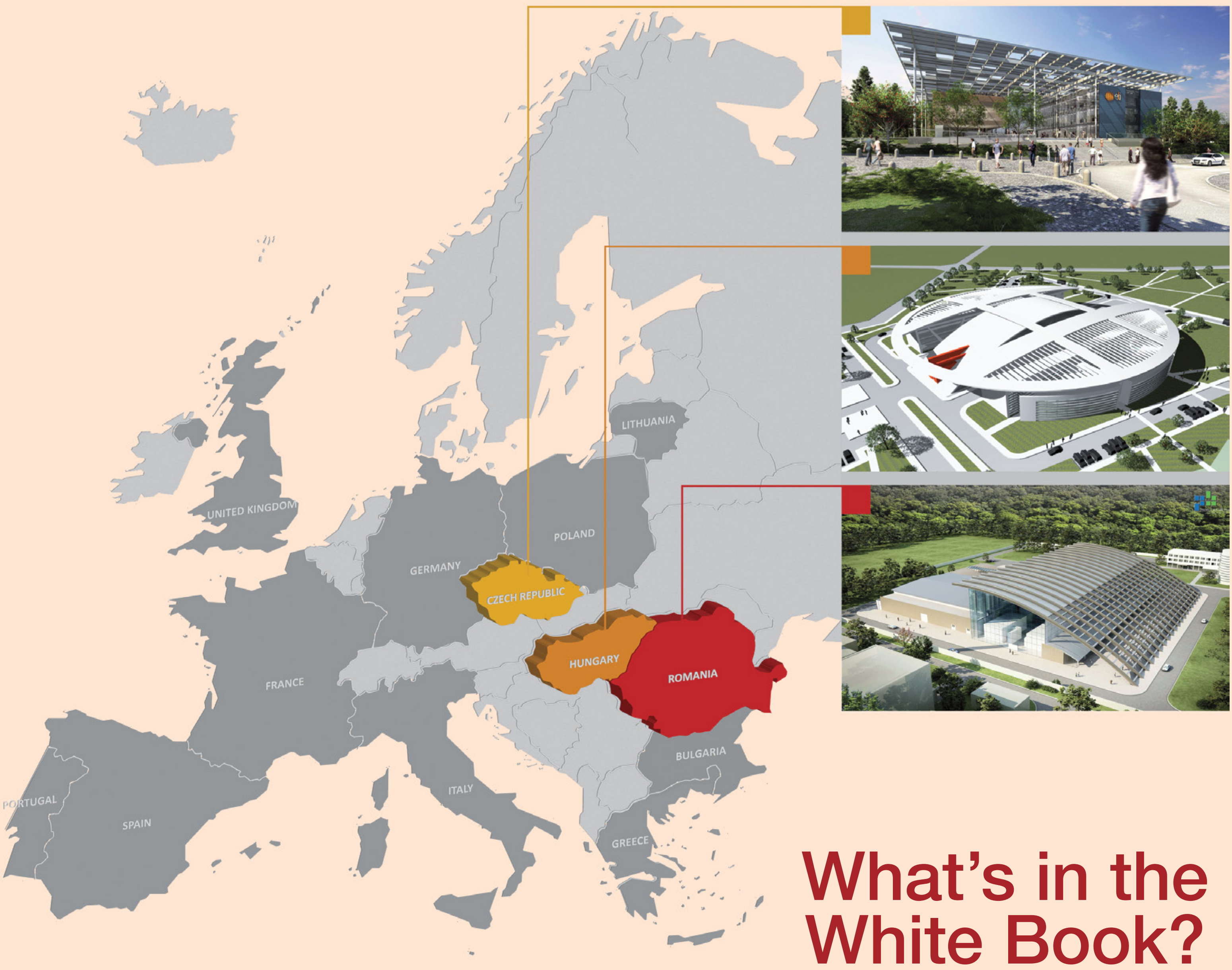
www.eli-laser.eu

eli Courier

Volume 2 No 4 December 2010

ISSN 2041-9023

News from the Extreme Light Infrastructure European project

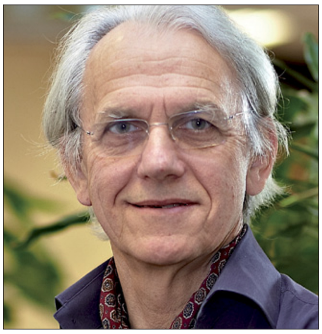


What's in the White Book?

EUROPEAN
COMMISSION

Focus on France and Portugal

The time for change is here


Gérard Mourou

Started in November 2007, the preparatory phase of ELI (ELI-PP) will come to its conclusion at the end of this year. While members of the various working groups are finalizing the very last deliverables, the host countries are getting ready to take over for the implementation phase. They will do so on solid grounds, thanks to the results of three years of intense efforts from all partners. By turning a concept into what will soon become a reality, the ELI-PP has fully accomplished its mission. This collective achievement is worth celebrating: it embodies the maturity and ambition of the European laser community as well as its ability to team up for an exceptional project.

