

OPEN Optics and Photonics Education News

Newsletter of the Optics and Photonics College Network

February 2018

Equipping Insects for Special Service DragonflEye Backpack Converts Insect into Optogenetically-Steered Drone



The MIT Draper Laboratory and Howard Hughes Medical Institute are using photonics to harness the biological finesse of an insect to perform robotic tasks, including pollination, surveillance, or carrying small payloads. A live dragonfly is equipped with a solar-powered backpack with sensors used for navigation. The insect is steered by an implantable optical neural interface called an optrode. Full article available at <http://www.draper.com/news/equipping-insects-special-service>.

From the Executive Director



This newsletter emphasizes the rapidly emerging innovations and applications of optics and photonics. The first graphic illustrates how an optogenetic device can control the actions of small insect, to be operated as a drone. The following article summarizes how advancements in ultrafast (very high-powered) lasers have enabled new scientific and medical applications, leading to improved economic development.

A recent meeting of faculty, employers and photonics technicians at the Photonics West Conference featured presentations on development of integrated photonics. Also highlighted, is an article about the release of a new brochure by the OSA Industry Development Associates summarizing the economic impact of eight application areas of photonics.

All of these news items reassure us that the photonics technicians being educated and trained by OPCN colleges will have opportunities to experience rewarding careers in this interesting and widely expanding field.

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Upcoming Events

03/18/18 - 03/21/18
Innovations Conference
2018
San Francisco, CA

04/28/18 - 05/01/18
American Association of
Community Colleges
(AACC) Annual Convention
Dallas, TX

06/18/18 - 06/20/18
Course 1 Faculty Capstone
Indian Hills Community
College

06/20/18 - 06/22/18
Course 2 Faculty Capstone
Indian Hills Community
College

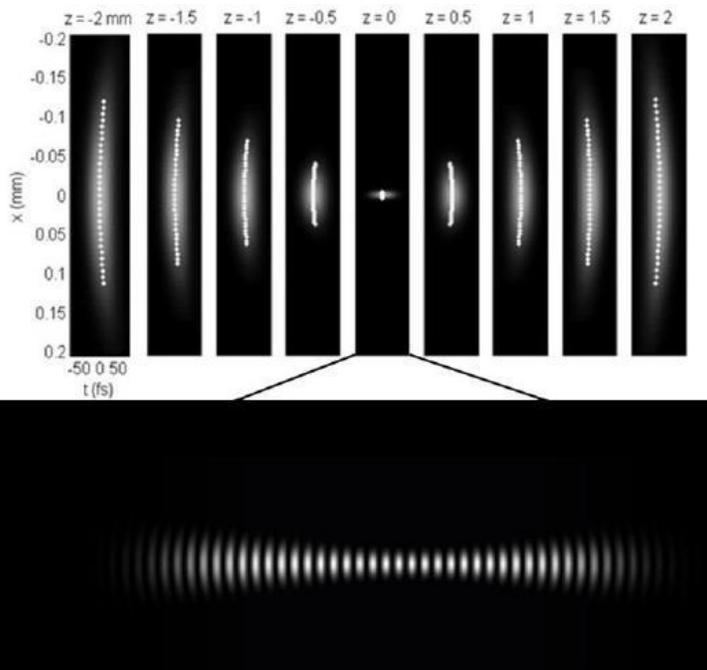
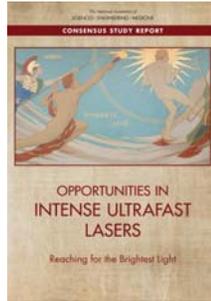
06/24/18 - 06/27/18
American Society for
Engineering Education
(ASEE) Annual Conference
Miami, FL

07/23/18 - 07/26/18
HI-TEC Conference
Miami, FL

Ultrafast Lasers: Recent Developments and Emerging Applications

High Intensity Laser Technologies

Petawatt lasers and the associated fields of high-intensity science are enabled by the technology of optical power compression that can concentrate joules of optical energy into a single packet only tens of microns in each dimension. High power lasers (nanosecond pulses in the megawatt to gigawatt range) are created by Q-switching with intracavity modulators. Mode-locking inside the laser cavity further compresses the laser power into picosecond pulses with power in the terawatt range. Even shorter, higher power pulses can be generated by "chirped-pulse amplification" (CPA), using a device outside the laser cavity that disperses the short pulse like the colors of a rainbow, enabling much higher amplification. "Optical parametric chirped-pulse amplification" (OPCPA) is a parametric amplifier, not a laser. It converts energy from the excitation source directly into the output laser in a single step. The host medium is just a converter; it does not need to store the energy, and this has advantages for scaling to higher powers.



