

OPEN Optics and Photonics Education News

Newsletter of the Optics and Photonics College Network

August 2017

From the Executive Director



Useful applications of lasers and optics are rapidly emerging and promise to make profound impact in the fields of IT, manufacturing, biomedical equipment, defense and others. In this month's issue we feature an article on "The Future of Wireless," which will require photonics technicians to acquire more knowledge and skills in the operation, installation and maintenance of new fibers and networks.

Each OPEN issue for the remainder of this year will feature a new application of photonics. Photonics faculty will need constant professional development to stay abreast of new developments and, when appropriate, augment their lessons to provide information to students. The most convenient and cost-effective strategy is viewing relevant, online webinars. See the OPEN article on the work and opportunities provided by the OPCN Professional Development Committee.

There are three more OPCN committees that are working to provide leadership and services to the membership. They are described in a subsequent article.

Dan Hull

The Future of Wireless Is Fiber



In the next few years wireless providers are planning the broad deployment of 5G wireless services. Current International Telecommunication Union (ITU) specifications for 5G specify a total download capacity of at least 20Gbps and 10Gbps uplink per mobile base station. In contrast, the peak data rate for current LTE cells is about 1Gbps. Under ideal circumstances, 5G networks will offer users a maximum latency of just 4ms, down from about 20ms on LTE 4G networks. The 5G

specification also calls for a latency of just 1ms for a stepped up service called ultra-reliable low latency communications (URLLC). In support of the Internet of Things, 5G must also support at least 1 million connected devices per square kilometer (0.38 square miles). This may seem like a lot but when every traffic light, parking space, and vehicle is 5G-enabled, we'll easily start to hit that kind of connection density and will see 5G towers on places like major highways every 100 feet or so.

How is connectivity delivered these days to wireless towers, and how will it be delivered in the future? Fiber!

5G networks will be predominantly fiber-based due to the combination of tower capacity and distance requirements. We will see limited

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Upcoming Events

8/7/17 - 8/11/17

MPEC Laser Materials Processing Workshop
Indian Hills Community College

8/14/17 - 8/15/17

MPEC Fundamentals of Photonics Workshop
Indian Hills Community College

10/16/17 - 10/19/17

SPIE Optifab
Rochester, NY

10/19/17 - 10/20/17

National Coalition of Advanced Technology Centers (NCATC) Fall Conference 2017
Portland, OR

10/23/17 - 10/25/17

ATE PI Conference
Washington DC

10/26/17 - 10/27/17

National Career Pathways Network (NCPN) Annual Conference
Saint Louis, MO

[View Events Webpage](#)

microwave antennas used in niche cases when fiber is not an option. Technicians will need to have a good understanding of fiber characterization testing and troubleshooting as these super-fast high capacity networks roll out. In addition, skills in troubleshooting dirty or damaged connectors, tight fiber bends, faulty fiber splices, index matching epoxies, Optical Time Domain Reflectometry (OTDR), attenuation, and chromatic and polarization mode dispersion will become even more critical.

For more information see [Preparing the Transport Network for 5G: The Future Is Fiber](#)

Webinars for Faculty Professional Development



Laser and optics applications continue to emerge at a rapid rate. Photonics technician faculty members at two-year colleges are challenged to learn about these new applications and identify how they may require updated content for the courses they teach. It is time-consuming to review over fifteen professional and trade journals published each month, which may contain useful information. Many faculty say, "There just isn't enough time!" for this important professional development.

Viewing online webinars is a useful, time-efficient strategy for professional development. Several photonics webinars are produced each month. These webinars are typically taught in 40-60 minutes. Although they are introduced at a particular time and date, they are "archived" and available for viewing for several additional months. The OPCN Professional Development Committee reviews the photonics webinar offerings and sends a notice to members to consider reviewing the ones the Committee considers most valuable. Interested faculty can log in and view these webinars when their schedule permits. If a full 40-60 minutes are not available in your schedule, it is possible to watch a portion of the webinar for a period of time, and complete watching it at a later time. A portion, or all of a webinar, can also be used in class or as a student assignment.

