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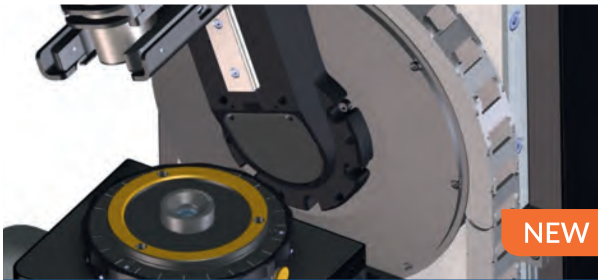

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Alter Technology opens photonics design center in Glasgow

German photonics giant predicts 20% sales growth in 2022 after a jump in orders.

Alter Technology TUV Nord, a provider of engineering and testing of components and equipment for space and other tech markets, has opened a Photonics Design Center in Glasgow, UK, at the University of Strathclyde. The aim of the center is to accelerate the commercialisation of photonic products into quantum technology and space markets.

The center, based in Strathclyde's Technology & Innovation Centre (TIC) in Glasgow, will support Alter's development of integrated, miniaturized photonic products for quantum-enabled positioning, navigation and timing systems and photonic-based satellite optical communications.

The partners will allocate around €6.0 million ($6.6 M) to the design center and its UK manufacturing site in Livingston, West Lothian, over the next three to five years to fund equipment, facilities, personnel and other research and development costs. Its existing manufacturing site will also benefit from additional investment in associated state-of-the-art robotic based manufacturing equipment and processes for photonic products.

Credit: University of Strathclyde.

The TIC building in Glasgow City Innovation District.

Projects have started

The center's engineering team is already working on projects and customer requests and expects to move into its new Glasgow facility in May, 2022. The Fraunhofer Centre for Applied Photonics and Strathclyde's Institute of Photonics are based within the same building, with the Physics Department, nearby.

The opening of the center, which complements the current global manufacturing, test, qualification, and sales operations of the group, was recently announced during a visit to Glasgow by a delegation of 60 industrial leaders from Lower Saxony in Germany, which included TUV Nord's Chief Executive Dirk Stenkamp.

Professor Sir Jim McDonald, Principal & Vice-Chancellor of Strathclyde, commented, "I am delighted that Alter Technology has chosen to open its new photonics design center within the TIC building in Glasgow City Innovation District.

"Strathclyde is well-connected to leading national and international academic centers of excellence, and it has strong links with UK industry, public sector organisations and research and technology organisations.

"As a valued partner of the University, Alter Technology's co-location with the Fraunhofer CAP, our Institute of Photonics, and Department of Physics will provide many benefits for the company and be a real boost to the Scottish photonics industry, the wider Scottish academic sector and the growing innovation ecosystem in Glasgow."

Stephen Duffy, CEO of Alter Technology TUV Nord UK, said, "There were a number of factors that played an important role in convincing us to select the Technology and Innovation Centre as the location for our Photonic Design Center.

"The key reasons were the importance of the local photonics and quantum eco-system, access to skills and proximity to our key partners at Fraunhofer UK and the research, innovation and leadership in quantum technology that takes place in the Physics Department."

https://optics.org/news/13/4/10

Credit: Alter Technology TUV Nord.

Alter Design Centre team: Una Marvet – Head of Alter Design Centre, Stephen Duffy – CEO of Alter Technology UK, Sir Jim McDonald – Principal and Vice Chancellor University of Strathclyde, Simon Andrews – CEO of Fraunhofer UK, Gillian Docherty – Chief Commercial Officer University of Strathclyde.

INTECH 2022: Trumpf's novel laser cutting method minimizes wastage

"Nano joint" technology lets users nest metal parts closely together in production.

Engineering and laser giant Trumpf will showcase a new laser-cutting technique at its INTECH in-house trade show, to be held from May 17 to 20, 2022.

Offering improved efficiency and more reliable processing, the "nano joint" method holds parts in place using tiny supporting tabs that are created at points where the laser does not cut all the way through the sheet, explains the firm's launch statement.

These tiny tabs, or nano joints, prevent the metal from shifting or tipping while the laser is cutting parts.

Product manager Patrick Schüle commented, "Users can improve the reliability of their laser-cutting process and make several of the steps in the process more efficient. Nano joints reduce costs and material usage by allowing users to nest parts closer together and minimize how much metal remains in the skeleton."

Depending on the shape of the specific parts, users may even be able to nest parts in a way that eliminates raw material waste completely. Nano joints also make it quicker and easier for workers to break parts out of the nest.

Different production options

The firm will offer nano joint technology on its TruLaser 5000 fiber, TruLaser 3000 fiber and TruLaser 1000 fiber series machines. The technology can be retrofitted to existing machines by means of a software update.

Currently, fabricators typically hold cut parts in place during laser cutting using tabs known as micro joints. Workers then break these tabs when they remove the parts from the nest. In contrast, nano joints speed up the process because it is quicker to produce tiny retaining points rather than conventional micro tabs during cutting, the company says.

The new joints also allow the operator to break parts free from the nest with less effort. In most cases, nano joints eliminate the need for finishing work, since the mark they leave when the parts are broken free from the nest is barely visible. In contrast, micro joints leave much more obvious contour damage which subsequently has to be manually corrected by production staff.

https://optics.org/news/13/4/4

Source: Trumpf.

Nano joint technology makes it quick and easy to break parts free from the nest. This saves time and makes life easier for workers.

Photo: Jenoptik/Rainer Wächter.

With the pending sales of its "Vincorion" mechatronics business to a private equity buyer, Jenoptik is set to increase its focus on photonics-based technologies. A company restructure will now divide the firm more clearly into "photonics" and "non-photonics" segments.

Jenoptik restructures again as business booms

German photonics giant predicts 20% sales growth in 2022 after a jump in orders.

Jenoptik is expecting its sales revenues to rise by at least 20 per cent this year, thanks to strong demand across all of its core photonics-related business activities.

The Jena-headquartered company posted sales of €751 million for 2021, up 22 per cent on a like-for-like basis (i.e. not including the €145 million total from the "Vincorion" mechatronics business), and provided that Russia's invasion of Ukraine does not escalate further, it expects profitability to improve this year as well.