A petawatt laser pulse can be explained by the following example: Consider a 100 joule laser pulse, delivered in 100 femtoseconds (10^{-13} seconds), at a wavelength of 800 nm, focused to a spot 10 microns across. If we could see the pulse itself then it would appear as a tissue-paper-thin pancake of energy in the form of an electric field traveling through space at the speed of light.

Since the invention of laser CPA in the 1980s, the power has increased about an order of magnitude every four to five years. The current limits are due to the optical elements with the lowest damage thresholds, which are the special dispersion optics required for pulse compression in CPA or OPCPA systems. CPA and solid-state laser technology have pushed the present peak intensity to the range of 10^{22} W/cm².

07/30/18 - 07/31/18
MPEC Fundamentals of Photonics Workshop
Indian Hills Community College
Ottumwa, IA

08/6/18 - 08/10/18
MPEC Fundamentals of Photonics Workshop
Indian Hills Community College
Ottumwa, IA

[View Events Webpage](#)

Capstone Dates Set



OP-TEC Provides Online Faculty Development for Fundamentals of Light and Lasers and Laser Systems and Applications

There is still plenty of time this semester to complete one of OP-TEC's online professional development courses that prepare faculty and laboratory staff to teach with Fundamentals of Light and Lasers (Course 1) or Laser Systems and Applications (Course 2). The open entry/open exit courses are available through the Canvas online learning management system 24/7 through May 31. Participants who successfully complete their online course will be invited to a hands-on laboratory capstone experience during the week of June 18-22 at Indian Hills Community College in Ottumwa, Iowa.

For more information or to enroll in Course 1, visit www.op-tec.org/faculty.

For Course 2, please email cdossey@op-tec.org.

HI-TEC Conference Plans

The national and regional

In December 2017, the National Academies of Science (NAS) released a report citing current applications of ultrafast lasers, which include:

- High-Density Laser-Plasma Interactions: The fundamental science underpinning laser fusion.
- Unique Secondary Sources: X-rays, gamma rays, protons, electrons, positrons, and neutrons have all been created using high-intensity lasers interacting with material targets. Particle beams created by intense lasers can be more effective sources for clinical medical therapies.
- Particle Acceleration: High-intensity lasers are a well-developed route to advanced particle accelerators. Laser-based acceleration schemes may provide one of the most viable possible reentry points for U.S. leadership in advanced technology for future linear colliders.
- Attosecond Science: High-intensity lasers are gateways to the attosecond (10^{-18} s) time scale. The strong fields in high-intensity lasers can create attosecond radiation by means of high harmonic generation (HHG) in bound atoms and molecules.
- Commercial Applications for High-Intensity Lasers: The first commercial application of lasers employing CPA, in 2002, was used for tissue cutting in LASIK vision correction. Since that time, the market for industrial/medical high-intensity lasers has reached several hundred million dollars per year, primarily for precision micromachining. For example, ultraprecision machining of hard materials such as for cell phone faceplates is in many cases performed with high-intensity femtosecond lasers. An emerging area with a potential enabling impact in the greater-than \$100 billion range is in the use of high-intensity lasers to implement "tabletop X-ray lasers" through coherent upconversion.

The NAS Report "Opportunities in Ultrafast Lasers: Reaching for the Brightest Light" can be downloaded at <https://www.nap.edu/download/24939>.

Impact of Optics and Photonics on the Economy and Job Market



A recent OSA/OSID brochure provides interesting and useful information that can help faculty at colleges to interest and recruit new

photonics centers will host the next annual in-person OPCN network meetings and photonics industry site visits at the HI-TEC Conference, July 23-26, 2018 in Miami, FL.

The HI-TEC Conference provides a wonderful opportunity for educators to learn, network, give presentations, share best practices, and disseminate project resources with other STEM educators.

OPCN events are being planned for the HI-TEC Preconference on Monday and Tuesday, July 23-24. The general conference keynotes, presentation sessions, and exhibits will take place on Wednesday and Thursday, July 25-26.

