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DAMAGE

CONNECTING MINDS.
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2017

LASER DAMAGE

XLIX ANNUAL SYMPOSIUM ON OPTICAL
MATERIALS FOR HIGH-POWER LASERS

TECHNICAL PROGRAM

Millennium Harvest House Hotel
Boulder, Colorado, USA

24-27 September 2017

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SPIE. LASER DAMAGE

24-27 September 2017

Millennium Harvest House Hotel
Boulder, Colorado, USA

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Welcome

Welcome to the 49th Annual Laser Damage Symposium also known as the Symposium on Optical Materials for High Power Lasers and is the leading forum for the exchange of information on the physics/technology of materials for high-power/high-energy lasers. The series of conference proceedings has grown to be a comprehensive source of information on optics for lasers and includes topics on laser-induced damage mechanisms, materials, and thin film preparation, durability properties modeling, testing, and component fabrication.

This symposium will start with the Sunday Evening Tutorial/Discussion on Femtosecond Laser Damage: Past, Present, and Future. Laser Damage will host a featured Mini-Symposium: Frontiers of Ultrafast Science: Sources, Basic Effects, and Mechanisms of Ultrafast Laser-Matter Interactions; the Thin-Film Laser-Damage Competition; and will include both poster and oral presentations with no parallel sessions.

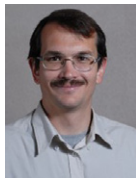
Distinguished international researchers in the field of optics for high-power/high-energy lasers will present invited talks. We have planned 3.5 days of information, networking, and enjoyment.

Take time to enjoy beautiful Boulder and its surroundings. We welcome you to Boulder!

CONFERENCE CHAIRS



Gregory J. Exarhos
Pacific Northwest
National Lab.
(USA)



Vitaly E. Gruzdev
Univ. of
Missouri-
Columbia (USA)



Joseph A. Menapace
Lawrence
Livermore
National Lab.
(USA)



Detlev Ristau
Laser Zentrum
Hannover e.V.
(Germany)



MJ Soileau
Univ. of Central
Florida (USA)

INTERNATIONAL PROGRAM COMMITTEE

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Hannover e.V. (Germany)
(Committee Chair)

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(United Kingdom)

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Semyon Papernov, Univ. of
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Livermore National Lab. (USA)

Wolfgang Rudolph, The Univ. of
New Mexico (USA)

Jianda Shao, Shanghai Institute of
Optics and Fine Mechanics (China)

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(USA)

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Livermore National Lab. (USA)



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Arthur H. Guenther and
Alexander J. Glass

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CONFERENCE SITE

The Millennium Harvest House
Boulder
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Boulder, CO 80302
www.millenniumhotels.com

QUESTIONS?

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SUNDAY 24 September	MONDAY 25 September	
SPIE LASER DAMAGE 2017		
REGISTRATION MATERIAL PICK-UP , 5:30 pm to 8:30 pm	REGISTRATION MATERIAL PICK-UP , 7:30 am to 4:00 pm	
TUTORIAL AND DISCUSSION Femtosecond Laser Damage: Past, Present, and Future , 6:00 to 7:00 pm	Poster Placement , 7:40 to 8:00 am	
Welcome and Social Mixer 7:00 to 8:30 pm <i>Registration Material Pick-up continues until 8:30 pm</i>	Opening Remarks and 2016 Award Presentations 8:00 to 8:30 am Alexander Glass Best Oral Presentation and Arthur Guenther Best Poster Presentation	
	SESSION 1 Surfaces, Mirrors, and Contamination I , 8:30 to 9:50 am	
	Monday Poster Overview , 9:50 to 10:20 am	
	Poster Viewing and Refreshment Break , 10:20 to 11:10 am	
	SESSION 2 Surfaces, Mirrors, and Contamination II , 11:10 am to 12:50 pm	
	Lunch Break 12:50 to 2:00 pm	

	TUESDAY 26 September	WEDNESDAY 27 September
	REGISTRATION MATERIAL PICK-UP, 7:30 am to 4:00 pm	REGISTRATION MATERIAL PICK-UP, 7:30 am to 3:00 pm
	Poster Placement, 7:40 to 8:00 am	
	SESSION 5 Mini-Symposium I: Frontiers of Ultrafast Science Sources, Basic Effects, and Mechanisms of Ultrafast Laser-matter Interactions, 8:00 to 9:50 am	SESSION 9 Thin Films II, 8:00 to 10:00 am
		Refreshment Break, 10:00 to 10:30 am
	Tuesday Poster Overview, 9:50 to 10:20 am	SESSION 10 Thin Films III, 10:30 am to 12:50 pm
	Poster Viewing and Refreshment Break, 10:20 to 11:10 am	
	SESSION 6 Mini-Symposium II: Frontiers of Ultrafast Science Sources, Basic Effects, and Mechanisms of Ultrafast Laser-matter Interactions, 11:10 am to 12:40 pm	
	Lunch Break 12:40 to 2:00 pm	Lunch Break 12:50 to 2:00 pm

SUNDAY 24 September	MONDAY 25 September	
	SESSION 3 Fundamental Mechanisms I, 2:00 to 3:40 pm	
	Poster Viewing and Refreshment Break, 3:40 to 4:30 pm	
	SESSION 4 Fundamental Mechanisms II, 4:30 to 6:10 pm	
	Closing Remarks, 6:10 to 6:20 pm	
	OPEN HOUSE AND RECEPTION, 6:30 to 8:00 pm	

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	TUESDAY 26 September	WEDNESDAY 27 September
	SESSION 7 Mini-Symposium III: Frontiers of Ultrafast Science Sources, Basic Effects, and Mechanisms of Ultrafast Laser- matter Interactions, 2:00 to 3:40 pm	SESSION 11 Materials and Measurements I, 2:00 to 4:00 pm
	Poster Viewing and Refreshment Break, 3:40 to 4:30 pm	Refreshment Break, 4:00 to 4:30 pm
	SESSION 8 Thin Films I, 4:30 to 5:50 pm	SESSION 12 Materials and Measurements II, 4:30 to 6:10 pm
	Closing Remarks, 5:50 to 6:00 pm	Closing Remarks, 6:10 to 6:20 pm
	WINE AND CHEESE TASTING RECEPTION, 6:30 to 8:00 pm	

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SPECIAL EVENTS

Sunday • 24 September

TUTORIAL AND DISCUSSION

Femtosecond Laser Damage: Past, Present, and Future

6:00 to 7:00 pm • Location: Grand Ballroom



Workshop Chair: **Enam A. Chowdhury**
The Ohio State Univ. (USA)

Over the past two decades, the field of femtosecond laser damage have made strides not only in expanding our understanding of a fundamental non-perturbative light matter interaction, but also in building next generation ultra-intense lasers and application of femtosecond laser materials processing. Experimental and theoretical development in this exciting and rapidly expanding field will be discussed.

