Research Networking Programmes

Science Meeting – Scientific Report

Scientific report (one single document in WORD or PDF file) should be submitted online within two months of the event. It should not exceed seven A4 pages.

Proposal Title: ***First CETAL- Petawatt workshop***

Application Reference N°: 5260

1) Summary (up to one page)

The First CETAL-Petawatt workshop was organized in Magurele, Ilfov, Romania during 19-20 November 2013. This is the first workshop in the series with the specific objectives to promote the suitability and accessibility of CETAL-PW facility for advanced scientific studies on Petawatt laser-based experiments, development of related simulations and theoretical advances and promote the national and international collaborations.

Emphasis of the meeting was on identifying and setting up the first stage experiments and associated time schedule. It was intended that experimentalists discuss several contemporary research ideas and advances, and identify the necessary equipments for the realization of their foreseen experimental proposals. Similarly, theoretical presentations and simulations were discussed with the prospects of corroborating the experimental results obtained on the CETAL PW laser facility and deepen the scientific knowledge.

2) Description of the scientific content of and discussions at the event (up to four pages)

Workshop was inaugurated by Mr. Tudor Prisecaru, Secretary of State, Ministerul Educației Naționale (MEN), Romania. While addressing the delegates Mr. Prisecaru mentioned the Romanian infrastructure on research and development and emphasized on the need and importance of hosting big European research projects including ELI - The Extreme Light Infrastructure to benefit national and international researchers.

Dr. I. Morjan, General Director INFLPR, in his opening address entitled "*Femtosecond laser systems at Bucharest"* elaborated the activities on INFLPR .
Dr. N.V. Zamfir, Director ELI-NP, delivered a speech on the status and prospects of the project "*Extreme Light Infrastructure-Nuclear Physics*".

CETAL facility and beam characteristics:

Currently, National Institute for Lasers, Plasma and Radiation Physics, in Bucharest hosts a PW laser system at CETAL facility which delivers about 26J optical energy in a duration 24-27fs after compression and has about 10^-10 contrast on few 100ps scale, Strehl ratio is above 0.75 and <5 microrad pointing stability. Commissioning of the beam transport to the interaction chamber inside the bunker is expected to be ready in April 2014. It is planned to commence the first experiment on CETAL during the second half of 2014 and this workshop has initiated the discussion for a preparatory phase on the anticipated experiments.

Presentations:

There were 21 oral presentations (see appendix 1), from which 17 by international experts desiring to perform the advanced research using CETAL facility. These presentations can be broadly classified in to following 7 categories.

1. High power laser interaction physics
2. Generation of energetic ion beams in tens of MeV range
3. Generation of energetic electron beams up to GeV range
4. Generation of neutron beams and γ-rays
5. High Harmonic Generation and Coherent XUV sources
6. Physics of High Energy Density and Material behaviour in extreme state
7. Development of new material for satellite applications and radiation monitoring with optical fiber based sensors.

   Generation of energetic ion/electron beams, X-rays and γ-rays have direct applications in the field of Nuclear physics, nuclear fusion, diagnostic developments, medical applications for treating tumours, sterilization of plants and irradiation of food, etc.

Current CETAL PW-laser beam parameters are expected to meet the specifications of the foreseen proposals.

Beam time:

Potential proposers expressed beam time requirement varying from 4 to 6 weeks including experimental preparatory stage.
Synergy of various research groups will devote in bench marking experiments, underlying physics and new scientific research.
CETAL facility researchers will actively be involved in the preparation of experiments and analysis of the experimental data along with Principal Investigator/team of the proposals to be accepted as per the call for proposal on CETAL facility.

Added value of the CETAL facility:

At the national level: This facility will add scientific excellence to national research and development program. This will help to improve academic background of university research students/professionals and provide job opportunities to young people. It will also promote involvement of Small and Medium scale Entrepreneurs (SMEs) in research and technology development and support local industrial growth. Active participation and enthusiasm of INFLPR researchers during the workshop was seen as an indication of advancing national research interest.

At the international level: Involvement and synergy of overseas researchers in the facility will promote collaborations and joint research activities involving national and international researchers. Such collaborations will mutually benefit researchers from increased access to knowledge, expertise, equipment, funding, human resources and improved contact between countries in building professional networking which is highly pivotal in multi-disciplinary activities.

Recommendations from international experts:

Current status of the CETAL and scientific expertise was presented by the CETAL researchers and based on the status further recommendations were made by the international experts in developing and implementing experimental diagnostics, sophisticated simulations and theoretical study.

