

# HPLA

INTERNATIONAL HIGH POWER LASER ABLATION

# Call for Abstracts

12 – 15 APRIL 2021  
SANTA FE, NEW MEXICO

PLEASE JOIN US!

**We invite you to participate in the 2021 International High Power Laser Ablation Symposium (HPLA) to be held April 12 – 15 at the beautiful La Fonda on the Plaza Hotel in Santa Fe, NM, USA. The event offers exceptional learning and networking opportunities for researchers in laser ablation, beamed energy, and very high intensity laser interaction physics. Our 2021 meeting will feature new and exciting topics relevant to today's issues. We will be honored to have a keynote by physics Nobelist Prof. Gérard Mourou.**

The HPLA series is one of the first scientific symposia to be organized around a broad physical phenomenon, laser ablation and its applications, rather than one narrow technology. It is a collegial meeting where long-term friendships are formed. Since 1998, HPLA has provided a unique forum for exchange of ideas on the physics and application of high intensity laser-materials interaction, including advances in relevant high power laser sources and problems of beam propagation and detection.

HPLA is a symposium of the very highest scientific quality. Each abstract is read and rated at least three times by our review committee. Based on the rating, presented papers are selected and placed in the official program. To provide balance, they will not always go to the session requested by the author. This will be our thirteenth meeting. Help us make "13" a good omen by bringing your very best original work! Original work is also necessary for your paper to qualify for OSA/Applied Optics and Journal of Optical Engineering Special HPLA issues which we again plan to provide. The complete list of 2021 session topics appears on the following pages. The best ways to fully engage in the symposium:

## Present

Take advantage of this opportunity to present your research or program results or progress to your colleagues. Submit an abstract for consideration for an oral or poster presentation addressing one or more of the key topic areas in this call for abstracts. *There is no need to resubmit your abstract if you submitted and were accepted for the 2020 cancelled event. It will carry forward.*

## Network

Networking and continuing education are key elements to staying current, promoting your research, developing a strong career, or building a successful business. One attendee wrote: "You have really been most successful to bring together such a large number of most distinguished scientists all around the world, active in the various fields of laser ablation. Congratulations for the high scientific level of all the contributions and for the wonderful organization." Please take advantage of this outstanding opportunity to convene with those on the leading-edge of this field!

## Exhibit

The 2021 Symposium will feature a small exhibit show co-located with posters. This is an excellent way to showcase your organization or technology to those in attendance. For more information visit: <https://www.usasymposium.com/hpla/exhibit.php>.

## Sponsor

Join the leaders in the industry as a sponsor of the HPLA. This is a great way to promote your company or organization. A variety of sponsorship packages are available for all budgets. For more information, contact Amy Voisard at [avoisard@blue52productions.com](mailto:avoisard@blue52productions.com) or 00+1+937-479-4255.

## KEY DATES TO REMEMBER

- **15 November 2020 – Abstracts Due**
- **Late November 2020 – Abstract Submitters will be notified of their selection status**
- **14 March 2021 – Final Poster Abstracts Due**
- **24 March 2021 – Final Presentations Due**
- **12 – 15 April 2021 – HPLA Symposium**

## Keynote Presentations

HPLA has multiple keynote presentations scheduled throughout the week. Keynote presentations confirmed as of this publication include:

**2018 Nobel Prize in Physics Recipient  
Passion Extreme Light**

Prof. Gérard Mourou, Ecole Polytechnique

**Accelerator on a Chip International Program**

Dr. R. Joel England, SLAC National Accelerator Laboratory

**Conceptual Progress of Breakthrough Starshot**

Dr. Kevin Parkin, Parkin Research, LLC

**Laser Synthesis of Atomically-Thin Two Dimensional Materials (Final Title TBA)**

Dr. David Geohegan, Oak Ridge National Laboratory

**Directed Energy & HEL Updates**

Dr. Fabio Di Teodoro, Raytheon Space and Airborne Systems

# SYMPOSIUM COMMITTEE

The symposium's technical program is guided and directed by an international esteemed committee. Interested in becoming a Symposium Committee member to help drive the program? Contact Dr. Claude Phipps at [crhipps@aol.com](mailto:crhipps@aol.com).