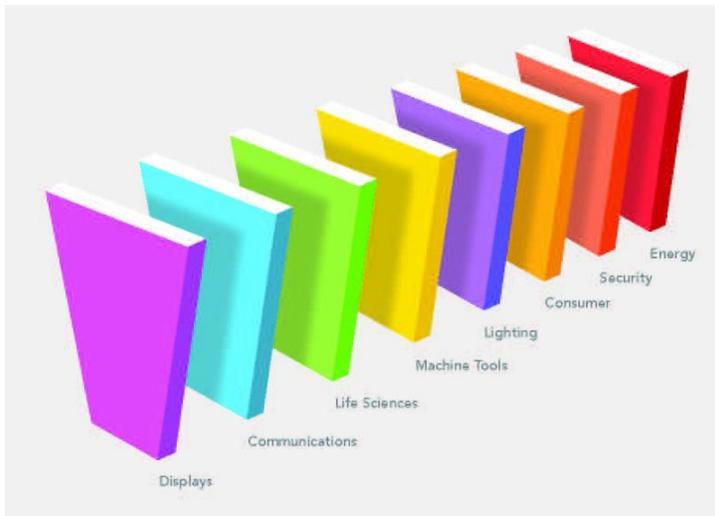
As in previous years, OP-TEC will be offering conference registration codes for OPCN representatives. OPCN Coordinators and Members will receive priority for these free registrations but the centers will also take requests to consider additional college faculty members or partners. As in previous years, OPCN Coordinators will be reimbursed for their airfares post-conference.

Interested educators at colleges with LASER-TEC or MPEC partnership agreements or subawards, should contact Chrys Panayiotou or Greg Kepner to request travel assistance. All other OPCN Members should contact Christine Dossey at OP-TEC.

We hope that all OPCN members will be able to attend July 23-26 in Miami!

HI-TEC Award Nominations

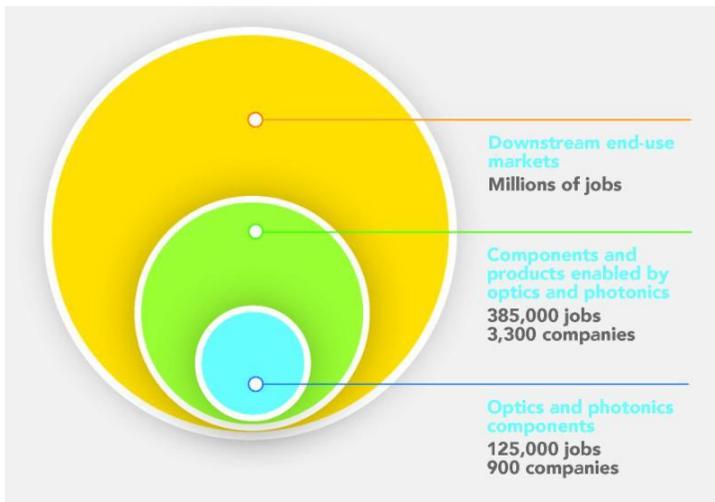
photonics technician students. It also contains information that will assist students to review photonics applications and select employers for possible job opportunities.



The combined optical components and subsystems businesses enable vertical markets each worth trillions of dollars per year. These vertical markets, in turn, enable approximately US \$78 trillion in global economic output.

In the last 20 years annual U.S. laser sales have grown from \$3.8 million to over \$13 billion.

Optic & Photonics Create Jobs



Click [here](#) to view the brochure in it's entirety.

Indian Hills Alumni & Friends Reception at SPIE Photonics West

Indian Hills Community College held an Alumni & Friends Reception in conjunction with a Photonics Workforce Development Meet & Greet on January 31, 2018 while at the Photonics West Exposition in San Francisco. The event was sponsored by the IEEE (Institute of Electrical and Electronics Engineers) Photonics Society with additional partners including MPEC (Midwest Photonics Education Center), OP-TEC (The National Center for Optics and Photonics Education), LASER-TEC (Southeast Regional Center for Laser and Fiber Optics Education), PRPI (Puerto Rico Photonics Institute), and AIM Photonics (American Institute for Manufacturing Integrated Photonics).



Nominations Deadline
March 30, 2018
5:00 pm CST

The HI-TEC Conference annually recognizes outstanding educators and industry representatives who make significant contributions to the training and education of today's technology workforce.

HI-TEC is now accepting award nominees for the following three awards:

Educator-of-the-Year,
Industry Recognition, and
Innovative Program.