Welcome and Social Mixer

7:00 to 8:30 pm

Location: Pavilion Gardens

Join your colleagues for light refreshments and mingling.

Registration Material Pick-up will continue until 8:30 pm.

Monday • 25 September

Poster Overviews- Monday

9:50 to 10:20 am

Posters authors are asked to give a 2-minute/2-slide overview of their poster in the order that they appear in the Monday poster sessions.



Poster Viewing and Refreshment Breaks- Monday

10:20 to 11:10 am and 3:40 to 4:30 pm

Location: Century Room

Conference attendees are invited to attend the Poster Sessions and review poster papers and interact with the authors who will be at their posters during both sessions.

Please be sure to wear your registration badge.

Open House and Reception

6:30 to 8:00 pm

Come, relax, and join your colleagues at Alpine Research Optics (ARO) for an enjoyable evening of refreshments and pleasant conversation.

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SPECIAL EVENTS

Tuesday • 26 September

Poster Overviews-Tuesday

9:50 to 10:20 am

Poster authors are asked to give a 2-minutes/2-viewgraph overview of their posters in the order that they appear in the Monday poster sessions.

Poster Viewing and Refreshment Breaks-Tuesday

10:20 to 11:10 am and 3:40 to 4:30 pm

Conference attendees are ed to attend the Poster Sessions and re-view poster papers and interact with the authors who will be at their posters during both sessions.

Please be sure to wear your registration badge.

Wine and Cheese Tasting Reception

6:30 to 8:00 pm

SPONSORED BY: **SPIE** and
the Conference Co-chairs of Laser Damage XLIX

Reception at NCAR

1850 Table Mesa Dr., Boulder, CO

All attendees are invited to join us for an enjoyable evening of wine tasting, local brews, and a selection of cheese appetizers.

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TRIBUTE TO

Prof. Mireille Commandré

This summer the worldwide laser-damage community suffered an irrecoverable loss: Prof. Mireille Commandré passed away on July 11, 2017. Mireille was a full professor with Ecole Centrale Marseille (France) and a leader of research team ILM (Laser Matter Interactions) at Fresnel Institute (Marseille, France). She worked in the field of laser-induced damage of optical materials since the beginning of her research career in 1980s. Since 2010, she served as a member of International Program Committee of Laser-Damage Symposium. Since 2003, she also served as a member of the Program Committee of another worldwide recognized international conference – Advances in Optical Thin Films. The Co-chairs of Laser Damage Symposium, members of International Program Committee of Laser Damage Symposium, and entire laser-damage community highly recognize and appreciate the outstanding contribution of Mireille to success of this conference and to the overall progress of research in the fields related to laser damage and optical materials for high-power lasers.



CONFERENCE 10447

Sunday–Wednesday 24–27 September 2017
Proceedings of SPIE Vol. 10447

Laser-Induced Damage in Optical Materials 2017

Conference Chairs: **Gregory J. Exarhos**, Pacific Northwest National Lab. (USA); **Vitaly E. Gruzdev**, Univ. of Missouri (USA); **Joseph A. Menapace**, Lawrence Livermore National Lab. (USA); **Detlev Ristau**, Laser Zentrum Hannover e.V. (Germany); **MJ Soileau**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

Program Committee: **Detlev Ristau**, Laser Zentrum Hannover e.V. (Committee Chair) (Germany); **James E. Andrew**, AWE plc (United Kingdom); **Jonathan W. Arenberg**, Northrop Grumman Aerospace Systems (USA); **Mireille Commandré**, Institut Fresnel (France); **Stavros G. Demos**, Univ. of Rochester (USA); **Leonid B. Glebov**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Takahisa Jitsuno**, Osaka Univ. (Japan); **Klaus Mann**, Laser-Lab. Göttingen e.V. (Germany); **Carmen S. Menoni**, Colorado State Univ. (USA); **Masataka Murahara**, Tokai Univ. (Japan); **Jérôme Néauport**, Commissariat à l'Énergie Atomique (France); **Raluca A. Negres**, Lawrence Livermore National Lab. (USA); **Semyon Papernov**, Univ. of Rochester (USA); **Wolfgang Rudolph**, The Univ. of New Mexico (USA); **Jianda Shao**, Shanghai Institute of Optics and Fine Mechanics (China); **Michelle D. Shinn**, U.S. Dept. of Energy (USA); **Christopher J. Stolz**, Lawrence Livermore National Lab. (USA)

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CONFERENCE 10447

SUNDAY 24 SEPTEMBER

REGISTRATION MATERIAL PICK-UP

Location: Sunshine RoomSun 5:30 pm to 8:30 pm

TUTORIAL AND DISCUSSION

Location: Grand Ballroom 6:00 pm to 7:00 pm

Femtosecond Laser Damage: Past, Present, and Future

Chaired by: **Enam A. Chowdhury**, The Ohio State Univ. (USA)

Over the past two decades, the field of femtosecond laser damage have made strides not only in expanding our understanding of a fundamental non-perturbative light matter interaction, but also in building next generation ultra-intense lasers and application of femtosecond laser materials processing. Experimental and theoretical development in this exciting and rapidly expanding field will be discussed.

WELCOME AND SOCIAL MIXER

Location: Pavilion GardensSun 7:00 pm to 8:30 pm

Join your colleagues for light refreshments and mingling.

Guest tickets are available onsite for \$35.

Registration Material Pick-up will continue until 8:30 pm.

MONDAY 25 SEPTEMBER

REGISTRATION MATERIAL PICK-UP

Location: Sunshine Room7:30 am to 4:00 pm

POSTER PLACEMENT-MONDAY

Location: Century Room 7:40 am to 8:00 am

OPENING REMARKS AND AWARD PRESENTATIONS

Location: Grand Ballroom 8:00 am to 8:30 am

Tribute to
Prof. Mireille Commandré

Announcement of the new
MJ Soileau Best Student Paper Award
starting in 2017

2016 BEST PAPER AWARD WINNERS

Alexander Glass Best Oral Presentation

Few-cycle pulse laser-induced damage of thin films in air and vacuum ambience [10014-14]

Kyle R. P. Kafka, Noah Talisa, Drake R. Austin, Kevin Werner, The Ohio State Univ. (USA); **Gabriel Tempea, Catalin Neacsu**, Spectra-Physics (Austria); **Enam A. Chowdhury**, The Ohio State Univ. (USA)

Arthur Guenther Best Poster Presentation

Characterization of NLO crystal absorption for wavelengths 1 ω to 4 ω [10014-59]

Christian Muehlig, Simon Bublitz, Leibniz-Institut für Photonische Technologien e.V. (Germany)



Alexander J. Glass and Arthur H. Guenther, Founding Organizers of Laser Damage Meeting

LD Annual Awards established in honor of founding organizers

Presented in 2017, the annual Best Oral Presentation and the Best Poster Presentation Awards are supported and renamed to honor the founding organizers for this meeting. These awards are intended to foster participation and advance the research in laser-induced damage, development of materials for high power lasers, and associated technologies, and will provide some financial assistance to researchers, engineers and students involved in the laser damage community.

