

# 2018 Source Workshop

November 5-7, 2018  
Prague ■ Czech Republic

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## Workshop Proceedings



## 2018 Source Workshop



2018 Source Workshop Group Photo  
November 6, 2018

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**Akira Endo (HiLASE), Co-Chair**  
**Ladislav Pina (CTU and Rigaku), Co-Chair**  
**Tomas Mocek (HiLASE), Co-chair**

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# Workshop Proceedings

# WORKSHOP PROCEEDINGS

(Please click on links to access presentations.)

## 2018 Source Workshop

November 5-7, 2018, Prague, Czech Republic

**Tuesday, November 6, 2018**  
**(HiLASE – ELI Auditorium)**

**9:30 AM Announcements and Introductions**

**Welcome -2018 Source Workshop**

Vivek Bakshi  
*EUV Litho, Inc., USA*

**Welcome to HiLASE**

Tomas Mocek  
*HiLASE*

**Announcements and Introductions (Intro-1)**

Padraig Dunne  
*UCD*

**9:50 AM            Session 1: Keynote Session -1**

**Session Chair:** Tomas Mocek (HiLASE)

**[Laser Produced Plasma Light Sources for Short Wavelength Applications \(S3\)](#)**

Gerry O’Sullivan  
*University College Dublin, Belfield, Dublin 4, Ireland*

**[Award Presentation](#)**

**Break 10:30(20 Mins)**

**10:50 AM            Session 2: Blue-X - I**

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**Session Chair:** Padraig Dunne (UCD) and Hans Hertz (KTH)

### **Blue-X – the New Frontier (S11)**

Vivek Bakshi  
*EUV Litho, Inc.*

### **Liquid-jet laser-plasma sources for sub-5-nm emission (S17) (Invited Talk)**

Hans M Hertz  
*Biomedical and X-Ray Physics, Dept of Applied Physics, KTH/Albanova,  
Stockholm, Sweden*

### **A Water Window Source for Soft X-Ray Microscopy and other Applications (S16) (Invited Talk)**

Paul Sheridan<sup>1</sup>, Alberto Manzoni<sup>1</sup>, Aodh O Connor<sup>1</sup>, Ciaran Rogers<sup>1</sup>, David Rogers<sup>1</sup>, Dunja Skoko<sup>1</sup>, Fergal O Reilly<sup>1,2</sup>, Gordon Murray<sup>1</sup>, Isaac Tobin<sup>1</sup>, James Costello<sup>1</sup>, Jason Howard<sup>1,2</sup>, Kenneth Fahy<sup>1</sup>, Martina Donnellan<sup>1</sup>, Stephen Brady<sup>1</sup>, Tony Donnelly<sup>1</sup>, Tony McEnroe<sup>1</sup>, William Fyans<sup>1</sup>  
<sup>1</sup>*SiriusXT Ltd, Dublin, Ireland*  
<sup>2</sup>*School of Physics, UCD Dublin, Ireland*

### **Recent Advances in Development and Application of Compact Laser-Plasma Soft X-ray Sources based on a Gas-Puff Target (S12) (Invited Talk)**

Henryk Fiedorowicz, Andrzej Bartnik, Przemysław Wachulak, Karol Janulewicz, Roman Jarocki, Jerzy Kostecki, Tomasz Fok, Łukasz Węgrzyński  
*Institute of Optoelectronics, Military University of Technology, Warsaw, Poland*

### **Wavelength and Brilliance Scaling Potential of Discharge based XUV Sources (S13) (Invited Talk)**

Klaus Bergmann, Lars Behnke, Alexander von Wezyk, Jochen Vieker  
*Fraunhofer Institute for Laser Technology – ILT, Steinbachstr. 15, 52074 Aachen, Germany*

### **Xe Laser-Plasma EUV Source – from 13.5 nm to 11 nm: Researche to Optimize the Xe LPP 11-nm Source (S14)**

S Kalmykov, M Sasin, et al  
*Ioffe Institute, St. Petersburg, Russia*

**12:50 PM Lunch (60 minutes)**



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### 1:50 PM Session 3: Blue-X – II