In the 2017-2018 year, the photonics centers plan to develop and produce webinars for faculty on the use of new teaching materials, teaching aids, and other professional support. Webinars can be short, anywhere from 5 to 15 minutes in length, and capture any relevant experiences that faculty have had with teaching and outreach activities. Please consider sharing your experience with your colleagues. If you have a webinar suggestion for the OPCN Professional Development Committee, please contact Dr. Anca Sala, anca.sala@baker.edu.

Leadership and Services through OPCN Committees

The Optics and Photonics College Network (OPCN) meetings at the annual HI-TEC conference, and subsequent discussions, substantiate the interest and actions of photonics faculty to increase their leadership and direction in the organization to provide services, resources and professional development for its members, as well as faculty from colleges that are planning new courses and programs in photonics.

Highlights from the OPCN Committees:

Student Recruitment Committee

A.J. Gevock, Chair, aj.gevock@indianhills.edu

Purpose: Encourage and support dedicated student recruiters by sharing recruitment materials, events and other strategies

OPCN at HI-TEC 2017



Optics and Photonics College Network members, colleagues, and educators interested in optics and photonics education traveled to Salt Lake City in July to attend the annual in-person meetings of the Optics and Photonics College Network (OPCN) at the HI-TEC Conference.

The annual meetings brought together 36 faculty and administrators from 20 colleges across the country to network with each other, share best practices, and learn about the hundreds of resources available through the national and regional photonics centers and the professional societies.

In addition to presentations by the national and regional photonics centers, the attending program lead from each college provided an update on the photonics initiatives at their respective colleges.

On Tuesday, July 18, OP-TEC sponsored the 7th annual professional development bus tour for 46 OPCN members and guests. The group traveled by chartered bus 90 minutes north to Logan, Utah where participants had opportunities to learn about Ophir Optics operations and visit several production and research departments there. The group was also able to meet with investigators at the atmospheric Lidar Observatory at Utah State University in Logan.

The HI-TEC general conference on Wednesday and Thursday included keynote speakers, luncheons, dozens of presentations, and an exhibit hall where the three photonics centers hosted a photonics outreach booth to build awareness of photonics careers and provide information and best practices with STEM faculty

Plans: Member teleconferences and reports to members

Members: Christina Barker, Andrés Díaz, Sean Diestel, Christine Dossey, Laurie Miller McNeill, Shannon Stevens, Greg Wilson, Kenneth Young

Equipment Committee

Frank Reed, Chair,
frank.reed@indianhills.edu

Purpose: Assure that colleges teaching photonics have safe, well-equipped, up-to-date labs

Plans: Enlist donations from employers and discounts from manufacturers for lab equipment

Members: Trenton Berg, Michael Cranney, Drew Collins, Mo Hasanovic, Dan Hull, Kary Ioannou, Bill Kellerhals, Hugh King, Fred Seeber

Professional Development Committee

Anca Sala, Chair, anca.sala@baker.edu

Purpose: Assure that faculty have convenient and cost-effective opportunities to keep up-to-date on emerging photonics applications and teaching strategies/supplements

Plans: Identify and report on useful technical update webinars and create new webinars to describe improved teaching support resources

Members: Christine Dossey, Larry Feist, Lazaro Hong, Judy Irwin, Marc Kalis, Ellis Love, Desiré Whitmore, Natalia Chekhovskaya, Dorian McIntire

Program Technical Assistance Committee

Gary Beasley, Chair, gbeasley@cccc.edu

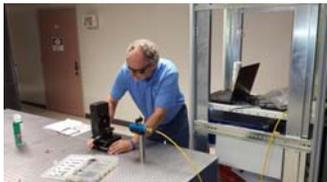
Purpose: Provide advice and information to assist colleges to plan new photonics courses/programs, and to update/alter existing courses/programs

Plans: Respond to requests for assistance from college faculty and center staff

Members: Jonathan Friedman, Dan Hull, Greg Kepner, Scott Prael, Fred Seeber, Rob Shroll, Gordon Snyder

Please contact a committee chair to request assistance, suggest specific actions or volunteer to serve on one of these committees. If you feel another committee should be formed, please contact Christine Dossey, cdossey@op-tec.org.

