NEWSLETTER

Issue 9, February 2018

Around the members

- Sofia University, Bulgaria
- Institute of Physics of the Academy of Sciences, Czech Republic
- EPFL, Switzerland
- University of the Aegean, Greece

In focus:

Extreme Light Infrastructure Attosecond Light Pulse Source (ELI-ALPS), Szeged, Hungary

The interview:

David Bereczkei, Project Management Coordinator, ELI-ALPS

HEPTech upcoming events

Sofia University receives funding for 3 Centres of Excellence

Three Centres of Excellence (CoE) are going to be established at Sofia University in the next years. The University is the leading organization in two of them and a partner in the third one.

The scientific domains of the future CoEs are (i) Informatics, Information and Communication Technologies, (ii) New Technologies in Creative and Re-creative Industries and (iii) Mechatronics and Clean Technologies.

The funding is provided by the European Regional Development Fund and European Social Fund through the Operational Programme “Science and Education for Smart Growth 2014–2020”. The first two projects will receive about 15 M€ each and the third one – about 35 M€. The funding is intended both for infrastructure and equipment, and for research and education.

The OP "Science and Education for Smart Growth" has two overall goals: strengthening research and innovation and enhancing education and social inclusion at all educational levels. It will invest over €243 million in developing centres of excellence and centres of competence, as hubs of high-quality research and innovation in the areas defined in the Research and Innovation Strategy for Smart Specialisation. Moreover, funding is allocated to research infrastructure of regional and national significance, as well as to support the specialisation of researchers and their involvement in the European Research Area. Over the funding period, the Programme is expected to create 11 new centres of excellence and competence, support 20 regional laboratories and pilot centres and involve over 1 500 researchers in various activities.

Innovative technique enhances proton therapy effectiveness

Use of proton-boron nuclear fusion to enhance proton therapy effectiveness in the cancer cell killing rate has been demonstrated experimentally as a result of a scientific collaboration among researchers coming from Laboratori Nazionali del Sud in Catania, ELI-Beamlines in Prague, Department of Physics of University of Naples Federico II and Fondazione Bruno Kessler in Trento. The experimental research, carried out in Catania is a result of two years of intensive experimental activity based on trials with various cell lines.

The experimental technique named PBCT (Proton Boron Capture Therapy) uses molecules containing ^{11}B nuclei which can potentially be administered onto a deep-seated tumor and then bombarded with a proton beam typically used in hadron therapy. As a consequence of the interaction of one proton with one ^{11}B nucleus, three alpha-particles with low energy (around 4 MeV) are generated and ultimately stopped inside the tumor, thus releasing their entire energy in a single cancer cell. The macroscopic effect is enhanced biological damage compared to that caused only by the incoming protons.

The innovative PBCT enhances the radiobiological effectiveness of proton therapy while at the same time keeping its unique ballistic properties, thus paving the way towards treatment of radio resistant tumors, such as glioma or pancreas tumors.

More information

Tumor treatment room in Catania (Photo: G. Agnello)

ELI-Beamlines is heading for an interdisciplinary Centre of Excellence

The European Development Fund and the Czech Ministry of Education, Youth and Sports have awarded cca. 250 million CZK to the ELIBIO project at the new ELI Beamlines laser facility of the Institute of Physics of the Czech Academy of Sciences. The ELIBIO project explores new frontiers in light and optics to create breakthrough science in biology, chemistry, and physics. The project will bring world-leaders in photon science and structural biology to the Czech Republic.

An essential goal of the project is to understand photon-material interactions in extremely intense X-ray fields where new physics can be expected. The experiments will explore fundamental questions in the physics of photoemission and electron dynamics in the relativistic regime with X-rays. The new knowledge in studies on structure, function and dynamics in cells, organelles, and biomolecules will be used to perform experiments that were impossible so far. We will develop new methods and technologies to enable such measurements and answer key questions in health and disease.

