

LIA TODAY

VOLUME: 28 NO: 5 | ICALEO 2020



SPONSOR INTERVIEWS

PG 9, 15, 16

ICALEO 2020 -
A VIRTUAL EXPERIENCE
RECAP

PG 12

ICALEO 2020 AWARDS

PG 20

Pres. &
Exec. Dir.
Messages
pg. 4

ICALEO Chair
Thank You
pg. 5

2020 Virtual
Experience
Recap
pg. 12

Lumentum
Interview
pg. 15

EKSPLA
Interview
pg. 16

2020
Awards
Results
pg. 20

TRUMPF
Interview
pg. 9

**Table of
Contents**





Gilbert Haas
LIA President 2020

PRESIDENT'S MESSAGE

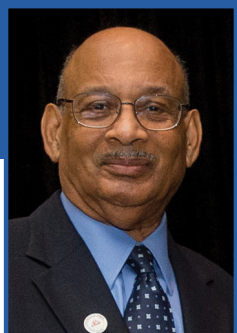
First, I would like to thank all of you for your continued support for the re-election of the Executive Committee (now LIA Officers) for another year during the LIA's transitional period. We are all committed to working together to finalize the remaining tasks needed during the upcoming year.

Second, I would like to also thank all of you for your support at the virtual ICALEO. Given your support, ICALEO had a record year in attendance! That's an accomplishment with a first-time virtual event under the COVID requirements and conditions.

And finally, we all would like to thank the LIA staff for designing and organizing this year's record-attendance ICALEO. They all worked long hours and under very tight deadlines

to pull everything together for this event. ICALEO would not have happened this year without their committed dedication.

Be well and stay safe.



Nat Quick
Executive Director

EXECUTIVE DIRECTOR'S MESSAGE

We are extremely proud of the LIA team comprised of LIA staff and member volunteers that successfully planned and executed our first virtual ICALEO conference. Their response to overcome COVID-19 obstacles was phenomenal; they overcame challenges with innovative solutions. Dr. Aravinda Kar, this year's General Conference Chair, also put in many hours to make this conference what is was and we would like to thank him for his dedication hard work. ICALEO 2020 had the largest attendance compared to any past ICALEO, with help from TRUMPF's generous sponsorship of registration and Intel's sponsorship of the technology platform.

Preliminary survey results show that the majority of conference participants were pleased with the technical content and the presentation of this content. If you have not responded to the survey, please do so since this information is critical in continuous improvement of the conference. As mentioned in the last LIA Today issue, by building on this virtual base we project a hybrid "virtual and person-to-person" conference format in the future that accommodates a wider audience and expansion of the conference.

Please join me in congratulating Professor Milan Brandt, winner of the Schawlow award, and Gil Hass and Henrikki Pantsar who were elected fellows of the LIA. We also congratulate the Steen Award winners, all student paper and poster winners, and the winner of Journal of Laser Application's Best Paper Award. More information on these awards and the 2020 winners is included in this issue. Finally, I would especially like to thank all presenters that decided to participate despite having the conference in a different format this year. Because of them, we were able to provide the same great content that attendees expect from the ICALEO conference.

Stay safe and keep others safe.

2020 CONFERENCE CHAIRS

A SPECIAL THANKS

LIA would like to extend a special thank you to this year's general and track chairs.

GENERAL CHAIR



Dr. Aravinda Kar
CREOL
University of Central Florida

This conference would not have been possible without their dedication to ICALEO and our mission to share and advance new industry knowledge.