MPEC Hosts Laboratory Capstone Experiences



Educators working together on laboratory activities at Indian Hills.

The Midwest Photonics Education Center (MPEC) hosted a hands-on laboratory capstone experience at Indian Hills Community College (IHCC) in June for laser and optics educators. Participants who had successfully completed online faculty development courses through the National Center for Optics and Photonics Education (OP-TEC) during the 2016-2017 school year were invited to come to the IHCC campus in Ottumwa, Iowa to perform laboratory activities with Professor Frank Reed. The attending community and technical college educators learned about lasers, optics, light manipulation, and photonics-related equipment. Capstone completers earned continuing education units through the IHCC Customized Learning Department. IHCC has been an OP-TEC partner college since 2006 and has been hosting a laser laboratory experience each summer for several years. Many of the course completers are implementing laser and photonics programs at their institutions to meet increasing industry demand for photonics laser and electro-optics technicians.



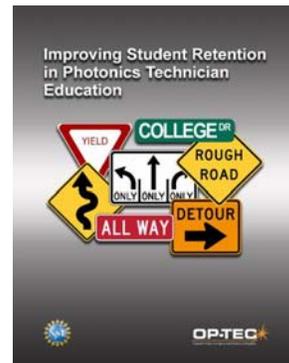
and administrators from other colleges.

On Thursday, Al Delong '15 (Central Carolina Community College) took part in a technician "fishbowl" session where four early career working technicians shared their experiences as two-year college graduates who were impacted by NSF ATE grant programs. We also had the opportunity to meet two Central New Mexico Community College photonics students who were attending the conference.

Copies of the OPCN meeting presentations and photos from the conference have been emailed to OPCN members and attendees. If you didn't get your email or if you have photos to share, please contact Christine Dossey, cdossey@op-tec.org.

Save the dates on your calendar for next year's HI-TEC conference to be held in Miami, Florida July 23-16, 2018!

Instructor Resource of the Month



Successful Strategies to Improve Student Retention

Photonics is uniquely interesting, but it can be challenging for technician students to complete a two-year associate degree program that requires understanding and using significant math and physics principles, as well as electronics, controls, and materials sciences. Excellent photonics technicians are hands-on learners who can understand all these

OP-TEC's hybrid, online faculty development courses in optics and photonics were developed for busy faculty who might have difficulty keeping up with weekly assignments in a "scheduled" course but who would have a period or periods of time during the semester or school year that would allow them to complete assignments and exams independently and at their own pace. They also provide an excellent opportunity for junior faculty, adjunct faculty, and lab technicians who may need to prepare to teach a college level or dual credit introductory photonics course. The online courses are currently being offered at no charge to U.S. high school, community college and technical college faculty interested in teaching a basic photonics course.

Online courses for *Fundamentals of Light and Lasers* and *Laser Systems and Applications* will open September 1. Interested faculty can read about the 2017-2018 *Fundamentals of Light and Lasers* (Course 1) introductory course and apply online at <http://www.op-tec.org/professional-development/faculty>. Successful completers of the Fundamentals course may apply for the *Laser Systems and Applications* (Course 2) at <http://www.op-tec.org/professional-development/faculty-development-isa>.

Irvine Valley College Advisory Board Meeting

Irvine Valley College Laser and Photonics Technology Program held its first Advisory Board meeting since hiring full-time faculty, Dr. Desiré Whitmore. The meeting was well attended and had representatives from fourteen (14) photonics companies throughout California, as well as IVC administration and IVC Photonics alumni. The meeting helped to guide the direction that the program is moving in, and resulted in direct industry collaborations and curriculum changes.



