

Report of Activities of SPIE The Penn State Univ. Chapter (September 2017 through August 2018)

Chun-Wei (Joe) Chen, *Chapter President* (May 2018–present)
&
Chang-Jiang Chen, *Former Chapter President* (May 2017–April 2018)

Name of Chapter

The Pennsylvania State University Student Chapter of the SPIE.

Website

spie.ee.psu.edu

Chapter Leadership

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Abbreviated SPIE-PSU Expense/Income Report

Beginning Balance	Sep. 2017	\$ 365.50
SPIE Funding Received	Jan. 2018	\$ 1100.00
O+P Trip Expenses	Aug. 2018	\$ 7540.00
Officer Travel Grant	Aug. 2018	\$ 1100.00
Subsidy from University	Aug. 2018	\$ 6000.00
Outreach Expenses	Mar. 2018	\$ 80.00
Invited Talk Expenses	Sep. 2017–Aug. 2018	\$ 902.57
Info Session and Social Events	Sep. 2017–Aug. 2018	\$ 474.29
Ending balance	Sep. 2018	\$ 235.86

Expenses for traveling, regular meetings, and team-building activities are not listed above.

Chapter Activities

Scope

As a student chapter, our goals are to **popularize optics, building bridges, and expand horizon**. At the beginning of every school year, we organize an information session to introduce SPIE and our chapter to students from various departments at Penn State. We review the activities and plans for the past and upcoming years. The activities—including invited talk series, outreach events, industry visit, social events—are designed to strive for the three goals, benefiting the Chapter Members, Penn State, and the city of State College as a community. Following is a review of the activities for the past year and prospects (note: regular, officer-only, and event meetings are omitted).

SPIE–OSA Invited Talk Series

We established the Invited Talk Series in the hope of expanding our horizons beyond our own optical research topics, as well as building bridges among chapter members, potential members, staff, and faculty members. In the past, we only organize talks given by professors, only, but, this year, we created opportunities for postdocs to present their research as well. This not only helps them gain experience of giving invited talks but also brings them into our community. From Fall 2017 to Spring 2018, we have organized a total of 5 talks (listed in chronological order). The number of attendees has grown from less than 10 to more than 30. Prospects are discussed at the end of this section.

Oct. 10, 2017

“Engineering the Flow of Light” —Shashank Pandey

Dr. Pandey is a joint Postdoctoral Scholar in Materials Science and Engineering Department and Physics Department at Penn State. He presented his work on a new class of THz waveguides based on structured metal geometries and how he used these structures to demonstrate intriguing optical phenomena such as negative index of refraction, Anderson localization, Dirac cones, and topological photonic behaviors.



Feb. 1, 2018

“Flying needles in a landscape-scale haystack: the challenge of observing foraging bees”

—Douglas Sponsler

Dr. Sponsler is a Postdoctoral Scholar in the Department of Entomology at Penn State. In the talk, he taught us about the honey bee foraging behaviors, for instance, the honey bee dance language. He then reviewed existing methods for tracking honey bee flight, explained their deficiencies, and opened a discussion of how optical science might provide the breakthrough the biological community has long been waiting for.



Feb. 13, 2018

“Reconfigurable droplets for tunable optics” —Lauren Zarzar

Dr. Zarzar is an Assistant Professor in the Department of Materials Science and Engineering and Department of Chemistry at Penn State. She discussed recent developments in using reconfigurable complex emulsion droplets as tunable optical materials which precisely manipulate the curvature and orientation of liquid-liquid interfaces. She then talked about how these responsive and reconfigurable fluids can be applied to tunable lenses, and enzyme sensors with a facile optical readout mechanism for point-of-care diagnostics.



Mar. 20, 2018

“Quantum efficiency analysis of perovskite light-emitting diodes under the high current regime”

—Hoyeon Kim

Dr. Kim is a Postdoctoral Scholar in the Department of Electrical Engineering at Penn State. He introduced us to hybrid organic-inorganic perovskites, which have tunable bandgap and solution-processible fabrication processes, as a promising class of semiconductors for LEDs and lasers. He then explained why the efficiency roll-off occurs in the high current density regime from various aspects, including transient photoluminescence, luminescence temperatures, and electroluminescence.



Mar. 29, 2018

“Lights, Sound, and Action: Photoacoustic Imaging of Mice and Men”

—Sri-Rajasekhar (Raj) Kothapalli

Dr. Kothapalli is an Assistant Professor in the Department of Biomedical Engineering at Penn State. He discussed why ultrasound-modulated optical tomography and photoacoustic imaging can be used to overcome poor spatial resolution at depths beyond the optical diffusion limit inside biological tissues, a serious weakness of most optical imaging technologies. He then presented a transrectal ultrasound and photoacoustic imaging system that his group developed for human prostate imaging, as well as on-going projects on novel imaging tools for clinical and pre-clinical applications in cancer and neurological diseases.