In this issue of *ELI Courier*, the last of the ELI-PP, you will find the latest news on the ELI White Book (p3), a document that will represent the most accomplished consolidated expression of the scientific, technical, legal, organizational and financial definition of ELI. You will also find an article about the last important scientific topic related to ELI – X-ray production and the use of such a source for various applications (p4). Two beneficiaries – France (p6) and Portugal (p7) – present themselves and their backgrounds in laser. At the end of this issue, as usual, you can find the latest news (p8), including the progress of the three host countries.

At this decisive turning point for the project, I wish to address my sincere thanks to all of you who have shown interest in ELI and followed the progress of the ELI-PP towards implementation. *ELI Courier* has been the messenger of this progress over the past years and I want to express my gratitude to all of those who have made it possible, notably to the editorial board, and particularly to Catia Peduto, Antonella Varaschin and Patrizio Antici, for the hard work and commitment they have put into each issue.

On the cusp of 2011, I wish all of you and your families a happy new year.

Gérard Mourou, ELI project co-ordinator

Contents

eli Courier

Chief editor
Patrizio Antici
CNRS
1, place Aristide-Briand
92195 Meudon Cedex
France

Managing editors
Catia Peduto and
Antonella Varaschin,
e-mail comm@eli-laser.eu

Editorial committee
Marta Fajardo
Eleftheria Katsouli
Zdislava Lojdová
Zsuzsanna Marton
Karoly Osvay
Carlos Russo

Chief scientific adviser
Gérard Mourou

Subscriptions
To subscribe or unsubscribe,
e-mail subscriptions@eli-laser.eu

ELI Courier is produced for ELI by
IOP Publishing
Dirac House
Temple Back
Bristol BS1 6BE
UK
Tel +44 (0)117 929 7481
www.iop.org

Publisher
Claire Bedrock

Art director
Andrew Giaquinto

Production editor
Kate Gardner

Technical illustrator
Alison Tovey

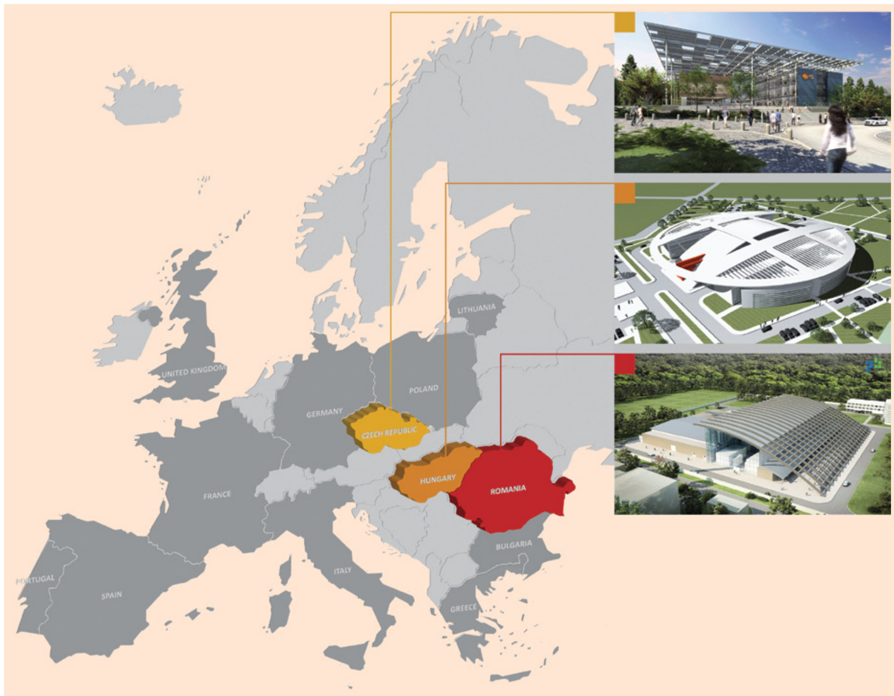
ISSN 2041-9023

Cover image: Architect drawings of the planned ELI buildings in the Czech Republic, Hungary and Romania. Courtesy: INFN.

IOP Publishing

ELI White Book nears completion

The preparatory phase of ELI (ELI-PP) is now, after more than three years of hard work, coming to its end, culminating in the ELI White Book. Georg Korn explains what this means and what is involved in putting the book together.



INFN

Architect drawings of the planned ELI buildings in the Czech Republic, Hungary and Romania.

The ELI-PP consortium of 13 countries has made big steps in all essential fields of preparation, including the science and technology, funding and organization of the future Extreme Light Infrastructure. The European Community has supported ELI-PP with a grant of €6m. The various work packages include science and technology (lasers, secondary sources, infrastructure, safety and radioprotection), support actions (management, legal, governance, strategy, site choice, finance) and communication actions (trans-national networking, international communication).

One of the essential documents to be delivered by the end of ELI-PP is the White Book. This will summarize the essential developments and results of the ELI-PP process, which has been supported extensively by the European Commission (both in grants and organizational help) and all 13 member countries through in-kind contributions. It is currently being written by a large team of European scientists and managers.