Requirement of the diagnostic:

A number of key laser technologies are necessary on the CETAL facility and several online diagnostics need to be mounted that are common and complimentary in analyzing the experimental results. CETAL researchers along with the international experts have drawn the list as shown below. These include;

- Circular polarized light
- Gas jet
- Ion/electron analyzer
- Ion/electron energy detectors
- Laser beam profile monitor
- Laser beam stability detection
- Pinhole camera
- Plasma mirror
- Photo-multiplier
- Probe beam
- Thomson parabola
- X-ray spectrometer
- X-ray detectors etc.

Specific diagnostics for the individual experiments: Proposers will lend the complex or sophisticated diagnostics which are not available with the CETAL facility during the experiment or jointly develop based on the expertise of the researchers.

Development of sophisticated simulations and corroborating experiments:

At present some sophisticated simulations are available for very intense beam-matter interaction. However, they are affected by assumptions, approximations and accuracy in the input values to derive the precise analysis of the data. It is expected to develop relevant simulations and perform validate/bench marking experiments with international collaborations.

Development of Theoretical activity:

In many cases, the periodicity property of the systems comprised of very intense laser beams, on one side, and electron plasmas, relativistic electron beams or atoms, on other side is a good approximation allowing a strong simplification of the modelling of these systems, without any penalty in accuracy, so it can be used to design experiments of interactions between very intense laser beams and electron plasmas, relativistic electron beams or atoms. Based on the existing results, the theoretical activity will continue in two directions: a) The modelling of new experiments, related to interactions between very intense laser beams and material surfaces; b) Experimental studies of some actual challenging problems, as for example, the dependence of the fundamental frequency on relativistic parameter, in interactions between very intense laser beams and electrons.

Participants:

Workshop was attended by 48 researchers including 31 from Romania and 17 from abroad representing well-established European laboratories from France, Germany, Poland, Sweden and UK. Some reports by the potential investigators expressing their interest in CETAL facility have been enclosed in the next section.

Visit to ELI-NP site:

Visit to construction site of ELI-NP (www.eli-np.ro/) was organized for the participants at the end of the 2nd day workshop.

3) Assessment of the results and impact of the event on the future directions of the field (up to two pages)

CETAL facility researchers received an overwhelming support and interest from the foreign participants to the meeting in performing advance experiments as the Petawatt laser characteristics satisfy the requirements needed for the advanced and innovative scientific experiments. Experiments are expected to start in the middle of 2014.
Experience gained from CETAL facility is perceived to support ~10 PW ELI-NP project (www.eli-np.ro/) currently under construction in the campus at Magurele, Bucharest.

Reports from experts expressing interest in joint research.

***Mr Victor MALKA**, Directeur de recherche CNRS*

PW electron acceleration experiment at CETAL.

The tremendous progresses made in recent years in the fields of laser-plasma accelerators [1,2] allow the deliver of high quality and tuneable electron beams with peak currents that exceed a few kA [2]. These accelerators open the way for the design of compact Free Electron laser that should deliver X-ray beams of 5th generation on the horizon of ten years. In the mid term, the electron beam that will be produced with the CETAL could have an interest for the production of X rays [3] using Betatron [4], Bremsstralhung [5] or Compton [6] radiation that are produced respectively when electrons oscillate in the transverse field of the bubble, in slowing down in a high Z material dense target, or when interacting with a laser pulse. Applications that do not require temporal resolution such as the use of electron beam for radiotherapy [7,8], the use of energetic X for tumour imaging, or the use of gamma rays for material science such as non destructive material inspection of dense object (of interest for safety for example [9]) are example of applications that will benefit of CETAL facility. Applications, that require high temporal and spatial resolution are another major development that will benefit from the CETAL and that are of interest for the studies of ultra fast phenomena for ultra fast material science, radiobiology [10] or chemistry [11].

E=15J (in the focal spot) Diameter = 30 cm (f/20)	n_e ($10^{18}cm^{-3}$)	L_{acc} (cm)	t_{laser} (fs)	a_0	w_0 (micron)	Energy (GeV)	Q (nC)	Focal length (m)
Blow-out/Bubble	1.1	2.46	47	4.4	22	2.5	0.41	6.5

The table 1 shows the expected electron beam performances with the corresponding plasma and *laser optimal parameters.*

One of the first challenges that can be reached by CETAL is related to state of art experiment on electron acceleration in a range of parameters yet unexplored. CETAL can play a major role, in reinforcing the European efforts in this very challenging and competitive research domain, in preparing and in creating a community of scientists able to face to technical and scientific issues that the community will have to face with the 10 PW laser of ELU-NP. The involvement of scientists, engineers and technicians from different backgrounds (accelerator, laser and plasma) is requested to realize this exciting challenge.