CEO Stefan Traeger said: "On the back of a good order situation, a well-filled project pipeline, and ongoing promising developments in the core photonics businesses, we are confident of achieving revenue growth of at least 20 per cent and further improving profitability in our continuing operations in 2022."

He added that the latest developments put Jenoptik "fully on track" to achieve its targeted group revenue figure of €1.2 billion by 2025, alongside an earnings before interest, tax, depreciation and amortization (EBITDA) margin of close to 20 per cent.

That effort will come amid the latest restructuring of the company, which will now be divided into business units more clearly defined as "photonics" and "non-photonics" in nature.

E-beam investment

Within the existing divisional structure, Jenopik's "light and optics" business segment is benefiting most from the current boom in demand - and from the semiconductor industry in particular.

The Trioptics business is now included in this segment, and contributed just under €100 million in sales as the divisional total rose by more than 40 per cent in 2021, to €461 million.

The more recently acquired SwissOptic and BerlinerGlas (BG) Medical businesses contributed €9.6 million to the total, with Jenoptik also pointing to strong demand from biophotonics applications.

But the semiconductor industry remains the main driver of growth, and with that in mind Jenoptik says it is investing in a new electron-beam lithography tool expected to go into operation at its Dresden site in mid-2022.

"It will be a core element for the development and production of the most sophisticated next-generation precision sensors, which are essential for the further development of DUV [deep ultraviolet] and establishing high-precision EUV [extreme ultraviolet] wafer exposure in semiconductor production processes," stated the firm in its annual report.

Restructuring

Meanwhile, Jenoptik's "light and production" business unit, which has a strong focus on the automotive industry, and includes lasers for materials processing,

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Jenoptik restructures again as business booms

posted annual sales of €176 million - almost exactly the same figure for 2020.

Things already look better for 2022, however, with Jenoptik reporting "improved sentiment" in the automotive industry, and a 20 per cent rise in divisional orders including particularly strong demand for laser processing equipment.

The latest restructuring will see Jenoptik combine the "light and optics" and "light and production" business segments to form a single unit called "advanced photonic solutions".

The former "light and safety" division, which is largely focused on road traffic monitoring systems, will become known as "smart mobility solutions".

Jenoptik's non-photonic activities, particularly with respect to the automotive market, will be separated as "non-photonic" companies within the group structure, and managed as independent brands.

The company is still in the process of selling the Vincorion business, which is set to be acquired by a private equity buyer later this year - and increase the overall focus on photonics technologies.

Better balance

Commenting on those developments in Jenoptik's annual report, CFO Hans-Dieter Schumacher added: "Our structure will simplify. Jenoptik is developing from a diversified group into a pure photonics player that will generate approximately three quarters of its revenue in the 'advanced photonic solutions' division in 2025."

That new business unit will combine activities in sectors as diverse as semiconductors and electronics, life sciences and medical technology, and optical metrology.

"This set-up will allow us to achieve a better balance between cyclical and less cyclical operations," Schumacher said, with Traeger adding:

"Since December, BG Medical (now called Jenoptik Medical) and SwissOptic have strengthened our activities in the areas of medical technology and metrology as well as in semiconductor equipment.

"For 2022, we expect additional revenue of around €130 million from the acquisition, with attractive margins."

Regarding the wider macroeconomic and geopolitical situation, Jenoptik's annual report highlighted the war in Ukraine and China's inflexible "zero Covid" pandemic response as two of the major risks to global trade and supply chains.

"Our [anticipated] growth pre-supposes that the Ukraine conflict - with the sanctions that have been implemented and potential impacts on price developments and supply chains - does not escalate further," stated the firm.

"Uncertainties also exist with regard to the development of the Covid-19 pandemic and continuing supply bottlenecks, although Jenoptik is confident to be able to manage them."

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Hannover Fair 2022: Laser welding reboots steel construction

Fraunhofer IWS-led group develops faster steel jointing with gentler machining power and lower energy need.

Today, energy and resource efficiency are ever more significant, considering rising costs and environmental concerns. So the Fraunhofer Institute for Material and Beam Technology (IWS) and partners have developed an alternative to conventional steel construction that not only offers a process technology solution, but also forms the basis for hardware and laser safety.

This technique facilitates gentler machining of high-strength materials, as well as significantly reducing energy consumption and costs while greatly increasing process speed. The energy required for the component can be cut by up to 80 percent compared with conventional joining processes, say the partners.

Not only that, subsequent straightening of the component is eliminated entirely from the process. The innovative welding process will be presented at the Hannover Messe, Germany. between May 30 and June 2 at the joint Fraunhofer booth in Hall 5, Stand A06.

Many technical structures feature some form of steel construction. Be it a container ship, railway vehicle, bridge or wind turbine tower, any one of these structures can have several hundred meters of welding seams.

Conventional industrial processes such as metal active gas welding or submerged arc welding are usually used for this purpose. The problem is that due to the low intensity of the arc, a large proportion of the energy expended is not actually used in the welding process, but is lost to the component in the form of heat.

"These energy-intensive processes cause significant thermal damage to the material and result in severe distortion of the structure, which then demands costly straightening work afterwards," said Dr. Dirk Dittrich, who heads up the Laser Beam Welding Group at IWS.

© Fraunhofer IWS/René Jungnickel

Researchers at the Fraunhofer IWS used an indoor crane segment made of S355J2 structural steel (4 by 0.75 by 0.5 meters) to demonstrate that the laser MPNG welding process they had developed reduces energy costs by up to 80 percent and filler material consumption by up to 85 percent compared to conventional welding processes.

Powerful laser welding

A team of researchers led by Dr. Dittrich has developed an energy-efficient alternative together with industrial partners as part of the "VE-MES – Energy-efficient and low-distortion laser multi-pass narrow-gap welding" project.

Laser multi-pass narrow-gap welding (laser MPNG, see box below) uses a commercially available high-power laser and stands out from conventional methods thanks to its reduced number of layers and drastically reduced seam volume. These elements of the welding process are its key benefits.

"Depending on the component, we can reduce the energy input for the component during welding by up to 80 percent, and we can lower filler material consumption by up to 85 percent compared to conventional arc processes," said Dr. Dittrich.