Prospects

Starting from Fall 2018, we plan to hold at least 4 invited talks in each semester. In the past years' Invited Talk Series, the topics all related to Optics but were scattered. The new series will have a few main themes that link the talks together. For Fall 2018, our themes are (I) low-dimensional (1D and 2D) materials, (II) ultrafast spectroscopy, (III) bio-sensing, and (IV) solar energy harvesting, and each theme will be covered by two speakers. Thus far, the scheduled talks are:

1. "Seeing the "Breathing" of Layered Materials Systems"—Prof. Shengxi Huang (Oct. 23, 2018; themes I, II, and III)
2. "Molecular Origins of Electronic Structure in Emerging Photovoltaic Materials: From Perovskites to Pentacenes"—Prof. John B. Asbury (Nov. 13, 2018; themes II and IV)
3. "When Small meets Smaller: Low-Dimensional Materials in Bio-Applications"—Dr. Yin-Ting Yeh (Nov. 14, 2018; themes I and III)
4. "Wide Angle High Concentration Planar Microtracking Photovoltaic System Exceeding 30% Power Conversion Efficiency"—Dr. Baomin Wang (Nov. 28, 2018; theme IV)

In Spring 2019, we plan to have 4 invited talks as well. In addition, the Penn State IEEE Chapter has agreed to collaborate with us on an invited lecture on Semiconductor Device & Fabrication given by Prof. Rongmin Chu. Besides talks given by researchers at Penn State, we also plan to apply for Visiting Lecturers from SPIE and OSA lecturer directories to give talks on their research and career advice.

Outreach Event — Exploration-U State College

Mar. 28, 2018

Together with other science clubs from Penn State, we attended *Exploration-U State College* and exhibited many fun optical experiments—ray refraction, polarizers & polarized sunglasses, mood pad (based on thermally tunable color reflection of liquid crystal), blue/red 3D movie, floating frog (3D microscope), peppergram projector, LED color mixing—to elementary and middle school children as well as their parents. These eye-catching demos are linked to fundamental optical phenomena that can be found everywhere in our daily life and are related to the latest optical technology. According to the report from Eberly College of Science Outreach Office, more than 600 people attended this event.

Prospects

We will continue to participate the Exploration-U in the future. Furthermore, we will work with IEEE Student Chapter on a joint workshop for Undergraduate Students in Spring 2019.

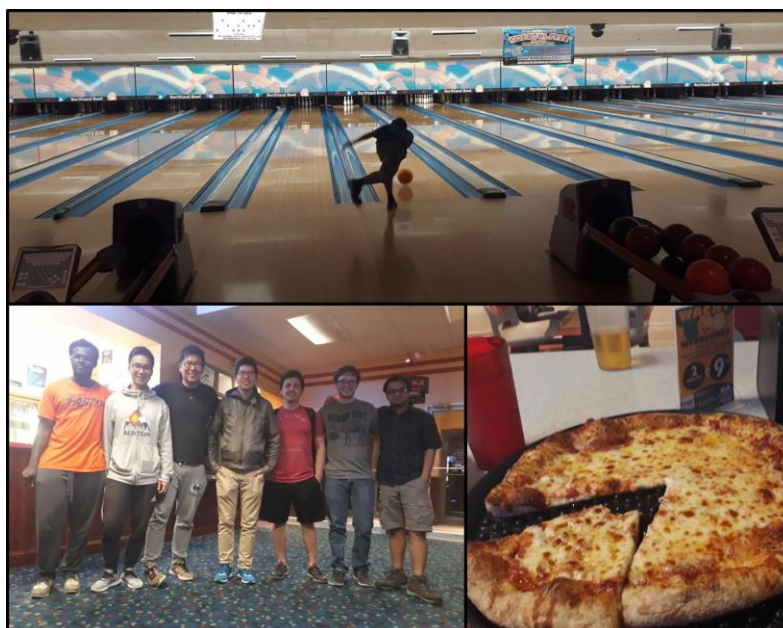


[Seeing kids' smiles just made your day!]

Bowling Night

May 23, 2018

Nothing compares to bowling with pizza and soda after work. We held a bowling night at the end of the Spring 2018 semester. Our social events offered a platform for chapter members to relax, chat, and know each other on a personal level. For our next social event, we are planning on going to a Big Ten basketball game at the Bryce Jordan Center in Spring 2019.