Supported and approved by the 2016 Laser Damage Cochairs, with funds matched by SPIE, the new established awards are:

The Alexander Glass Best Oral Presentation Award

The Arthur Guenther Best Poster Presentation Award

CONFERENCE 10447

SESSION 1

Location: Grand Ballroom Mon 8:30 am to 9:50 am

Surfaces, Mirrors, and Contamination I

Session Chairs: **Gregory J. Exarhos**, Pacific Northwest National Lab. (USA); **MJ Soileau**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

8:30 am: **Particle damage sources and their mitigation on high energy laser systems** (*Keynote Presentation*), Christopher W. Carr, Jeffrey D. Bude, Philip E. Miller, Thomas Parham, Pam K. Whitman, Marcus V. Monticelli, Rajesh N. Raman, David A. Cross, Brian Welday, Frank Ravizza, Tayyab I. Suratwala, James Davis, Matthew J. Fischer, Ruth A. Hawley, Henry Lee, Manyalibo J. Matthews, Mary A. Norton, Michael C. Nostrand, Diana Vanblarcom, Stanley C. Sommer, Lawrence Livermore National Lab. (USA) [10447-1]

9:10 am: **Contamination, debris, and shrapnel generation arising from large area laser target interactions**, James E. Andrew, AWE plc (United Kingdom) [10447-2]

9:30 am: **Research on the cleanliness control technologies for high-power laser facility**, Xiaodong Yuan, Wanguo Zheng, Xinxiang Miao, Haibing Lv, China Academy of Engineering Physics (China) [10447-3]

MONDAY POSTER OVERVIEWS

Location: Grand Ballroom 9:50 am to 10:20 am

Posters authors are asked to give a 2-minute/2-slide overview of their poster in the order that they appear in the Monday poster sessions.

POSTER VIEWING AND REFRESHMENT BREAK- MONDAY AM

Location: Century Room 10:20 am to 11:10 am

Posters will be displayed for viewing during refreshment breaks on Monday from 10:20 am to 11:10 am and again from 3:40 pm and 4:30 pm.

POSTER SESSION

Location: Century Room Mon 10:20 am to 11:10 am

Surfaces, Mirrors, and Contamination

Monolithic antireflection grating on fused silica beam sampling grating for high power laser system, Ying Liu, Huoyao Chen, Univ. of Science and Technology of China (China) [10447-55]

Elucidation of laser resist removal phenomenon without causing laser damage, Takayuki Yamashiro, Kousuke Nuno, Yuji Umeda, Yusuke Funamoto, Tomosumi Kamimura, Osaka Institute of Technology (Japan); Ryosuke Nakamura, Osaka Univ. (Japan); Takashi Nishiyama, Hideo Horibe, Osaka City Univ. (Japan); Hiroyuki Kuramae, Osaka Institute of Technology (Japan). [10447-56]

Development of optimal mitigation contours and their machining flow by micro-milling to improve the laser damage resistance of KDP crystal, Jian Cheng, Mingjun Chen, Wenjing Ma, Hao Yang, Qi Liu, Harbin Institute of Technology (China); Chenhui An, Zhichao Liu, China Academy of Engineering Physics (China) [10447-57]

Optimum inductively coupled plasma etching of fused silica to remove subsurface damage layer, Xiaolong Jiang, Ying Liu, Univ. of Science and Technology of China (China) [10447-59]

Materials and Measurements

System for investigation of laser induced damage dynamics of optical materials for high energy lasers: a brief overview, Baoan Liu, Chang Liu, Xin Ju, Univ. of Science and Technology Beijing (China); Chengyu Zhu, Zhiwei Lv, Harbin Institute of Technology (China) [10447-60]

Bulk absorption properties of LBO crystals, Christian Muehlig, Leibniz-Institut für Photonische Technologien e.V. (Germany) [10447-62]

Optical defects absorption produced in fused silica during laser-induced damage, Chunyan Yan, Xin Ju, Univ. of Science and Technology Beijing (China) [10447-63]

Influence of sintering aids for optical properties in Nd³⁺:YAG ceramics, Shingo Tsujimoto, Yuji Umeda, Yusuke Funamoto, Tomosumi Kamimura, Osaka Institute of Technology (Japan); Yan Lin Aung, Akio Ikessue, World Lab Co., Ltd. (Japan). [10447-64]

An optimized strategy for the measurement of the defect distribution near threshold, Jonathan W. Arenberg, Northrop Grumman Aerospace Systems (USA); Luke A. Emmert, Wolfgang Rudolph, The Univ. of New Mexico (USA). [10447-65]

A method for the determination of the defect density distribution from standard damage frequency measurements, Jonathan W. Arenberg, Northrop Grumman Aerospace Systems (USA); Carmen S. Menoni, Colorado State Univ. (USA). [10447-66]

An empirical investigation of the laser survivability curve: VIII-Summary, Jonathan W. Arenberg, Northrop Grumman Aerospace Systems (USA); Andrius Melninkaitis, Vilnius Univ. (Lithuania); Wolfgang Riede, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Alessandra Ciapponi, European Space Research and Technology Ctr. (Netherlands); Jonathan Herringer, Arrow Thin Films, Inc. (USA); Denny Wernham, European Space Agency (Netherlands) [10447-67]

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Superficial modification of a Ti-6Al-4V alloy by laser peening, Hector G. Carreon, Univ. Michoacana de San Nicolás de Hidalgo (Mexico); Sandra Barriuso, Ctr. Nacional de Investigaciones Metalúrgicas (Spain); A. Asensio, M. Angeles Montealegre, AIMEN Ctr. Tecnológico (Spain); M. Carreon, Univ. Michoacana de San Nicolás de Hidalgo (Mexico); J.A. Jiménez, Jose Luis González-Carrasco, Ctr. Nacional de Investigaciones Metalúrgicas (Spain) [10447-68]