**Session Chair:** Torsten Feigl (optiXfab) and Oscar Versolato (ARCNL)

#### **Multilayer Optics for 1 nm to 13.5 nm: Can We Reduce the Lithography Wavelength Further? (S18) (Invited Talk)**

Torsten Feigl<sup>a</sup>, Marco Perske<sup>a</sup>, Hagen Pauer<sup>a</sup>, Tobias Fiedler<sup>a</sup>, Philipp Naujok  
Christian Laubis<sup>b</sup>, Frank Scholze<sup>b</sup>

<sup>a</sup>optiX fab GmbH, Hans-Knöll-Str.6, 07745 Jena, Germany

<sup>b</sup>Physikalisch-Technische Bundesanstalt, Abbestr. 2-12, 10587 Berlin, Germany

#### **Depth-modified Bragg Mirrors for sub-10-nm Wavelengths (S19)**

R. Meisels and F. Kuchar **(Invited Talk)**

*Institute of Physics, Montanuniversität Leoben, 8700 Leoben, Austria*

#### **New Architectures for PW-Scale High Peak Power Lasers Scalable to Near-MW Average Powers and Their Application to EUV Generation (S15) (Invited Talk)**

C.W. Siders, S. Langer, A.J. Bayramian, A.C. Erlandson, T.C. Galvin, E.F. Sistrunk,  
T.M. Spinka, and C. L. Haefner

*Advanced Photon Technologies, Lawrence Livermore National Laboratory, NIF &  
Photon Science Directorate, 7000 East Avenue, Livermore CA 94550*

### 2:50 PM Break and Group Photograph (25 Minutes)

### 3:10 PM Session 4: Lasers

**Session Chair:** Akira Endo (HiLASE) and Thomas Metzger (Trumpf)

#### **Beam Quality of Pulsed High-power CO<sub>2</sub>-Lasers for EUV Lithography (S36) (Invited Talk)**

Johannes Kaschke

*TRUMPF Lasersystems for Semiconductor Manufacturing GmbH,  
Johannes-Maus-Str.2, 71254 Ditzingen, Germany*

#### **Progress on laser-driven soft x-ray lasers at LOA (S32) (Invited Talk)**

S. Sebban<sup>1</sup>, E. Oliva<sup>2</sup>, M. Zürch<sup>3</sup>, A. Depresseux<sup>1</sup>, F. Tissandier<sup>1</sup>, J.P. Goddet<sup>1</sup>, A.  
Tafzi<sup>1</sup>, F. Tuitje<sup>3</sup>, T. Helk<sup>3</sup>, C. Spielmann<sup>3</sup>, M. Kozlova<sup>4</sup>, J. Nejdil<sup>4</sup>, G. Maynard<sup>5</sup> and J.  
Gautier<sup>1</sup>

1) LOA, Université Paris-Saclay, 91762 Palaiseau cedex, France;

2) Universidad Politécnica de Madrid, E-28006, Madrid, Spain;

3) Institute of Optics and Quantum Electronics, Abbe Center of Photonics, Jena



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- 4) *ELI Beamlines project, Institute of Physics of AS CR, v. v. i.  
Na Slovance 2, 182 21, Prague 8, Czech Republic*
- 5) *LPGP, CNRS-Université Paris Sud 11, Orsay, France*

### Technologies and Applications of High-average-power Lasers at HiLASE (S33) (Invited Talk)

Tomas Mocek

*HiLASE Centre, Institute of Physics of the Czech Academy of Sciences,  
Za Radnici 828, 25241 Dolni Brezany, Czech Republic*

### Ultrafast Thin-Disk Amplifiers (S35) (Invited Talk)

Thomas Metzger

*TRUMPF Scientific Lasers GmbH & Co. KG, Feringastr. 10a, 85774 Unterföhring,  
Germany*