"What's more, it was not necessary to carry out a straightening process on the component studied. As a result, we can cut production time and costs, process high-strength steel materials and significantly improve the CO2 balance of the entire production chain. Given the significant number of steel structures being built in Germany and around the world, this could prove to be hugely advantageous."

This is because the high intensity of the laser beam guarantees that the energy input is highly localized at the welding point, whereas the surrounding areas of the component remain comparatively cold. "The welding time is also reduced by 50 to 70 percent," said Dittrich, citing another advantage.

The new process also excels in terms of weld seam quality – the seams are significantly slimmer and the edges are virtually parallel, whereas in conventional welding processes the seams are V-shaped.

"If laser welding were used in steel construction processes, it would become a unique selling point for medium-sized businesses in Germany and strengthen its market position in the face of international competition," says Dittrich with confidence. "We are providing the industry with an efficient form of joining technology that is set to revolutionize steel construction on account of its cost-effective application and resource-saving production process."

Steel girders for crane construction

The researchers from Fraunhofer IWS demonstrated the performance of their new development using a practical example from indoor crane construction. They deployed the new welding technology using special system technology and an integrated beam protection concept.

The design of the experimentally built, four-meter-long rectangular profile of an indoor crane segment conformed to the design and manufacturing guidelines of comparable, conventionally produced components. Weld seams typical of the application were produced: a butt joint on 30-millimeter plates and a fully joined T-joint (15mm plate).

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Laser developer LASEA awarded €10 million in new investment

Belgium-based developer of precision lasers for industry gains development funds from M80, Noshaq, SRIW, and Épimède.

With offices in Belgium, France, Switzerland, and the USA, LASEA develops and manufactures precise laser micromachining machines and solutions intended for major manufacturing industries.

This week, LASEA has announced that it has been awarded €10 million in new new investment from a combination of the private equity fund M80, and other investors Noshaq and SRIW.

LASEA, founded in 1999, has seen continuous growth and doubling revenues every couple of years. The company said it invests heavily in research and development and now has a portfolio of over 100 laser technology patents. Clients across five continents include leading brands in the luxury goods and medical technology industries, and electronics, and research institutes.

The company's investment statement says that the capital injection from M80 "will drive international expansion and investment opportunities. It will boost innovation in areas such as new optical components, machines, and software and it will enable further integration of the recently acquired Belgium-based laser micromachining company Optec".

M80 becomes the second largest investor and will be an active partner in LASEA's further development. LASEA's founder, Axel Kupisiewicz, remains the largest shareholder and will continue to steer the organization as its CEO. Both Noshaq and SRIW – together with the Épimède fund early backers of LASEA – have expressed their continued support by increasing their shareholding, maintaining LASEA's ties to Liège and Belgium's Walloon region.

'Right partner'

Axel Kupisiewicz, CEO of LASEA, commented, "We found in M80 the right partner to further enable our growth. They will not just provide funds, but especially act as the right soundboard and hands-on partner that we need to bring LASEA to the next level."

Carl Annicq, of M80, added, "With high-end laser machining technology breaking through on many fronts, this is an exciting industry for M80 to invest in. LASEA has strong leadership and a long list of top tier clients. Now is the right time for scale-up and we're delighted to be on board."

LASEA supplies production lines to what it calls "the most prestigious companies in the world" – including the top three Swiss watchmakers, glasses manufacturers, the pharmaceutical and medical industry (intra-ocular, vascular and cochlear implants), as well as some Silicon Valley firms.

Credit: LASEA.

LASEA has already installed more than 1500 laser production systems worldwide.

Active in 30 countries and on five continents, LASEA has already installed more than 1500 laser production systems worldwide. In addition to its headquarters in Belgium, on Liège Science Park, LASEA has subsidiaries in Mons, Belgium; Bordeaux, France; San Diego, CA, US; and Biel, Switzerland, and employs 110 people.

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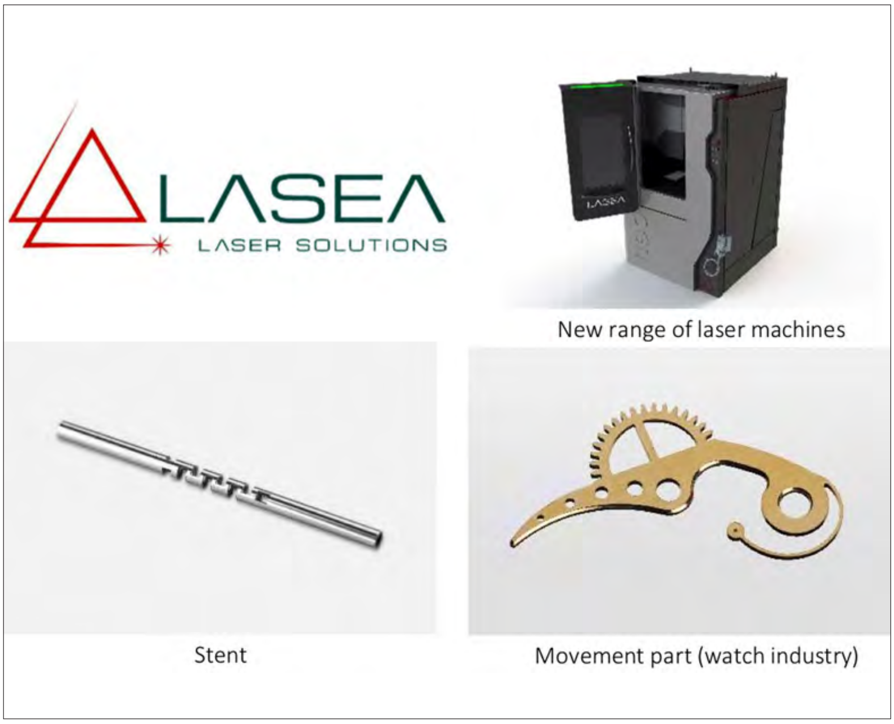

Credit: LASEA.

Clients make luxury goods, medical tech, electronics, and work in research.

LZH develops underwater laser method to defuse explosive ordnance in the sea

Project UNLOWDET develops Laser-induced Low-Order Detonation to safely remove stray ordnance.

Together with project partners, researchers at Laser Center Hannover, Germany (LZH) are developing a process to defuse world war ammunition under water using a laser. Their goal: to affect the ecosystem as little as possible while saving time and costs.