MELBA: a fully customizable laser for damage experiments, Matthieu Veinhard, Commissariat à l'Énergie Atomique (France) and Institut Fresnel (France); Odile Bonville, Roger Courchinoux, Romain Parreault, Laurent Lamaignère, Commissariat à l'Énergie Atomique (France); Jean-Yves Natoli, Institut Fresnel (France) [10447-69]

Calibration accuracy of laser calorimetry for common crystal geometries, Istvan Balasa, Laser Zentrum Hannover e.V. (Germany) [10447-70]

Quantitative absorption data from thermally induced wavefront distortion on UV, Vis, and NIR optics, Klaus Mann, Bernd Schäfer, Laser-Lab. Göttingen e.V. (Germany); Uwe Leinhos, MicroLiquids GmbH (Germany); Maik Lübbecke, Laser-Lab. Göttingen e.V. (Germany)[10447-71]

Giant tuning of infrared plasmonics on layered Graphene-based metal nanotrench, Noor Uddin, Guangqing Du, Feng Chen, Yu Lu, Qing Yang, Yanhong Dong, Huanrong Fan, Xi'an Jiaotong Univ. (China) [10447-88]

Visual defects diffraction in high power lasers: impact on downstream optics prediction, Stéphane Bouillet, Florian Tournemene, Claude Rouyer, Commissariat à l'Énergie Atomique (France) . . . [10447-89]

SESSION 2

Location: Grand Ballroom Mon 11:10 AM to 12:50 PM

Surfaces, Mirrors, and Contamination II

Session Chairs: **James E. Andrew**, AWE plc (United Kingdom);
Joseph A. Menapace, Lawrence Livermore National Lab. (USA)

11:10 am: **CW laser damage testing of RAR nano-textured fused silica and YAG**, Douglas S. Hobbs, Bruce D. MacLeod, Anthony Manni, Ernest Sabatino III, TelAztec LLC (USA); David M. Bernot, Sage DeFrances, Joseph A. Randi, Jeffrey G. Thomas, The Pennsylvania State Univ. (USA) [10447-4]

11:30 am: **Laser damage of optical windows with random antireflective surface structures on both interfaces**, Christopher R. Wilson, Matthew G. Potter, The Univ. of North Carolina at Charlotte (USA); Lynda E. Busse, Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA); Ishwar D. Aggarwal, Sotera Defense Solutions, Inc. (USA); Menelaos K. Poutous, The Univ. of North Carolina at Charlotte (USA) [10447-5]

- 11:50 am: **Three-dimensional profile of laser-induced surface damage pit of fused silica and its evolution during wet chemical etching**, Taixiang Liu, Ke Yang, Lianghong Yan, Xiaodong Yuan, Hongwei Yan, China Academy of Engineering Physics (China) [10447-6]
- 12:10 pm: **Growth of laser-induced damage on the exit surface of fused silica optics with a millimetric laser beam**, Matthieu Veinhard, Commissariat à l'Énergie Atomique (France) and Institut Fresnel (France); Odile Bonville, Roger Courchinoux, Romain Parreault, Laurent Lamaignère, Commissariat à l'Énergie Atomique (France); Jean-Yves Natoli, Institut Fresnel (France) [10447-7]
- 12:30 pm: **Damage performance under 351nm, nanosecond pulses of magnetorheological finishing-polished fused-silica samples using different polishing compounds and postprocessing methods**, Kyle R. P. Kafka, Semyon Papernov, Univ. of Rochester (USA); Michael A. DeMarco, Christopher A. Hall, QED Technologies, Inc. (USA); Kenneth L. Marshall, Brittany N. Hoffman, Stavros G. Demos, Univ. of Rochester (USA) [10447-8]
- Lunch Break Mon 12:50 pm to 2:00 pm

SESSION 3

Location: Grand Ballroom Mon 2:00 pm to 3:40 pm

Fundamental Mechanisms I

Session Chairs: **Detlev Ristau**, Laser Zentrum Hannover e.V. (Germany); **Semyon Papernov**, Univ. of Rochester (USA)

2:00 pm: **Virtual and real materials for interference coatings** (*Keynote Presentation*), Marco Jupé, Holger Badorreck, Laser Zentrum Hannover e.V. (Germany) [10447-9]

2:40 pm: **Laser-induced modifications in fused silica up to damage initiation caused by multiple UV nanosecond pulses**, Alexandre Beaudier, Frank R. Wagner, Jean-Yves Natoli, Institut Fresnel (France) [10447-10]

3:00 pm: **Enhancement of light intensity related to distribution of defects in the final optics assembly**, Zhaoyang Jiao, Mingying Sun, Jianqiang Zhu, Shanghai Institute of Optics and Fine Mechanics (China) [10447-11]

3:20 pm: **Simulation of internal stress waves generated by laser-induced damage in multilayer dielectric gratings**, Sheryl M. Gracewski, Sean Boylan, John C. Lambropoulos, Terrance J. Kessler, James B. Oliver, Stavros G. Demos, Univ. of Rochester (USA) [10447-12]

CONFERENCE 10447

POSTER VIEWING AND REFRESHMENT BREAK- MONDAY PM

Location: Century Room 3:40 pm to 4:30 pm

Posters will be displayed for viewing during refreshment breaks on Monday from 10:20 to 11:10 am and again from 3:40 and 4:30 pm.

SESSION 4

Location: Grand Ballroom Mon 4:30 pm to 5:50 pm

Fundamental Mechanisms II

Session Chairs: **Jianda Shao**,

Shanghai Institute of Optics and Fine Mechanics (China);

Jérôme Néauport, Commissariat à l'Énergie Atomique (France)

4:30 pm: **Material fatigue damage under large number of laser or FEL pulses**, Lin Zhang, Alan R. Fry, SLAC National Accelerator Lab. (USA) [10447-13]

4:50 pm: **Wavelength dependence of the mid-IR ablation threshold of ZnSe**, Drake R. Austin, The Ohio State Univ. (USA); Kyle R. P. Kafka, Univ. of Rochester (USA); Yu H. Lai, Zhou Wang, Kaikai Zhang, Hui Li, Cosmin I. Baga, Allen Y. Yi, Louis F. DiMauro, The Ohio State Univ. (USA); Vitaly E. Gruzdev, Univ. of Missouri (USA); Enam A. Chowdhury, The Ohio State Univ. (USA) [10447-14]

5:10 pm: **The transient dynamics of femtosecond laser-induced ripples on fused silica**, Guangqing Du, Xi'an Jiaotong Univ. (China) . . . [10447-15]

5:30 pm: **First principles simulation of the dynamics of transient warm dense matter during the formation of ultrashort laser pulse induced damage using the particle-in-cell method**, Alex Russell, Douglass W. Schumacher, The Ohio State Univ. (USA) [10447-16]

CLOSING REMARKS

Location: Grand Ballroom 6:10 pm to 6:20 pm

OPEN HOUSE AND RECEPTION

6:30 pm to 8:00 pm

Come, relax, and join your colleagues at Alpine Research Optics (ARO) for an enjoyable evening of refreshments and pleasant conversation.

