

PROCEEDINGS OF SPIE

Research Using Extreme Light: Entering New Frontiers with Petawatt-Class Lasers III

Georg Korn
Luis O. Silva
Editors

24–26 April 2017
Prague, Czech Republic

Sponsored by
SPIE

Cooperating Organisations
Science and Technology Facilities Council (United Kingdom)
ELI Beamlines (Czech Republic)
Laserlab Europe
AILU—Association of Laser Users (United Kingdom)
European Optical Society
HiLASE (Czech Republic)
AWE—Atomic Weapons Establishment (United Kingdom)

Published by
SPIE

Volume 10241

Proceedings of SPIE 0277-786X, V. 10241

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Research Using Extreme Light: Entering New Frontiers with Petawatt-Class Lasers III, edited by
Georg Korn, Luis O. Silva, Proc. of SPIE Vol. 10241, 1024101 · © 2017 SPIE
CCC code: 0277-786X/17/\$18 · doi: 10.1117/12.2282012

Proc. of SPIE Vol. 10241 1024101-1

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Research Using Extreme Light: Entering New Frontiers with Petawatt-Class Lasers III*, edited by Georg Korn, Luis O. Silva, Proceedings of SPIE Vol. 10241 (SPIE, Bellingham, WA, 2017) Seven-digit article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510609839
ISBN: 9781510609846 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Copyright © 2017, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/17/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE. DIGITAL LIBRARY
SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

- v *Authors*
vii *Conference Committee*

PLENARY SESSION III

- 10241 02 **High average power, diode pumped petawatt laser systems: a new generation of lasers enabling precision science and commercial applications (Plenary Paper)** [10241-300]

ACCELERATION OF PARTICLES USING HIGH POWER PW CLASS LASERS I

- 10241 0E **Design and development of the HELL User Station for multi-disciplinary experiments (Best Student Paper)** [10241-12]

EXTREME LIGHT SOURCES AND FACILITIES II

- 10241 0J **ELI-beamlines: progress in development of next generation short-pulse laser systems (Invited Paper)** [10241-17]

EXTREME LIGHT SOURCES AND FACILITIES III

- 10241 0N **High contrast high intensity petawatt J-KAREN-P laser facility at QST (Invited Paper)** [10241-22]

HIGH POWER INTENSE LASER SOURCES WITH ENHANCED REPETITION RATES

- 10241 0U **Development of high energy, sub-15 fs OPCPA system operating at 1 kHz repetition rate for ELI-Beamlines facility** [10241-29]

HIGH FIELD PHYSICS AND SIMULATIONS II

- 10241 0V **Modelling the effect of the radiation reaction force on the acceleration of ultra-thin foils** [10241-30]
10241 0Y **Evolution of relativistic electron vortices in laser plasmas** [10241-33]
10241 12 **Particle dynamics and pair production in tightly focused standing wave** [10241-37]

SECONDARY SOURCES GENERATED BY HIGH POWER LASERS I

- 10241 14 **Extreme laser pulses for possible development of boron fusion power reactors for clean and lasting energy** [10241-40]

SECONDARY SOURCES GENERATED BY HIGH POWER LASERS II

- 10241 1I **Ion acceleration with radiation pressure in quantum electrodynamic regimes (Invited Paper)** [10241-54]
- 10241 1J **Generation of attosecond electron pulses using petawatt lasers** [10241-55]
- 10241 1K **Ultra-intense laser interaction with specially-designed targets as a source of energetic protons** [10241-56]
- 10241 1L **Numerical studies on alpha production from high energy proton beam interaction with Boron** [10241-57]