To build up such accelerators, electrons need to be injected into the wakefield created by the laser pulse with a sufficient initial energy. Doing so, electrons can be trapped and accelerated until they diphase, when their velocities reach the laser group velocity. The so-called 'bubble/Blow-out regime' [12,13] can be reached easily at CETAL and it will allow to drive the wakefield to extremely high amplitudes in a very-nonlinear regime and to control the transverse breaking of the plasma wave [14-16]. With CETAL laser parameters, electron beams in the few GeV range could be produced over centimetre distances, with relative energy spreads of the order of 5-10 % and a charge of hundreds of pC as shown in the table 1 and using the experimental set-up presented on Figure 1.

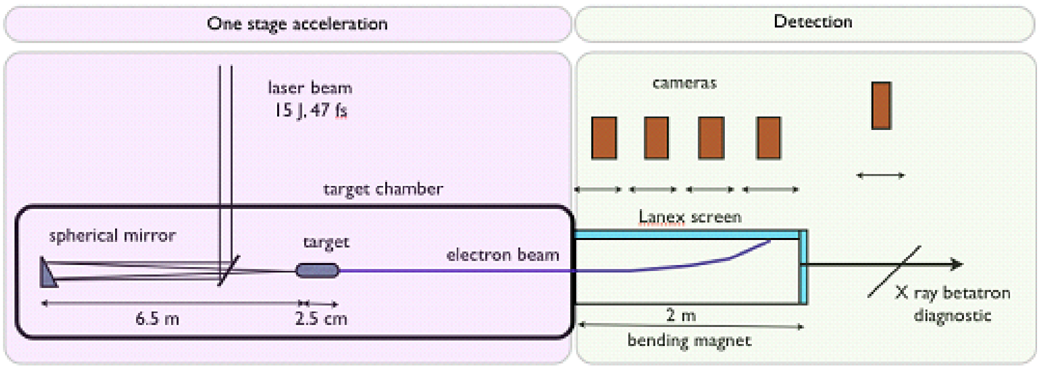

Figure 1: Experimental set-up for bubble/blow out regime

The second scheme, the colliding laser pulses as shown on figure 2, is based on the use of two laser pulses. In its simplest form, the scheme uses two counter-propagating ultra-short pulses with the same wavelength and polarisation [17]. The first laser pulse, the 'pump' pulse, creates a wakefield whereas the second laser, the 'injection' pulse is only used for injecting electrons in this wakefield. The laser pulses collide in the plasma and their interference creates an electromagnetic beatwave pattern, which pre-accelerates some electrons. A fraction of these has enough energy to be trapped in the wakefield driven by the pump pulse and further accelerated to relativistic energies. This scheme offers more flexibility: experiments have shown that the electron beam energy can be tuned continuously. The electron beam has a quasi-monoenergetic distribution with energy spread in the % range, charges in the 10-100 pC range and its parameters are stable within 5-10% fluctuations. This approach is promising for the control of the electron beam parameters, and might allow tuning both the charge and the energy spread. With the similar experimental set-up one can also explore advanced schemes such as Cold Injection [18] or Transverse colliding laser pulses [19] scheme that can improve the properties of the electron beam.