In the North and Baltic Sea, an estimated approximately 1.6 million tons of war ammunition lie on the seabed. But the danger of their unforeseen detonation is not the only problem. Over time, the water causes the steel shell of the explosive ordnance to corrode, releasing the explosives into the sea – with significant environmental consequences for humans, animals and the entire ecosystem.

Removing explosive ordnance, however, is a challenge: blasting underwater is not only dangerous, it also creates significant pressure waves and affects the sea dwellers that live there. Furthermore, unreacted, environmentally harmful explosives can spread in the sea after detonation.

In the project UNLOWDET, scientists of the LZH are working on a solution together with the companies Laser on Demand and Eggers Kampfmittelbergung. Together they are researching how to defuse explosive ordnance underwater remotely controlled by a laser. Thereby, the impact of the blasting on the environment will be reduced.

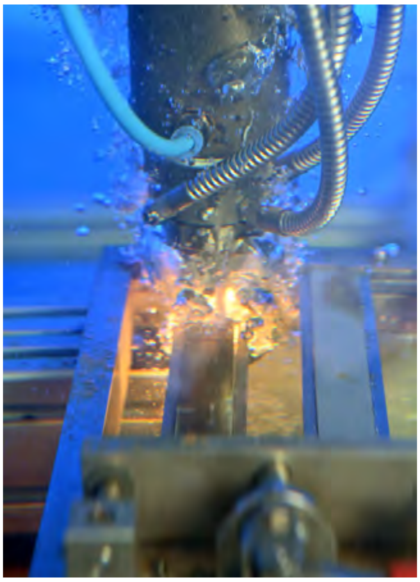

Photo: LZH.

With laser-induced detonation, explosive ordnance is to be defused more safely, efficiently and in a more "environmentally friendly" manner.

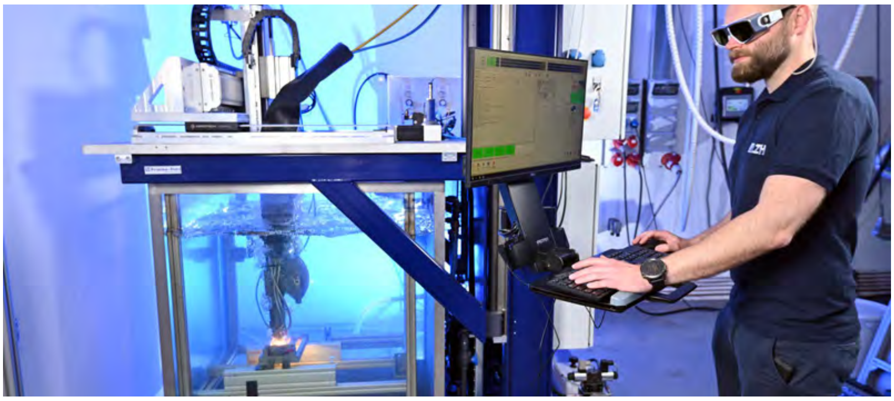

Photo: LZH.

LZH, together with project partners, is developing a process to defuse World War II ammunition under water using a laser.

Laser-induced detonation

For this, the project partners are following the approach of a so-called "Low-Order Detonation", in which, in contrast to a "High-Order Detonation", only a small part of the explosive is reacted.

In the first step, a laser beam is used to make a defined cut in the explosive ordnance, thus weakening the shell. In the second step, a Low-Order Detonation is then to be triggered with the laser beam, so that the detonator is removed and the ignition chain is interrupted. Since the system technology is to be positioned at the explosive ordnance with a diving robot, the process can be controlled from a safe distance.

This method makes the process of defusing not only safer but also significantly more efficient: For example, the time-consuming and cost-intensive application of bubble curtains, which are usually used for noise protection during blasting, can be dispensed with. At the same time, the risk of unreacted explosives spreading in the sea after detonation is minimized.

UNLOWDET making it quieter!

In the project UNLOWDET, the partners are developing a process for laser-induced underwater Low-Order Detonation for the efficient defusing of explosive ordnance in the sea. In addition to the LZH, Eggers Kampfmittelbergung, and Laser On Demand GmbH are involved.

LZH and partners previously developed a new method for defusing unexploded ordnance on land based on laser technology in the project DEFLAG (pictured, right).

Associated partners advising the project are the Hamburg Fire Department, the Lower Saxony State Office for Geoinformation and Land Surveying, the Bremen Police, the Schleswig-Holstein State Criminal Police Office, the State Office for Central Police Tasks and Technology, the GEOMAR Centre for Ocean Research Kiel and the Lower Saxony Ministry for the Environment, Energy, Building and Climate Protection.

The joint research project is funded by the German Federal Ministry for Economic Affairs and Climate Action under the funding code 03SX550B by the project coordinator Jülich.

https://optics.org/news/13/3/19

Photo: LZH.

LZH has already developed a new method for defusing unexploded ordnance on land based on laser technology in the project DEFLAG.

Q.ANT-led quantum optics consortium wins €50 million research funding...

...and europium is key to novel optical quantum processing approach by European group.

A consortium led by quantum start-up Q.ANT is set to receive €50 million in research funding. Approximately €42 million of this will come from the German Federal Ministry of Education and Research, while the consortium partners will contribute around €8 million.

The funding will be used to construct a demonstration and test system for quantum computer chips and other quantum computer components. This will enable the consortium to conduct research into algorithms and technologies for photonic quantum computing and prepare for industrial scale-up. Q.ANT, a subsidiary of Trumpf, recently proposed a method that could be used to fabricate extremely powerful quantum computer chips.

By creating highly specialized optical channels on silicon chips, this photonic chip process is able to transport, control and monitor quanta with virtually zero loss, even at room temperature. In future, say the developers, this will also enable the chips to be used in conventional mainframe computers.

"This funding is a clear indication of Germany's strength as a hotbed of innovation. We're on the cusp of the quantum computing era, and the global race to secure market share in this future technology has begun. The funds that have now been earmarked for this research alliance are a key enabler on the path toward building quantum computers in Germany," said Q.ANT CEO Michael Förtsch.