The White Book structure reflects the work done within the work packages of ELI-PP as well as the progress achieved toward the realization of the next step – the implementation of ELI at the three allocated sites – and thoughts on the ultra-intense laser pillar (200 PW peak power) that will be developed and realized on the back of the three sites in the Czech Republic (Prague), Hungary (Szeged) and Romania (Magurele near Bucharest).

The book is composed of four parts:

1. ELI vision describes the international scientific and societary landscape of ELI, its position in the European Strategy Forum on Research Infrastructures (ESFRI) process, links with other major ESFRI facilities like HiPER and X-FEL, how it will stimulate science community growth, including education, through the integrated proposals of three countries, and how it may stimulate new industrial developments and help to secure European leadership in photonic science and in industry developments as a user facility.

2. ELI science presents different scientific topics that generate the quest for extreme light with a short time duration, very high intensity and a covering of extreme spectral ranges, from terahertz to gamma radiation. Topics include: attosecond science, high-intensity physics, astrophysics, nuclear physics and X-ray sciences, as well as electron and ion acceleration. A special chapter will be devoted to the application of the new extreme light sources in other fields of science and technology, such as medicine, material science and X-ray imaging. Theory and numerical simulations will round up this section.

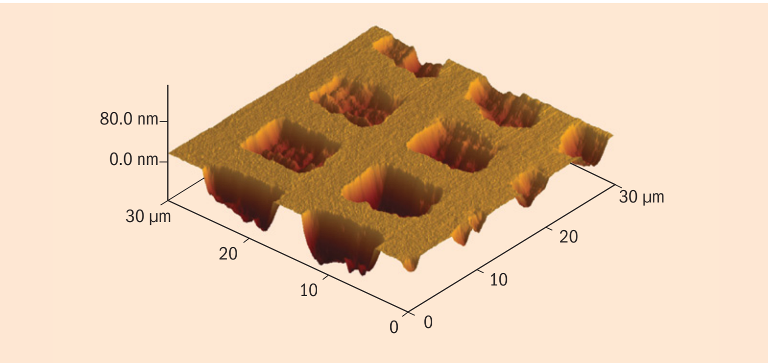
3. ELI technology summarizes in detail the main technological approaches for the construction and control of short-pulse high-intensity lasers and the basis for the generation and design of secondary sources of advanced short-pulse X-rays, XUV-attosecond beams, and particle beams of electrons and ions. The laser and secondary sources of ELI will be perfectly synchronized and therefore enable new experiments using, at the same time, primary laser and secondary sources of radiation and particle beams.

4. Implementation strategy details the main steps on the way to building an integrated ELI facility. The three planned facilities and their corresponding science pillars are described: the Czech beamlines facility, the Hungarian attosecond facility and the Romanian facility for nuclear physics.

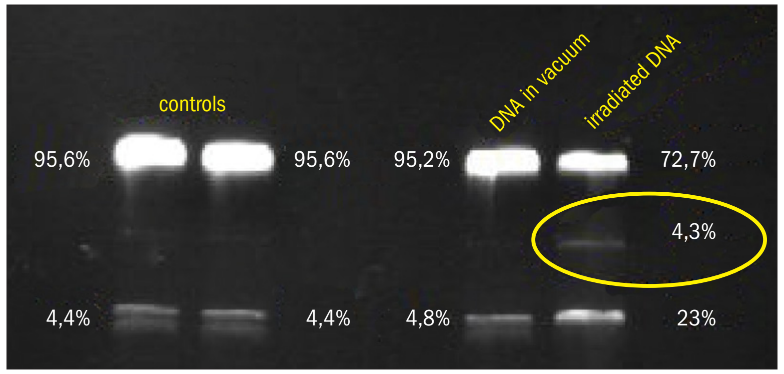
Georg Korn (ELI deputy co-ordinator)

ELI looks to become soft X-ray source

With the unique capacity of ELI to combine high repetition rate, high-energy long pulses with ultra-intense ultrashort lasers, outstanding soft X-ray lasers will become reality



Nanopatterning achieved at PALS with a 21.2 nm soft X-ray laser irradiating PMMA. Pattern depth is typically 100 nm with very sharp edges.



Electrophoresis of DNA strands showing the creation of a double break (yellow circle) when irradiated by the 18.6 nm SXRL of the LASERIX facility in France.

Since the discovery of the laser, researchers have tried to shorten its wavelengths and increase its intensity. Thanks to the discovery of chirped pulse amplification, laser intensities followed an impressive rise over the 25 last years. In parallel, after decades of intensity stagnation, soft X-ray sources have finally demonstrated ultra-high intensities in the 10^{16} W cm^{-2} range at FLASH (Germany) and up to 10^{18} W cm^{-2} at LCLS (US) using free-electron lasers. Thousands of researchers worldwide have shown interest in these soft and hard X-ray lasers, producing a tremendous number of high-impact discoveries in biology, physics, chemistry and astrophysics. If ELI succeeds in achieving soft X-ray lasers (SXRLs) with comparable parameters, it should have a very fertile future.