Dr. Brian Monacelli discussing our current curriculum with the IVC Photonics Advisory Board. Pictured, from left to right: David Shieh (Boeing, current student), Itzhak Sapir (Irvine Sensors Corp.), Desiré Whitmore (IVC faculty), Lazaro Hong (Pima CC faculty), Donn Silberman (Starrett Kinematic Engineering), Arnie Bazensky (Schott Glass), Michael Ushinsky (Raytheon), Brian Monacelli (IVC faculty, JPL), Nick Lambert (Precision Optical), Michael Mele (II-VI Optical Systems), Haissam Bazzas (Tower Jazz Semiconductors), Jeremy Parkinson (IVC alumni, U of A student), Reese Jernigan (Alcon), Thuan Ha (Opto-Sigma, current student), Cole Meyers (Newport Corp, IVC alumni), Vladimir Markov (Advanced Systems and Technologies), Corinne Doughty, (IVC Dean).

3 Friends & Their Employer Talk about Benefits of Photonics Career Pathways

Timing can be everything. And the success of three young graduates of Indian Hills Community College (IHCC) indicates its Lasers and Optic Technology program is in sync with the ways teenagers think at key decision points.

Davian K. Tevault, Tyler Dumbacher, and Ryland Plummer landed in the introductory laser course at Columbia Area Career Center

principles and technologies if they are presented in the context of how they are used-and if they are motivated to persist in this program, which will lead those to rewarding careers.

Some photonics students are not prepared; others lack motivation, and still others lack confidence that they can complete this program of study. Dropout rates among photonics students can be high, but the experiences of seasoned photonics faculty members have proven that retention can be greatly improved through the use and adaptation of proven retention strategies.

A new OP-TEC monograph *Improving Student Retention in Photonics Technician Education* has captured these strategies and offers plans for photonics faculty to adopt for their students.

Copies of this monograph can be obtained through the OP-TEC store website at www.optecstore.org

One of the retention strategies is to assure that all first term photonics students learn about the major concepts and applications of this field during their first term at the college. OP-TEC staff have developed an introductory, one-credit course entitled *Introduction to Lasers and Optics*, which requires no math prerequisites. This course, which is also found on the OP-TEC store website will be described in the September issue of the OPEN newsletter.

PACT Alumni Spotlight



Going back to college, **Riley Guest** wanted to study something exciting and

because it had openings, and other courses were already full when they scheduled their sophomore classes. They became friends while taking classes and residing in dorms at IHCC. After graduating with associate degrees in 2014, the three moved together to take jobs as laser-electro-optic technicians at Lawrence Livermore National Laboratory in Livermore, California.



Laser-electro-optic technicians Davian Tevault, Tyler Dumbacher, and Ryland Plummer work in different parts of Lawrence Livermore National Laboratory. Tevault and Dumbacher characterize and align the injection laser system at the National Ignition Facility. Plummer works in the test chamber pictured here.

The scheduling alignment was serendipitous for three guys who at the time had no postsecondary plans. However, the dual enrollment photonics program at their high school and IHCC's College Immersion Experience for juniors and seniors are the quite intentional results of National Science Foundation Advanced Technological Education grants to the Midwest Photonics Education Center (MPEC) at IHCC and the National Center for Optics and Photonics Education (OP-TEC).

"I personally like the ATE programs because I know what the standard is. I know how the oversight from the National Science Foundation is working," said G. Ron Darbee, superintendent of the Engineering Division of Laser Systems and Operations at Lawrence Livermore National Laboratory (LLNL). Darbee talked about his recruitment of graduates from IHCC and other programs affiliated with the ATE centers during an interview at the 2016 ATE Principal Investigators Conference in Washington, D.C.

Darbee likes the "quality of the curriculum, interaction with employers" of the NSF-ATE photonics programs, which focus on the physical science of light including laser and optic technologies. "We understand if they graduate from one of these programs, they've got the basic fundamentals." Since 2013 alone, LLNL has hired 11 graduates of IHCC's laser and optics technology program. Darbee was involved in the national lab's decision to employ Tevault, Dumbacher, and Plummer, whom he calls "the three amigos."

Dual Credit Photonics Courses Provide First Step

The ATE centers' industry-related curriculum and the professional development for high school and college faculty meant that the Introduction to Lasers course that Plummer, Tevault, and Dumbacher landed in was engaging and challenging in ways that encouraged them to sign up for the next course. "Once I was in the class and was taking it, I found I really enjoyed the science behind it; that's how it led me to continuing on," Ryland Plummer said, adding, "I really enjoy the math and science behind it; the physics." Tevault said, "I really liked the challenge. It was a lot different than a lot of other students were taking in high school. It was overall just interesting, cool subject to study."