One of the aims of the ELIBIO project is to establish an Interdisciplinary Centre of Excellence at the European Extreme Light Infrastructure, under construction in Dolní Břežany near Prague. The new centre combines biology, chemistry and physics, and will exploit some of the most powerful photon beams in the world from the immense lasers of the ELI-Beamlines facility. The ELIBIO team will use these beams to perform breakthrough studies in life sciences.

The international team of ELIBIO creates an interface between two complementary research centers of the Czech Academy of Sciences: the ELI-Beamlines facility near Prague, and the Institute of Biotechnology (IBT) of the BIOCEV Centre nearby. IBT is focused on biomedical and biotechnological research while the Institute of Physics and its ELI-Beamlines facility is a leader in photon physics with high-power lasers.

The ELIBIO project that will run for an initial duration of nearly 6 years, will be embedded into an international framework of research infrastructures, including the European XFEL and the Linac Coherent Light Source at Stanford (California, USA).

More information

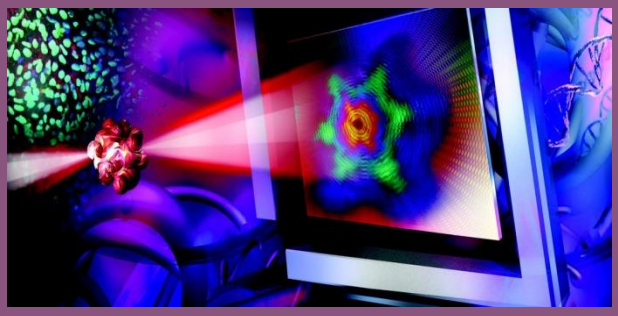

Photo: ELI-Beamlines

Smart buildings manage our electricity needs

Researchers at EPFL have developed a system that can be installed in a building to collect data on people's energy usage. The aim is then to send this data directly to a smart electric grid that will allocate resources optimally. The grid decides how best to distribute energy based on availability, cost and customers' needs – that's the energy concept being developed by researchers in the School of Engineering's Electronics Laboratory. They have designed a system capable of collecting data on people's energy usage and comfort within buildings. By gathering data sent from connected devices – like smartphones and the sensors in electronic appliances – the system can obtain an overall picture of a building's electricity needs over time and by room. This data then can be passed on to a smart grid in order to anticipate energy needs and decide how best to allocate available resources.

Buildings already have systems that can collect data from certain devices. But these interfaces all work separately to enhance the user's comfort or save energy in different ways. The new interface will be able to combine all these data and thus cover various energy needs. It uses an open source computer code and ensures the best possible data protection.

According to the researchers, the smart grid will ensure that users get a top-notch service. This involves managing energy peaks and volatility in renewable energy output while at the same time keeping costs down and ensuring a constant level of comfort.

More information

Photo: iStock

"Aegean Startups" leads entrepreneurship efforts in the Greek islands

"Aegean Startups" is an academic initiative which motivates and supports potential young entrepreneurs to start new ventures in the islands of the Aegean sea. It is focused on tackling youth unemployment and increasing market growth in the Aegean islands.

"Aegean Startups" competition aims at potential young entrepreneurs - both within the students' and young citizens' communities, with ideas that leverage on the offerings of the University of the Aegean and target local and international markets. Since January, the competition accepts new submissions and is expected to be completed by July 2018. Submitted business plans may fall into one of the following categories:

- Agricultural Growth/Nutrition/Health/Education
- Shipping/Commerce/Transport
- Tourism/Culture/Environment
- Information Technology/Telecommunications/ Governance/Social Entrepreneurship

Distinguished proposals can expect financial prizes and extensive support not only by the University of the Aegean but also by collaborating organizations from Greece and abroad. UC Berkeley, TU Delft, Orange Grove, Microsoft Innovation Centre, ACE-in, in4Capital are among the organisations with a strong collaboration with "Aegean Startups" on entrepreneurship methods and tools. More than 50 successful business executives support the organisation as mentors and coaches, while several business chambers and enterprises based in the Aegean islands contribute with business needs and market-oriented ideas. More www.aegean-startups.gr

Photo UAegean: "Aegean Startups" teams at the Orange Grove Incubator in Athens

IN FOCUS

ELI-ALPS: A unique research infrastructure becomes operational

The first three laser systems - the mid-infrared, the Terahertz and the high repetition rate lasers have been installed at the ELI-ALPS research institute in Szeged, Hungary, thus turning it into an operational research infrastructure.