### Quantum Technology and kW, ps thin disc lasers (S34) (Invited Talk)

Akira Endo

*HiLASE Centre, Institute of Physics CAS, Za Radnicí 828, 252 41 Dolní Břežany,  
Czech Republic*

### High-harmonic Generation for EUVL: Source Developments and Applications for Spectroscopy and Metrology (S31) (Invited Talk)

Peter Kraus

*ARCNL, Science Park 110, NL-1098 XG Amsterdam, The Netherlands*

## 5:15 PM Break (15 Minutes)

## 5:30 Session 5 Poster Session

**Session Chairs:** Vivek Bakshi (EUV Litho, Inc.) and Padraig Dunne (UCD)

### Lasers

### High-Harmonic Generation for EUV Frequency-Comb Spectroscopy of He<sup>+</sup> (S37) BEST POSTER AWARD: SECOND PLACE

J. Weitenberg,<sup>1,2</sup> A. Ozawa,<sup>1</sup> P. Rußbüldt,<sup>2</sup> D. Esser,<sup>2</sup> F. Schmid,<sup>1</sup> J. Schulte,<sup>2</sup>  
H.-D. Hoffmann,<sup>2</sup> R. Poprawe,<sup>2,3</sup> Th. Udem,<sup>1</sup> Th. W. Hänsch<sup>1,4</sup>

<sup>1</sup> *Max-Planck Institute of Quantum Optics MPQ, Hans-Kopfermann-Str. 1, 85748  
Garching, Germany*

<sup>2</sup> *Fraunhofer Institute for Laser Technology ILT, Steinbachstr. 15, 52074 Aachen,  
Germany*

<sup>3</sup> *RWTH Aachen University, Chair for Laser Technology LLT, Steinbachstr. 15, 52074  
Aachen, Germany*

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<sup>4</sup> Ludwig-Maximilian University Munich LMU, Faculty of Physics, Chair of Experimental Physics, Schellingstr. 4/III, 80799 München, Germany

### 0.5-kW Picosecond Thin-disk Laser System for Pre-pulsing in High-power EUV Sources (S38)

J. Mužík, M. Smrž, M. Chyla, O. Novák, A. Endo, T. Mocek  
HiLASE Centre, Institute of Physics CAS,  
Za Radnicí 828, 252 41 Dolní Břežany, Czechia

### High-energy Burst-mode Thin-disk Multipass Amplifier for Laser Compton X-ray Source (S39)

Siva Sankar Nagisetty<sup>1,2</sup>, Michal Chyla<sup>1</sup>, Martin Smrž<sup>1</sup>, Akira Endo<sup>1</sup>  
and Tomáš Mocek<sup>1</sup>

<sup>1</sup> HiLASE Centre, Institute of Physics AS CR, v.v.i. Za Radnicí 828, Dolní Břežany 252 41, Czech Republic

<sup>2</sup> Czech Technical University in Prague, Břehová 7, Prague 115 19, Czech Republic

### Development of a High-energy, Cryogenically-cooled Yb:YAG Laser System (S40)

Paweł Sikociński, Martin Smrz, Akira Endo and Tomas Mocek  
HiLASE Centre, Institute of Physics of the Czech Academy of Sciences, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic

### Adopting Crab Crossing to Laser-Compton Scattering X-ray (S70)

Yuya Koshiba<sup>1</sup>, Shogo Ota<sup>1</sup>, Ryosuke Morita<sup>1</sup>, Kazuyuki Sakaue<sup>1, 2</sup>,  
Masakazu Washio<sup>1</sup>, Akira Endo<sup>1, 3</sup>, Takeshi Higashiguchi<sup>4</sup>, Junji Urakawa<sup>5</sup>  
<sup>1</sup> Research Institute for Science and Engineering, Waseda University, 3-4-1 Okubo, Shinjuku-ku, Tokyo, 169-8555, Japan

<sup>2</sup> Photon Science Center, Graduate School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

<sup>3</sup> HiLASE Centre, Institute of Physics AS CR, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic

<sup>4</sup> Utsunomiya University, 7-1-2 Yoto, Utsunomiya, Tochigi, 321-8585, Japan