LAM



Dr. Milan Brandt
RMIT University
Melbourne, Australia



Dr. Edward Reutzel
Pennsylvania State University
Pennsylvania, USA

MACRO



Dr. Masahiro Tsukamoto
Osaka University
Osaka, Japan



Verena Wippo
Laser Zentrum Hannover e.V.
Hannover, Germany

MICRO



Dr. Constantin Haefner
Fraunhofer Institute for Laser Technology
Aachen, Germany



Dr. John Lopez
University of Bordeaux
Bordeaux, France

NANO



Dr. Ya Cheng
East China Normal University
Shanghai, China



DR. Koji Sugioka
RIKEN
Japan

FLA



Robert Braunschweig
LASEA
USA



Eric Mottay
Amplitude Laser Group
USA



CARBIDE

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FOR INDUSTRY AND SCIENCE

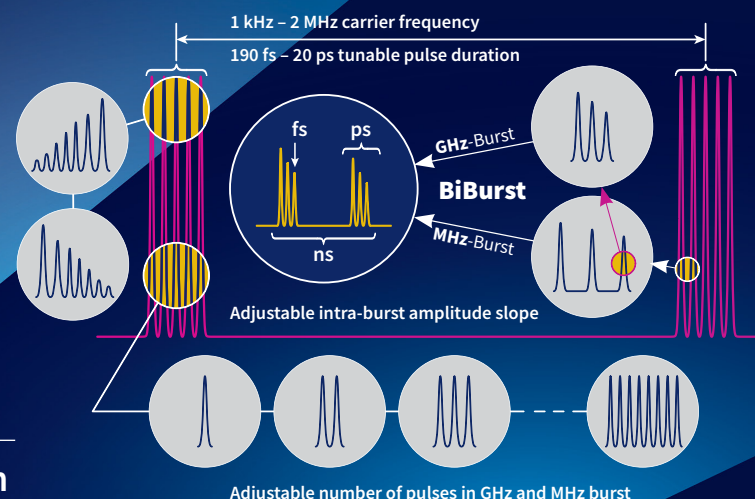
80 W	800 μ J
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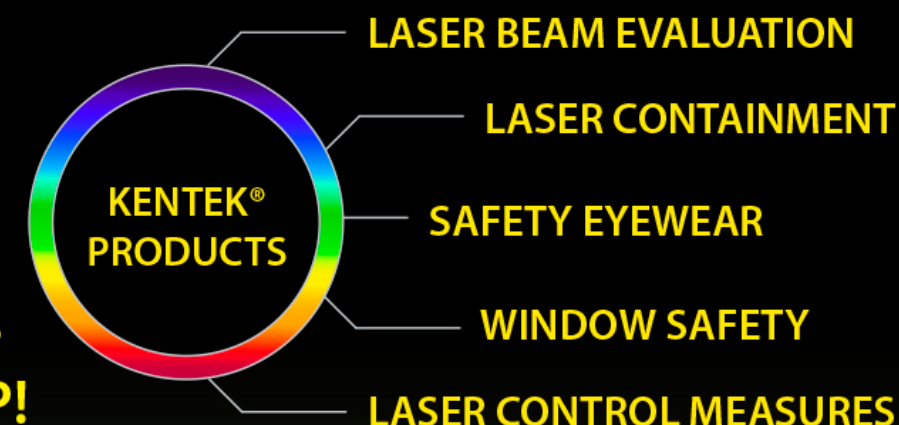


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ICALEO 2020 Registration Sponsorship Dedicated Interview – TRUMPF Inc.

Please introduce yourself and what you do at TRUMPF Inc.

David Havrilla, Lead Instructor of Laser Technology.

We understand that TRUMPF Inc. is the Registration sponsor this year at ICALEO. How long has TRUMPF Inc. been participating in this conference?

Not exactly sure, but they have been involved at least since we were established in the Detroit area back in 1996, and perhaps earlier via our Connecticut presence.

What made you feel so passionate about the event as to sponsor the attendee's registration cost?

ICALEO is a well-established event with a reputation of attracting outstanding leading edge academic and hands-on laser application experts from around the globe to share their experience and insights. We are hoping that sponsoring the registration costs will allow more individuals to join and learn about laser technology and how it can help overcome challenges, add design value to components (like light weighting or unique features), and improve quality in the manufacturing sector.

What are your impressions of the event transitioning to a virtual event this year?

For this particular season, which the world has not experienced in the last century, this was the only and right way to move forward with the event.

Can you tell us about the importance of companies like yours attending events like ICALEO?

The event is important on several fronts. First, to connect with our own team from headquarters, and with academic and industry experts from around the globe. Second, to gain insights from the latest research and experiences from various experts. Third, to contribute to the overall knowledge base and growth of industrial laser processing by presenting the latest advancements from TRUMPF's perspective, and finally, to connect with industry attendees and have a chance to talk with them about their on-going projects, or potential laser applications.

Has TRUMPF Inc. been impacted in any other ways due to the pandemic?

Of course, we have instituted all the government mandated protocols, which has required many of our employees to work remotely. We also saw a significant reduction of orders and service missions during the first couple months of COVID. These have now returned to normal and even above anticipated levels.

Do you anticipate any long-term changes due to COVID-19 that TRUMPF Inc. will make moving forward?

We are evaluating a new paradigm for remote work and also

how we might better utilize our office space in lieu of this new reality, even post-COVID.

Has the pandemic had any unexpected positive effect on your company?

I would say that the flexibility of remote work, and less geographical constraints for future talent base because of our new posture regarding remote work, are two positive effects. In addition, many people are saving commute time, fuel costs, have more personal flexibility, etc., and in the end, I believe employees will have greater job satisfaction and we will have reduced turn-over.

Is TRUMPF Inc. currently working on anything that you think our readers should know about?

I can only speak for the Training Department. We have launched a new portfolio of courses for our lasers and systems as of July 1st, and are currently working on several e-Learning courses for customers who are unable to travel. We will offer the e-Learning courses at 50% off, and also offer the same in-person course at 50% off if the customer takes the same course within a year of completing the e-Learning course.

