ICUIL News

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Chief Editor: Christine Labaune

ICUIL

The International Committee on Ultra-High Intensity Lasers

Greetings from the ICUIL Chair, T. Tajima

Fakulty of Physics, Ludwig Maximilian University Munich, D-85748 Garching

Belated season's greetings !

We at the International Committee for Ultra Intense Lasers (ICUIL) have been eager to put together a newsletter to communicate what is new at ICUIL and the scientific activities associated with the ICUIL mission. We also wanted to communicate with members of this community and related broader communities world-wide and to make closer touch on the latest developments. We have managed to do so through our HP (www.icuil.org), our Report to IUPAP (International Union of Pure and Applied Physics, our parent organization) and its publication/HP, and our Committee's General Assembly and ICUIL Conference (each of these takes place the every other year around the globe). However, we admit that these are not sufficient to make deeper and broader contact with you we wish. Here, in order to bridge this gap, we manage to put together a first Newsletter of ICUIL. It is our plan that every year we publish one such newsletter, hopefully collecting from you all's news and advices. If we get sufficient amount of daily contacts and communications, we might increase the periodicity of publications. We very much welcome your contact with us and sending us as much news as possible throughout the globe in the advancement of ultra intense lasers and their applications. I would love to hear your inputs!

To begin with, may I ask for your suggestion of your entry of newsletter's title and also possibly a logo for the newsletter (if we do not, we have to use the usual ICUIL logo or possibly use the front drawing of this issue)? (I can attach one candidate as your reference. In fact, you can alternatively send us your approval or disproval of this candidate logo). Please send your entry of these to me (toshiki.tajima@physik.uni-muenchen.de) or Editor Prof. Christine Labaune (christine.labaune@polytechnique.fr). We will announce the winner of these.

The last year's General Assembly took place at Arcachon, France, in September, 2009. We have reviewed our liaison activity on laser acceleration between ICUIL and our senior sister organization ICFA (International Committee for Future Accelerators) among other topics. We were excited that both ICUIL and ICFA agree to form a joint task force to closely study what and how to achieve a joint goal of a future laser accelerator in high energies. This year also witnessed the decision by the Steering Committee of ELI (Extreme Light Infrastructure) to award the sites to Czech, Hungary and Rumania. More details should appear in this Newsletter. Many new ultra intense laser developments have commenced or been finished around the world. In addition to such regions and/or countries like Europe, American, and Japan, now we see many labs in China, India and elsewhere are joining us. Again detailed are in the below Newsletter. Also this Newsletter will be cross-referenced to PMRC Newsletter (from Kizu, Japan).

This year we plan to have the fourth ICUIL Conference at the finger lake area of upstate New York. Information is available on this Conference in this Newsletter below. We heartily welcome your participation in this event next year.

Finally, we belatedly wish you a happiest new year and more umph from your ultra intense laser this year!

2010 ICUIL Conference - September 26 – October 1, 2010 | Watkins Glen, New York

As sponsors for the 2010 ICUIL Conference, the University of Rochester's Laboratory for Laser Energetics welcomes your participation at this biennial event. The technical program will include approximately 60 oral and 45 poster presentations for attendees from all around the world. Session topics will include the following aspects of ultra-high intensity lasers:

- Ultra-high intensity laser design and performance
- Emerging applications of ultra-intense lasers
- Grating compressor developments
- Temporal and spatial pulse control and characterization
- Lasers for accelerator physics
- High-average power, ultra-intense, lasers

Abstract Submission Deadline - April 16, 2010
Early Registration Deadline - May 15, 2010
Hotel Reservation Deadline - June 26, 2010

2009 Annual Report to IUPAP*

Over the past year, the ultra-intense laser community continued to progress as evidenced by a growing number of scientific and technological applications, by the wide participation in a design study for a facility approaching the exawatt power level and by the progress of laser fusion projects involving radiographic backlighting and fast ignition. Several highly visible projects demonstrate the vitality of the high-intensity field. In addition, over the last several months, ICUIL leadership spoke with the ICFA General Assembly and their leadership to jointly pursue collaborative study and development of laser acceleration, which involves both the future laser source development and the appropriate laser acceleration science and technology. Furthermore, the high intensity laser field continues to grow with rapid expansion in Asia where a new network for research training of students and post-doctorate staff exists today.