For decades, laser-based SXRL dominated the world of coherent soft X-ray sources. In the late 1960s researchers proposed using the multi-charged ions present in plasmas – because they are natural intense emitters of X-rays – to produce SXRLs. In 1971 Jaeglé and collaborators observed the first super-radiance in soft X-rays (10.57 nm), meaning a clear signature of population inversion, in laser-produced plasmas. The physics of laser–matter interaction began simultaneously with SXRL research, leading to a long period of wholesale developments up to 1985, when the Livermore team in the US demonstrated the first strong amplification at 20.6 nm. The consequence was to impose its so-called collisional excitation scheme over others. This scheme consists of creating population inversion through the collision of lasing ions with free electrons present in the plasma and heated by an infrared laser. The dynamic was launched; saturation of the first SXRL was achieved in 1991 at RAL in the UK through a France–UK collaboration.

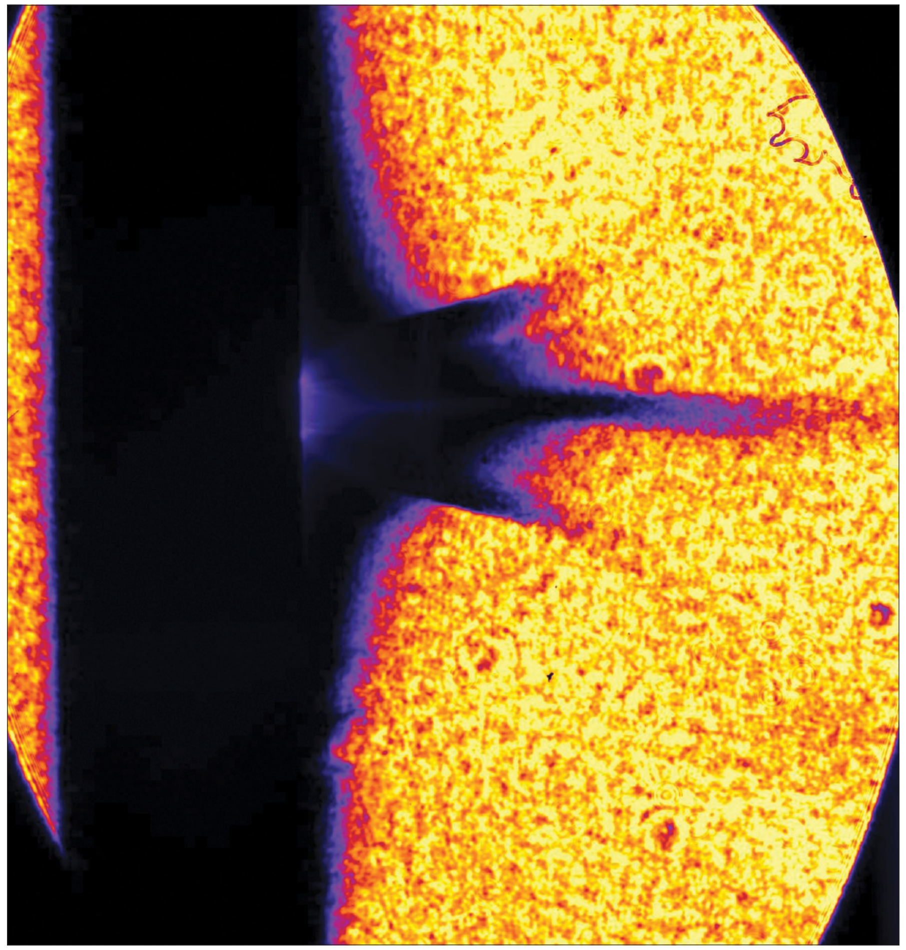
The main drawback of the collisional scheme is the need for a multi-kilojoule pump laser, available only in a few laboratories worldwide. At first, applications demonstrated using these sources were unattractive to users due to the extremely low repetition rate of one shot per hour. The first major step towards actual high-repetition rate SXRLs was achieved in France thanks to a defective laser of "only" 400 J. B Rus and collaborators observed an astonishingly strong emission at 21.2 nm. The pump laser emitted a train of unwanted pre-pulses, creating cold plasma prior to the arrival of the pump pulse, strongly modifying the plasma parameters at the locale and instant of population inversion. The second major breakthrough was achieved in 1997 by P Nickles and team at MBI (Germany) who pumped titanium (32.6 nm) with only a few joules by decoupling the plasma creation, which is intrinsically energy consuming, and heating free-electrons, which can be efficiently achieved at low energy. Finally, in 2001 S Sebban at LOA (France) achieved the first 10 Hz repetition rate and saturated SXRL.

In 2003 a conceptually revolutionary breakthrough was achieved with the so-called seeding technique. To understand its real impact, it is worth presenting and discussing some of the numerous applications achieved so far. We may distinguish two kinds of applications: imaging and excitation of matter. In terms of imaging, plasma radiography or interferometry, and holography of rat sperm were tested. Interferometry was extended by P Zeitoun and collaborators to a dynamic study of electrical breakdown in niobium, and by B Rus *et al* on laser-induced damage of optics.