If so, how do you see this shaping our industry going forward?

Greater accessibility to training should lead to quicker and higher levels of competency, leading to higher equipment uptime, greater confidence in utilization of laser material processing lasers and systems, and in the long-term (combined with the on-going reduction of laser prices) should lead to an expansion in the market.

Is there anything else you think worth discussing?

Hot topics within the TRUMPF organization at the moment are:

1. OEM laser advancements: increasing green wavelength laser to higher CW powers, high CW powers for various ultra-short pulse lasers in the TRUMPF portfolio
2. Sensor technology for part & seam detection with remote welding, weld depth monitoring, advanced monitoring for 3D metal printing
3. Industry 4.0 topics like Condition Monitoring and OPC-UA interface
4. SPI Laser product integration into the TRUMPF portfolio

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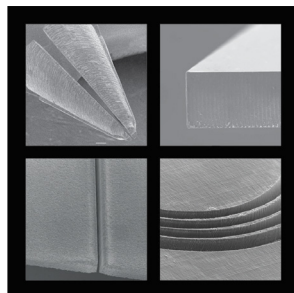
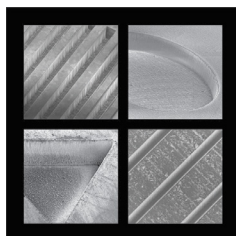
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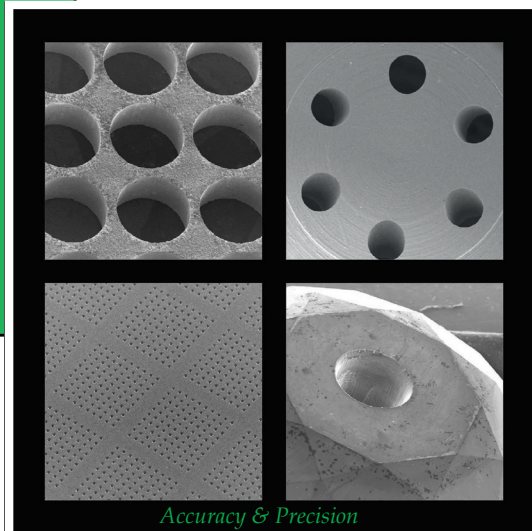
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Amplitude

Amplitude's Frontiers in Laser Applications (FLA) track:
"GHz femtosecond laser processing" presented by
Eric Mottay, CEO Amplitude Laser Group

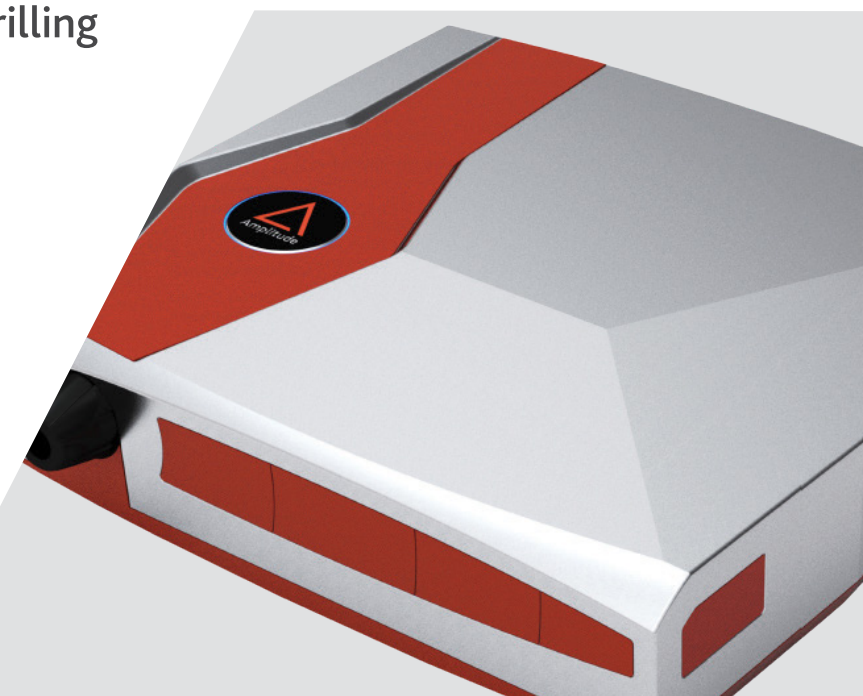
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- Microelectronics
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ICALEO 2020 At-A-Glance

Take a look at some of the statistics of this year's conference!

