event targeting professionals from industry will be held during Leti's 50th anniversary year.
www.letidays.com/2017

June 28–29, Alpexpo
European MedTech Business
Convention organized by Medicalps, Eurosanté and Alsace Biovalley
www.medfit-event.com

July 3–7, Maison MINATEC
InMRAM Summer School
Introductory course on Magnetic Random Access Memory organized by SPINTEC
www.inmram.com

July 3–7, Orsay Campus
24th Congress of the French Physics Society
www.sfp2017.fr

July 4–5, Ideas Laboratory®
Ideas Days
www.ideas-days.com

July 11–12, MINATEC
Inno'Cup Junior finals
www.innocupjr.fr

September 24–26, Longueuil-Montreal
High Level Forum on innovation and smart living (a delegation from Grenoble will participate)
http://hlf-giant-grenoble.org

October 19, 20, and 21, Maison MINATEC Grenoble Institute of Technology Auditorium
10th Parvis des Sciences science fair
Contact: pds@giant-grenoble.org

October 22, Presqu'île
10th Grenoble Ekiden relay marathon
www.grenoble-ekiden.fr

November 16, CEA
1st Nanosafety Workshop
www.nanosafety-platform.com

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MINA-NEWS >

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