Excitation of matter covers a wide span of experiments. Among others, we may cite the study of luminescent materials of interest for medical detectors or the SXRL break of DNA strands for cancer study at the PALS and LASERIX facilities.

It is striking to observe that all of the applications took advantage of the extremely high number of photons contained in a single SXRL pulse. This is the scientific "niche" for SXRL. The world record is held by PALS (10^{15} photons), to be compared at the same wavelength of 21.2 nm with FLASH (10^{13} photons) and high-harmonic generation (HHG) sources (10^{8}–10^{10} photons).

This positive view should be tempered by a detailed study of experiments that pointed out some critical problems. Users are still waiting for a true laser, i.e. one that is coherent in both time and space, with a beam having Gaussian energy distribution, good wavefront and that is polarized. Adjustable polarization is highly desirable because polarizers are difficult to manufacture at short wavelengths and are highly absorbing. None of the cited SXRLs answer these requirements. Experiments at FLASH since 2003 have demonstrated unambiguously that the dynamic study of matter at nanometric and femtosecond resolutions is the new paradigm of SXRLs. However, until now the shortest laser-based SXRL demonstrated had only a 2 ps duration.



Radiography of a a gold target irradiated at 4×10^{13} W cm^{-2} with the PALS iodine laser (1.315 µm). The laser moved from right to left. The darkest part of the image corresponds to the densest zone of the plasma.

Why aren't SXRLs coherent? Why don't they exhibit a polarized beam? Why is the pulse duration blocked at 2 ps? The answer to these questions is in one acronym: ASE. The solution is "seeding" and corresponds to a modern approach of SXRLs mirroring infrared amplification chains.

Usually in a laser chain the seed is a "pure" wave resulting from bumping the beam back and forth in a cavity called the oscillator. But soft X-ray optics face very strong absorption of material. Mirrors reach at best 67% reflectivity (as opposed to up to 99.99% in infrared). Consequently, a fully stable cavity, with 1000 roundtrips, is hardly realistic. Unstable cavity (three trips) has been tested at LLNL with moderate success, while half-cavity – consisting of only one mirror for re-injecting once the beam is in the plasma – has led to the first saturated SXRL. This solution demonstrated better beam qualities but is still far from full coherence. Until a few years ago, every SXRL ran in ASE mode (amplification of spontaneous emission), that is amplification of quantum noise. Thus, ASE SXRLs cannot exhibit good coherence or be polarized.

The solution lies in seeding the plasma with an external "perfect" femtosecond beam, i.e. an HHG beam. In 1995 T Ditmire and collaborators tested this with mitigated results. It was successfully demonstrated in 2003 at LOA and is now considered worldwide to be the reference architecture. LOA achieved the first true SXRL with full coherence, full (tunable) polarization and diffraction-limited wavefront but with a duration of about 1 ps. The duration was limited due to the use of gas, a low-density amplifier that is known to have a narrow lasing line. In 2008 Wang *et al* tested a solid amplifier but with the surprising result of a pulse duration also in the picosecond range. This was due to the peculiar pumping geometry, under grazing incidence, which has the advantage of saving pump energy but the drawback of creating population inversion in the low-density part of the plasma.

The second surprising feature of the Wang *et al* experiment is the output energy of only 90 nJ, 10 times lower than was achieved by the LOA experiment (1 µJ). Based on the novel generation of hydrodynamic codes developed at UPM (Spain), E Oliva *et al* demonstrated that most of the pump energy was transferred to plasma kinetic energy and not to population inversion. Plasma shaping (K Cassou *et al*) completed by the use of large seeded amplifiers should theoretically produce truly coherent SXRLs emitting pulses of about 200 fs duration and energy around 20–50 µJ. Such seeded SXRLs should reach intensities of about 10^{16} W cm^{-2}. More advanced studies show the need for elaborate architecture composed of the seed source and two consecutive plasmas (100 µm and 1 mm wide). Aligning and synchronizing this SXRL chain is conceivable only with high repetition-rate pump lasers. As a first step, such a SXRL will be installed at the ELI-beamlines facility and we hope that another will be built at another ELI pillar. The beam parameters will compete with soft X-ray free-electron lasers, to date the world's most intense soft X-ray sources, attracting hundreds of users.

Although this step is crucial, it does not represent the ultimate goal. PALS is currently running the most energetic SXRL (10 mJ/pulse) but in ASE mode. The Czech Republic, hosting the ELI-beamlines facility, would naturally benefit from the unique knowledge acquired at PALS. Therefore, a fascinating goal would be to seed an amplifier for generating a 100 fs pulse with energy exceeding 10 mJ while maintaining high optical quality of the seed. This is precisely the Ditmire *et al* experiment, showing an output beam fully dominated by ASE on which a weak, poorly amplified seed was superimposed.

The race is on to find the solution for transferring most of the stored energy of the seed. Success would be a seeded SXRL of every superlative, with about 10 mJ of energy, 100 fs duration (D Whittacker *et al*) and that is diffraction-limited, therefore able to achieve intensities as high as 10^{19} W cm^{-2}.