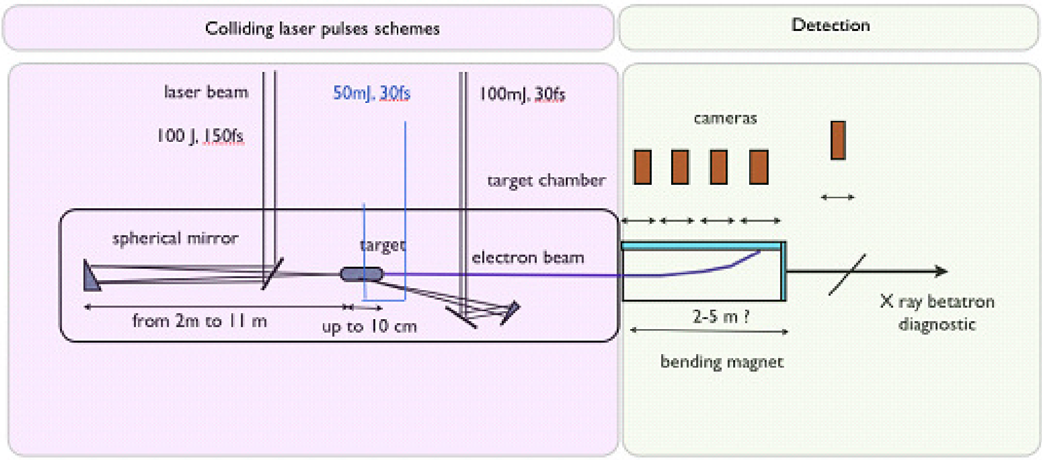

Figure 2: Experimental set-up for Colliding laser pulses scheme

References:
[1] V. Malka, Phys. Of Plasmas, **19**, 055501 (2012)
[2] V. Malka et al., Nat. Phys. **4**, 447 (2008)
[2] O. Lundh et al., Nature Physics **7**, 219 (2011)
[3] S. Corde et al., Review of Modern Physics **1** (2013)
[4] A. Rousse et al., Phys. Rev. Lett. **93**, 135005 (2004)
[5] Y. Glinec et al., Phys. Rev. Lett. **94**, 025003 (2005)
[6] K. Ta Phuoc et al., Nature Photonics **6**, 308 (2011)
[7] Y. Glinec et al., Med. Phys. **33**, 155 (2006)
[8] T. Fuchs et al., Phys. Med. Biol. **54**, 3315 (2009)
[9] A. Ben-Ismail et al., Appl. Phys. Lett. **98**, 264101 (2011)
[10] O. Rigaud et al., Cell Death Dis. **1**, e73 (2010)
[11] Y. Gauduel et al., Eur. Phys. J. D **60**, 121 (2010)
[12] A. Pukhov et al., Appl. Phys. B **74**, 355 (2002)
[13] W. Lu et al., Phys. Rev. Lett. **96**, 165002 (2006)
[14] S. P. D. Mangles et al., Nature **431,** 535 (2004)
[15] C. G. R. Geddes et al., Nature **431**, 538 (2004)
[16] J. Faure et al., Nature **431**, 541 (2004)
[17] J. Faure et al., Nature **444**, 737 (2006)
[18] X. Davoine et al., Phys. Rev. Lett. **102**, 6 (2009)
[19] R. Lehe et al., Phys. Rev. Lett. **111**, 085005 (2013)

Mr. Bastian Aurant, *Prof.Department of Physics; Lund University; Sweden*

Effects from high-power high-contrast interactions on solid targets

Our collaboration is interested in experiments on solid-state targets using the new high-power, high-contrast CETAL-PW laser facility. The unique opportunities of intensities up to 10^{21} W/cm^2 from a 25 fs laser combined with a high initial contrast of 10^{-10} and a repetition rate of 0.1Hz will allow further studies in advanced laser ion acceleration schemes as well as experiments creating Relativistically Oscillating Mirror (ROM) harmonics.
Ion acceleration schemes like Radiation Pressure Acceleration (RPA) or Directed Coulomb Explosion (DCE) will profit from the advantages of a short interaction time of laser and target and high laser energy at the same time, which allows driving those

collective acceleration schemes very efficient. Numerical Simulations show the possibility to create mono-energetic proton and heavy ion bunches with energies of few 10’ of MeV/u.
Another class of experiments creating Relativistically Oscillating Mirror (ROM) harmonics uses a similar setup and comparable laser parameters as the ion acceleration. Due to the high intensity and the good initial contrast ROM harmonics will be a very efficient way to produce, characterize and use a multi-keV gamma-source for applications as well as further diagnostic tool for other experiments at CETAL-PW.
Depending on the laser contrast and potential pre-pulses an additional plasma mirror (PM) – increasing the contrast by another 10^3 – could further improve the results by allowing the use of even better suited targets for both experiments. Besides that, both proposed ion acceleration schemes request the use of circularly polarized light introduced by a □/4-plate or a special designed mirror. Expertise for both devices can be found within the collaboration.

Mr. Paul McKenna , *Prof. Department of Physics, SUPA, University of Strathclyde,*