Invitation and driving instructions included in your Registration Packet.

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TUESDAY 26 SEPTEMBER

REGISTRATION MATERIAL PICK-UP

Location: Sunshine Room 7:30 am to 4:00 pm

POSTER PLACEMENT

Location: Century Room 7:40 am to 8:00 am

SESSION 5

Location: Grand Ballroom Tue 8:00 am to 9:50 am

Mini-Symposium I: Frontiers of Ultrafast Science: Sources, Basic Effects, and Mechanisms of Ultrafast Laser-matter Interactions

Session Chairs: **Vitaly E. Gruzdev**, Univ. of Missouri (USA);
Jonathan W. Arenberg, Northrop Grumman Aerospace Systems (USA)

8:00 am: **Attosecond x-rays generated with intense, few-cycle MIR lasers** (*Plenary Presentation*), Zenghu Chang, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [10447-18]

8:30 am: **Electron dynamics just below the damage threshold and a dream of petahertz electronics** (*Plenary Presentation*), Vladislav S. Yakovlev, Michael S. Wismer, Max-Planck-Institut für Quantenoptik (Germany); Mark I. Stockman, Georgia State Univ. (USA) . . . [10447-19]

9:00 am: **Self-consistent modeling of laser energy deposition in photo-ionized dielectronics** (*Plenary Presentation*), Arnaud Couairon, Ecole Polytechnique (France); Nikita S. Shcheblanov, Ecole Polytechnique (France); Mikhail E. Povarnitsyn, Lasers, Plasmas et Procédés Photoniques (France); Stéphane Guizard, Commissariat à l'Énergie Atomique (France) [10447-20]

9:30 am: **Revealing the relative contribution of photo- and impact-ionization in ultrashort pulse laser-induced damage in solid dielectrics**, Peter Jürgens, Anton Husakou, Mikhail Ivanov, Marc J. J. Vrakking, Alexandre Mermillod-Blondin, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) [10447-21]

CONFERENCE 10447

TUESDAY POSTER OVERVIEWS

Location: Grand Ballroom 9:50 am to 10:20 am

Posters authors are asked to give a 2-minute/2-slide overview of their poster in the order that they appear in the Tuesday poster sessions.

POSTER VIEWING AND REFRESHMENT BREAK- TUESDAY AM

Location: Century Room 10:20 am to 11:10 am

Posters will be displayed for viewing during refreshment breaks on Tuesday from 10:20 to 11:10 am and again from 3:40 and 4:30 pm.

POSTER SESSION

Location: Century Room Tue 10:20 am to 11:10 am

Fundamental Mechanisms

Kinetic model of optical damage in transparent crystals under continuous-wave laser irradiation, Susumu Kato, National Institute of Advanced Industrial Science and Technology (Japan); Atsushi Sunahara, Purdue Univ. (USA); Sunao Kurimura, National Institute for Materials Science (Japan) [10447-72]

Model for visualizing high-energy laser (HEL) damage, Gail Erten, Raytheon Space and Airborne Systems (USA) [10447-73]

A practical model of laser induced damage on fused silica: from defect to damage growth, Yi Zheng, Zhichao Liu, Feng Pan, Chengdu Fine Optical Engineering Research Ctr. (China); Jian Cheng, Harbin Institute of Technology (China); Jian Wang, Qiao Xu, Chengdu Fine Optical Engineering Research Ctr. (China) [10447-74]

Single-shot femtosecond mid-infrared laser induced multi-stage damage and ablation of silicon, Kevin Werner, Noah Talisa, Kyle R. P. Kafka, Shivam Tickoo, Drake R. Austin, Enam A. Chowdhury, The Ohio State Univ. (USA) [10447-75]

Femtosecond pre-breakdown dynamics in dielectric chirped mirror, Xin Xing, Wei Yuan, Shanghai Institute of Optics and Fine Mechanics (China) and Univ. of Chinese Academy of Sciences (China); Bing Xue, Takayoshi Kobayashi, The Univ. of Electro-Communications (Japan); Juan Du, Yuxin Leng, Yuan'an Zhao, Jianda Shao, Shanghai Institute of Optics and Fine Mechanics (China) [10447-76]

UV laser damages from the nano- to the femtosecond regime, Mark Gyamfi, Istvan Balasa, Laser Zentrum Hannover e.V. (Germany) [10447-77]

Beyond the Drude model: the Keldysh-Vinogradov model of ultrafast generation and heating of electron-hole plasma, Vitaly E. Gruzdev, Olga Sergaeva, Univ. of Missouri (USA); Drake Austin, Enam A. Chowdhury, The Ohio State Univ. (USA) [10447-78]

Thin Films

Structural modifications of hafnia/silica composite coatings deposited by ion assisted coevaporation, Xinshang Niu, Hongfei Jiao, Xinbin Cheng, Jinlong Zhang, Zhanshan Wang, Tongji Univ. (China); Sebastian Paschel, Istvan Balasa, Detlev Ristau, Laser Zentrum Hannover e.V. (Germany) [10447-79]

Few-cycle pulse laser-induced damage of thin films, Noah Talisa, The Ohio State Univ. (USA); Kyle R. P. Kafka, The Ohio State Univ. (USA) and Univ. of Rochester (USA); Drake R. Austin, Kevin Werner, The Ohio State Univ. (USA); Gabriel Tempea, Spectra-Physics Vienna (Austria); Enam A. Chowdhury, The Ohio State Univ. (USA) [10447-80]

High LIDT mirrors for 355nm wavelength based on combined ion beam sputtering and glancing angle deposition technique, Giedrius Abromavicius, Tomas Tolenis, Lina Grinevičiūtė, Rytis Buzelis, Simonas Kicas, Ctr. for Physical Sciences and Technology (Lithuania); Andrius Melninkaitis, Lidaris Ltd. (Lithuania) and Vilnius Univ. (Lithuania); Egidijus Pupka, Lidaris Ltd. (Lithuania) [10447-81]

A comparison of LIDT behavior of metal-dielectric mirrors in ns and ps pulse regime at 1030nm with regard to the coating technology, Václav Škoda, CRYTUR spol s.r.o. (Czech Republic); Jan Vanda, Institute of Physics of the ASCR, v.v.i. (Czech Republic); Stepan Uxa, CRYTUR spol s.r.o. (Czech Republic) [10447-82]