Nominations can only be submitted by NSF ATE Centers or Projects, and/or their partners, and HI-TEC sponsors. A nominator may submit no more than one application for each award category. Nominees must be affiliated with an NSF ATE Center/Project or HI-TEC sponsor.

The awards will be presented at the HI-TEC Awards Luncheon on Wednesday, July 25, 2018 at The Intercontinental Miami Hotel in Miami, FL. HI-TEC will provide the airfare, registration, and two nights lodging for each winner in addition to their prestigious award recognition.

For more information and nominations click [here](#). For questions about the award, contact Pamela Silvers, HI-TEC Awards Chair, psilvers@abtech.edu.

For assistance with the nomination form, contact Sheila Wilson swilson@cord.org.

PACT Alumni Spotlight



Photonics West, North America's largest photonics focused exposition and conference, was the perfect venue for these partners to meet and discuss photonics workforce development. The event was held at Jillian's, a popular gathering place near the Moscone Center. IHCC President Dr. Marlene Sprouse welcomed and thanked everyone for coming and for their continued support of IHCC through hiring program graduates, donating equipment, funding scholarships, partnering in events, and providing company tours. Additional speakers included Doug Razzano (IEEE), Dr. Chrys Panayiotou (LASER-TEC), Dr. Anca Sala (OP-TEC & MPEC), Dr. Jonathan Friedman (PRPI), and Madeline Glick (AIM Photonics).

The nearly 200 attendees included alumni, students, and instructors from IHCC, IEEE members, representatives from MPEC, OP-TEC, LASER-TEC, PRPI, and AIM Photonics, as well as friends from companies such as TRUMPF Inc., Thorlabs, RPMC Lasers Inc., LightPath Technologies, NUBURU, Amplitude, Electro-Optics Technology Inc., Lightel, Optimax Systems, Kimmon Koha USA Inc., the Lawrence Livermore National Laboratory and others. IHCC alumni in attendance are now working in a wide range of careers including Program Managers, Business Development Managers, Vice Presidents, Sales Managers, Product Managers, Applications Engineers, Sales Engineers, and Engineering Technicians.

Sixteen IHCC students traveled to California for the event and to attend Photonics West. They also had the opportunity to tour Lawrence Livermore National Laboratory, Spectra Physics, and the Lick Observatory. The students raised travel funds throughout the year by selling barbecued pork and chicken sandwiches and pancakes, holding raffles, and other fundraising activities.

Workforce Meet & Greet at SPIE Photonics West

OP-TEC's collaborative work with AIM Photonics was showcased during the Alumni & Friends Reception hosted by Indian Hills Community College (IHCC) and the IEEE Photonics Society at the SPIE Photonics West Conference. AIM Photonics, the American Institute for Manufacturing Integrated Photonics, is an industry driven public-private partnership focused on becoming a global leader in the manufacturing of photonic integrated circuits (PIC). PIC's are expected to enable substantial advances in several areas including cloud computing and storage data centers, ultrahigh bandwidth radio and microwave communications, sensors for medical, military, and autonomous vehicles applications, and others.

Turner Frederick discovered his hands-on skills restoring classic cars in an auto body shop where he worked during high school. When he graduated, he decided to continue his education at a technical school. During a tour of Texas State Technical College, Turner became fascinated by the applications of lasers, photonics, and electronics technologies when he observed an instructor use a prism to split a beam of white light into all the colors of the rainbow. That was a turning point, says Turner, "I wanted to go to school and learn more about why it did that."

After doing some research and talking to instructors and advisors, Turner enrolled in TSTC's Laser Electro-Optics Technology program. Turner remembers thinking that the program would be "a walk in the park and we'd get to play with lasers all day." Instead, he found his laboratory classes challenging and his writing skills got a lot of use as he prepared lab reports about his experiments. Working hard, Turner made the dean's list and graduated with an associate of applied science degree in laser electro-optics technology.

Today, Turner works as a Team Lead/Field Service Technician at NovaCentrix, a company that provides photonic curing tools, conductive inks, materials, and expertise enabling development and production of next generation printed electronic devices. Turner enjoys learning on the job and appreciates that photonics has opened so many doors for him. Since joining NovaCentrix, he has



Workforce development, including the preparation of technicians to support this advanced technology, is an important part of the mission of AIM Photonics. Due to OP-TEC's deep experience and contributions to photonics technician education, the National Science Foundation asked OP-TEC to lead other NSF ATE Centers in a joint effort with AIM Photonics to create educational programs for technicians who work in Integrated Photonics. To date OP-TEC has developed skill standards for technicians performing test and assembly of PIC's, and an introductory course on Integrated Photonics (IP). Future work includes the development of a second course focused on maintenance and use of equipment for IP testing and integration, skill standards for technicians working in fabrication of PIC's, and assisting colleges interested in teaching IP.