OSA Ambassador's Visit & Industry Trip

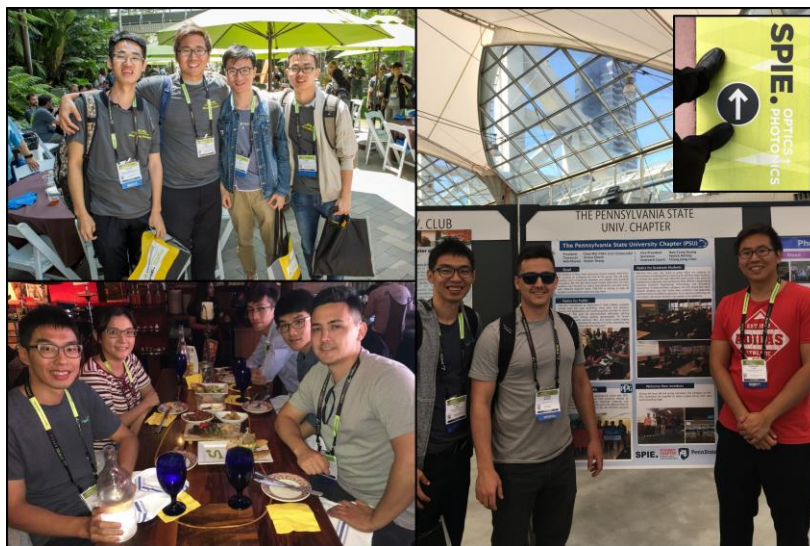
Sep. 13, 2018

Arlene Smith (Ambassador for OSA in 2017) from Avo Photonics visited us during the Career Fair Week. We had a fun breakfast meet-up with her. She told her story of a career in optics and gave us good advice on job hunting and making decision between industry and academia. We shared with her how the SPIE and OSA student chapters work together at Penn State. We then started to plan for a visit to Avo Photonics.



SPIE Optics + Photonics — technical conferences, leadership workshop, & chapter poster exhibition

Aug. 19–23, 2018



[Photo credit (upper-left panel): SPIE Students Facebook Page]

This year, our Activity Coordinator and former President, Chang-Jiang Chen, applied to and was awarded the Officer Travel Grant for the SPIE Optics and Photonics in San Diego. He went to the Leadership Workshop learned and made many new friends from other chapters/countries (see upper-left panel in the figure below). We summarized what we did in the past year in a poster and shared our stories with others in the Student Chapter Poster Exhibition (*cf.* the right panel). We had 9 chapter members present a total of

25 papers at the conference. The officer travel grant was evenly shared by all attendees. In the Technical Conference, we met new friends, got together with former colleagues, and discussed about science, research, and life of research with them (*cf.* the lower-left panel). These are in line with our goals of Building Bridges among researchers and Expanding the Horizons of our chapter members.

Following is a list of papers presented in SPIE O+P 2018: ([**proceeding paper number**], title, authors)

- [10719-28] Advanced multi-objective and surrogate-assisted optimization of topologically diverse metasurface architectures, Sawyer D. Campbell, Danny Z. Zhu, Eric B. Whiting, Jogender Nagar, Douglas H. Werner, Pingjuan L. Werner
- [10719-41] Multiscale design of optical metafilms with bianisotropic homogenization (Invited Paper), Alexander V. Kildishev, Zhaxylyk Kudyshev, Ludmila J. Prokopenva, Derek A. Olson, William D. Henshaw, Sawyer D. Campbell, Douglas H. Werner
- [10721-9] Approaches towards actively tunable mid- to far-infrared nanophotonics (Invited Paper), Joshua D. Caldwell, Adam Dunkelberger, Chase T. Ellis, Evan Runnerstrom, Kyle Kelley, Thomas G. Folland, Virginia Wheeler, J. Ryan Nolen, Joseph Tischler, Jeffrey C. Owrutsky, Igor Vurgaftman, Daniel Ratchford, Chul Soo Kim, Mijin Kim JonPaul Maria
- [10721-69] Macroscopic consequences of topologically insulating states (Invited Paper), Akhlesh Lakhtakia
- [10728-16] Artificial neural network to predict the refractive index of a liquid infiltrating a chiral sculptured thin film, Patrick D. McAtee, Akhlesh Lakhtakia, Satish T. S. Bukkapatnam
- [10731-9] Bragg supermirrors and polarization-state-dependent attenuation and amplification, Tom G. Mackay, Vikas Vepachedu, Akhlesh Lakhtakia
- [10731-22] Light trapping in nonhomogeneous CIGS solar cells, Faiz Ahmad, Tom H. Anderson, Peter B. Monk, Akhlesh Lakhtakia
- [10732-36] Unidirectional spin Hall and Rashba-Edelstein magnetoresistance in topological insulator-ferromagnet layer heterostructures (Invited Paper), Yang Lv, James Kally, Delin Zhang, Joon Sue Lee, Mahdi Jamali, Nitin Samarth, Jian-Ping Wang
- [10735-17] Electronic optical nonlinearities of cholesteric liquid crystals with picoseconds supercontinuum, Chun-Wei Chen, Alyssa N. Brigeman, Noel C. Giebink, Iam Choon Khoo
- [10735-19] Fabrication of stable blue phase photonic crystals beyond cubic lattices (Invited Paper), Duan-Yi Guo, ChunWei Chen, Cheng-Chang Li, Hung-Chang Jau, Iam Choon Khoo, Tsung-Hsien Lin
- [10735-20] Polarization-free and high-resolution all-optical image processing with photosensitive blue-phase liquid crystals, Tsung-Jui Ho, Chun-Wei Chen, Iam Choon Khoo
- [10736-43] Toward organic-inorganic hybrid perovskite laser diodes (Invited Paper), Noel C. Giebink
- [10753-8] Light-activated gigahertz ferroelectric domain dynamics (Invited Paper), Venkatraman Gopalan, Hirofumi Akamatsu, Yakun Yuan, Vladimir Stoica, Gregory Stone, Tiannan Yang, Zijian Hong, Shiming Lei, Yi Zhu, John Freeland, Long-Qing Chen, Haidan Wen
- [10753-9] Nano-femto characterization of nanomaterials and structures, Joshua Noble, William T. Murray, Brandon Long, Hans D. Hallen, Zhiwen Liu