The main International Ultra Intense Laser Initiatives are the following:

- Promoting expanded infrastructure in Europe, Asia, Africa, and the Americas
- Establishing a path beyond laser-matter interaction in the relativistic regime towards ultra-relativistic sciences
- Initiation of collaboration between ICUIL and ICFA on laser acceleration

ICUIL and ICFA agreed to form a joint "Task Force" to promote and encourage international collaboration between the accelerator and laser communities on future applications of laser acceleration. The first joint workshop will be held in April 8-10, 2010 at GSI Darmstadt.

Several high intensity laser projects within the USA, OMEGA EP at LLE, NIF ARC and Titan at LLNL, the Z-PW at SNL and Trident at LANL, have advanced over the last year and, collectively, will define a new age of advance experimental facilities.

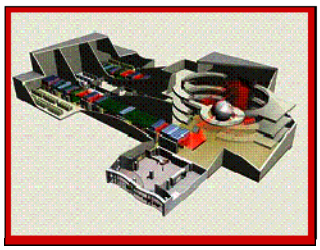
Europe's commitment towards ultra-high intensity physics and laser fusion is exemplified in the LASER-LAB EUROPE initiative, which is a consortium of 17 laser infrastructures from 9 European countries forming an integrated infrastructure. High Power Laser Energy Research (HiPER), a civilian laser fusion research project and Extreme Light Infrastructure (ELI, see p.8), an exawatt laser facility, are both on the European roadmap for large facilities and continue to be funded and includes partners from Europe, Asia, and North America.

The Asian Intense Laser Network (see p.4) has emerged strongly as an organization established for the promotion of collaboration in the areas of intense laser science and technology.

The National Laser Centre (NLC) in Pretoria (see p.6), South Africa, founded in 1999, performs applied research and development within the Council for Scientific and Industrial Research, Department of Science and Technology. Recently, NLC started a femtosecond laser project in close cooperation with the Laser Research Institute (LRI) at the University of Stellenbosch.

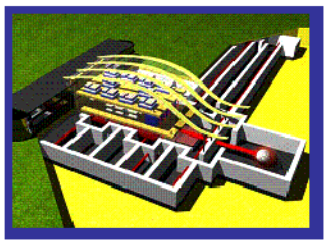
The International Committee on Ultra-High Intensity Lasers (ICUIL) is an organization actively concerned with the growth and vitality of the whole international field of ultra-high intensity laser science, technology and education. The ICUIL organization has been advanced with ICUIL member rotation, charter revision, ICUIL website and corporate funding. ICUIL biennal conferences and workshops are organized.

HiPER



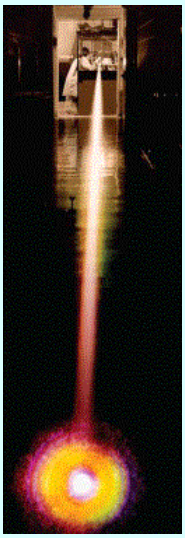
High Power laser Energy Research

ELI



Extreme Light Infrastructure

* International Union of Pure and Applied Physics



2010 : The 50 Years of the Laser in the City of Light

A very special event is organized by the Extreme Light Institute for the 50th anniversary of the laser.

A symposium under the chairmanship of Professor C. H. Townes will be held in Paris and in Palaiseau on June 22 and 23.

In the plenary sessions, C. H. Townes and other laser pioneers will recount the history of the laser and describe early research activities. This will be followed by presentations by several Nobel Prize winners and other notables in laser physics. They will describe the evolution of the laser and its scientific and societal applications.

On June 23rd, a pedagogic day, including special sessions, demonstrations and question and answer session, will take place in Palaiseau.