My proposal is to use the CETAL laser facility for experiments on the topic of laser-driven ion acceleration in the radiation pressure acceleration regime.
The scientific motivation in developing laser-driven ion sources lies in the many potential applications of compact sources of energetic ions. One of most cited potential applications is in laser-driven ion oncology. This is a very promising cancer therapy tool, but is limited at present due to the high costs associated with building high energy radio frequency accelerators and beam delivery systems. Laser-based sources hold the promise to reduce the size and cost of this treatment tool in the longer term. Another motivation for investigating laser-driven ion acceleration at the CETAL facility is the synergy with ELI-NP. One of the key scientific objectives of ELI-NP is to explore nucleosynthesis via the r-process by inducing fission-fusion reactions using laser-accelerated heavy ion beams. This objective requires dense high energy heavy ions to be accelerated via radiation pressure acceleration. Very little or no research has been done to date on heavy ion acceleration via RPA. CETAL provides an opportunity to do this - it will provide focused laser intensities higher than presently achievable at other high power laser facilities, and thus provide important new understanding of how ion acceleration by RPA scales with intensity. This will provide some insight into what ion beam properties can be expected at the higher intensity ELI-NP when it comes online.
I propose the following scientific objectives:
1. Measure the scaling of the maximum energy and energy conversion efficiency of protons and carbon ions accelerated by sheath acceleration (Target Normal Sheath acceleration, TNSA) in micron-thickness targets. This is a relative simple objective to begin ion acceleration experiments and yet provide important insight into the scaling at laser intensities higher than achieved to date.
2. Investigate the onset of radiation pressure acceleration, including the scaling of the ion maximum energy, the energy spectrum and the stability of the acceleration process. This is a necessary step forward for the field as the properties of RPA ions are much more promising that TNSA ions. The objective is harder because the targets are thinner, typically tens of nanometer thickness, and thus very high contrast laser pulses are required. CETAL will be one of the few few laser systems capable of achieving peak laser intensities of around 10^21 W/cm^2 in a short pulse and therefore these measurements will provide important new insight into RPA ion acceleration.
3. Investigate the potential to use RPA to accelerate heavy ions. This is an important development step on route to ELI-NP.

4) Annexes 4a) and 4b): Programme of the meeting and full list of speakers and participants

Annex 4a: Programme of the meeting

Date	Session Title	Time	Speaker/ Institution	Presentation Title
			9,00- 9,15 Opening and General Information	
19. 11. 2013	Theory and Experiments (I)	9,15- 9,35	**Tudor Prisecaru**, MEN	*Welcome on behalf of MEN*
		9,35 9,55	**Ion Morjan,** INFLPR	*Femtosecond laser systems at Bucharest*
		9,55 – 10,15	**Nicolae Victor Zamfir ,** *ELI-NP*	*ELI-NP*
		10,15 – 10,35	**Ioan Dancus,** *INFLPR &ELI-NP*	*CETAL PW laser facility*
		10,35 10,55	***Coffee break***	
			Chair: Dino Jaroszynski	
		10,55 11,15	**Thomas Kuehl,** *GSI, Germany*	*Investigation of highly collimated mono-energetic target surface electron (TSE) beams*
		11,15 - 11,35	**Victor Malka** , *LOA, France*	*Electron acceleration experiments at CETAL-PW facility*
		11,35 - 11,55	**Paul McKenna,** *Strathclyde Univ., UK*	*Investigations of ion acceleration using the CETAL PW laser*
		12,00 13,15	***The CETAL facility presentation and visit*** *Project Director* C-tin Grigoriu	
		13,15 14,30	***Lunch Break***	

			Chair: Victor Malka	
		14,30- 14,50	**Bastian Aurand,** *Lund Univ., Sweden*	*Radiation Pressure Assisted Acceleration of Heavy Ions*
		14,50- 15,10	**Dino Jaroszynski FInstP,** *Strathclyde Univ.*	*Intense gamma ray emission in the radiation reaction regime*
		15,10 15,30	***Coffee break***	
			Chair: Paul McKenna	
		15,30 15,50	**Marilena Tomut** , *GSI Germany*	*Materials under extreme strain rate and radiation conditions using high power lasers*
		15,50 16,10	**Daniel Ursescu,** *ELI-NP&INFLPR*	*CETAL -ELI-NP synergy in experimental design*
		16,10 16,30	**Alexandru Popa**, *INFLPR*	*Accurate models of interactions between very intense laser beams and*
		16,30 16,50	**Gabriel Cojocaru**, *INFLPR*	*Coherent XUV sources and CETAL developments*
20. 11. 2013	Theory and Experiments (II)		*Chair:* Thomas Kuehl	
		9,15 9,35	**Tiberio CECCOTTI,** *CEA-DSM/IRAMIS/SPAM*	*Some tracks for HHG and laser-driven particles acceleration in the PW interaction regime*
		9,35 9,55	**Sophia Chen** *LULI, Palaiseau, France*	*Experimental ideas in the context of high energy density physics*
		9,55 10,15	**Edmond Turcu,** *Central Laser Facility, RAL, U.K.*	*Astra-Gemini PW laser interaction area and plasma physics experiments – a brief*
		10,15 10,35	**Mihai Ganciu**, *INFLPR*	*Testing of Radiation Hardened Satellite Equipment by Using High-Power Laser*
		10,35 11,00	***Coffee break***	