<sup>5</sup> High Energy Accelerator Research Organization, 1-1 Oho, Tsukuba, Ibaraki 305-0801 Japan

## **Laser Produced Plasma (LPP)**

### EUV-induced Plasma of Hydrogen with Nitrogen Admixture (S45)

P. V. Krainov<sup>1,2</sup>, B. Wedershoven<sup>3</sup>, Yu. Mankelevich<sup>4</sup>, M. van Kampen<sup>3</sup>, D. I. Astakhov<sup>2</sup>, V. V. Medvedev<sup>2</sup>, K. N. Koshelev<sup>2</sup>, A. M. Yakunin<sup>3</sup>, and M. van de Kerkhof<sup>3</sup>

1 Moscow Institute of Physics and Technology (State University), Institutsky

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pereulok 9, Dolgoprudny, Moscow region 141701, Russia

<sup>2</sup> Institute for Spectroscopy RAS (ISAN), Fizicheskaya str. 5, Troitsk, Moscow 108840, Russia

<sup>3</sup> ASML Netherlands B.V., De Run 6501, 5504DR Veldhoven, The Netherlands

<sup>4</sup> Skobel'tsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Leninskie gory, Moscow 119991, Russia

### **Validation of Radiation Hydrodynamic Model against Experiment with CO<sub>2</sub>-laser-produced tin Plasma (S46) BEST POSTER AWARD: FIRST PLACE**

B.V. Lakatos<sup>1</sup>, D.B. Abramenko<sup>2,3</sup>, A.S. Grushin<sup>4</sup>, V.V. Ivanov<sup>2,3</sup>, V.M. Krivtsun<sup>2,3</sup> and V.V. Medvedev<sup>2,3</sup>

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<sup>3</sup> Institute for Spectroscopy RAS, Fizicheskaya str. 5, Troitsk, Moscow 108840, Russia

<sup>4</sup> Keldysh Institute of Applied Mathematics RAS, Miusskaya sq. 4, Moscow 125047, Russia

### **Metrology Sources**

#### **Xenon plus additives in the Energetiq EQ-10: Initial Results (S57)**

Kosuke Saito, Stephen F. Horne, Don Smith, Matt Partlow, Debbie Gustafson, Matt Besen, Paul Blackborow, Michael Roderick  
Energetiq Technology, Inc.

#### **The Extendibility of the Maintenance- interval of a Discharge based EUV Source (S58)**

Jochen Vieker and Klaus Bergmann

Fraunhofer Institute for Laser Technology – ILT, Steinbachstr. 15, 52074 Aachen, Germany

#### **Advances in Laser-heated Discharge-plasma Sources (S59)**

Florian Melsheimer<sup>1,2,3,4</sup>, Detlev Grützmacher<sup>2,4,5</sup>, Larissa Juschkin<sup>1,2,4</sup>

<sup>1</sup> RWTH Aachen University, Experimental Physics of EUV, Germany

<sup>2</sup> Forschungszentrum Jülich GmbH, Institute for Semiconductor Nanoelectronics, Peter Grünberg Institut-9, 52425 Jülich Germany

<sup>3</sup> Fraunhofer Institute for Laser Technology, Steinbachstraße 15, 52074 Aachen, Germany

<sup>4</sup> JARA-FIT, Forschungszentrum Jülich GmbH and RWTH Aachen University, Germany

<sup>5</sup> Forschungszentrum Jülich GmbH, JARA-Institute for Green-IT, Peter Grünberg Institute -10, 52425 Jülich, Germany

### **EUV PLASMA SOURCE AT HILASE (S60)**

Chiara Liberatore<sup>1</sup>, Matthias Müller<sup>2</sup>, Jonathan Holburg<sup>2</sup>, Michal Chyla<sup>1</sup>, Klaus Mann<sup>2</sup>, Simon Hutchinson<sup>1</sup>, Akira Endo<sup>1</sup>, Alexander V. Bulgakov<sup>1</sup>, Nadezhda M. Bulgakova<sup>1</sup>, Tomas Mocek<sup>1</sup>