Paris / Palais du Louvre / 22nd June 2010
Palaiseau / Ecole Polytechnique / 23rd June 2010

http://www.laser50paris.com

NIF* Dedication day

Funded by the U.S. Department of Energy's National Nuclear Security Administration, construction of NIF began in 1997 and was officially dedicated on May 29, 2010, marking the beginning of a new era in scientific research. NIF is the world's largest and highest-energy laser. The Laser Megajoule (LMJ), which is essentially a twin to NIF, is being built near Bordeaux in southwest France and should be completed soon.

Last summer, NIF has begun experiments that focus the energy of 192 giant laser beams on a BB-sized target filled with hydrogen fuel. NIF's goal is to fuse the hydrogen atoms' nuclei and produce net energy gain. It will also explore High Energy Density physics.

To mark the dedication of the National Ignition Facility (NIF), a symposium, "ICF: Lasers, Fusion, Applications – Past, Present and Future," looked at the evolution of lasers and ICF research at Lawrence Livermore and other laboratories in the United States and overseas and highlighted the contributions of national and international collaborators for the past 50 years.

*National Ignition Facility

IFSA*2009 Conference

The IFSA conference brings together scientists once every two years in the fields of inertial fusion sciences, high energy density physics, and related applications. In 2009, the IFSA conference in San Francisco was a big success with 521 attendees representing 21 countries

Significant advances have been presented in high energy density science, with dramatic technical achievements using lasers, Z-pinch and particle beam systems, including research results in fast ignition, central hot spot ignition, equations of state, warm dense matter, particle acceleration and laser-plasma interactions. Ignition and subsequent high gain target experiments have become realistic near-term goals with the construction of two large-scale national projects, the National Ignition Facility (NIF) in the U.S.A., completed in March 2009, and the Laser Megajoule in France, to be completed soon.

The scheme of fast ignition and the development of high-intensity lasers have opened a new field of relativistic laser-plasma interactions. The extreme states achieved in this field will advance contributions to science and industrial applications such as high-intensity x-ray applications, material processing, novel accelerators and laboratory astrophysics.

*Inertial Fusion Sciences and Applications

The 890TW/29fs laser system at SIOM

This system is based on chirped pulse amplification (CPA) scheme, with a peak power of 890TW and a pulse duration of 29fs. It consists of a Ti:sapphire oscillator, a pulse stretcher, four stages of amplifiers and a four-grating pulse compressor.

Final amplifier and pump laser

See X. Liang et al., Opt. Express 15, 15335 (2007) for details.

LEI 2009 Conference

The first international conference of the Extreme Light Infrastructure (ELI) project, the LEI2009 - Light at Extreme Intensities conference, took place in Brasov, Romania from 16 to 21st of October. Around 180 scientists from the European Union, Russia, Korea, China, India and the USA attended the conference dedicated to explore the perspectives and future experiments of the Extreme Light Infrastructure.

The main topics, concerning lasers, secondary sources of particles, X-rays, attosecond science and high-field physics, were discussed and presented in plenary talks or during poster sessions. Three young scientists were awarded an ELI prize for their special research in a field related to ELI's activity: S. Banerjee from STFC (UK) for a breakthrough in diode-pumped scheme enabling kJ-class pumping, S. Martins from IST (Portugal) for laser-plasma simulations scaling to ELI intensities and Zs. Major from MPQ (Germany) for the progress in the Petawatt Field Synthesizer. The conference included a social program with visits to the Peles and Pelisor royal Castles in Sinaia and the Dracula Castle in Bran. The conference proceedings will be published by the American Institute of Physics (AIP).

PHELIX in GSI

End of 2009 the PHELIX "Petawatt High-Energy Laser for Heavy-Ion Experiments" recorded shot 1000 on it's internal log sheet. The speciality of PHELIX is the possibility to perform combined experiments with synchronized laser and heavy-ion pulses, which was first utilized in May 2008.