20. 11. 2013	Theory and Experiments (II)	Time	Speaker	Topic
		11,00 12,30	**Round table** – *open discussions (planning experiments, complementarities and synergies)*	
		12,30 14,00	***Lunch Break***	
			Chair: Bastian Aurand	
		14,00 14,20	**Rajendra Prasad,** *Heinrich Heine University, Duesseldorf*	*Magnetic field coalescence in cylindrical geometry*
		14,20 14,40	**Piotr Raczka,** Institute of Plasma Physics and Laser	*Ion acceleration with CETAL-PW using advanced target designs*
		14,40 15,00	**Catalin Ticos,** *INFLPR*	*Laser plasma accelerator at CETAL PW*
		15,00 15,20	**Dan Sporea**, *INFLPR*	*Radiation monitoring and dosimetry with optical fiber based sensors*
		15,20 15,40	***Coffee break***	
		15,40 16,40	***ELI-NP site visit***	
		16,40 17,30	***Concluding Remarks, Closing session and meeting***	

Annex 4b: Full list of speakers and participants

Nr.	*Name, institution*	*e-mail address, phone, fax*
1	**Ion.Morjan** ***Invited Speaker*** INFLPR, General Director Atomistilor 409, P.O.Box MG36, Magurele, Ilfov. 077125 ROmania	ion.morjan@inflpr.ro Tel: + 40 21 4574550 Fax: + 40 21 457
2	**Tudor Prisecaru** ***Invited Speaker*** Research State Department, Romanian Ministry of the National Education Gen Berthelot 28-30,010168 Bucharest, Romania	Tel: +4021 4056200 Fax : 4021 4056300
3	**Nicolae Victor Zamfir** ***Invited Speaker*** IFIN-HH, General Director ELI-NP & Horia Hulubei-Nat. Inst. of Phys. and Nucl. Eng., Romania;Str Reactorului 30, P.O.Box MG-6, Magurele, Ilfov, Romania	dirgen@nipne.ro fax: + 4021 45744 60 tel: +4021 40423 00
4	**Traian. Dascalu** INFLPR, Scientific Director;Atomistilor 409, P.O.Box MG36, Magurele, Ilfov. 077125Romania	traian.dascalu@inflpr.ro Tel: + 40 21 4574550 Fax: + 40 21 457

5	**Viorica Stancalie** INFLPR, Head/ Dept. Lasers Atomistilor 409, P.O.Box MG36, Magurele, Ilfov. 077125 Romania	viorica.stancalie@inflpr.ro tel/fax: +4021 4574467
6	**Daniel Ursescu** ***Invited Speaker*** ELI-RO & INFLPR, Dept. Lasers Atomistilor 409, P.O.Box MG36, Magurele, Ilfov. 077125 Romania	daniel.ursescu@eli-np.ro daniel.ursescu@inflpr.ro tel/fax: +4021 4574467
7	**Razvan Dabu** ELI-RO & INFLPR, Dept. Lasers Atomistilor 409, P.O.Box MG36, Magurele, Ilfov. 077125 Romania	razvan.dabu@inflpr.ro razvan.dabu@eli-np.ro tel/fax: +4021 4574467
8	**C-tin Grigoriu** ***Invited Speaker*** INFLPR, Dept. Lasers Atomistilor 409, P.O.Box MG36, Magurele, Ilfov. 077125 Romania	grigoriu@nipne.ro tel/fax: +4021 4574467
9	**Ioan Dancus** ***Invited Speaker*** INFLPR, Dept.Lasers Atomistilor 409, P.O.Box MG36, Magurele, Ilfov. 077125 Romania	ioan.dancus@inflpr.ro tel/fax: +4021 4574467
10	**Tiberio CECCOTTI** ***Invited Speaker*** *Physique à Haute Intensité; CEA-DSM/IRAMIS/SPAM, France*	phone: +33 1 69084182 fax: +33 1 69081213 e-mail: tiberio.ceccotti@cea.fr http://iramis.cea.fr/spam/MEC/PHI.php
11	**Tara Desai** Research reactor section, Division of nuclear fuel cycle and waste technology, Department of nuclear energy International Atomic Energy Agency Vienna International Centre, P.O. Box 100, 1400 Vienna, Austria.	Fax : (+43-1) 2600-26007 Tel: (+43-1) 2600-22763, t.desai@iaea.org
12	**Bastian Aurand** ***Invited Speaker*** Department of Physics Lund University;PO Box 118;22100 Lund; Sweden	Phone: +46 46 222 7597 Fax: +46 46 222 4250 E-mail: bastian.aurand@fysik.lth.se
13	**Edmond Turcu** ***Invited Speaker*** Central Laser Facility, STFC Rutherford Appleton Laboratory, R1, 2-58, Harwell Oxford, Didcot, Oxfordshire, OX11 0QX. UK	Tel +44 (0) 1235 821900 Fax +44 (0) 1235 445888 Direct +44 (0) 1235 446491 edmond.turcu@stfc.ac.uk http://www.clf.rl.ac.uk/
14	**Paul McKenna,** ***Invited Speaker*** Department of Physics,University of Strathclyde, 107,Rottenrow,Glasgow G4 0NG, U.K.	Tel: +44 141 548 5712 Mobile: +44 7854 355740 Fax: +44 141 552 2891 Email: p.mckenna@phys.strath.ac.uk
15	**Victor Malka** ***Invited Speaker*** LOA, ENSTA, 91761 Palaiseau, FRANCE	Tel :33 1 69 31 99 03 victor.malka@ensta.fr
16	**Dino Jaroszynski FInstP** ***Invited Speaker*** University of Strathclyde	Tel: +44 (141) 548 3057 FAX: +44 (141) 552 2891 mobile/cellphone: +44 7966152465