<sup>1</sup> HiLASE Centre, Institute of Physics CAS, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic

<sup>2</sup> Laser-Laboratorium Göttingen e.V., Hans-Adolf-Krebs-Weg 1, 37077 Göttingen, Germany

### **Metrology**

### **Free-standing Carbon Nanotube Membranes for Applications in Extreme - ultraviolet and Soft X-ray Optics (S61)**

V. M. Gubarev<sup>1,2</sup>, Yu. G. Gladush<sup>3</sup>, M. G. Sertsu<sup>4</sup>, V. Y. Yakovlev<sup>3</sup>, O. F. Yakushev<sup>1</sup>, V. M. Krivtsun<sup>1,5</sup>, V. V. Medvedev<sup>1,5</sup>, A. Sokolov<sup>4</sup>, F. Schafers<sup>4</sup>, A. G. Nasibulin<sup>3,6</sup> and K.N. Koshelev<sup>1,5</sup>

<sup>1</sup> RnD-ISAN/EUV Labs, Troitsk, Moscow 108840, Russia

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<sup>3</sup> Skolkovo Institute of Science and Technology, Moscow 143026, Russia

<sup>4</sup> Helmholtz Zentrum Berlin (BESSY-II), Albert-Einstein-Strasse 15, D-12489 Berlin, Germany

<sup>5</sup> Institute for Spectroscopy of the Russian Academy of Science, Moscow, Troitsk, Russia

<sup>6</sup> Department of Applied Physics, Aalto University, 15100, FI-00076 Aalto, Espoo, Finland

### **Design and Evaluation of a Focusing EUV Monochromator for Laboratory-based Photoemission-electron Microscopy beyond He II (S62)**

Daniel Wilson<sup>1,2</sup>, Gordon Staab<sup>2,3</sup>, Detlev Grützmacher<sup>3,4</sup>, Claus M. Schneider<sup>1</sup>, and Larissa Juschkina<sup>2,3</sup>

<sup>1</sup> Peter Grünberg Institut 6 (PGI-6), Forschungszentrum Jülich GmbH, JARA-FIT, 52425 Jülich, Germany

<sup>2</sup> Experimental Physics of EUV, RWTH Aachen University, JARA-FIT, Steinbachstraße 15, 52074 Aachen, Germany

<sup>3</sup> Peter Grünberg Institut 9 (PGI-9), Forschungszentrum Jülich GmbH, JARA-FIT, 52425 Jülich, Germany

<sup>4</sup> JARA-FIT Institute Green IT (PGI-10), Forschungszentrum Jülich GmbH and RWTH Aachen University, 52425 Jülich, Germany

### **Monitoring EUV and DUV spectral emission ratios of a high power EUVL source (S63)**

Muharrem Bayraktar<sup>1</sup>, Fei Liu<sup>2</sup>, Bert Bastiaens<sup>3</sup>, Caspar Bruineman<sup>4</sup>  
and Fred Bijkerk<sup>1</sup>

<sup>1</sup> *Industrial Focus Group XUV Optics, MESA + Institute for Nanotechnology, University of Twente, The Netherlands*

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<sup>3</sup> *Laser Physics and Nonlinear Optics, MESA + Institute for Nanotechnology, University of Twente, The Netherlands*

<sup>4</sup> *Scientec Engineering, The Netherlands*

### **A Single-shot NEXAFS Spectroscopy using Laser Plasma Double Stream Gas Puff Target SXR Source (S64)**

Martin Duda<sup>1,2</sup>, Przemysław Wachulak<sup>3</sup>, Tomasz Fok<sup>3</sup>, Łukasz Węgrzyński<sup>3</sup>,  
Alexandr Jančárek<sup>2</sup> and Henryk Fiedorowicz<sup>3</sup>

<sup>1</sup>*HiLASE Centre, Institute of Physics CAS, Za Radnicí 828, 252 41 Dolní Břežany, Czech Republic*