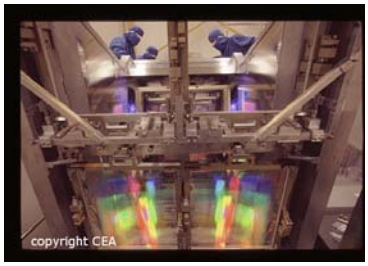
Shot director Sabine Kunzer and Dr. Udo Eisenbarth preparing for shot 1000 on the PHELIX log (Photo G. Otto, GSI).

The laser, being part of Laserlab Europe has been delivering ns-pulses in the kilojoule range and compressed pulses at below 500 ps duration close to 0.5 Petawatt peak power to the plasma physics community since the end of 2007.

PETAL, the Petawatt Laser in Aquitaine

The PETAL laser facility is a high-energy multi-petawatt laser, which will be able to deliver pulses of up to 3.5 kJ energy with a duration of 0.5 to 5 ps. This petawatt laser is being built along the LIL facility (the prototype of the LMJ).

The expected long pulse energy beams (~30 kJ) combined with high intensity beams (~3 kJ) will allow to perform integrated experiments in the context of fast ignitor at intermediate scale and to explore new branches of physics in the High Energy Density Physics regime relevant in many extreme astrophysical and laboratory scenarios.

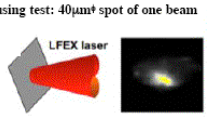


Nowadays, the promising results of the NIF in Livermore, the developments at OMEGA-EP in Rochester and Firex in Osaka, and the common strategy inside the european program HiPER, led the french community to consider the direct coupling of the PETAL with the LMJ at the horizon of 2014.

The ongoing reflexions by the French Institut for Lasers and Plasmas (ILP) as well as the international Science Advisory Committee for PETAL will determine the opportunity of this coupling.

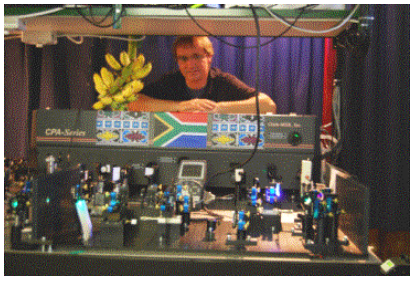
The LFEX laser

A new laser facility, LFEX, Laser for First Ignition EXperiment, which has 10PW/10kJ has been completed in Osaka University on March of 2009. The final adjustment is now being made to obtain the specification. This facility will be used for high energy density sciences such as laser fusion, particle acceleration and laboratory astrophysics.



The Laser Research Institute
at the University of Stellenbosch

The Laser Research Institute is positioned within the Physics Department of the University of Stellenbosch in South Africa. Our research focuses on high-power fibre laser and gas laser development and high resolution VUV spectroscopy, as well as ultrafast physics and chemistry, where we apply conventional femtosecond laser techniques and ultrafast electron diffraction to investigate ultrafast structural dynamics.



Dr. Heinrich Schwoerer

We benefit from scientific cooperations with the National Laser Centre, the African Laser Centre and partners in Africa, Europe and Northern America.

Together with the Department of Science and Technology we are preparing the Photonics Initiative of South Africa PISA, whose initial flagship project was an interdisiplinary South African high intensity laser facility.

Extreme Light III (XL-III)

The Extreme Light III(XL-III) was established in Institute of Physics (IoP), Chinese Academy of Sciences, Beijing, China in 2005. This Ti:sapphire laser facility was designed with top-able configuration and can output peak power to 350TW with pulse duration of 30fs per 20 minutes. With further upgrade works by using OPCPA as front stage amplifier and optimized multipass amplifiers in recent, now the facility is able to delivery laser pulse to 750TW, contrast ratio about 10-8, central wavelength at 810nm, focused laser intensity up to 1021W/cm2. Upper: 527nm Nd:glass pump laser and 750TW Ti:sapphire facility. Bottom: Laser target chamber and diagnostic system.