Philippe Zeitoun (LOA), Pedro Velarde (UPM) and Bedrich Rus (PALS)

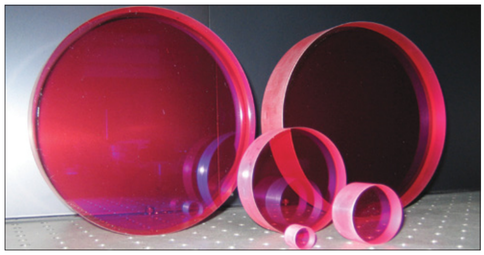
‘Made in France’ lasers top the game

Lasers have, since their invention 50 years ago, played a very important role for France. It is one of the leading countries in the knowledge, technology and production of high-power, high-energy lasers, specializing in Ti-sapphire technology. It is one of the few European countries that has the technology and the industrial suppliers to build an entire high-power laser, including crystals, gratings and power amplifiers.

In the 1970s, France – and in particular the Commissariat à l’Energie Atomique (CEA) – put a lot of effort and investment into high-power laser technology. It follows that many laser manufacturers and suppliers are based in France.

Today, French companies such as Thales, Amplitude, Quantel and FastLite are reference points for high-power laser technology. Some of these companies are also attracted to the CEA project “Laser Megajoule” (LMJ), one of the biggest high-energy laser facilities currently under construction, near Bordeaux. LMJ is intended to deliver about 1.8 MJ of laser energy to its targets, to achieve inertial confinement fusion (ICF). It should be as powerful as its US counterpart, the National Ignition Facility, and is the largest ICF experiment to be built outside the US.

Left: target chamber of the LMJ. The metallic flanges indicate where the different laser beams come in.



Right: amplifying crystals for the APOLLON laser at ILE.

There are many laboratories and universities, most of them near Paris or Bordeaux, working in laser and its applications, delivering scientific results of exceptional quality – including ILE, LULI, LOA, LPGP, LLR, CELIA, LOB, CPHT, LIXAM and Institut Optique – employing hundreds of scientists and training generations of young scientists and technicians who then spread this knowledge all over the world.

Considering France’s investment in lasers, it is not surprising that France is giving a strong contribution to ELI in terms of know-how, technology and manpower. The new APOLLON laser (see *ELI Courier* vol. 2 no. 2), currently under construction at ILE, can be considered as a prototype for ELI and will, when finished, be the most powerful short-pulse laser in the world. This will further confirm French excellence in the field and open up new challenging opportunities for the scientific community.

Interview

Mme Cesarsky is high commissioner for atomic energy at the Commissariat à l’Energie Atomique (CEA). The CEA, with around 15 000 employees and a budget of €4bn, has a long history and involvement with lasers. She told us about the importance of lasers for the CEA.

Catherine Cesarsky.

What have been the CEA’s major achievements in laser development and its applications?
The CEA has greatly contributed to the increase in energy deliverable by lasers, from early small-scale pioneering lasers to the current Laser Megajoule (LMJ) project. Its laser teams were also among the first to understand the potential of chirped pulse amplification (CPA) for fundamental science: on several occasions they broke world records for peak power. They launched nonlinear physics applications that became attophysics and ultrahigh-intensity (UHI) physics.

What is the role and importance of lasers for the CEA?
Lasers are now indispensable tools, allowing the CEA to fulfill missions ranging from fundamental science and technology, such as the development of alternative energies, to defence.

How do you see the evolution of lasers at the CEA?
The long history of laser development and applications at the CEA will certainly continue. Over the next few years there will be increased activity – the operation of the LMJ from 2014; the growing synergy between fusion science, UHI physics and high-energy physics; and CEA participation in innovative projects like the Institut de la Lumière Extrême (ILE) in France and the pan-European ELI and HiPER programmes.

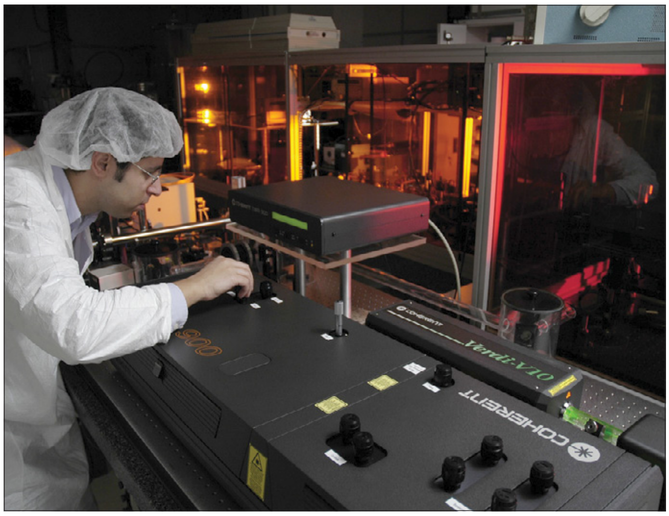
How will the CEA contribute to the future of lasers?
The programme of thermonuclear plasma simulations using large-scale lasers will continue to drive major efforts and advances, both to increase laser performance and to design highly sophisticated experiments. Closely connected with this, the CEA will continue to explore the fundamental nonlinear interaction of light with matter at femtosecond or even attosecond timescales.