Dr. Madeleine Glick, Industrial Liaison Officer with AIM Photonics Academy, and Dr. Anca Sala, Dean of the College of Engineering at Baker College, spoke on behalf of AIM Photonics and OP-TEC during the event. Their remarks were well received by the more than 100 participants, from IHCC, the NSF ATE MPEC and LASER-TEC Centers, other colleges teaching photonics, as well as professional members and leadership of the IEEE Photonics Society.

OP-TEC will continue to contribute to the preparation of IP technicians by offering online courses, an annual summer school with AIM Photonics Academy, training workshops with ATE Centers, and a 25-credit Integrated Photonics Certificate for two and four-year colleges.

PRPI Students Help Reconnect Puerto Rico

After hurricane Maria LASER-TEC, and the National Science Foundation assisted Puerto Rico Photonics Institute (PRPI) by funding the internships of their photonics certificate program.



As of the end of January 2018, two students have finished their internships at Critical Hub, a fiber optics company, having unique experiences from being on the "front lines" of rebuilding San Juan's communications infrastructure. As a result, they had both broad and deep experience, reconstructing network backbones as well as installing "fiberhoods". The work, almost exclusively with fiber optics,

been promoted twice and has had the opportunity to travel to China to provide client support.

Read more about Trent and other successful technicians in [Success Stories in Photonics Careers](#).

OPCN Committees

The Committees of the Optics and Photonics College Network are dedicated to sharing expertise, best practices, resources, and advice on issues of importance to photonics technician educators at colleges throughout the United States.

Professional Development Committee

Anca Sala, Chair
anca.sala@baker.edu

Student Recruiting Committee

A.J. Gevock
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Program Assistance Committee

Gary Beasley, Chair
gbeasley@cccc.edu

Equipment Committee

Frank Reed, Chair
frank.reed@indianhills.edu

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included repairing and replacing damaged fibers, installing network infrastructure, and restoring point-to-point connections (via radio links). One of the students was offered a full time job when he finishes his certificate in April.

The situation for PRPI is slowly improving. On December 30, power was restored to PRPI laboratory building. However, contractors have not yet begun to clean the building. Drywall and air conditioning ducts are contaminated with fungus and will have to be thoroughly cleaned to re-establish a safe working environment. PRPI staff have completed an initial inspection of the laboratory and restarted dehumidifiers. Once the air conditioning is back on, they can begin the process to carefully inspect the laser optics and other sensitive systems and components.



OP-TEC Publishes New One Credit Coursebook

**Enthuse
and
Prepare
Students
to
Study
Photonics**

**Introduction to
Lasers and Optics**

OP-TEC

1-Credit Introductory Lab Course

Seven laboratory demonstration are included, complete with instructions, an equipment list, and diagrams.

15 Modules Covering:

- **Spectrum of Light**
- **Laboratory Safety**
- **Polarization**
- **Mirrors and Lenses**

The image shows the cover of a coursebook titled 'Introduction to Lasers and Optics' published by OP-TEC. The cover features a blue background with a central image of a rainbow spectrum. The text is arranged in a structured layout, with the main title and course information at the top, and a list of features and modules at the bottom.

Most first semester photonics technician students are required to learn required math, science and basic electronics to prepare them for taking optics and laser courses in subsequent semesters. Introduction to Lasers and Optics is a one-credit course that can be offered to first semester students to get them excited about photonics and maintain their interest in their selected major. The content requires little math to understand the basic concepts presented. Students are assigned to review selected videos of laser/optical equipment and operation. Students are also introduced to basic laser/optics equipment labs to observe interesting and useful phenomena.

A companion Reference Guide for Instructors contains a course outline and key graphics. Instructors can request a [Review Copy](#) and [Reference Guide](#) on the OP-TEC online store.



Join the Conversation

We hope you enjoyed this edition of the OPEN newsletter. We would really like to hear from you. If there is some subject that you would like us to discuss or look into, please let us know at prmanager@op-tec.org.

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