Measurement of nonlinear refractive index in optical thin films, Morten Steinecke, Marco Jupé, Kevin Kiedrowski, Detlev Ristau, Laser Zentrum Hannover e.V. (Germany) [10447-83]

Influence of temperature and environment on the laser damage threshold of ion-beam sputtered anti-reflective coatings at 355nm wavelength, Roelene Botha, Rhysearch (Switzerland) and NTB Interstaatliche Hochschule für Technik Buchs (Switzerland); Thomas Gischkat, Igor Stevanovic, Andreas Bächli, Rhysearch (Switzerland); David Bischof, Markus Michler, Stefan J. Rinner, Carsten Ziolk, NTB Interstaatliche Hochschule für Technik Buchs (Switzerland) [10447-84]

Spectroscopy of the absorption in dielectric optical coatings, Frank Kühnemann, Jens Kiessling, Markus Leidinger, Fraunhofer-Institut für Physikalische Messtechnik (Germany); Thorsten Best, Elmar Elbinger, Optics Balzers Jena GmbH (Germany) [10447-85]

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Mitigation and removal of laser damaged antireflection coatings from laser damaged KDP optics, Selim Elhadj, William A. Steele, Diana Vanblarcom, Ruth A. Hawley, Kathleen I. Schaffers, Paul Geraghty, Lawrence Livermore National Lab. (USA) [10447-86]

Testing the limits of the Stoney Equation for assessing stress in thin films from interferometric wavefront deformation measurements, Elzbieta Jankowska, Colorado State Univ. (USA); Slawomir Drobczynski, Wroclaw Univ. of Science and Technology (Poland); Carmen S. Menoni, Colorado State Univ. (USA). [10447-87]

Recent improvements in LIDT of optical components for pulsed and CW applications, Christian Grunert, Laser Components GmbH (Germany); Martin Rumpel, Marwan Abdou Ahmed, Univ. Stuttgart (Germany); Lars Mechold, Laser Components GmbH (Germany). [10447-90]

SESSION 6

Location: Grand Ballroom Tue 11:10 am to 12:40 pm

Mini-Symposium II: Frontiers of Ultrafast Science: Sources, Basic Effects, and Mechanisms of Ultrafast Laser-matter Interactions

Session Chairs: **Vitaly E. Gruzdev**, Univ. of Missouri (USA);
Wolfgang Rudolph, The Univ. of New Mexico (USA)

11:10 am: **Atomic and molecular dynamics in mid-infrared fields**
(*Plenary Presentation*), Louis F. DiMauro, The Ohio State Univ.
(USA) [10447-22]

11:40 am: **Band-gap excitation dynamics at optical frequencies**
(*Plenary Presentation*), Martin Schultze, Max-Planck-Institut für
Quantenoptik (Germany) [10447-23]

12:10 pm: **Ultrafast strong-field effects in semiconductors**
(*Plenary Presentation*), Mack Kira, Univ. of Michigan (USA); Stephan W.
Koch, Philipps-Univ. Marburg (Germany). [10447-24]

Lunch Break Tue 12:40 pm to 2:00 pm

SESSION 7

Location: Grand Ballroom Tue 2:00 pm to 3:40 pm

Mini-Symposium III: Frontiers of Ultrafast Science: Sources, Basic Effects, and Mechanisms of Ultrafast Laser-matter Interactions

Session Chairs: **Vitaly E. Gruzdev**, Univ. of Missouri (USA);
Detlev Ristau, Laser Zentrum Hannover e.V. (Germany)

2:00 pm: **First-principles calculations for ultrafast energy transfer from laser to solids** (*Plenary Presentation*), Kazuhiro Yabana, Univ. of Tsukuba (Japan) [10447-25]

2:30 pm: **Interferometric frequency-resolved optical gating for probing optical nonlinearities as the verge of multiphoton-induced breakdown** (*Plenary Presentation*), Günter Steinmeyer, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) [10447-26]

3:00 pm: **Time-resolved investigations of laser-dielectric interaction mechanisms**, Allan Bildé, Stéphane Guizard, Ecole Polytechnique (France); Sergei M. Klimentov, A. M. Prokhorov General Physics Institute of the Russian Academy of Sciences (Russian Federation); Andrius Melninkaitis, Julius Vaicenavicius, Balys Momgaudis, Vilnius Univ. (Lithuania); Alexandros Mouskeftaras, Ecole Polytechnique Fédérale de Lausanne (Switzerland) [10447-27]

3:20 pm: **Conversion of direct-gap energy bands of a wide-band-gap crystal into indirect-gap transient bands by ponderomotive potential of Bloch oscillations driven by ultrashort laser pulse**, Vitaly E. Gruzdev, Olga Sergaeva, Univ. of Missouri (USA) [10447-28]

POSTER VIEWING AND REFRESHMENT BREAK- TUESDAY PM

Location: Century Room 3:40 pm to 4:30 pm

Posters will be displayed for viewing during refreshment breaks on Tuesday from 10:20 to 11:10 am and again from 3:40 and 4:30 pm

CONFERENCE 10447

SESSION 8

Location: Grand Ballroom Tue 4:30 pm to 5:50 pm

Thin Films I

Session Chairs: **Carmen S. Menoni**, Colorado State Univ. (USA);
Christopher J. Stolz, Lawrence Livermore National Lab. (USA)

4:30 pm: **Optical damage of high-performance thin film transparent electrodes** (*Keynote Presentation*), Selim Elhadj, Jae-Hyuck Yoo, Andrew Lange, Nan Shen, Raluca A. Negres, Marlon G. Menor, Antonio Correa Barrios, Phil Ramsey, Jeffrey D. Bude, John J. Adams, Lawrence Livermore National Lab. (USA) [10447-29]

5:10 pm: **Next-generation all-silica coatings for UV applications**, Andrius Melninkaitis, Vilnius Univ. (Lithuania); Tomas Tolenis, Lina Grinevičiūtė, Giedrius Abromavicius, Ctr. for Physical Sciences and Technology (Lithuania); Lina Mažule, Linas Smalakys, Vilnius Univ. (Lithuania); Egidijus Pupka, Mindaugas Ščiuka, UAB Lidaris (Lithuania); Rytis Buzelis, Simonas Kičas, Ctr. for Physical Sciences and Technology (Lithuania) [10447-30]

5:30 pm: **Optimal coating solution for the total internal reflection surface of zig-zag slab laser amplifier**, Fei Liu, Xinbin Cheng, Hongfei Jiao, Jinlong Zhang, Bin Ma, Zhanshan Wang, Tongji Univ. (China) [10447-31]

CLOSING REMARKS

Location: Grand Ballroom 5:50 pm to 6:00 pm

WINE AND CHEESE TASTING RECEPTION

6:30 pm to 8:00 pm

All attendees are invited to join us for an enjoyable evening of wine tasting, local brews, and a selection of assorted cheese appetizers.