How do you see the evolution of lasers in terms of application and capability for the CEA? What could be the next major advance?
The start of operations at LMJ and its coupling with PETAL (a multi-petawatt class CPA laser), integrated into the HiPER project, will open up new perspectives in several domains, such as laboratory astrophysics and of course the production of energy by inertial confinement fusion with fast ignition. Laser technology progresses so fast! New large-scale ultrashort lasers just appear, which will create accessible new exciting frontiers, such as relativistic optics, and push ahead our knowledge of ultimate matter dynamics.
PA

IPFN has big plans in store with ELI

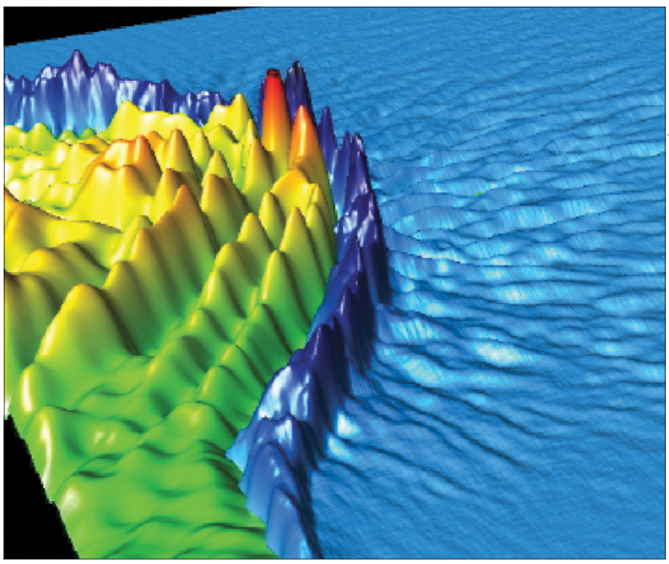
The Instituto de Plasmas e Fusão Nuclear (IPFN), a research unit at the Instituto Superior Técnico (IST), is the host for ELI science in Portugal. Benefiting from the intellectual and technological effervescence of its location at the heart of IST, the biggest engineering university in Portugal, IPFN is an "associated laboratory", an elite status established by the Portuguese National Science Foundation, since 2001. It is also, since 1990, the research unit of the Contract of Association between the European Atomic Energy Community (EURATOM) and IST, and the lead Portuguese contractor of the European Fusion Development Agreement (EFDA) and the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E).

These unique circumstances provide a privileged setting for world-class research, fostering scientific and technological excellence in an international context. Our global position allows us to act as a central hub for research, advanced formation and training, technological transfer in plasma physics and engineering, controlled nuclear fusion, lasers and photonics, and advanced computing.



NI, IPFN

Laboratório de Lasers Intensos at IPFN.



F FIUZA, GOLP/IPFN, IST

A simulation of filamentation in a relativistic laser–plasma interaction.

Under such auspicious beginnings, the Laser and Plasma Group (GoLP) – the group within IPFN that is specifically involved with ELI – was born in 1994. Founded by Prof. Tito Mendonça, one of the most prominent Portuguese physicists of our time, it started out as a small theoretical group studying plasma physics, fusion, nonlinear optics and dynamic systems. With his vision – that of a "golpe", a blow to stir the waters in Portuguese research – Mendonça managed to attract a group of highly motivated young scientists.

Following a consistent growth plan, over the years we have extended our abilities to develop a solid reputation in experimental physics and computer simulations, and the scope of our research has broadened to encompass high-power and ultrashort lasers, laser–plasma interaction, complex plasmas, extreme plasma physics, quantum optics and astrophysics, as well as several other fields. Most importantly, we have equipped our laboratory with two major infrastructures that are the focus of our two major axes of research: L2I, or Laboratório de Lasers Intensos, a 10 TW laser facility, home to our laser–plasma experiments, and the epp cluster, or Extreme Plasma Physics, devoted to advanced computing in laser–plasma interaction.

In the last few years, GoLP has focused its activities on answering some of the fundamental questions in plasmas and photonics, associated with extreme laser or particle beam intensities, in line with ELI's major objectives.

One of our current goals is to be a key player in the X-Games of Contemporary Science: high-energy density science. We aim to understand matter at extreme intensities, in a variety of complex laboratory and astrophysical scenarios. For that we have combined the relativistic kinetic theory that provides the theoretical framework to describe these processes and numerical simulations capable of capturing the kinetic features of plasmas and intense beam–plasma interactions. In a unique combination in Europe, we are developing in parallel the experimental tools that will enable us to bridge the gap between theory and experimentation.

Leveraging on the know-how at GoLP and IPFN we have also been exploring the possibility of creating a regional infrastructure, called ELI High Field Computational Sciences, capable of providing the theoretical and simulation support to explore the frontiers to be unravelled by ELI.