The IoP group also set up a sub-5fs laser platform for High order Harmonic Generation and Attosecond Science. It can output CEP controlled laser pulse with pulse duration of 4.4fs, energy of 0.6mJ at 1kHz repetition rate.

Network Activities on High Field and Photon Science in Asia and in Japan

Yoshiaki Kato and R. Kodama

The Asian Intense Laser Network has been active since 2004 in organizing conferences, workshops and summer schools in Asia. In Japan, the MEXT Photon Frontier Network Program has been started in 2008 to promote research and foster young researchers in photon science.

The **Asian Intense Laser Network** (AILN, http://apri.gist.ac.kr/ailn/) was established in 2004 in order to promote scientific exchanges and collaboration among the scientists and young researchers in Asia. Under organization of AILN, the Asian Symposium on Intense Laser Science (ASILS), Asian Summer School on Laser Plasma Acceleration and Radiation, Asian Workshop on Generation and Applications of High Order Harmonics have bben held.

Photon Frontier Network (PFN)

A new 10-years program "Photon Frontier Network" has been started in 2008 by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan. This Program is intended to explore frontier of photon science and technology, to foster young researchers, and to enhance collaboration with industry.

The PFN is intended to (1) provide advanced facilities to general users, (2) develop advanced light sources, and (3) foster young researchers. This program

is coordinated by Y. Kato as the Program Director (PD) and Y. Sano, S. Yagi and T. Yabuzaki as the Program Officers (PO). The Photon Frontier Network is composed of two research consortia; "Advanced Photon Science Alliance (**APSA**)" located in Kanto District and "Consortium for Photon Science and Technology (**C-PhoST**)" located in Kansai District.

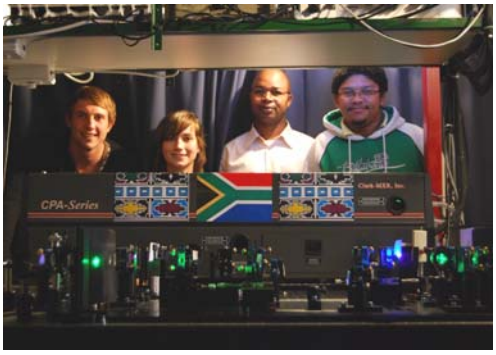
The major research plan at APSA is based on collaboration between the specialists in the optical frequency standard research and the attosecond science research, through control of frequency and phase of the optical waves. Also planned is the development of fiber lasers and ceramic lasers with high power and in UV regions by collaboration between the material science and the laser science researchers.

The C-PhoST is based on the collaboration between the specialists in high power lasers and semiconductor lasers. A high quality laser system QUADRA will be developed, where LD-pumped high average power Yb ceramic laser will pump OPCPA to generate ultrashort duration, high rep rate, high peak power laser. QUADRA will be used to generate radiations from THz to gamma-ray regions, to develop plasma photonic devices, and to apply quantum control to basic science and energy research.

Laser Related Activities and Institutions in Africa

Due to the Western world technological standard of the country the major scientific and institutional laser related activities in Africa are located in South Africa. Their main historic origin lies in a former molecular laser isotope separation program, which was shut down and dismantled in the mid of the '90's. The remarkable expertise and infrastructure in CO_2 lasers and excimer lasers was subsequently gathered and reorganised in the National Laser Centre (NLC) in Pretoria which was founded 1999, and in the only significant laser producing company Scientific Development and Integration, SDI in the continent, also situated in Pretoria.