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WEDNESDAY 27 SEPTEMBER

SESSION 9

Location: Grand BallroomWed 8:00 am to 10:00 am

Thin Films II

Session Chairs: **Joseph A. Menapace**, Lawrence Livermore National Lab. (USA); **MJ Soileau**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

8:00 am: **Pulsed laser damage resistance of nano-structured high reflectors for 355nm**, Douglas S. Hobbs, Bruce D. MacLeod, Anthony Manni, TelAztec LLC (USA) [10447-32]

8:20 am: **355-nm, Nanosecond laser mirror thin film damage competition**, Raluca A. Negres, Christopher J. Stolz, Lawrence Livermore National Lab. (USA); Michael D. Thomas, Mark Caputo, Spica Technologies, Inc. (USA) [10447-33]

8:40 am: **Time resolved digital holography measurements of the nonlinear optical filters**, Balys Momgaudis, Vilnius Univ. (Lithuania); Tatiana V. Amotchkina, Max-Planck-Institut für Quantenoptik (Germany); Linas Smalaky, Vilnius Univ. (Lithuania); Michael K. Trubetskov, Max-Planck-Institut für Quantenoptik (Germany); Andrius Melninkaitis, Vilnius Univ. (Lithuania); Ferenc Krausz, Max-Planck-Institut für Quantenoptik (Germany); Vladimir Pervak, Ludwig-Maximilians-Univ. München (Germany) [10447-34]

9:00 am: **Characterization of laser induced damage of HR coatings with picosecond pulses**, Yuan'an Zhao, Shanghai Institute of Optics and Fine Mechanics (China); Cheng Fu Li, Yueliang Wang, Peng Xiacong, Shanghai Institute of Optics and Fine Mechanics (China) and Univ. of Chinese Academy of Sciences (China); Chong Shan, Shanghai Institute of Optics and Fine Mechanics (China) and Changchun Univ. of Science and Technology (China); Meiping Zhu, Jianguo Wang, Jianda Shao, Shanghai Institute of Optics and Fine Mechanics (China) [10447-35]

9:20 am: **Picosecond pulse damage mechanism of hafnia-silica high reflectors Investigated by high-resolution microscopy**, Alexei A. Kozlov, Semyon Papernov, Stavros G. Demos, James B. Oliver, Amy Rigatti, Brittany N. Hoffman, John C. Lambropoulos, Univ. of Rochester (USA) [10447-36]

9:40 am: **Femtosecond laser-induced blister structure in high dispersive mirrors**, Yanzhi Wang, Yu Chen, Meiping Zhu, Kui Yi, Jianda Shao, Shanghai Institute of Optics and Fine Mechanics (China) . [10447-37]

Refreshment Break Wed 10:00 am to 10:30 am

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SESSION 10

Location: Grand Ballroom Wed 10:30 am to 12:50 pm

Thin Films III

Session Chairs: **Stavros G. Demos**, Univ. of Rochester (USA);
Jonathan W. Arenberg, Northrop Grumman Aerospace Systems (USA)

10:30 am: **Approaches toward optimized laser-induced damage thresholds of chirped mirrors for few cycle pulses in the near-infrared spectral range**, Thomas Willemsen, Malte Brinkmann, Sebastian Schlichting, Marco Jupé, Henrik Ehlers, Laser Zentrum Hannover e.V. (Germany); Uwe Morgner, Leibniz Univ. Hannover (Germany); Detlev Ristau, Laser Zentrum Hannover e.V. (Germany) [10447-38]

10:50 am: **Nonlinear response of dielectric optical coatings**, Tatiana V. Amotchkina, Max-Planck-Institut für Quantenoptik (Germany); Vladimir Pervak, Ludwig-Maximilians-Univ. München (Germany); Michael K. Trubetskov, Max-Planck-Institut für Quantenoptik (Germany); Kilian Fritsch, Oleg Pronin, Ferenc Krausz, Ludwig-Maximilians-Univ. München (Germany) [10447-39]

11:10 am: **Comparison of aging effects in Hafnia and Titania thin films on the laser damage resistance of high reflection coatings for 1054nm**, Ella S. Field, Damon E. Kletecka, Sandia National Labs. (USA) .. [10447-40]

11:30 am: **Characterization of hafnium oxide thin films with varying oxygen content**, Semyon Papernov, Michael D. Brunsman, James B. Oliver, Brittain N. Hoffman, Alexei A. Kozlov, Stavros G. Demos, Alexander Shvydky, Univ. of Rochester (USA); Fabio Cavalcante, Le Yang, Carmen S. Menoni, Colorado State Univ. (USA); Benshad Roshanzadeh, Steve T. Boyd, Luke A. Emmert, Wolfgang Rudolph, The Univ. of New Mexico (USA) [10447-41]

11:50 am: **Laser damage of Scandium oxide and Hafnium oxide thin films in ultrahigh vacuum**, Peter Langston, Dinesh Patel, Brendan A. Reagan, Fede Furch, Jorge J. Rocca, Carmen S. Menoni, Colorado State Univ. (USA) [10447-42]

12:10 pm: **Link between mechanical strength and laser damage threshold for antireflective coating made by sol-gel**, Hervé Piombini, Jérémy Avice, Christophe Boscher, Philippe Belleville, Commissariat à l'Énergie Atomique (France); Pascal Ruello, Gwenaëlle Vaudel, Guillaume Brotons, Vitaliy E. Goussev, Ctr. National de la Recherche Scientifique (France) [10447-43]

12:30 pm: **Deciphering mechanistic sources of high-power laser induced damage in dielectric coatings fabricated by ion beam sputtering method**, S. Roger Qiu, Lawrence Livermore National Lab. (USA) [10447-44]

Lunch Break Wed 12:50 pm to 2:00 pm

SESSION 11

Location: Grand BallroomWed 2:00 pm to 4:00 pm

Materials and Measurements I

Session Chairs: **Klaus Mann**, Laser-Lab. Göttingen e.V. (Germany);
Raluca A. Negres, Lawrence Livermore National Lab. (USA)

2:00 pm: Nanosecond multiple pulse measurements and the different types of defects (<i>Keynote Presentation</i>), Frank R. Wagner, Jean-Yves Natoli, Alexandre Beaudier, Mireille Commandré, Institut Fresnel (France) [10447-45]
--