POSTER SESSION

- 10241 1M **Multiparametric PIC simulations of electron vortices in relativistic laser plasmas** [10241-58]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Alkhimova, Mariya A., 0N
Antipenkov, Roman, 0J, 0U
Bakule, Pavel, 0J, 0U
Bartoníček, J., 0J
Baše, R., 0J
Batysta, František, 0J, 0U
Bayramian, A., 02, 0J
Betts, S., 02, 0J
Blackman, David R., 11
Boge, Robert, 0J, 0U
Bopp, R., 02
Buck, S., 02, 0J
Bulanov, Sergey V., 0N, 0Y, 1M
Cajiao Vélez, Felipe, 1J
Capdessus, Remi, 0V, 11
Chériaux, G., 0J
Collier, J., 0J
Cupal, J., 02, 0J
Del Sorbo, Dario, 0V, 11
Ditmire, T., 0J
Donovan, M., 0J
Dover, Nicholas P., 0N
Drouin, M. A., 02, 0J
Duff, Matthew J., 0V, 11
Ďurák, M., 0J
Edwards, C., 0J
Eliezer, S., 14
Erlandson, A., 02, 0J
Ertel, K., 0J
Esirkepov, Timur Zh., 0Y, 1M
Faenov, Anatoly Ya., 0N
Fibrich, M., 0J
Frederickson, C., 0J
Friedman, G., 0J
Fukuda, Yuji, 0N
Gaul, E., 0J
Green, Jonathan T., 0J, 0U
Griffani, Gabriele Maria, 0E
Haefner, C. L., 02, 0J
Hammond, D., 0J
Havlíček, T., 0J
Hernandez-Gomez, C., 0J
Hidinger, D., 0J
Himmel, B., 0J
Homer, P., 0J
Honsa, A., 0J
Hora, H., 14, 1L
Horáček, Jakub, 02, 0U
Horáček, Martin, 0J, 0U
Horner, J., 02, 0J
Hříbek, P., 0J
Hubáček, J., 0J
Hubka, Zbyněk, 0J, 0U
Indra, Lukáš, 0J, 0U
Jarboe, J., 02, 0J
Jirka, M., 12
Jochmann, A., 0J
Johnson, G., 0J
Kalinchenko, G., 0J
Kamenets, Fedor F., 0Y, 1M
Kamiński, Jerzy Z., 1J
Kando, Masaki, 0N
Kasl, K., 02, 0J
Kepler, M., 0J
Kim, D., 02, 0J
King, M., 0V
Kirchhoff, G. J., 14
Kiryama, Hiromitsu, 0N
Klimo, O., 12
Kniazev, Alexey R., 0Y, 1M
Koga, James, 0N
Koh, E., 02, 0J
Kondo, Kiminori, 0N
Kondo, Kotaro, 0N
Korn, Georg, 0E, 0Y, 12, 14, 1L
Korous, P., 0J
Košelja, M., 0J
Koubíková, L., 02, 0J
Krajewska, Katarzyna, 1J
Kramer, D., 0J
Lagron, J. C., 0J
Lalousis, P., 14, 1L
Laub, M., 0J
Levato, Tadzio, 0E
Lezhnin, Kirill V., 0Y, 1M
Lintern, A., 0J
Luo, Wen, 11
Malato, C., 0J
Maranville, W., 02
Marshall, C., 02, 0J
Martinez, M., 0J
Mason, D., 02, 0J
Mason, P., 0J
Matys, M., 1K
Mazanec, T., 0J
Mazurek, P., 02
McKenna, Paul, 0V, 11
Meadows, A., 0J