*Symposium Chair: Dr. Claude Phipps, Photonic Associates, LLC (USA)*

*Symposium Co-Chair: Prof. Leonid Zhigilei, University of Virginia (USA)*

Prof. Sergei Anisimov, L. D. Landau Institute of Theoretical Physics (Russia)

Prof. Victor Apollonov, General Physics Institute (Russia)

Prof. Michel Autric, Université de la Méditerranée (France)

Prof. Dieter Bäuerle, Johannes Kepler University (Austria)

Prof. Willy Bohn, Bohn Laser Consult (Germany)

Prof. Nadezhda Bulgakova, HiLASE Project, Prague (Czechia)

Dr. Eric Davis, Institute for Advanced Studies at Austin (USA)

Dr. Vitaly Gruzdev, University of Missouri (USA)

Prof. Richard Haglund, Vanderbilt University (USA)

Dr. Victor Hasson, Consultant (USA)

Prof. Hideyuki Horisawa, Tokai University (Japan)

Prof. Andrei Ionin, P. N. Lebedev Physical Institute (Russia)

Prof. Andrei Kanaev, CNRS - LSPM UPR3407 (France)

Prof. Kimiya Komurasaki, University of Tokyo (Japan)

Mr. Michael Lander, Stratonics, Inc. (USA)

Prof. Thomas Lippert, Paul Scherrer Institut (Switzerland)

Prof. Gérard Mourou, École Polytechnique, Paris (France)

Dr. Ross Muechausen, Los Alamos National Laboratory (USA)

Dr. Leik Myrabo, Lightcraft Technologies, Inc. (USA)

Prof. José Ocaña, Centro Laser UPM (Spain)

Dr. Kevin Parkin, Parkin Research, LLC (USA)

Prof. Johannes Pedarnig, Johannes Kepler University (Austria)

Dr. Joseph Penano, Naval Research Laboratory (USA)

Prof. Baerbel Rethfeld, Technische Universität Kaiserslautern (Germany)

Dr. Yuri Rezunkov, Research Institute for Optical Instrument Engineering (Russia)

Prof. Thierry Sarnet, University Aix-Marseille (France)

Prof. Akihiro Sasoh, Nagoya University (Japan)

Prof. Klaus Sokolowski-Tinten, University of Duisburg-Essen (Germany)

Prof. Rongqing Tan, Chinese Academy of Sciences (China)

Dr. Tony Valenzuela, Army Research Laboratory (USA)

Prof. Takashi Yabe, Tokyo Institute of Technology (Japan)

ABSTRACTS DUE: 15 NOVEMBER 2020

## Submission Topics

Original abstracts are solicited for the topics listed below. This list is offered for guidance and is not intended to exclude relevant topics not listed. If you would like to submit an abstract in a topic not listed, simply select "Other" on the abstract submission form.

### **Beamed Energy Propulsion**

**Topic Chair: Prof. Hideyuki Horisawa, Tokai University**

This topic area is devoted to aspects related to the science and technology of beamed energy propulsion (BEP) in its various forms and applications. Special interest is given to new BEP concepts (microwave or laser), basic science and technology, mission analysis, and flight experiments. Experimental techniques and new concepts for the determination of relevant propulsion parameters such as thrust, plasma temperature, shockwave velocity, exhaust plume divergence, and plume velocity distributions will also be addressed.

### **Biological Applications of Lasers**

**Topic Chairs: Dr. Tatiana Itina, Hubert Curien Lab CNRS/UJM**

This topic area is dedicated to the use of modern laser technology for advanced biomedical research. Recent growth in the applications of lasers to medicine and biology has been explosive. The objective of the topic area is to bring together international researchers to jointly examine how new laser technologies have provided new knowledge in biology, and pave the way for innovative medical procedure developments. HPLA attendees will have the chance to critically assess the state of the biological application of lasers and to set goals for the future.