Today the National Laser Centre (NLC) performs applied research and development in the fields of laser machining, infrared solid state laser development and LIDAR, and it operates a successful laser rental pool program through which higher educational institutions in the country can rent out laser equipment for there own scientific projects. Recently the National Laser Centre (NLC) started a femtosecond laser project in close cooperation with the Laser Research Institute (LRI) at the University of Stellenbosch. The National Laser Centre operates within the Council for Scientific and Industrial Research (CSIR), which in turns comes under the Department of Science and Technology (www.csir.co.za/lasers)

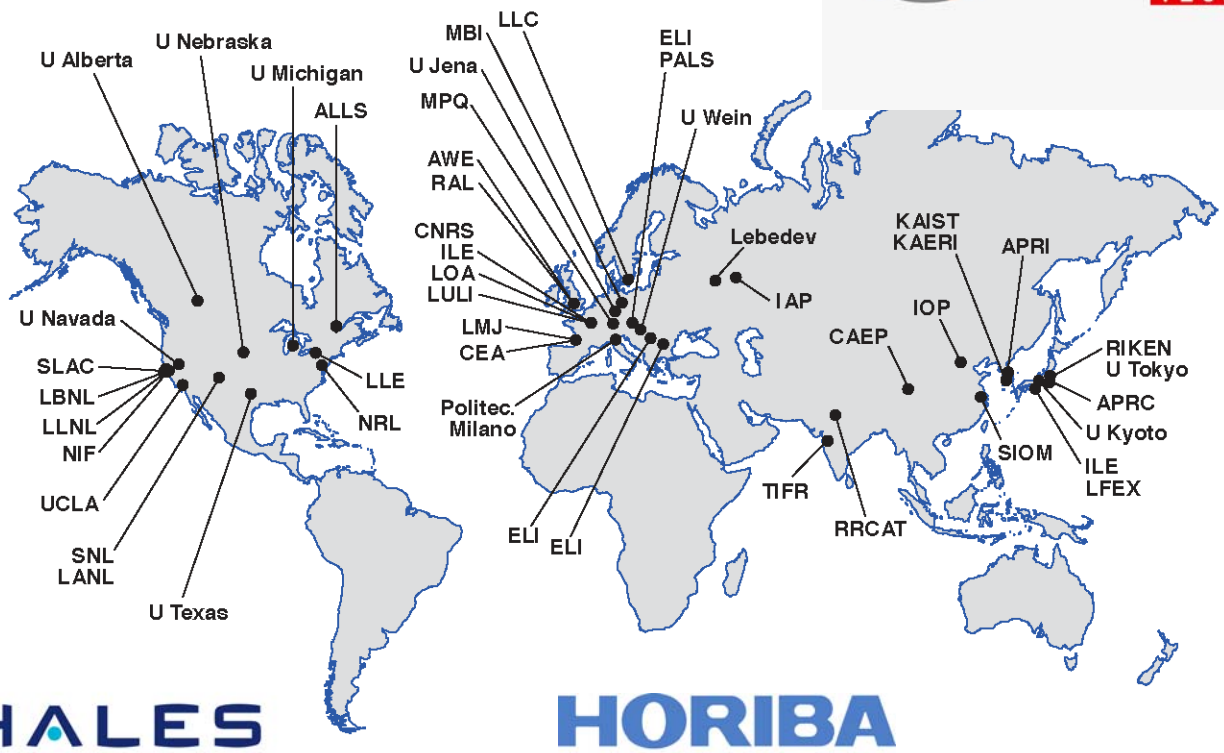


The University of Stellenbosch in the Western Cape of South Africa houses the Laser Research Institute (LRI) within its Physics Department (see p.5).

In 2003 an African Laser Centre (ALC, (www.africanlasercentre.org) was founded as a pan-African institution for the support of laser science and technology within the continent. The vision of the ALC is to become a pan-African forum for scientific exchange and education in the field of lasers driven by scientists and funded through contributions from all the currently about twenty countries with member institutions.

Several smaller laser physics related activities are present in North Africa, as the National Institute of Laser Enhanced Science NILES in Cairo, Egypt, founded in 1994. In Senegal Prof Ahma Wague operates the African Laser Atomic Molecular & Optical Sciences Network LAM, which is devoted to the promotoin of education and networking in laser technology and science in Africa.