- [10753-10] Reconfigurable particle assembly for optical applications, ChengYu Wang, Philip P. Donahue, Chenji Zhang, Jennifer R. Miller, Nicholas Nye, Rong Tang, Demetrios Christodoulides, Christine D. Keating, Zhiwen Liu
- [10753-11] Characterization of band shifting imaging probes under two-photon excitation, Yizhu Chen, Jimin Kim, Dingbowen Wang, Yimin Ding, Xingjie Ni, Jian Yang, Zhiwen Liu
- [10753-21] Characterization of second-order nonlinear optical properties of twodimensional transition metal dichalcogenides, William T. Murray, Ana LauraElias, Kazunori Fujisawa, Michael Lucking, Ethan Kahn, Yimin Ding, Humberto Terrones, Mauricio Terrones, Xingjie Ni, Zhiwen Liu
- [10753-25] Giant second harmonic generation with metasurfaces (Invited Paper), Xingjie Ni, Xi Chen, Xuexue Guo, Yimin Ding, Zhiwen Liu
- [10755-6] High out-coupling efficiency organic light emitting diodes using an internal oblique nanorod array layer, Chang-Jiang Chen, Ju-Hung Chao, Wenbin Zhu, Annan Q. Sang Jr., Yun Goo Lee, Shizhuo Yin
- [10755-27] Recent development of high energy solid state laser: A review (Invited Paper), Shizhuo Yin
- [10755-33] Influence of piezoelectric effect on the performance of high speed KTN deflectors (Invited Paper), Annan Q. Shang Jr., Yun Goo Lee, Wenbin Zhu, Ju-Hung Chao, Chang-Jiang Chen, Shizhuo Yin
- [10759-28] Coupled pseudo-spectral-hybridizable-discontinuous-Galerkin modelling of thin-film photovoltaic solar cells, Benjamin J. Civiletti, Tom H. Anderson, Peter B. Monk, Akhlesh Lakhtakia
- [10761-9] Progress in development of adjustable optics for x-ray astronomy, Vincenzo Cotroneo, Paul B. Reid, Casey T. DeRoo, Vanessa Marquez, Eric D. Schwartz, Alexey Vikhlinin, Daniel A. Schwartz, Vladimir Kradinov, Susan Trolier-McKinstry, Julian Walker, Thomas N. Jackson, Tianning Liu, Mohit Tendulkar
- [10770-1] Measuring and modeling the air-sea interface and its impact on FSO systems (Invited Paper), Omar Alharbi, Peng Deng, Timothy J. Kane, Minghao Wang
- [10770-2] Propagation of laser beams through air-sea turbulence channels, Minghao Wang, Xiuhua Yuan, Peng Deng, Timothy J. Kane, Omar Alharbi

Future Directions and Additional Comments

Our Chapter is working hard to create a beneficial experience for its Student Members, Penn State, and the city of State College as a community. The Officers get together on a bi-monthly basis to discuss and plan events. Future plans include continuations of Exploration-U Outreach Activities and a strong showing at the SPIE O+P next year. We are also excited about our upcoming SPIE–OSA Invited Talk Series, aiming at organizing more than 8 talks per year around different Themes of Optics, as well as a SPIE–IEEE workshop of electronics, optics, and optoelectronics for undergraduate students. Moreover, we plan on inviting a SPIE Visiting Lecturer to give talks on career development and his/her research. To strengthen our chapter, we will continue to promote and introduce the SPIE Penn-State Chapter to new students and faculty.