### **Burst Ultrafast Laser Machining on the GHz Forefront**

**Topic Chair: Prof. Peter Herman, University of Toronto**

GHz-rate lasers are now rapidly emerging in the femtosecond arena, extending 'burst' effects into new realms of 'ablative cooling' and strongly accelerated machining rates. Is this the cusp for a new world of ablation physics? Are these processes inhibited by traditional thermal effects? This session examines the controversial benefits of GHz-Burst machining by exploring the underlying science, the state-of-the-art technology, and the emerging applications.

### **Emerging Laser-Enabled Applications**

**Topic Chair: Prof. Thierry Sarnet, University Aix-Marseille**

This topic area will demonstrate recent progress on laser sources, laser coatings, and their advantages for various applications, like Additive Manufacturing, 3D printing, Micro/Nano fabrication, 3D structuring, or high efficiency solar cells.

### **Fundamentals of Ultra-Short Laser-Materials Interactions: Theory and Simulations**

**Topic Chair: Prof. Antonio Miotello, University of Trento**

The interaction of pulsed laser radiation with materials involves a wealth of the physical processes, depending on the material kind and laser light properties, whose deep understanding is critical not only for further advancing lasers in the fields of surface processing, new material synthesis, nanotechnology, and biomedicine, but also to possibly improve our knowledge of condensed matter in extreme thermodynamic conditions. The goal of this topic area is to provide a broad overview of the methods for theoretical interpretations and numerical simulations which enable us to gain insight into dynamical behavior of laser-excited matter at different temporal and spatial scales, and at temperatures even close to the critical thermodynamic one. Kinetic, thermodynamic, mechanical, and other related aspects of laser-matter interaction will be discussed.

## High-Power Lasers in Directed Energy

**Topic Chair: Dr. Fabio Di Teodoro, Raytheon Space and Airborne Systems**

The potential of high-power lasers for transforming defense systems has long been established through large historic programs like the Strategic Defense Initiative and the Airborne Laser. In more recent years, diode-pumped solid-state lasers (DPSSLs) have become a key reference technology for directed-energy (DE) applications owing to their reliance on electrical prime power only, with high electrical-to-optical efficiency and favorable specific-power quantifiers (laser power per unit mass and unit volume). Among DPSSLs, fiber lasers have emerged as a promising solution to increase technological readiness and expedite integration and field-deployment, owing to their high material/component maturity and reliability inherited from the optical telecommunication industry. In particular, beam-combined fiber lasers with output powers up to ~ 100 kW are being aggressively pursued by many Government agencies involved in DE system development, for rapid integration in ground-, sea-, and air-based tactical platforms, with further power scaling to 100s of kW viewed as a near-/medium-term objective.

This topic area is open to contributions addressing all aspects of high-power laser development for DE applications, including laser power performance, efficiency, thermal management, and beam delivery on target. Within the scope of the topic are both mature technologies, as well as others more advanced and/or at earlier stages of development. Examples include power scaling of individual fiber and “bulk” DPSSLs, beam combining (spectral and coherent) schemes, direct-diode phased arrays, highly efficient laser prime-power source/thermal-management subsystems, and approaches to high power beam control.

## High Power, Ultra-Short Pulse Lasers: Applications in Materials Science and Particle Acceleration

**Topic Chair: Dr. Claude Phipps, Photonics Associates, LLC**

Ultrafast pulsed excitation produces highly non-equilibrium states of matter characterized by extreme electronic excitation, high temperature and pressure. Subsequent to the initial deposition of energy, secondary processes can lead to dynamics on very rapid time-scales. One of the most interesting of these is laser produced plasma wakefield acceleration. In LPWA, the optical electric field can be efficiently coupled into particle acceleration and produce GeV particles. In future, one thinks of “CERN on a chip.” Abstracts from other areas of ultrafast research such as dielectric laser acceleration not covered in Fundamentals of Ultra-Short Laser-Materials Interactions: Theory and Simulations are also welcome.