Known as PhoQuant for short, the research project will run for a total of five years. Q.ANT is in charge of the industrial side of the consortium, which also includes 14 other German companies, applied research institutions and universities.

Quantum chips – and jobs

Förtsch added, "If we want to achieve the goal of German-made quantum computer chips – plus all the jobs that would involve – we need to get top-class researchers and companies working together. The only way to harness Germany's expertise as a major player in the world of science and research and transform it into successful industrial products is by fostering close cooperation between businesses, universities and applied research institutions."

Silberhorn from Paderborn University.

The PhoQuant project is part of the framework program "Quantum technologies – from basic research to market", financed by the German Federal Ministry of Education and Research. A key organization participating in the project is the Jena-based Fraunhofer Institute for Applied Optics and Precision Engineering (IOF).

"Researchers in Jena are working on a number of developments within the scope of this project, including integrated

Credit: Q.ANT GmbH.

A Q.ANT employee holds up a wafer from which photonic chips are cut.

The project partners hope to present an initial prototype within two-and-a-half years, and they aim to produce a quantum computer chip that can perform large-scale calculations within five years at the latest.

"Over recent years and decades, we've carried out some of the world's most pioneering basic science work in this area of research. For the first time, this project gives us an opportunity to put the results of this work into practice through demonstration set-ups," said Prof. Christine

optical quantum light sources and low-loss integrated optical and fiber-optical interferometers as the basic building blocks of photonic quantum computers," said Prof. Andreas Tünnermann, director of Fraunhofer IOF.

"This requires expertise not only in quantum optics and photonics, but also in hybrid packaging and interconnection technology. We'll be injecting these skills into this highly dynamic project

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Q.ANT-led quantum optics consortium wins €50 million research funding

and working with all the participating companies and institutions to reach our common goal of creating a powerful photonic quantum computer."

Europium is key to novel optical quantum processing

In another quantum-photonics development, researchers from Karlsruhe Institute of Technology (KIT), Strasbourg University, Chimie ParisTech and the French research center CNRS have achieved what they call "major progress in the development of materials for processing quantum information with light." In Nature, they present a europium molecule with nuclear spins, by means of which an effective photon-spin interface can be produced.

"For practical applications, we have to be able to store, process, and distribute quantum states," commented Professor Mario Ruben, Head of the Molecular Quantum Materials Group of KIT's Institute for Quantum Materials and Technologies and of the European Center for Quantum Sciences at Strasbourg University.


Credit: Q.ANT GmbH.

Preparing a photonic chip for the next step in the process.

"We have now identified a promising novel type of material: A europium molecule containing nuclear spins. Europium belongs to the rare-earth metals," he added. The team of Professors Mario Ruben and David Hunger from the IQMT and Dr. Philippe Goldner from the École nationale supérieure de Chimie de Paris developed this innovative material.

The molecule is structured such that it exhibits luminescence in case of laser excitation. This means that it emits photons carrying the nuclear spin information. By means of specific laser experiments, an effective light/nuclear spin interface can be produced. The work covers the addressing of nuclear spin levels with the help of photons, coherent storage of photons, and the execution of first quantum operations.

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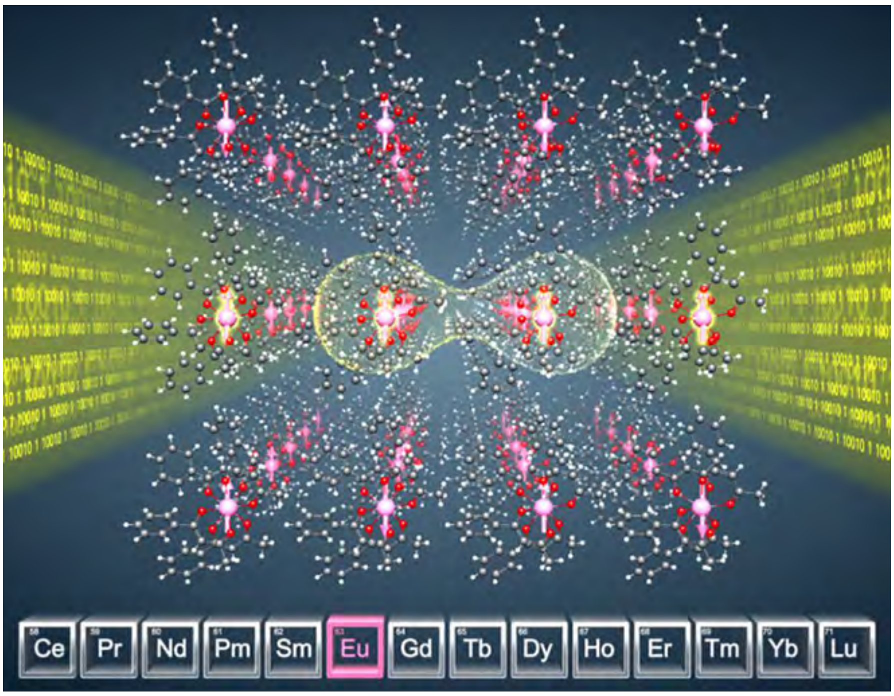

Graphic: Christian Grupe, KIT.

Photon-spin interface with the europium molecule crystal for entanglement of nuclear spin qubits (arrows) with the help of photons (yellow).

LLNL constructing high-power laser for new facility at SLAC

Advanced Photon Technologies program will develop powerful petawatt laser systems.

Lawrence Livermore National Laboratory's decades of experience in developing high-energy lasers is now being tapped to provide a key component of a major upgrade to the U.S. SLAC National Accelerator Laboratory's Linac Coherent Light Source, located at Stanford University, California.

Over the next several years, LLNL's Advanced Photon Technologies program is scheduled to design and construct one of the world's most powerful petawatt (quadrillion-watt) laser systems for installation in an upgraded Matter in Extreme Conditions (MEC) experimental facility at LCLS, funded by the Department of Energy's Office of Science-Fusion Energy Sciences program.

The new laser will pair with the LCLS X-ray free-electron laser to advance the understanding of high-energy density physics, plasma physics, fusion energy, laser-plasma interactions, astrophysics, planetary science and other physical phenomena.