The mid-infrared laser has been developed in a joint project led by Fastlite, with the participation of ELI-ALPS experts, for approximately 1,6M€. It is a special new device for physicists, chemists, biologists and biophysicists. Due to the scaling laws of nature, mid-infrared lasers, as drivers of secondary radiation sources, permit the generation of coherent short wavelength radiation pulses reaching the so called “water window” spectral range. This is the soft X-ray region in which water is transparent and thus the investigation of biological samples becomes possible in this part of the electromagnetic spectrum.

The high repetition rate laser has been developed by a consortium of the University of Jena, the Fraunhofer Insitute and the Active Fiber Systems GmbH for approximately 3M€. The high repetition rate laser is unique in terms of its architecture and design. This is the very first research grade short pulse laser based on a well-established diode and fiber laser technologies, combining it with the advanced methods of pulse shortening and phase stabilization. The result is a robust, yet tabletop laser system providing two optical cycle pulses at 100kHz repetition rate with a 24h long shot-to-shot stability.

The research and development tender for the design, implementation and start-up of the Terahertz source was won by the University of Pécs in Hungary for 2,74M€.

Photo: ELI-ALPS

This system surpasses the current ones not only in peak power by a factor of 3-5 but also in operational stability.

The total amount of the implementation phase is 231,4 million €, 85% of which is provided by the EU Regional Development Fund.

In the beginning of 2018, research teams from Switzerland and Greece (ETH Zürich and FORTH, respectively) started the first “commissioning” experiments on lasers, in collaboration with a local team of researches and engineers.

The main objective of ELI-ALPS project is to create a unique European research center, providing the international research community with laser pulses and further sources based on them. The Szeged facility is expected to lead to outstanding results not only in the field of ultrafast physical processes but also in biological, medical and materials sciences.

After its inauguration in May 2017, the ELI-ALPS facility has been the venue of many remarkable scientific events. In 2018, it will host the ELI Summer School as well as the annual HEPTech Symposium for early-stage researchers, among many other events.

General information on ALPS

- Laser based photon and particle sources - from THz to X-ray
- ELI-ALPS offers more than just the use of the novel class, state-of-the-art laser systems. The unique combination of the outstanding laser pulses with the pioneering secondary sources technologies will open up new opportunities in experimental research.
- The peak power and repetition rate of few cycle phase stabilized lasers systems are ranging from fraction of TW to multi-PW, and 100 kHz to 10 Hz, respectively.
- High-energy extreme ultraviolet photons (10 eV - 10 keV) will be generated via high-harmonic processes in gases and on solids, leading to single pulses with a pulse duration as short as tens of attoseconds.
- X-rays (100 keV) will result from a dedicated relativistic laser-electron Thomson scattering source (available after intensive development phase following 2020).
- THz pulses with even mJ energy are generated via optical rectification in nonlinear crystals.

Main research fields and applications at ELI-ALPS

- Development and parameterisation of attosecond light sources

The ELI-ALPS lasers will generate unique attosecond pulses and pulse trains in the VUV and X-ray spectral regions. Generation, measurement and characterisation of the extreme pulses is non-trivial and will require development of new technologies, optical devices and measurement techniques.

- Biological imaging technologies

High-definition nanometre (10-9 m) imaging of functional biological materials in a biological environment is essential to understanding the connection between structure and function in these materials.