A Recap of ICALEO 2020 - A Virtual Experience

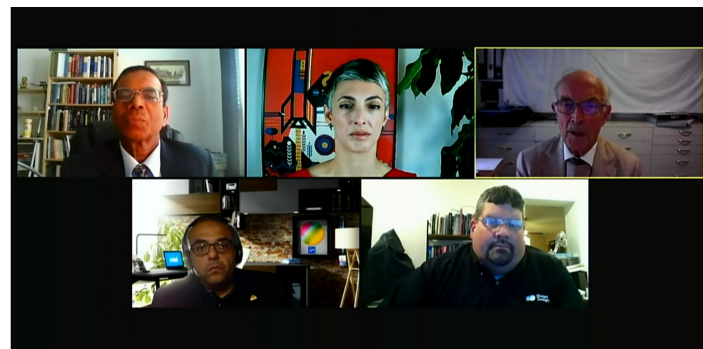
ICALEO 2019 ended with so many faces saying, "see you next year in Chicago!" No one could have predicted what ICALEO 2020 would actually look like. We were all looking forward to meeting up with old and new friends in Chicago and listening to Beer's Law while discussing the conference ahead over food. In the wake of the COVID-19 pandemic, there were unfortunately a lot of events in our industry, as well as all others, that were forced to cancel. Some conferences that are held later in the year were able to take some time to convert their events to be virtual. ICALEO was lucky enough to be one of those conferences, which is how we got here: to ICALEO 2020 – A Virtual Experience.

Traditionally an in-person four-day event packed with presentations in different industry tracks, ICALEO had to be transformed in order to accommodate an audience virtually. That unfortunately meant cutting down content to fit into two days; still packed with those same interesting presentations, but now virtually. Although there are many different formats for a virtual conference, LIA tried to pick one that best fit a traditional ICALEO feel. That is why each presentation had the opportunity for attendees watching live to engage in a short Question and Answer session with the speaker after their presentation was over. All speakers also had their email available for people to contact them directly.

One of the highlights of ICALEO 2020 was the Live Panel Session: Lasers in the Photonics Era: From Manufacturing Factory to Space Exploration. This session was moderated by the esteemed Dr. William M. Steen, who led a very engaging discussion with special guests Dr. Aravinda Kar, Dr. Islam Salama, Dr. Ty Olmstead, and Dr. Nina Lanza. Each of these panelists are industry experts in different fields, bringing their own special knowledge and perspective to the given topics and audience questions.

The panel began with the discussion of how working with lasers has evolved over the past few decades. Each of the panelists were able to discuss how they have seen it develop most in their personal areas of expertise including laser processing, manufacturing, and even space exploration. They also had some very interesting discussion about how Artificial Intelligence is up-and-coming, how it compares to evolution, and how it has played a role in the various aspects of the laser industry.

If you were not able to participate in or watch the panel and would like to watch the recording, please contact icaleo@lia.org for more information.



A feature of the virtual format that LIA was particularly excited to share is the On-Demand Library. Cognizant of the fact that many ICALEO attendees are international, and therefore in various time zones, the idea behind having an On-Demand Library was so anyone could register and then watch presentations on their own time. While there were benefits to participating in the live portion of the conference, all of the presentations from the two-day conference as well as a few extra presentations were recorded and are now available to watch at any point for the entire year. This was also a benefit to anyone who has interests in multiple tracks because they didn't have to choose which presentation to miss for another one.

Although this was an attempt at something new due to circumstance, and therefore perhaps not perfect, it was a great way to keep ICALEO and its purpose alive. It has also shown a promising way of moving forward with the possibility of more inclusion for our future conferences. If you were able to join us, we hope you enjoyed this virtual experience and we hope to see you in person next year in San Diego!

By: Jana Langhans, LIA

854 Registrants
for Virtual ICALEO 2020 and
the On-Demand Library

44 Countries
around the world that
virtually attended ICALEO

124 Presentations
given virtually throughout
the 5 industry tracks

41 Peer-Reviewed
presentations that will be
published in the JLA





Reliable laser solutions for high-volume manufacturing

High-speed macromaterials processing
– field-proven, high-brightness fiber lasers

High-precision micromachining
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To meet with a Lumentum representative during the event, [contact us](#).



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ICALEO 2020 Platinum Sponsorship Dedicated Interview – Lumentum

[Please introduce yourself and what you do at Lumentum.](#)

My name is Vincent Issier and I'm Director of Product Line Management within the Commercial Lasers Business Unit. I'm currently managing a broad range of laser and component products for applications ranging from metrology to biotech to micromachining and macro-machining. I held various R&D positions and then moved to the product line management position in 2010, either designing lasers or driving micromachining business. I have been attending ICALEO for many years.