The existing MEC facility uses optical lasers coupled to X-ray laser pulses from LCLS to probe the characteristics of matter at extreme temperatures and pressures. MEC experiments have produced groundbreaking science, such as the first observations of "diamond rain" under conditions thought to exist deep inside giant icy planets like Uranus and Neptune.

The MEC-Upgrade (MEC-U) is motivated in part by increasing calls for the U.S. to re-establish leadership in high-power laser technology, such as in the 2018 National Academies of Science, Engineering, and Medicine report, Opportunities in Intense Ultrafast Lasers: Reaching for The Brightest Light.

Partnership

SLAC is partnering with LLNL and the University of Rochester's Laboratory for Laser Energetics to design and construct the MEC-U facility in a new underground cavern. LLNL's rep-rated laser, able to fire at up to 10 Hz, and a high-energy kilojoule laser developed by LLE will feed into two new experimental areas containing a target chamber and a suite of dedicated diagnostics tailored for HED science.

Image by Matt Beardsley/SLAC.

Researchers work in the "MEC hutch" of SLAC's LCLS Far Experiment Hall. The MEC optical laser system creates extreme temperatures and pressures in materials and the LCLS X-ray laser beam captures the material's response.

The LCLS, part of SLAC's two-mile-long linear particle accelerator in Menlo Park, Calif., can deliver 120 X-ray pulses a second, each one lasting a few femtoseconds (quadrillionths of a second). A concurrent upgrade dubbed LCLS-IIwill deliver a million pulses a second in an almost continuous X-ray beam that, on average, will be 10,000 times brighter and will double the X-ray energy previously attainable.

"The new high-power lasers being designed by Livermore and Rochester are world-leading in their own right," said Alan Fry, the MEC-U project director. "Coupling them to LCLS dramatically increases their scientific utility and the combination will be an unprecedented capability."

"With the 10Hz petawatt laser that we're building, along with LLE's long-pulse compression laser and the upgraded LCLS capabilities, the LCLS and its MEC-U facility will become the U.S. flagship for high-repetition-rate, laser-driven HED experiments," said Vincent Tang, NIF & Photon Science program director for High Energy Density and Photon Systems.

"Marrying the latest and the best ultrafast laser technologies with the LCLS beamline at the MEC-U facility will give the United States a fundamentally new high-throughput HED capability for discovery science and national security research," Tang added. "We will be able to rapidly increase our understanding of plasmas and materials at extreme pressures and temperatures, while advancing our ability to operate HED technologies and systems at a repetition rate and scale relevant to important future applications like inertial fusion energy."

The National Nuclear Security Administration (NNSA) has also expressed interest in developing a high-energy long-pulse laser that could team with LCLS to support NNSA's core mission areas. Among the goals would be to improve scientists' ability to predict the performance of next-generation materials in extreme environments, understand how material aging affects material properties, and study the microphysics of inertial confinement fusion.

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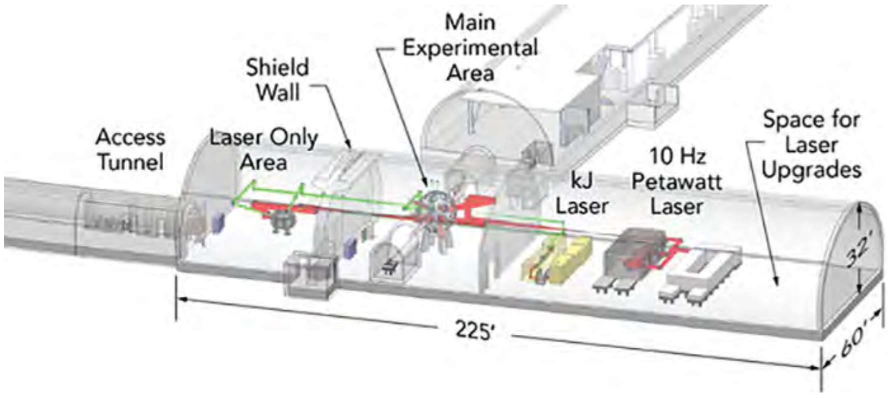
LLNL constructing high-power laser for new facility at SLAC

HAPLS supercharged

Tom Spinka, project manager and chief scientist for LLNL's RRL, said that it will be a simplified and more energetic version of the High-Repetition-Rate Advanced Petawatt Laser System (HAPLS), designed and developed by the APT Program from 2014 to 2018. HAPLS, the world's first all-diode-pumped petawatt laser, is now a key component of the European Union's Extreme Light Infrastructure Beamlines facility in the Czech Republic.

"The RRL will build on the groundbreaking work that was done on HAPLS," Spinka said. "It will pair the direct chirped-pulse amplification technique used in NIF's flashlamp-pumped neodymium-doped glass Advanced Radiographic Capability with the HAPLS diode-pumped glass pump laser technology in a refined architecture developed through LLNL's Laboratory Directed Research and Development program.



Images by Gilliss Dyer/SLAC.

Design for the new MEC-U cavern at the end of the LCLS XFEL. The facility will include space for LLE's kilojoule (kJ) laser, LLNL's 10-Hz rep-rated petawatt/long-pulse laser system, a main target chamber, and a multi-purpose second interaction site downstream of the main target chamber.

"This architecture, originally dubbed the Scalable High-power Advanced Radiographic Capability, or SHARC, eliminates the lossy second, titanium-doped sapphire, stage of the HAPLS laser system," Spinka said, "ultimately delivering about five times higher energy than HAPLS at the same peak power and repetition rate."

LLNL's RRL for the MEC-U facility will be developed in parallel with performance ramping of the HAPLS (now known as L3-HAPLS) laser at ELI-Beamlines to its full design specifications. It also will leverage additional advanced laser technologies being developed by APT, including a new high-energy Faraday rotator developed under a Cooperative Research and Development Agreement with Electro-Optics Technologies Inc.

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Fraunhofer ILT initiating strategic alliances with quantum partners

"EIN Quantum NRW" competence network to advance photonics-based quantum technologies.

On March 7, 2022, leading universities and research institutions in Germany's North Rhine-Westphalia (NRW) state government launched the competence network EIN Quantum NRW.

The network partners are pooling their expertise in researching and implementing quantum technologies to help players from industry and science network more effectively, and to create a broad knowledge infrastructure. Also involved is the Fraunhofer-Gesellschaft, which is focusing on technology transfer to industry.