2:40 pm: **Multiple pulse nanosecond laser induced damage threshold on hybrid mirrors**, Jan Vanda, Mihai-George Muresan, Vojtech Bilek, Matej Sebek, Danijela Rostohar, Tomáš Mocek, Institute of Physics of the ASCR, v.v.i. (Czech Republic); Václav Škoda, CRYTUR spol s.r.o. (Czech Republic) [10447-46]

3:00 pm: **Large-area defect mapping for laser damage prediction**, Alexander R. Martin, Sam Richman, Quentin Turchette, Trey Turner, Research Electro-Optics, Inc. (USA) [10447-47]

3:20 pm: **A real-time laser conditioning technique coupled with photothermal lens probe on 1064nm mirror**, Zhichao Liu, Yi Zheng, Feng Pan, Ping Ma, Jian Wang, Qiao Xu, Chengdu Fine Optical Engineering Research Ctr. (China) [10447-48]

3:40 pm: **Photo-thermal measurements of the optical absorption in LBO with a “proxy pump” calibration technique**, Ashot S. Markosyan, Stanford Univ. (USA); Alexei L. Alexandrovski, Stanford Photo-Thermal Solutions (USA); Roger Route, Stanford Univ. (USA); Hanna Cai, GAMDAN Optics (USA); Martin M. Fejer, Stanford Univ. (USA) [10447-49]

Refreshment BreakWed 4:00 pm to 4:30 pm

CONFERENCE 10447

SESSION 12

Location: Grand Ballroom Wed 4:30 pm to 6:10 pm

Materials and Measurements II

Session Chairs: **Gregory J. Exarhos**, Pacific Northwest National Lab. (USA); **Vitaly E. Gruzdev**, Univ. of Missouri (USA)

4:30 pm: **U.S. National Committee proposed revision to the ISO Laser Damage Standard**, Donna J. Howland, Northrop Grumman Corp. (USA); Jonathan W. Arenberg, Northrop Grumman Aerospace Systems (USA); Michael D. Thomas, Spica Technologies, Inc. (USA); Trey Turner, Research Electro-Optics, Inc. (USA); John C. Bellum, Coherent Technologies (USA); Christopher Wren Carr, Lawrence Livermore National Lab. (USA); Jason Yager, Quantel USA (USA); Allen Krisiloff, Triptar Lens Co., Inc. (USA) [10447-50]

4:50 pm: **Characterization of 1-on-1 damage in high reflectors using the spatially-temporally resolved optical laser-induced damage (STEREO-LID) technique**, Yejia Xu, Luke A. Emmert, The Univ. of New Mexico (USA); Travis Day, Carmen S. Menoni, Colorado State Univ. (USA); Wolfgang Rudolph, The Univ. of New Mexico (USA) [10447-51]

5:10 pm: **Damage resistance of nematic liquid crystal materials at femtosecond, picosecond, and nanosecond pulse lengths**, Tanya Z. Kosc, Alexei A. Kozlov, Kenneth L. Marshall, Semyon Papernov, Stavros G. Demos, Univ. of Rochester (USA) [10447-52]

5:30 pm: **Convection- and radiation-dependent laser-induced damage thresholds for continuous-wave irradiation of coated, free-standing polymer films**, Keith Slinker, Universal Technology Corp. (USA) and Air Force Research Lab. (USA); Jeremy J. Pitz, UES, Inc. (USA) and Air Force Research Lab. (USA); Gregory J. Ehlert, Jonathan P. Vernon, Air Force Research Lab. (USA) [10447-53]

5:50 pm: **Optical properties of a float-zone rectified and Czochralski grown in a steady magnetic field crystalline Si**, Ashot S. Markosyan, Riccardo Bassiri, Brian T. Lantz, Roger Route, Martin M. Fejer, Stanford Univ. (USA); Angus S. Bell, Jessica Steinlechner, Iain W. Martin, Sheila Rowan, James Hough, Univ. of Glasgow (United Kingdom); Eric Gustafson, Rana Adhikari, California Institute of Technology (USA) [10447-54]

CLOSING REMARKS

Location: Grand Ballroom 6:10 pm to 6:20 pm

GENERAL INFORMATION

Onsite Information

Onsite Registration Hours / Badge Pick-Up

Sunday 24 September	5:30 pm to 8:30 pm
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Wednesday 27 September	7:30 am to 3:00 pm

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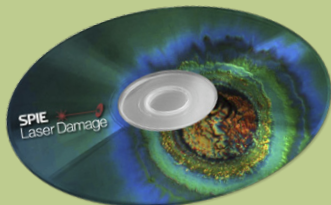
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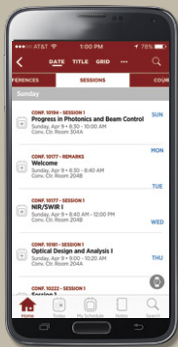
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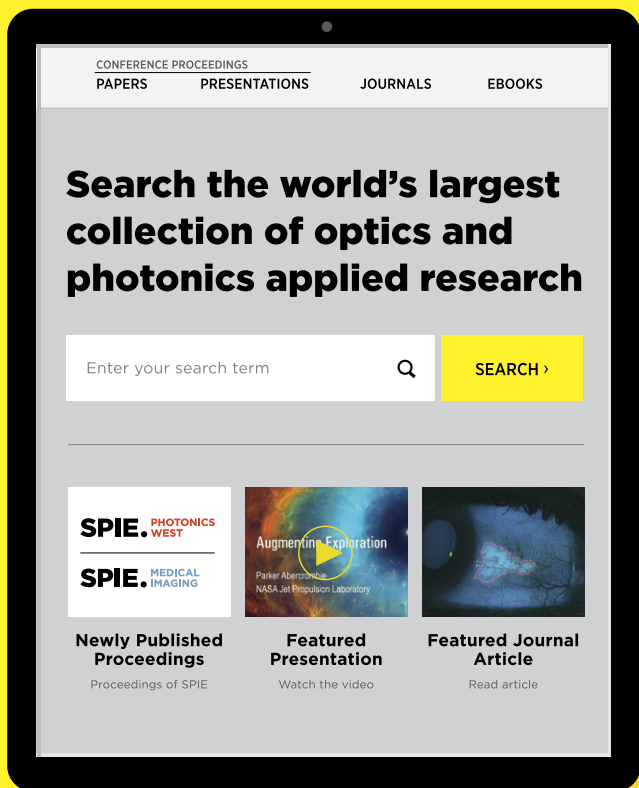
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