	Physics Department Scottish Universities Physics Alliance (SUPA) John Anderson Building 107 Rottenrow Glasgow G4 0NG Scotland, UK	e-mail: D.A.Jaroszynski@strath.ac.uk http://www.scapa.ac.uk http://www.ngacdt.ac.uk http://tops.phys.strath.ac.uk http://phys.strath.ac.uk/alpha-x/ http://ppp.phys.strath.ac.uk
17	**Thomas Kuehl** ***Invited Speaker*** GSI-Helmholtzzentrum für Schwerionenforschung GmbH Planckstr. 1 D-64291 Darmstadt	Office: +49-(0) 6159 71 2438 Mobile: +49-(0) 174 3281 469 Home: +49-(0) 6151 718306 FAX: +49-(0) 6159 71 2814 E-Mail: t.kuehl@gsi.de
18	**Marilena Tomut** ***Invited Speaker*** GSI-Helmholtzzentrum für Schwerionenforschung GmbH;Planckstr. 1;D-64291 Darmstadt.	M.Tomut@gsi.de tel.: +49-6159-71-2919 fax: +49-6159-71-3266 office: C27.2.022
19	**Piotr Raczka** ***Invited Speaker*** Institute of Plasma Physics and Laser Microfusion Hery Str. 23, 01-497 Warsaw, Poland	Piotr.Raczka@ifpilm.pl fax: *+48 22 666 83 72* Tel : *+48 22 638 14 60*
20	**Rajendra Prasad** ***Invited Speaker*** Institute for Laser and Plasma Physics Heinrich Heine University, Duesseldorf Germany	Rajendra.Prasad@uni-duesseldorf.de Tel: +49-211-81-12864
21	**Martin Hansson** Department of Physics Atomic Physics; Lund University;P.O. Box 118;SE-221 00 Lund ,Sweden	martin.hansson@fysik.lth.se Phone: +46 46 222 7597 Fax: +46 46 222 4250
22	**Sophia Chen** ***Invited Speaker*** LULI, Ecole Politechnique, 91761 Palaiseau, FRANCE	sophia.chen@polytechnique.edu
23	**Olle Lundh** Research Associate (Forskarassistent) Department of Physics, Lund University P.O. Box 118;SE-221 00 Lund;Sweden	Olle.Lundh@fysik.lth.se Phone: +46 46 222 7597 Fax: +46 46 222 4250
24	**Christophe RADIER PhD** PROJECT MANAGER – R&D SCIENTIST Laser Solutions Department – THALES OPTRONIQUE SA ;2, avenue Gay Lussac 78995 - ELANCOURT CEDEX - FRANCE	christophe.radier@fr.thalesgroup.com Tel. : +33 (0)1 30 96 89 21 Fax : +33 (0)1 30 96 89 59
25	**Bertrand DE BOISDEFFRE** Chargé de mission pour la coopération scientifique Institut Français de Roumanie Bd. Dacia nr. 77, 020051 BUCURESTI	bertrand.boisdeffre@diplomatie.gouv.fr Tél : 0374 125 262 / +40 374 125 262 Fax : 0374 125 271 / +40 374 125 271 **www.institutfrancais-roumanie.com** **BE Sciences&Technologies Roumanie**
26	**Alexandru Popa** ***Invited Speaker*** INFLPR, Dept.Lasers Atomistilor 409, P.o. box MG36, Magurele, Ilfov, Romania	alexandru.popa@inflpr.ro Tel/Fax: +40 21 4574467
27	**Mihai Ganciu** ***Invited Speaker*** INFLPR , Dept Plasma	m.ganciu@u-psud.fr tel: +4021 4574460