- Medical applications

Energetic ions, generated from secondary sources, will facilitate radiobiological research and contribute to the advancement of cancer therapy.

- Energy research: from solar cells to artificial photosynthesis

Researchers at ELI-ALPS (Photo: ELI-ALPS)

Time-resolved real-time imaging of chemical changes, reaction pathways and kinetics of advanced solar cells and batteries materials and processes will be possible at ELI-ALPS. These time-based processes will have atomic resolution.

- High peak power photonics

ELI-ALPS will have a laboratory environment for development of high-power short-pulse laser systems for industrial partners.

Beyond attoscience, the laser sources of ELI-ALPS would also provide regional and national, basic and applied science projects with experimental opportunities in radiobiology, biophotonics, plasma and particle physics.

THE INTERVIEW

David Bereczkei

Project management coordinator

David, the ELI-ALPS research infrastructure is already operational. What happens next?

ELI-ALPS had its Grand Scientific Opening in November 2017, celebrating the first operational laser equipment. The site acceptance tests, delivery and assembly of all laser equipment on site are an ongoing process. The end of the implementation phase project is nearing to its end; soon the facility will become fully operational. In the meantime, according to the current schedule, the ELI ERIC (European Research Infrastructure Consortium) will be born by the next year. The management of the three ELI pillars as well as the other members of the ELI Delivery Consortium have prepared the necessary documents (Statute, Technical and Scientific Description of the project) to be submitted to the European Commission. The so called Step 1 application was submitted in December 2016, the Commission reacted positively and the members of the Delivery Consortium are preparing for the Step 2 phase. Once the internal process of the Commission is completed, the formal decision will be published in the Official Journal of the European Union.

Do you have already any specific knowledge/technology transfer objectives or challenges?

The preparation of the ELI Science Park has started - by the early 2020's a dedicated science park will host companies and university faculties next to the ELI-ALPS facility.

The feasibility study allows 5% of the beam-time to be purchased by companies for industrial use. A special regulation applies for these companies in the ELI access policy.

A Technology Transfer team has already been established at ALPS to prepare for the operational phase of the facility. It will be working towards achieving some figures concerning the number of international patent applications expected. Our main challenge is that ELI-HU Nonprofit Ltd (the company responsible for the implementation of the ELI-ALPS project) was established in 2010 without any institutional background, for the sole purpose of implementing the ALPS project, which means that in the field of technology transfer we are learning by doing, with the help of international best practice, where we should mention at first the HEPTech Network.

ELI-ALPS is hosting the HEPTech Symposium 2018 dedicated to early-stage researchers with entrepreneurial potential. Why should they attend it?

Attending the 5th HEPTech Symposium in Szeged is a unique opportunity for young researchers to receive first-hand experience on handling IP rights, commercialization of research results and responsible research and innovation. They will enjoy an exclusive tour of the world-class facility of ELI-ALPS and will be informed about the state-of –the-art equipment of the Hungarian and the other two pillars of ELI, while also enjoying the vibrant life of the university town of Szeged that is dubbed the city of sunshine in Hungary.

HEPTech upcoming events

- Steering Committee, 12th March 2018, at CERN, with VideoConference
- Academia-Industry Matching Event on the Mutual Impact of Industry 4.0 and High-Energy Physics, 15th – 16th March 2018, High Tatras, Slovakia
- HEPTech Leadership Training, 3rd – 4th May 2018, Abingdon, UK
- Steering Committee, 8th May 2018, at CERN, with VideoConference
- Large Laser Facilities for R&D in Industry, 24th – 25th May 2018, Prague
- HEPTech Symposium, 11-15 June 2018, ELI-ALPS, Szeget, Hungary
- Board Meeting, 19th June 2018, at CERN, with VideoConference
- Steering Committee, 17th October 2018, at CERN, with VideoConference
- Steering Committee, 21st November 2018, at CERN, with VideoConference
- Board Meeting, 7th December 2018, at CERN, with VideoConference