[We understand that you are the Platinum sponsor this year at ICALEO. What are your impressions of the event transitioning to a virtual event this year?](#)

At Lumentum, the safety of our employees and communities is a top-priority. We understand the challenging decision to transition ICALEO to a virtual event, but support and align with the conference's commitment to safety while continuing to move the industry forward.

[Can you tell us about the importance of companies like yours attending events like ICALEO?](#)

ICALEO brings leaders and experts in the laser industry together. It is important for companies like ours to adapt during these unprecedented times to continue to share innovative solutions and ideas. ICALEO has been at the forefront of the industrial laser applications and we are very proud to be supporting this event.

[Has Lumentum been impacted in any other ways due to the pandemic?](#)

Like many companies that have internal manufacturing, Lumentum has altered its operations to address the safety of our employees, their families, and our global communities.

Lumentum has adopted signage to support social distancing, provided face coverings and training for proper use, temperature monitoring, and physical modifications to seating configurations and installing no touch faucets, doors, etc. We are also supporting work-from-home for people and functions that can perform their role remotely.

[Do you anticipate any long-term changes due to COVID-19 that Lumentum will make moving forward?](#)

The safety of our employees and communities have always been and will remain our top-priority as a company. We will maintain our COVID-19 safety protocols based on our own requirements in addition to local and state government regulations.

[Has the pandemic had any unexpected positive effect on your company?](#)

The pandemic has connected and unified our global company through one goal, to ensure the safety of our employees and communities. Through this unprecedented time, we have

enhanced our communication to drive transparency and stay connected to the changing needs of our employees.

[Is Lumentum currently working on anything that you think our readers should know about?](#)

We have recently announced a new addition to our picosecond laser series to address the micromachining market. The higher power PicoBlade™ 3 employs a new design which enables faster processing and improved throughput for micromachining applications including OLED, PCB, semiconductor, metal and solar cell processing.

Lumentum ultrafast lasers are known for their excellent beam quality, high pulse-to-pulse stability, and long-term output power stability. These characteristics are also built into the PicoBlade 3, but now at significantly higher power (up to 50 W at 355 nm). Available in IR, green, and UV wavelengths, the PicoBlade 3 also incorporates the added benefits of Lumentum's FlexBurst™, MegaBurst™, AccuTrig™, and SYNC capabilities.

[If so, how do you see this shaping our industry going forward?](#)

Today, picosecond lasers are increasingly becoming the workhorses of the laser micromachining industry. The continuous trend toward miniaturization in the smartphone, automotive, and medical device industries increases the need for higher power, precision, and flexibility in the lasers used in manufacturing processes. When developing PicoBlade 3, our objective was to release a new product increasing the power by a factor of four to enable higher throughput in existing applications. By doing so, we enable a faster processing and reduce cost-of-ownership.

[Is there anything else you think worth discussing?](#)

Here at Lumentum, our focus is to develop leading-edge, high performance lasers designed for industrial applications with maximized uptime. We have also been a critical component supplier in the fiber laser market for more than 20 years. With our extensive in-house capabilities from wafer fabrication and diode packaging, to optical fiber fabrication and fiber laser integration truly highlights our vertical integration and why Lumentum is a world-leading supplier for fiber lasers and subsystems. Our CORELIGHT® fiber laser systems provide extreme operational performance with an industry-leading brightness. Optimal beam quality from high-brightness fiber lasers is our key differentiator that increases processing throughput, improves the quality of processed material, and lowers cost of ownership. Our compact and rugged fiber laser systems are ideal for the most demanding macro-materials processing applications and environments.

You can find information about all Lumentum products on our website <https://www.lumentum.com/en>

ICALEO 2020 Platinum Sponsorship Dedicated Interview – EKSPLA

Please introduce yourself and what you do at EKSPLA.

Aldas Juronis, Head OEM lasers program

We understand that you are the Platinum sponsor this year at ICALEO. What are your impressions of the event transitioning to a virtual event this year?

Although we prefer the face to face interaction from a live event, we understand that right now we have an unordinary situation with the pandemic, and we are making our efforts to find new and different ways of communication with our customers. Being active in participation and sponsorship of virtual conferences, such as ICALEO 2020, is one of those ways we have started to exploit from the beginning of global pandemic.

Can you tell us about the importance of companies like yours attending events like ICALEO?

ICALEO is an important event for us, because it is one of the biggest in the field of laser applications for processing of different materials. In our portfolio we have number of industrial grade lasers: NL200 and NL230 series nanosecond lasers for micromachining and LIBS, Atlantic series picosecond lasers for black marking and micromachining, FemtoLux series femtosecond lasers for multiphoton photopolymerization, glass marking and micromachining. While attending at ICALEO we have opportunity to meet with scientists and application engineers, find out new areas and trends of laser material processing, and to present our developments on new laser sources.