The problems that we address today in our team, associated with extreme intensities in plasmas, with a combination of plasma theory and massively parallel numerical simulations, are the breakthroughs that ELI will achieve experimentally in the years to come. With our team of experimentalists working hands-on in the core business of ELI – the lasers of the future, clever plasma sources for more performant plasma accelerators, and upgraded XUV sources – we will make our dreams come true.

Related websites

- EURATOM: www.euratom.org
- Fundação para a Ciência e a Tecnologia: http://alfa.fct.mctes.pt/index.phtml.pt
- GoLP: http://golp.ist.utl.pt
- IPFN: www.ipfn.ist.utl.pt/portal#
- IST: www.ist.utl.pt

Marta Fajardo (Instituto de Plasmas e Fusão Nuclear Instituto Superior Técnico)

Progress at ELI

ELI-Beamlines Facility

The European Commission is performing a thorough review of the funding application and has expressed satisfaction with respect to the quality of the materials. Final approval is expected from Brussels soon, with a signature on the grant agreement by the end of the year. In the meantime, on 23 September, the building permit was secured. A detailed technical and cost review of the building is under way, with the objective of starting construction mid-2011.

ELI-Attosecond Facility

The scientific case of ELI-ALPS has been completed. Following recommendation, the repetition rate of the primary sources has been increased in comparison with early plans. The scientific case will be discussed with international experts and reviewed by the ELI Scientific Advisory Committee. Design of the building has been started. The signature ceremony of the contract for the Hungarian preparatory project continues to be delayed by the National Development Agency.

ELI-Nuclear Physics Facility

Romania is now just waiting for the official green light before starting construction. People are submitting proposals for new directions of investigation that can be followed when ELI-NP becomes operational. While ELI Delivery Consortium activities are ramping up, huge thanks are due to all those who made it possible to reach this point. Without the team who led us through ELI-PP, we couldn't contemplate today the shores of unknown future scientific frontiers.

Where east meets west

On 16–18 February 2011 the High-Intensity Lasers and High-Field Phenomena (HILAS) topical meeting will be held in Istanbul, Turkey, for the first time.

The meeting, organized by the Optical Society (OSA), specializes in both fundamental science and applications of high-field phenomena, as well as technical aspects related to source development.

In addition to several invited presentations, there will be speeches about: high-peak-power lasers and high-intensity laser–matter interactions; recent progress in terawatt and petawatt lasers; laser technology for fusion- and laser-based EUV and X-ray sources; strong-field laser science including interactions with atoms, molecules, clusters and plasmas; advances in attosecond science; high harmonic generation, high-field rescattering physics; relativistic nonlinear phenomena; plasmas in ultra-high fields; and laser-based particle acceleration.

HILAS will be co-located with three other OSA topical meetings: Advanced Solid-State Photonics (ASSP), Advances in Optical Materials (AIOM) and Fibre Laser Applications (FILAS).

Sandro De Silvestri

DIETMAR GILJOHANN

The Ottoman Neo-Baroque style Ortaköy Mosque in Istanbul. Creative Commons Attribution-Share Alike 3.0 Unported Licence.

Synergies

At the end of July, the European Commission published a call related to the implementation of common solutions in infrastructures on the ESFRI roadmap in the fields of physics, astronomy and analytics. The basic idea is to generate synergies in the development of components common to several infrastructures and thus optimize resources.

ELI is participating in this call, called "CRISP" and coordinated by ESRF, in all work-packages. This includes the topics of accelerator components, instrumentation, detectors, and data management and dissemination. Several of our beneficiaries set up synergies with other infrastructures, such as X-FEL, EuroFEL, FAIR, SPIRAL-2 and ESFR. This confirms ELI's broad scientific activity in different cross-linked research topics.

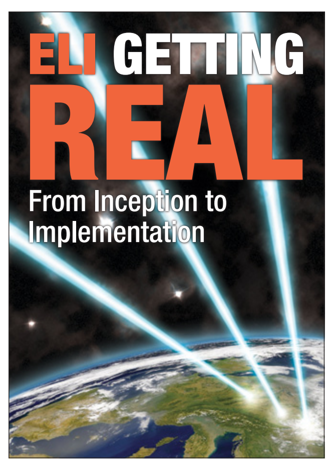
PA

ELI gets real from here

10 December 2010 was an important milestone in the history of ELI. In a dedicated event – "ELI getting real: from inception to implementation" – hosted by the Czech Embassy in Paris, the ELI Delivery Consortium officially took the lead of the project from ELI Preparatory Phase (ELI-PP), thereby announcing the imminent launch of ELI's implementation.

In an afternoon seminar, key players of ELI-PP highlighted the major achievements accomplished over the past three years. The three plenipotentiaries (Czech Republic, Romania and Hungary) presented the mission, organization and work plan of the newly formed ELI Delivery Consortium.

Toshiki Tajima, chairman of the ELI Scientific Advisory Committee, concluded the seminar by giving a lecture with the title "Extreme Light Infrastructure: Icebreaker and integrator of 21st century science". An evening reception held in the salons of the embassy was a festive complement to the afternoon conference and an occasion to wish good luck to ELI.



Catherine Sarrazin