	Atomistilor 409, P.o. box MG36, Magurele, Ilfov, Romania	
28	**Catalin Ticos** *Invited Speaker* INFLPR, Dept. Accelerators Atomistilor 409, P.o. box MG36, Magurele, Ilfov, Romania	catalin.ticos@inflpr.ro +4021 4574460
39	**Liviu Neagu** ELI-NP & INFLPR, Dept Lasers Atomistilor 409, P.o. box MG36, Magurele, Ilfov, Romania	liviu.neagu@inflpr.ro tel/fax: + 4021 4574467
30	**Andreea Mihailescu** INFLPR, Dept. Lasers Atomistilor 409, P.o. box MG36, Magurele, Ilfov, Romania	andreea.mihailescu@inflpr.ro tel/fax: +4021 4574467
31	**Gabriel Cojocaru** *Invited Speaker* INFLPR, Dept Lasers Atomistilor 409, P.o. box MG36, Magurele, Ilfov, Romania	gabriel.cojocaru@inflpr.ro tel/fax: 4021 4574467
32	**Razvan Ungureanu** INFLPR, Dept.Lasers Atomistilor 409, P.o. box MG36, Magurele, Ilfov, Romania	razvan.ungureanu@inflpr.ro tel/fax: 4021 4574467
33	**Viorica Florescu** University of Bucharest, Faculty of Physics Atomistilor 111,	vdflor39@yahoo.com
34	**Madalina Boca** University of Bucharest	madalina.boca@g.unibuc.ro
35	**Dan Sporea** *Invited Speaker* INFLPR, Atomistilor 409, POBOx MG-36, Magurele, Ilfov	dan.sporea@inflpr.ro +4021 4574467
36	**Adelina Sporea** INFLPR, Atomistilor 409, POBOx MG-36, Magurele, Ilfov	adelina.sporea@inflpr.ro +4021 4574467
37	**Laura Mihai** INFLPR,Atomistilor 409, POBOx MG-36, Magurele, Ilfov	laura.mihai@inflpr.ro +4021 4574467
38	**Andrei Stancalie** INFLPR , Atomistilor 409, POBOx MG-36, Magurele, Ilfov	andrei.stancalie@inflpr.ro +4021 4574467
39	**Mihai Dondera** University of Bucharest	don@barutu.fizica.unibuc.ro
40	**Theodor Asavei** ELI-NP ELI-NP & Horia Hulubei-Nat. Inst. of Phys. and Nucl. Eng., Romania Str Reactorului 30, P.O.Box MG-6, Magurele, Ilfov, Romania	theodor.asavei@eli-np.ro fax: + 4021 45744 60 tel: +4021 40423 00
41	**Elena Stancu** INFLPR Atomistilor 409, P.O.Box MG-36, Magurele, Ilfov	elena.stancu@inflpr.ro +4021 4574460
42	**Cristian Petcu** IFIN_HH ELI-NP ELI-NP & Horia Hulubei-Nat. Inst. of Phys. and Nucl. Eng., Romania	cristian.petcu@eli-np.ro fax: + 4021 45744 60

	Str Reactorului 30, P.O.Box MG-6, Magurele, Ilfov, Romania	tel: +4021 40423 00
43	**Andreea Oprisa** ELI-NP ELI-NP & Horia Hulubei-Nat. Inst. of Phys. and Nucl. Eng., Romania Str Reactorului 30, P.O.Box MG-6, Magurele, Ilfov, Romania	andreea.oprisa@eli-np.ro fax: + 4021 45744 60 tel: +4021 40423 00
44	**Gabriela Florescu** CITON SA, Atomistilor 409, Magurele, Ilfov, Romania	florescug@router.citon.ro + 40 21 4574429
45	**Doina Pantazi** CITON SA Atomistilor 409, Magurele, Ilfov, Romania	pantazid@router.citon.ro + 40 21 4574429
46	**Marian Toma** IFIN_HH ELI-NP ELI-NP & Horia Hulubei-Nat. Inst. of Phys. and Nucl. Eng., Romania; Str Reactorului 30, P.O.Box MG-6, Magurele, Ilfov, Romania	marian.toma@eli-np.ro fax: + 4021 45744 60 tel: +4021 40423 00
47	**Cernaianu Mihail** IFIN_HH ELI-NP ELI-NP & Horia Hulubei-Nat. Inst. of Phys. and Nucl. Eng., Romania; Str Reactorului 30, P.O.Box MG-6, Magurele, Ilfov, Romania	mihail.cernaianu@eli-np.ro fax: + 4021 45744 60 tel: +4021 40423 00
48	**Mircea Udrea** Apel Laser SRL Bd Constructorilor 20, Corp A, Sector 6, Bucuresti, 060512 Romania	mircea.udrea@apellaser.ro

Dr Viorica Stancalie