Has EKSPLA been impacted in any other ways due to the pandemic?

The whole world is impacted by the pandemic, and Ekspla is no exception. Fortunately, this impact has not been as big for us, because we have diversified markets both business and geographic. In the beginning of the year we felt lower activity from our customers in China, as they were the first to face a complete lock down, our customers in other markets were still active. However, after a few months the situation changed and we saw a slowdown from our customers in Europe and US, while the Chinese market has started to recover. From a business perspective, our major revenue is still coming from scientific customers which were less affected in terms of spending, comparing to industrial ones. Of course, due to the pandemic, some decisions by our customers are not made as quickly as before, with some decisions being delayed or postponed.

From another perspective, the virus spread in Lithuania was managed well. Therefore, Ekspla's operations in general weren't affected, which allowed us to continue our new products development.

Do you anticipate any long-term changes due to COVID-19 that EKSPLA will make moving forward?

Yes, and it actually it changed quite a lot of things we do. First of all, we noticed that distance meetings in some cases can replace live ones. Another important point is that due to traveling restrictions, products should require minimal efforts for installations and servicing.

Has the pandemic had any unexpected positive effect on your company?

I think the biggest effect is that it helped us to learn new ways in contacting with customers and partners. In addition, it helped us to review process and products, to make them more self-servicing.

Is EKSPLA currently working on anything that you think our readers should know about?

We have chosen ICALEO to introduce our newest upcoming industrial laser; our 30 W FemtoLux30 femtosecond laser that could work 24/7/365 without any interruptions. Typically, other lasers with high optical power use water for cooling, which means an additional bulky and heavy water chiller is needed which require periodical maintenance (cooling system draining and rinsing, water and particle filter replacement, etc...). Moreover, in the unfortunate event of water leakage, not only can the laser head be damaged, but also the more expensive equipment. Our FemtoLux30 laser uses an innovative direct refrigerant cooling (DRC) method that does not contain any water inside the laser head, and it is much more efficient. Another advantage is that the laser cooling equipment is integrated together with the power supply unit into a single 4U rack mounted housing with a total weight of just <15kg.

The FemtoLux30 laser has a tunable pulse duration from <350fs to 1ps and can operate in very broad AOM controlled range of pulse repetition rate from a single shot to 4MHz, while max energy of >250μJ could be achieved while operating in a burst mode. We believe that the FemtoLux30 laser will be a perfect tool for display and microelectronics manufacturing, as well as for micro processing and marking of brittle materials (glass, sapphire, ceramics), along with the highest quality micro processing of different metals and polymers. While high reliability and zero maintenance requirement will assure uninterrupted laser operation and fast ROI to the end user of the laser equipment. We will be launching this laser to the market during first half of next year.

If so, how do you see this shaping our industry going forward?

We believe that FemtoLux30 introduces new standards in performance and reliability among higher powered industrial femtosecond lasers.

COMING SOON

Reliability redefined

New 30W
"dry" cooled
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for flat panel display
and microelectronics
fabrication

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30W at 1030nm

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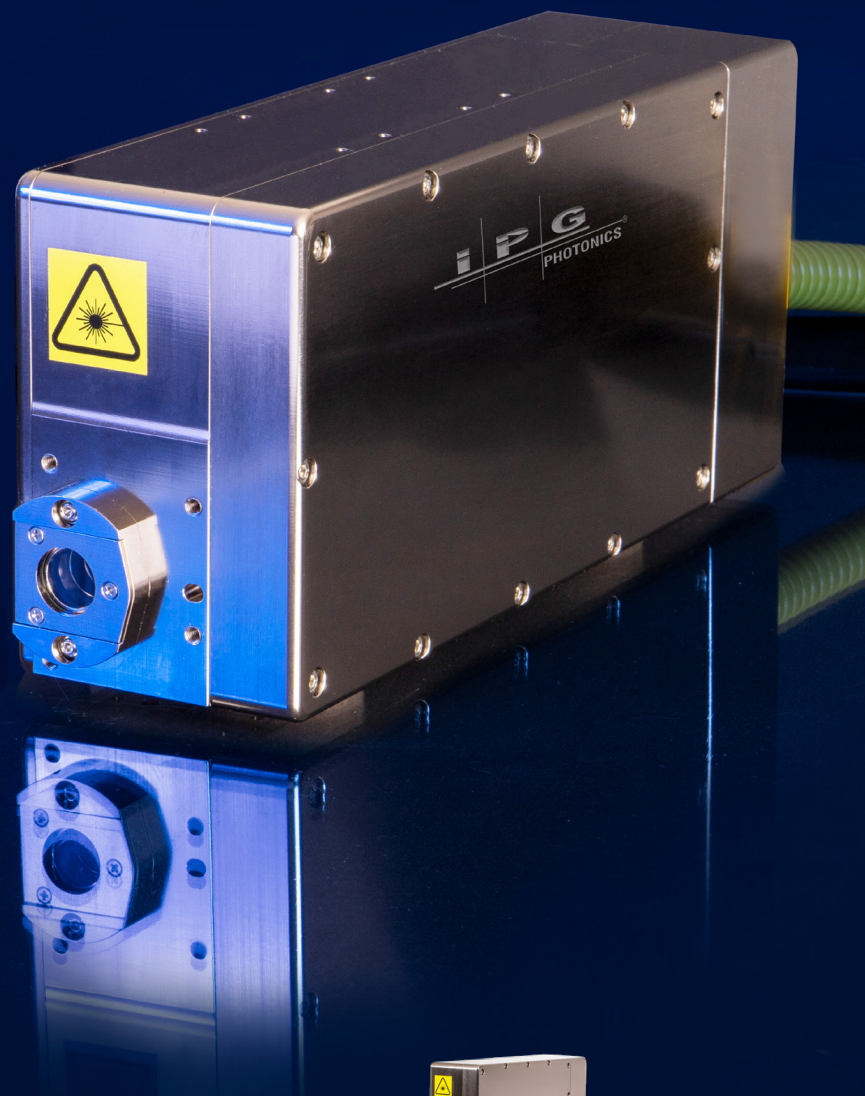
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for ease of integration