## Laser Ablation for PLD and MAPLE

**Topic Chair: Dr. Eniko Gyorgy, CSIC-ICMAB**

This topic area is related to current progress in laser-based materials processing and thin film growth by pulsed laser deposition (PLD) and matrix-assisted pulsed laser evaporation (MAPLE). Key application areas of laser deposited nano-entities, nanocomposites, and thin films consisting of both organic and inorganic materials, as energy storage and conversion, electronic devices, bio and chemical sensors, gas sensors, photovoltaics, mechanical systems, catalysis and photocatalysis, and biomedical applications will be considered. In addition to the latest research results, perspectives on commercial scale-up of laser-based materials synthesis and thin film growth techniques will be provided.

## Laser Direct Writing

**Topic Chair: Prof. Craig Arnold, Princeton University**

The Laser Direct Writing topic area provides an interdisciplinary forum for discussing the most recent progress in laser-matter interactions, with a focus on laser material transfer, such as laser-induced forward transfer and matrix-assisted pulsed laser evaporation – direct write. This topic is also focused on advancements in laser material processing for organic electronics and sensing, including very recent research fields such as biomedical applications and biotechnology. Experimental and theoretical abstracts, as well as contributions from industry are welcome.

## Lasers in Additive Manufacturing

**Topic Chair: Prof. Ji Ma, University of Virginia**

The “Lasers in Additive Manufacturing” session presents recent progress in laser-based additive manufacturing techniques and applications with particular emphasis on the laser-material interactions.

## **Laser-Induced Modification of Material Microstructure and Surface Morphology**

**Topic Chair: Prof. Leonid Zhigilei, University of Virginia**

Surface modification by laser irradiation is in the core of many modern surface processing applications where desired material properties are achieved through the formation of metastable phases, grain refinement, generation/annealing of crystal defects, redistribution of the alloying elements and, in the ablation regime or upon irradiation of multiple laser pulses, generation of complex surfaces morphology. This topic area will review recent progress in the fundamental understanding of the mechanisms responsible for the laser-induced modification of surface microstructure and morphology.

## **Laser Induced Shock Applications**

**Topic Chair: Dr. Laurent Berthe, PIMM CNRS UMR**

The development of high-power laser sources is currently undergoing technological developments with strong industrial prospects. HPLA 2021 provides an opportunity to take stock of these technological developments and the applications fostering them. The state-of-the-art on applications such as laser shock peening, laser shock adhesion test, up-to-date diagnostics, and laser shocks to improve our knowledge of the dynamic behavior of materials under severe conditions will be at the heart of this HPLA topic.

## **Laser Materials Interaction in Liquid Environment**

**Topic Chairs: Prof. Nadya Bulgakova, HiLase Centre and Prof. Wolfgang Kautek, Institute of Physics CAS Vienna**

Laser materials interactions in a liquid environment provides the basis not only for example submarine laser-induced plasma spectroscopy, but also nanoparticle generation by lasers in liquids as an alternative path to produce ligand-free colloidal nanoparticle building blocks. Nanoparticles as functional components on surfaces, in bulk materials, and as nanohybrids may be applied in optics, biomedicine, catalysis, or energy science. Another recently emerged application of pulsed laser ablation in liquids is surface nanostructuring, which requires relatively low laser fluences as compared to conventional laser processing techniques and can provide micro/nano-features with unique properties. Fundamental studies and scalable applications are under way.

## **Laser Systems for Precise Orbit Measurement and Traffic Management of LEO Debris**

**Topic Chair: Dr. Claude Phipps, Photonics Associates, LLC**

Since the space launches started in 1957, they have led to more than 18,000 tracked objects. A much larger population that cannot be tracked (due to their smaller size) is estimated to exceed 500 thousand larger than 10cm, finally leading to an unstable debris environment (Kessler Syndrome). Therefore there is an urgent need to address the problem of debris removal and/or mitigation not only from the technical point of view but also from the operational and legal aspects. This topic area's emphasis will be given to laser ablation and radiation pressure based solutions, including new laser sources and long range propagation. We will also discuss the new area of Large Debris Traffic Management, first initiated by workshops at the French agency CNES. The role of laser solutions vs microwaves and more conventional approaches will be discussed.