Together with the Fraunhofer Institutes FHR (High Frequency Physics & Radar), IAIS (Intelligent Analysis & Information Systems), IMS (Microelectronics) and SCAI (Scientific Computing) located in NRW, Fraunhofer ILT (Laser Technology) and the Research Center Jülich are establishing a Center of Quantum Science and Engineering in the Rhineland region.

On an international level, the Fraunhofer-Gesellschaft and the Dutch research center QuTech – a collaboration of TU Delft and TNO – already joined forces in December 2021, signing a Memorandum of Understanding for cooperation in the field of quantum networks.

In the run-up to this cooperation, Fraunhofer ILT and QuTech developed a quantum frequency converter (QFC) with a world record for low noise – a significant step toward achieving a stable quantum internet. The partners said that "the overall QFC efficiency is comparable to that of converters based on conventional design principles".

With QuTech, Fraunhofer ILT is developing key components for the quantum internet. Pictured, here, is a laboratory prototype for a low-noise quantum frequency converter.

However, compared to the current state of the art in NV (nitrogen vacancy) center qubits, the number of noise photons is simultaneously reduced by at least a factor of four, resulting in a significantly increased signal-to-noise ratio for the transfer of quantum information.

This is a prerequisite for the rapid networking of quantum computers at different locations, especially via already installed fiber optic lines. Using this as a basis, Fraunhofer ILT in Aachen is planning to set up the first German quantum node in a transnational quantum network coordinated by QuTech, which includes the cities of Delft, Leiden, The Hague and Amsterdam.

Laser Technology Congress AKL´22

Results from quantum research, potentials of new quantum technologies and current approaches for industrial applications are the focus of the new expert forum "Quantum Technology & Photonics" at the upcoming AKL´22 – International Laser Technology Congress, hosted by Fraunhofer ILT in Aachen.

On Wednesday May 4, 2022, quantum technology experts and interested parties from industry and academia will gather at AKL´22 to explore current photonic developments in quantum computing, sensing, and communication with speakers from renowned institutions.

AKL ´22 is running from May 4 to 6, hosted by Fraunhofer ILT in Aachen, Germany.

https://optics.org/news/13/3/23

Fraunhofer, Trumpf team up on laser material deposition

Laser giant signs technology transfer deal with Aachen-based Fraunhofer Institute for Laser Technology.

The Fraunhofer Institute for Laser Technology (ILT) has signed a new cooperation agreement with the industrial laser giant Trumpf that aims to accelerate the transfer of laser material deposition (LMD) techniques into commercial use.

Scientists and engineers from the two German partners say that industry stands to benefit from a unique combination of world-leading laser system technology and several years of application-specific process know-how.

The hook-up aims to help customers improve the productivity of LMD, select the best materials for a given process, and increase the speed of the approach - with applications in automotive part production among those likely to benefit first.

Complementary expertise

Fraunhofer ILT's Thomas Schopphoven said: "Our core business is developing application-adapted processes and system technology components. The basis for this is our 30 years of experience in LMD - in applications we have developed for a wide variety of industries."

Schopphoven and his team are well known for their work in the LMD field, with their innovations in high-speed approaches winning various prizes and successfully implemented by industry.

"When we transfer our technologies to industrial applications, our customers are increasingly focusing on the questions of systems engineering implementation, especially with regard to the availability, stability and suitability of the components," Schopphoven added.

To complement that expertise, Trumpf will bring its experience and know-how in robust and reliable laser materials processing equipment.

Trumpf's industry manager Marco Göbel describes the latest agreement as a "win-win" for customers. "Thanks to the close cooperation with Fraunhofer ILT, we can offer solutions for the entire production chain from a single source," he said.

"By combining our system technology - optimized for industrial use - with processes adapted or specially developed for this purpose, we help customers all over the world benefit from these innovations."

Industrially relevant

Under the terms of the deal, Trumpf will provide the ILT team in Aachen with state-of-the-art laser systems featuring a variety of optical features and powder feed nozzles.

"In this way, we research our processes directly on industrially relevant systems," says Schopphoven. "This enables us to transfer our research into customer applications particularly efficiently."

The laser systems are set to be installed imminently, with initial test runs slated to begin during the spring. Promising applications that have been identified already include coating of brake discs and corrosion protection of hydraulic cylinders in cars.

According to the two partners, the LMD agreement represents just the latest cooperation in what is now a long-standing collaboration. "Plans are already underway to expand the cooperation between Trumpf and Fraunhofer ILT in other areas of laser materials processing," they stated.

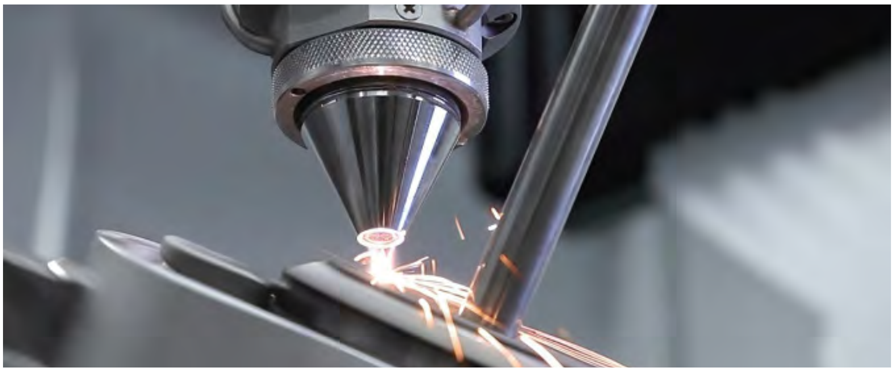

Photo: Trumpf.

Applications that stand to benefit from the cooperation on LMD include the production of brake discs and hydraulic cylinders in the automotive industry.

- Trumpf also reports that it has developed a technology that increases the speed and efficiency of sheet-metal cutting. Known as "BrightLine Speed", the new approach is said to offer particularly striking benefits for 3D cutting of hot-formed parts typically used to produce B-pillars and door frames in vehicle manufacturing.

According to the firm, the innovation increases cutting speed by up to 60 per cent for sheets up to four millimeters thick. Trumpf product manager Ralf Kohllöffel says that, at the same time, the technique consumes only half of the amount of cutting gas typically used to make each part.