<sup>2</sup>*Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Břehová 7, 115 19 Praha 1 Prague, Czech Republic*

<sup>3</sup>*Institute of Optoelectronics, Military University of Technology, 2 Urbanowicza Str., 09-908 Warsaw, Poland*

### **Soft X-ray Spectroscopy and Microscopy using a Table-top Laser-induced Plasma Source (S65)**

Matthias Müller, Jonathan Holburg, and Klaus Mann

*Laser-Laboratorium Göttingen e.V., Hans-Adolf-Krebs-Weg 1, 37077 Göttingen, Germany*

### **Study of Light Sources in the Soft X-ray Region for the Development of a Tabletop Microscope (S66)**

M. Olszewski, H. Weltz<sup>1</sup>, T. Donnelly, G. Joseph, P. Dunne, F. O'Reilly

*Department of Physics, UCD, Dublin, Ireland*

<sup>1</sup>*Phelma, Grenoble INP*

## 2018 Source Workshop

**Wednesday November 7, 2018**

**9:30 AM Announcements (Intro-2)**

**9:50 AM Session 6: Keynote 2**

**Session Chair:** Ladislav Pina (CTU and Rigaku)

**[EUV Source for Lithography: Readiness for HVM and Outlook for Increase in Power and Availability \(S1\)](#)**

Igor Fomenkov

ASML US LP, San Diego, CA 92127, USA

**[High Power LPP-EUV Source with Long Collector Mirror Lifetime for Semiconductor High Volume Manufacturing \(S2\)](#)**

Hakaru Mizoguchi

Gigaphoton Inc., Hiratsuka Kanagawa, 254-8567, JAPAN

**11:10 AM Break (20 minutes)**

**11:30 PM Session 7: Metrology Sources**

**Session Chairs:** Klaus Bergman (Fraunhofer) and Samir Ellwi (ISTEQ)

**[Characterization and Performance Improvement of Laser-assisted and Laser driven EUV sources for Metrology Applications \(S56\) \(Invited Talk\)](#)**

Yusuke Teramoto<sup>1</sup>, Bárbara Santos<sup>1</sup>, Guido Mertens<sup>1</sup>, Margarete Kops<sup>1</sup>, Ralf Kops<sup>1</sup>, Reza Bayemani<sup>1</sup>, Klaus Bergmann<sup>2</sup>

<sup>1</sup>BLV Licht- und Vakuumtechnik GmbH / Ushio Inc., Steinbachstrasse 15, 52074 Aachen, Germany

<sup>2</sup>Fraunhofer ILT, Steinbachstrasse 15, 52074 Aachen, Germany

**[High-brightness Light Source Based on a New Concept of LPP for Actinic EUV microscopy and Metrology Applications \(S54\) \(Invited Talk\)](#)**

Konstantin Koshelev<sup>1,2</sup>, Alexander Vinokhodov<sup>1</sup>, Oleg Yakushev<sup>1</sup>, Dimitri Abramenko<sup>1</sup>, Alexander Lash<sup>1</sup>, Mikhail Krivokorytov<sup>1,2</sup>, Yuri Sidelnikov<sup>2</sup>, Vladimir Ivanov<sup>2</sup>, Vladimir Krivtsun<sup>2</sup>, Vyacheslav Medvedev<sup>1</sup>, Denis Glushkov<sup>3</sup>, Pavel Seroglazov<sup>3</sup>, Samir Ellwi<sup>3</sup>

<sup>1</sup>RnD-ISAN/EUV Labs, Troitsk, 108840 Russia

<sup>2</sup>Institute for Spectroscopy RAS, Troitsk, 108840 Russia

<sup>3</sup>ISTEQ, 5656 AG Eindhoven, The Netherlands

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### [Mixed gas fueling experiments on the Energetiq EQ-10 \(S52\) \(Invited Talk\)](#)

Stephen F. Horne, Ron Collins, Michael Roderick, Don Smith, Matt Partlow, Debbie Gustafson, Matt Besen, Paul Blackborow  
*Energetiq Technology, Inc.*