Menapace, J., 02
Metzger, T., 0J
Miley, G. H., 14
Miller, P., 02
Miyahara, Takumi, 0N
Moustazis, S. D., 14, 1L
Naylon, Jack A., 02, 0J, 0U
Nishitani, Keita, 0N
Nishiuchi, Mamiko, 0N
Novák, Jakub, 02, 0J, 0U
Ogura, Koichi, 0N
Pasley, John, 1I
Peceli, D., 02, 0J
Pikuz, Tatiana A., 0N
Pirozhkov, Alexander S., 0N
Polan, J., 0J
Psikal, J., 1K
Ridgers, Christopher P., 0V, 1I
Robinson, Alexander P. L., 1I
Rosso, P., 02
Ruhl, Hartmut, 1D
Rus, Bedřich, 0J, 0U
Sagisaka, Akito, 0N
Sakaki, Hironao, 0N
Schaffers, K., 02
Schultze, M., 0J
Sheng, Zheng-Ming, 1I
Sistrunk, E., 02, 0J
Slade-Lowther, Cody, 1I
Small, Kristina, 1I
Smith, D., 02, 0J
Snopek, David, 0J, 0U
Šobr, V., 0J
Soloviev, Sergei V., 0Y, 1M
Spinka, T., 02, 0J
Stanley, J., 02, 0J
Steele, R., 02
Stolz, C., 02, 0J
Strkula, Petr, 0U
Suratwala, T., 02, 0J
Telford, S., 02, 0J
Thoma, J., 02, 0J
Trojek, P., 0J
Tykalewicz, Boguslaw, 0J, 0U
VanBlarcom, D., 02
Velpula, P., 0J
Verhagen, E., 0J
Vranic, M., 12
Vyhřídka, Š., 0J
Watanabe, Yukinobu, 0N
Weber, Stefan A., 0Y, 12
Wegner, P., 02
Weiss, J., 02, 0J

Conference Committee

Symposium Chairs

Jiri Homola, Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic)
Bedrich Rus, Institute of Physics of the ASCR, v.v.i. (Czech Republic)
Chris Edwards, Central Laser Facility, Science and Technology Facilities Council (United Kingdom)
Mike Dunne, SLAC National Accelerator Laboratory (United States)
Ivo Rendina, Istituto per la Microelettronica e Microsistemi, CNR (Italy)

Conference Chairs

Georg Korn, Institute of Physics of the ASCR, v.v.i. (Czech Republic)
Luis O. Silva, Universidade Técnica de Lisboa (Portugal)

Conference Program Committee

Sergei V. Bulanov, Japan Atomic Energy Agency (Japan)
Dimitrios Charalambidis, Foundation for Research and Technology-Hellas (Greece)
Cristina Hernandez-Gomez, Rutherford Appleton Laboratory (United Kingdom)
Mattias Marklund, Umeå Universitet (Sweden)
Matthew Zepf, Queen's University Belfast (United Kingdom)
Victor Zamfir, Horia Hulubei National Institute of Physics and Nuclear Engineering (Romania)

Session Chairs

- 1 Special Session Honoring Prof. Wolfgang Sandner: Extreme Light Sources and Facilities I
Carlo Rizzuto, Extreme Light Infrastructure Delivery Consortium International (Belgium)
- 2 High Field Physics and Simulations I
Georg Korn, Institute of Physics of the ASCR, v.v.i. (Czech Republic)
- 3 Acceleration of Particles Using High Power PW Class Lasers I
Georg Korn, Institute of Physics of the ASCR, v.v.i. (Czech Republic)
- 4 Extreme Light Sources and Facilities II
Károly Osvay, ELI-ALPS Research Institute (Hungary)

- 5 Extreme Light Sources and Facilities III
Pavel Bakule, ELI Beamlines, Institute of Physics of the ASCR, v.v.i.
(Czech Republic)
- 6 High Power Intense Laser Sources with Enhanced Repetition Rates
Daniel Kramer, ELI Beamlines, Institute of Physics of the ASCR, v.v.i.
(Czech Republic)
- 7 High Field Physics and Simulations II
Stephan Weber, ELI Beamlines, Institute of Physics of the ASCR, v.v.i.
(Czech Republic)
Marija Vranic, ELI Beamlines, Institute of Physics of the ASCR, v.v.i..
(Czech Republic)
- 8 Secondary Sources Generated by High Power Lasers I
Daniel Kramer, ELI Beamlines, Institute of Physics of the ASCR, v.v.i.
(Czech Republic)
- 9 High Field Physics and Simulations III
Felix Mackenroth, Max-Planck-Institut für Physik komplexer Systeme
(Germany)
- 10 Acceleration of Particles Using High Power PW Class Lasers II
Paul McKenna, University of Strathclyde (United Kingdom)
- 11 Secondary Sources Generated by High Power Lasers II
Marco Borghesi, Queens University, Belfast (United Kingdom)