"Our new cutting technology is faster and uses less gas – and that translates into tangible cost savings and a real boost in productivity for our customers," Kohllöffel said.

Critical to BrightLine Speed is a new, Trumpf-patented laser light cable (LLK) with an inner and outer fiber core. A TruDisk disk laser couples laser light into the LLK and distributes the laser power to both the inner and outer cores using a wedge switch.

"This allows users to adapt the laser power and beam profile more precisely and flexibly to the thickness of the sheet currently being processed," Trumpf said.

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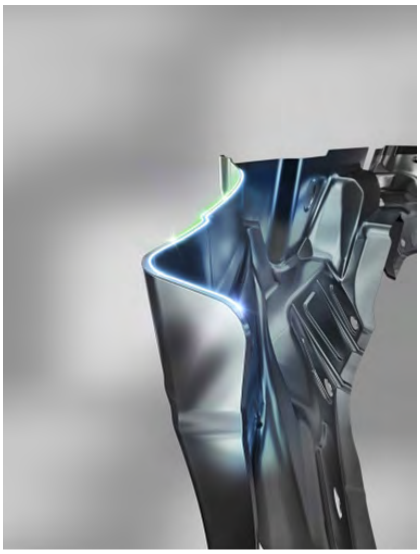

Image: Trumpf.

The new 'BrightLine Speed' approach to laser 3D cutting from Trumpf promises to speed the production of hot-formed parts for car production, while consuming less cutting gas than conventional laser processing.

€3 million Danish consortium PhotoQ to create photonic quantum computer...

...and Xanadu collaborating with GlobalFoundries to develop high-volume manufacturing of photonic chips for quantum computers.

Over the next four years, the newly-assembled PhotoQ consortium is aiming to create a photonic quantum computer. The group says it will develop a new platform based on "a different technology from the best current quantum processors – and will have the potential to beat them."

In March consortium partner NKT Photonics outlined the reasons behind the project on its website: "Today, even the largest supercomputers have problems handling the calculations and large amounts of data it takes to solve complex problems, such as advanced logistics and the development of medicine.

"Quantum computers may be the solution. However, today's quantum computers only give us a glimpse of what they are capable of and they are nowhere near reaching their full potential."

The PhotoQ project is intended to take the technology in a new direction and pave the way for scalable photonic quantum processors. The project will map how the photonic quantum computer can make a difference in the logistics and pharmaceutical industries. NKT states, "PhotoQ ensures an innovation leap towards the development of a quantum computer that can crush computational problems that classic computers have to spend years on – the so-called quantum advantage."

PhotoQ is also expected to secure Denmark a share of a rapidly growing global market, estimated to reach an annual turnover of €80 billion in 2040. In Denmark alone, it may lead to over 2000 new jobs, say the partners.

Professor Ulrik Lund Andersen, of DTU Fysik, commented, "In recent years, we have purposefully pursued an ambition to develop a photonic quantum processor and demonstrate the potential of the platform. We have come a long way, and PhotoQ lets us go from research to innovation and set the course for a universal error-corrected quantum computer."

Photo: Jonas Schou Neergaard-Niels.

Optical system: the foundation for the photonic quantum computer.

Scalable photonic quantum computers

PhotoQ is aiming to build a photonic quantum computer based on pioneering research from DTU. The platform has several significant strengths compared to the platforms that have driven the development so far. A photonic processor is significantly easier to scale than, for example, superconducting quantum processors as the latter require expensive and energy-intensive cryotechnology to keep their quantum bits stable.

NKT says that the ambitions of PhotoQ go beyond the quantum technological core innovation. In parallel with the hardware development, the consortium will develop algorithms that will solve known issues within pharma and logistics, such as molecular modeling and route optimization. The project will map and evaluate the applications and identify the problems where photonic quantum computers can offer the greatest possible technological improvements.

Lasse Jiborn, Commercial Director of Intelligent Optimisation at AMCS Group, said, "When we deliver route optimization to the logistics industry, we solve an extended traveling salesman problem – a 10-stop trip has over 3 million possible routes. It requires enormous computing power to identify the optimal route. PhotoQ is an ideal opportunity for us to investigate the benefits a quantum computer can bring to our company."

The consortium behind PhotoQ covers the entire value chain: expertise in logistics optimization from AMCS Group; quantum chemistry from Molecular Quantum Solutions; quantum algorithmic expertise from Aarhus University and Kvantify; laser technology from NKT Photonics, and development of photonic quantum computer hardware from the Technical University of Denmark. The Innovation

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€3 million Danish consortium PhotoQ to create photonic quantum computer

Fund Denmark has already invested close to €3 million in the project.

Xanadu announces collaboration with GlobalFoundries


Image courtesy of Xanadu.

Since 2016, Xanadu "has consistently doubled its qubit count."

Quantum computing firm Xanadu has announced a collaboration with semiconductor contract manufacturing and design company GlobalFoundries "to take the first steps toward high-volume manufacturing of photonic chips for universal and fault-tolerant quantum computers."

Taking advantage of the sophistication and feature set offered by GF Fotonix, Xanadu says it is now designing integrated photonic devices, used for implementing quantum error correction, for 300mm wafer fabrication. The partners say that the first fully functional devices will be ready by the end of 2023.

Xanadu's architecture implements error correction on silicon photonic chips that operate fully at room temperature, using photodetector technology borrowed from the optical telecommunications and lidar industries. This makes Xanadu's approach compatible with existing silicon photonics manufacturing capabilities such as those developed by GF.

GF Fotonix is a monolithic platform, which combines its differentiated 300mm photonics features and 300GHz-class RF-CMOS on a silicon wafer. "GF Fotonix moves data optically using processes that combine efficient CMOS manufacturing with the capabilities of silicon photonics," said Anthony Yu, the company's VP Computing and Wired Infrastructure.

"Many chips, operating in parallel and networked together, are required to process the large number of qubits involved in fault-tolerant quantum computing algorithms," said Zachary Vernon, Head of Hardware at Xanadu. "Leveraging an existing advanced 300mm platform like GF Fotonix gives us a huge advantage in the race to deliver a useful, error-corrected quantum computer."

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