Ultrahigh Intensity Laser Labs World Wide



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ICUIL — The International Committee on Ultra-High Intensity Lasers

ICUIL Committee Members

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Wolfgang Sandner	Co-Chairman	Max Born Institute, Germany
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Wim Leemans		Lawrence Berkeley National Laboratory, USA
Ryosuke Kodama		Osaka University, Japan
Heinrich Schwoerer		Laser Research Institute, South Africa

Go East Young Man !
The "Extreme Light Infrastructure" (ELI) is ready to take off.

Launched in November 2007, the Preparatory Phase of ELI, involving nearly 40 research and academic institutions from 13 EU Members Countries, has led to the decision (on October 1st, 2009) that this pan-European Laser Infrastructure will be based on three to four sites: The three firsts will be in Prague (Czech Republic), Szeged (Hungary) and Magurele (Romania). The fourth one dealing with the ultrahigh peak power will be decided in 2012, according to the validation of the adopted technology. It is an investment in laser science and applications of an unprecedented amount, **exceeding several hundred millions of euro**. A large fraction of funding will be based on EU structural funds: ELI is an extremely bright example of **Europe giving priority to Science**. ELI will address studies inaccessible by current laser system facilities. The three selected sites have been mandated to start forming a pan-European Research Infrastructure Consortium, named **ERIC**, which constitutes an appropriate legal vehicle approved by the European Commission. **ERIC will be open to all European nations willing and ready to contribute to the realization of ELI**. A centralized access management will preside to the European and World-wide users willing to perform **experiments at the fore front of laser science** at ELI.

The excellence of ELI will be a strategic way towards the creation of a **"hub of intellectual capital"** that will promote knowledge-sharing. ELI will open the possibility of taking snap-shots in the attosecond scale (10^{-18} s) of the electron dynamics in atoms, molecules, plasmas and solids. With the possibility of going into the ultra-relativistic regime, ELI will afford new investigations in particle physics, nuclear physics, gravitational physics, nonlinear field theory, ultrahigh-pressure physics, astrophysics and cosmology (generating intensities exceeding 10^{23} W/cm^2). Besides its fundamental physics mission, a paramount objective of ELI will be to provide ultra-short energetic particle (10 GeV) and radiation (up to few MeV) beams produced from compact laser plasma accelerators. The Facilities built in Prague, Szeged and Magurele will have their mission oriented towards particle acceleration and X-ray generation, attosecond science, and laser-based photonuclear physics, respectively. **The decision of investing in countries willing to grow their expertise** in the ultra-intensity laser field and related applications reveals an extremely **positive strategic view in spreading knowledge advances over Europe.** The research activities will be based on radical improvements in laser performances from the petawatt (10^{15} W) to a fraction of exawatt (10^{18} W). This last step (with its location) will be preceded by an initial phase of experiments with the aim of determining the most successful technology.

ELI will be a scientific platform that will promote aggressive technology transfer. Fields such as laser and particle accelerator engineering, nuclear pharmacology, oncology, X-ray and gamma-ray imaging could be revolutionized by ELI. **Technological developments outsourced by ELI to European industries will help to maintain their leadership**. The participation of industrial actors is first required during the construction phase through the supply and development of the finest equipments and components, but also during the operation, in order to guarantee the sustainability and the potential upgrade of the infrastructure.

The different applications mentioned in the project have the potential of making a great impact on society. ELI could help to clarify the aging of nuclear power plants, control the lifetime of nuclear waste, fabricate new nuclear pharmaceutical products at the patient's bedside, or develop new types of hadron therapy. **ELI will interest a very broad community of physicists, engineers, oncologists, and environmental scientists**. With its broad scientific and engineering scope **ELI will attract and train a large number of students** in the field of ultra-high intensity laser technology, ultra-relativistic optics, atomic and molecular physics, plasma physics, etc.

Go East Young Man! ELI will be the first European large scale infrastructure east of the European community. It signals a reversal from the existing paradigm. It will certainly be a magnet for the best scientists worldwide.

ELI steering Committee meeting for the site decision

Contacts Editor: Christine Labaune, christine.labaune@polytechnique.fr
Toshiki Tajima, toshiki.tajima@physik.uni-muenchen.de