### [Electron impact type laboratory EUV source for metrology and imaging \(S55\) \(Invited Talk\)](#)

Ladislav Pina  
*Rigaku and Czech Technical University, Prague*

### [EUV/X-ray Sources driven by New-generation of Lasers for User-applications at ELI Beamlines \(S51\) \(Invited Talk\)](#)

Jaroslav Nejdil  
*ELI Beamlines project, Institute of Physics AS CR,  
Na Slovance 2, 182 21, Prague 8, Czech Republic*

**1:30 PM Lunch and Steering Committee Meeting**

**3:00 PM Session 8: FEL**

**Session Chair:** Hiroshi Kawata (KEK) and Akira Endo (HiLASE)

### [Upgrade plan of cERL for the POC as a First-Stage of the Development on EUV-FEL High-power Light Source \(S21\) \(Invited Talk\)](#)

Hiroshi Kawata, Norio Nakamura, and Ryukou Kato  
*High Energy Accelerator Research Organization (KEK), Tsukuba, Ibaraki 305-0801, Japan*

### [Surface Ablation by Soft X-ray Laser Pulse for EUV nano-scale fabrication \(S22\) \(Invited Talk\)](#)

Masaharu Nishikino  
*Kansai Photon Science Institute, QST, Kizugawa Kyoto, 619-0215, Japan*

### [Laser-cooled Electron Source \(S23\) \(Invited Talk\)](#)

Jom Luiten  
*Eindhoven University of Technology, The Netherlands*

### [Fs-laser driven free-electron laser development in ELI-BL \(S24\)](#)

Alexander Molodtsov<sup>1</sup>, Georg Korn<sup>1</sup>, Andreas Maier<sup>2,3</sup>, Florian Gruner<sup>2</sup>

<sup>1</sup>*IoP CAS, ELI-BL*

<sup>2</sup>*CFEL, DESY*

<sup>3</sup>*University of Hamburg*



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**4:20 PM**            **Break**

**4:40 PM**            **Session 9: LPP Sources**

**Session Chair:** Joost Franken (ARCNL) and Konstantin Koshelev (RnD-ISAN)

### **[Nd:YAG-laser-driven Sn plasma: an ARCNL research update \(S41\) \(Invited Talk\)](#)**

O. O. Versolato

*Advanced Research Center for Nanolithography (ARCNL), Science Park 110, 1098 XG Amsterdam, The Netherlands*

### **[Tin-ion Interactions \(S42\) \(Invited Talk\)](#)**

Ronnie Hoekstra

*Advanced Research Center for Nanolithography (ARCNL),  
Science Park 110, 1098 XG Amsterdam, the Netherlands and  
Zernike Institute for Advanced Materials, University of Groningen, 9747 AG  
Groningen, the Netherlands*

### **[Influence of Opacity in Nd:YAG Laser-produced Tin-Plasmas \(S43\)](#)**

R Schupp<sup>1</sup>, F Torretti<sup>1,2</sup>, J Colgan<sup>3</sup>, J Scheers<sup>1,2</sup>, R Hoekstra<sup>4</sup>, W Ubachs<sup>2</sup>,  
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- 1. Advanced Research Center for Nanolithography, Science Park 110, 1098 XG Amsterdam, The Netherlands*
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- 4. University of Groningen, Broerstraat 5, 9712 CP Groningen, The Netherlands*

### **[EUV & Soft X-ray Sources based on Medium-Z LPPs \(S44\) \(Invited Talk\)](#)**

*P. Dunne, E. White, F. O'Reilly, M Olszewski, E. Sokell, T. Miyazaki & G. O'Sullivan  
School of Physics, University College Dublin, Belfield, Dublin 4, Ireland*

### **[Computer modeling of contamination and cleaning of EUV source optics \(S47\) \(Invited Talk\)](#)**

Dmitry Astakhov

*RnD- ISAN*

**6:20 PM**            **Announcements and [Workshop Summary](#)**

**6:30 PM**            **Workshop Adjourned – Depart for Dinner**