Campus Visits Nudged Their Thinking

The well-timed College Immersion Experience at IHCC led the three and several other students from their high school to enroll full time at the college's laser and optics technology program right after high school. During the two-day College Immersion Experience the high school students learn about educational and career opportunities, laser club activities, financial aid. They spend time in the college's photonics lab and tour the entire campus. MPEC Director Greg Kepner wrote in an email, "The highlight of the experience is when they perform laboratory activities in the laser lab along with second-year college students."

"In high school I had no idea what I wanted to do," Dumbacher said. As a junior he took the overnight trip to IHCC only because it was two days off school. By the time of the trip his senior year he was more focused. He paid closer attention when the faculty talked about the types of work and the potential to earn \$37,000 to \$62,000 a year for entry-level jobs with an associate degree. To Dumbacher applying to a bunch of four-year colleges seemed an "annoying process."

cutting edge. Fascinated by the growing photonics industry and application of lasers, Riley enrolled in the Laser and Optics Technology program at Indian Hills Community College. Putting aside his skepticism regarding the math and science classes, Riley soon realized his interest in photonics. According to Riley, the instructors at Indian Hills were "awesome", and the learning atmosphere was one of the best parts of returning to school. Most days, he worked in the laser lab doing hands-on activities with other students in his tight-knit class.

Completing an associate of applied science degree in lasers and optics technology, Riley began working as a laser technician for Foro Energy. He says the best thing about working in photonics is "when you realize you are working with light!" Riley's advice to someone considering a career in photonics is to choose a field that is personally interesting to you. Technical degrees offers a variety of opportunities and "Every place you go to work needs technicians."

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

Continuing to take photonics courses seemed like a better financial opportunity with a simpler enrollment process.

Tevault said the job placement information caught his attention. "For me the appeal was mostly the job placement that they advertised—that if you want a job you'll get a job right out of college ... my sole purpose of going to college was to continue my life toward that next step." Other than one uncle, Tevault is the only member of his family with a college degree. His mom helped as much as possible, but he took out loans for the majority of the out-of-pocket costs for tuition, dormitory, and fees at IHCC. The return on his investment has been quick and satisfying. "Actually, I paid off all my school bills within 10 months of graduating. So I consider that quite the feat in terms of the pay that you receive and the amount of work you put into it to actually get that pay," Tevault said.

Many Opportunities to Meet Employers

All three young men talked about the importance of meeting employers on campus, attending SPIE Photonics West Conference in San Francisco, and touring LLNL with IHCC faculty and students. Tevault said at the conference "We were out there kind of trying to sell our name; pretty much trying to find a job. I was able to find a job that way." Also our instructor [Frank Reed] had a week or two of employers coming out, interviewing us, kind of doing presentations on what the company is all about, what kind of work it entails, They were trying to scout out people from our school. We're really kind of put out there and it was up to us if we really wanted it or not." Kepner and Reed estimate the program interacts with 90 employers. Its relationship with LLNL is the longest; it began in 1989.

Good Work Ethic Emphasized

All three said they were well prepared. In addition to the solid academic foundation and understanding of the technology, Dumbacher said that the most valuable part of the program may have been its emphasis on practical personal skills. He said, "Reed drilled a good work ethic and common sense." He emphasized showing up on time, and not being absent. He gave lab assignments with deadlines to mimic what it's like in a real lab.

Advice to Indecisive Teens

Plummer said working as a laser technician is a "great job." He likes collaborating with the research scientists; they discuss the design of their experiments with him. He offers "input along with helping them set up and build their projects." Tevault recommends laser and photonics careers and offers this advice: "It's all about your motivation and your drive. It's going to be as complicated as you make it. You can really be successful, if you just show up, try to grasp as much knowledge as you can, and you'll be fine."

Reprinted from ATE@20 Blog post by Madeline Patton, July 10, 2017

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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