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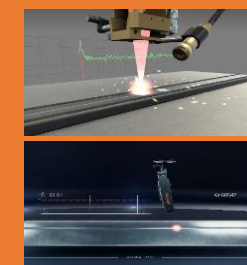
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Virtual Awards Ceremony Results

ARTHUR L. SCHAWLOW AWARD

One of LIA's most prestigious honors, the Arthur L. Schawlow Award recognizes outstanding, career-long contributions to basic and applied research in laser science and engineering, leading to fundamental understanding of laser materials interaction and/or transfer of laser technology for increased application in industry, medicine, and daily life.

The Schawlow honoree is acknowledged at the LIA Awards Ceremony, during which the recipient will give an address.

Eligibility: Nominations are open to candidates who made outstanding contribution to basic and applied research in laser science and engineering. The recipient does not have to be a member of LIA but sustained service to LIA can be one of the additional contributions that is considered for the award. Nominations are active for three years.



2020 WINNER

DISTINGUISHED PROFESSOR MILAN BRANDT

RMIT UNIVERSITY

MELBOURNE, AUSTRALIA

Milan Brandt is a professor in Advanced Manufacturing in the School of Engineering, Technical Director Advanced Manufacturing Precinct and Director RMIT Centre for Additive Manufacturing, RMIT University, Melbourne Australia. Professor Brandt has been involved with lasers and manufacturing technologies professionally for some 36 years and is recognized nationally and internationally as the leading Australian researcher in the field. He is the recipient of a number of awards and is the author of over 200 publications, 5 book chapters and a book on laser additive manufacturing. He has also commercialized the results of his research through the companies he has helped establish.

Professor Brandt is a Fellow and currently an executive member of LIA. In 2018 he was the president of LIA. He has had a 33 year association with LIA being involved on the organizing committees for ICALEO and LAM for many years, as well as serving on the LIA Board of Directors. He is also the Senior Editor of JLA in additive manufacture.

WILLIAM M. STEEN AWARDS

2020 WINNERS



Universidade de Vigo
1st

NIST
National Institute of
Standards and Technology
2nd

PRECITEC
3rd

The Laser Institute of America is pleased to invite applications for the prestigious William M. Steen Award for significant developments in laser material processing named after one of the early pioneers in the subject. Laser Material Processing is one of the growth points in modern manufacturing. To bring focus to the many developments taking place and to promote the development of new ideas the LIA is making awards for the top three ideas of the year as adjudicated by a prize giving panel.

In order to qualify the innovative development should have experimental proof of concept in the use of lasers or monitoring of laser processes and should fit one of the criteria stated below:

- Open a new area of application for lasers.
- Be of benefit to manufacturing with lasers.
- Solve a problem either particular or general by the use of lasers.
- Show some novel sensing system by using optics or when monitoring laser processes.
- A development in photo chemistry.
- A development in photo-therapies.
- A development in 3D printings with lasers

FELLOWS AWARD



The grade of Fellow is the highest level of membership in the LIA. It is awarded to recognize members of the institute who have:

- Attained unusual professional distinction in the LIA mission areas of laser science and technology, laser applications and/or laser safety, and
- Provided outstanding service to their field.

Nominations are open to candidates who must have practiced the profession of laser science and engineering in academia, medicine, industry or government for at least 10 years, and fellow membership for any individual shall not be instituted or remain in effect unless his/her membership is current. For exceptional candidates, the Executive Committee may waive the eligibility requirements.