## **Optical Limiting and Beam Control using Phase Changing Materials**

**Topic Chair: Prof. Richard Haglund, Vanderbilt University**

This topic area focuses on emerging materials, structures and techniques that enable control of intense optical beams by electronic or structural phase transformations initiated electrically, optically, or thermally.

## **Panel: The Business Side of High Power Beam Applications**

**Topic Chair: Ms. Julie Mikula, NASA ARC**

Science has to be funded. Often we are tempted to do our scientific work independently from this important consideration, and then go looking for funding – a solution looking for a problem. This panel will explore the intersection between science and its users, by connecting users with HPLA researchers. The panel will also discuss topics ranging from state-of the art high directed energy technologies and availability of sources.

## **Physical Fundamentals of Ultra-High Power Laser Technologies, Trends and Challenges**

**Topic Chair: Dr. Victor Hasson, Consultant**

This topic encompasses modeling and proof-of-concept supporting data and addresses issues of peak and average power scaling. The topic also includes new future applications of these systems.

## **Terawatts to Petawatts - Lasers and Secondary Sources for Societal Applications**

**Topic Chair: Dr. Marc Sentis, CNRS-AMU**

The ongoing development of ultra-high intensity laser sources and secondary sources opens the way for very promising societal applications. Indeed Terawatt laser sources now can deliver high average power thanks to the increase of their repetition rate and many projects across the world like ELI in Europe will provide very soon Petawatt class lasers working at few Hz. This topic welcomes contributions on the recent developments and perspectives of UHI laser sources, secondary sources (THz, X ray, electrons, protons, etc.) and their applications in areas such as biology, medicine, imaging, detection, inspection, material sciences, instrumentations.

## **Thermal Coupling in Laser and Microwave Propulsion Problems**

**Topic Chair: Dr. Stefan Scharring, Institute of Technical Physics/German Aerospace Center (DLR)**

This topic area is dedicated to the latest results in pulsed laser-matter interaction in terms of coupling mechanisms with the target material. The comprehensive understanding of thermo-mechanical coupling processes, ranging from shockwave generation, material vaporization or spallation to phase explosion, is crucial for the optimization of laser ablation applications. In particular, insights on thermal coupling of laser energy into the target material can provide for valuable perspectives on constraints of new technological developments in the field of beamed energy propulsion. Moreover, contributions on similar issues in Microwave Propulsion are appreciated as well. Abstract submitters are invited to assess and discuss the latest results and upcoming application trends.

## **Time-Resolved Imaging and Probing of Ablation Plumes and Material Transformations**

**Topic Chairs: Dr. Erik Brambrink, Ecole Polytechnique and Prof. Klaus Sokolowski-Tinten, University of Duisburg-Essen**

This topic area will present recent progress on characterizing ablation processes and material transformations with high temporal resolution using optical and x-ray diagnostics.

## **Poster Session**

The HPLA Poster Session adds an additional option for presenters to share their material. Some information, especially highly technical material, needs a format more conducive to presenting in-depth details, equations, citations, etc. than the oral presentation format can provide. All poster submissions should address one of the topics listed above. Poster abstracts will be accepted until 14 March 2021, or until space runs out. Because space is limited, we encourage you to submit your abstract as soon as you are able to.

## **Submission Process**

We look forward to receiving your abstract(s) for the 2021 HPLA Symposium. Submitted abstracts should be no more than 400 words long. Please be sure to include the title of your abstract in the body of the submission (this does not count against the 400 word count). In late November 2020, you will be contacted regarding the status of your acceptance. Final presentations will be due 24 March 2021. Abstracts will be accepted for both oral and poster presentations for all topics listed on the previous pages.

For technical questions regarding the topics on the previous pages, please contact Dr. Claude Phipps at [crhipps@aol.com](mailto:crhipps@aol.com). For questions about the submission process, please contact Ms. Sherry Johnson at [sjohnson@blue52productions.com](mailto:sjohnson@blue52productions.com).

**To submit your abstract, visit <https://www.usasymposium.com/hpla/cfa.php>.**

**Abstracts Are Due: 15 November 2020**