LIA is proud to recognize the following members as Fellows:

Gilbert Haas - Haas Laser Technologies, Inc.

Dr. Henrikki Pantisar - TRUMPF North America

JLA BEST PAPER AWARD

The Journal of Laser Applications Best Paper Award is given annually in recognition of outstanding laser applications research to the primary author of a selected paper published in the journal in the preceding three years. Each Editor nominates a single paper in their topical area for consideration by the full Editorial team based on the quality and significance of the work. The winning author receives free registration to ICALEO and a Crystal Award.



Dr. Valerie Gunenthiram

The 2020 JLA Best Paper award has been awarded to Valérie Gunenthiram for her winning article, "Analysis of laser–melt pool–powder bed interaction during the selective laser melting of a stainless steel," J Laser Appl. 29, 022303 (2017). The award was presented at the 2020 ICALEO® Virtual Conference on October 19.

Valérie Gunenthiram studied material science at the Cergy-Pontoise University in France. Following her master's thesis on study of the thermal and electromagnetic diffusion of an industrial process by numerical simulation, she obtained a doctorate on selective laser melting process in PIMM (Processing and engineering in Mechanics and Materials) laboratory in Paris. She studied powder bed - melt pool interactions and porosity formation, both on stainless steel and on aluminum alloys. Her doctorate work was focused on hydrodynamics of melt pool, formation of metal ejections, denudation and material densification conditions. Since 2019, she has been working on the development of instrumentation of selective laser melting machines in a project which brings together different french companies and laboratories around additive manufacturing, including the PIMM laboratory.

POSTER PRESENTER AWARD

Awards: The following awards are given for 1st, 2nd and 3rd place:

First Place: Certificate of Merit, \$500 cash

Second Place: Certificate of Merit, \$250 cash

Third Place: Certificate of Merit, \$100 cash

The judging is conducted by a team of 3 judges and based on the following criteria:

Originality: A new problem is solved with new or old methods, or an old problem is solved with a new method.

Technical Approach: Clear technical outlook, stated objectives, clarity of information and conclusions.

Artistic Presentation of Materials: Artistic appeal, art works (graphics and figures) well organized, coloring and lettering in the title, header and text is neatly done.

LIA is proud to announce the 2020 winners:

3rd Place – Jihun Noh - "Thermal Conditions for 3D Printing Metal Structures by Selective Laser Melting"

2nd Place – Jihuh Noh - "Pulsed-Laser Sintering of Silver Nanoparticles on Flexible Substrates"

1st Place – Kazuhiro Ono - "Pure Copper Rod Formation by Multi-Beam LMD Method with Blue Diode Lasers"

STUDENT PAPER AWARD

Future generations of laser industry experts have been contributing papers at ICALEO for 20 years. LIA once again will recognize the importance of student contributions with the 21st Annual ICALEO Student Paper Award. Not only does the student paper contest illuminate the great work of up-and-coming researchers, but cash awards will be presented to the first-, second- and third-place winners. Winning papers are also given the opportunity to submit to LIA's Journal of Laser Applications® for publication (papers will undergo a peer-review process).

Student papers accepted for competition will be judged by an international panel based on originality of topic/material presented, scientific and technical merit, and presentation quality. Professors will not judge their own students' papers.

LIA is proud to announce the 2020 winners:

3rd Place – Yassin Abraham Mayi "Transient Dynamics and Stability of Keyhole at Threshold in Laser Powder Bed Fusion"

2nd Place – Parvin Fathi-Hafshejani - "Laser-assisted Selective and Localized Surface Transformation of Titanium to Anatase, Rutile, and Mixed Phase Nanostructures"

1st Place – Leonardo Caprio - "Non-intrusive Estimation of Sub-Surface Geometrical Attributes of the Melt Pool Through the Sensing of Surface Oscillations in Laser Powder Bed Fusion"

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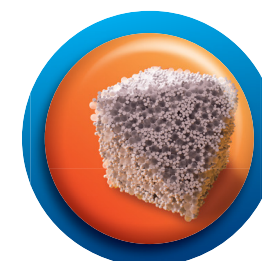
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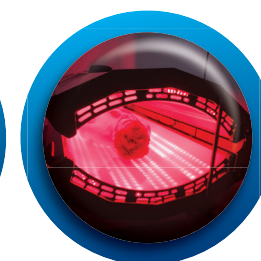
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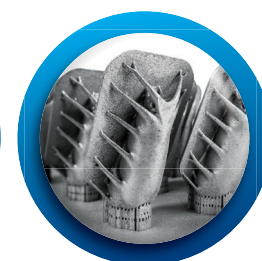
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