PHYSICS ALUMNI NEWS

QUEENS COLLEGE OF CUNY • DEPARTMENT OF PHYSICS • SPRING 2021

A Message from the Chair

Steven Schwarz

We hope this newsletter finds you and your family in good health and spirits. Despite budget cuts and a sudden transition to online instruction in the spring of 2020, we have maintained our essential courses while providing innovative instruction of high quality. A particular challenge was the presentation of laboratory exercises in a virtual format. Many institutions opted for commercial software packages, but our faculty and staff were determined to provide higher-level student experiences. Laboratory exercises based on videos of our own equipment, coupled with analytical software, were developed on a just-in-time basis. We are proud of the results and thankful to the faculty and staff who invested so much of their time in this effort. We were able to offer upper-level laboratories in hybrid mode, with students only occasionally coming to campus. Alumni contributions enabled us to purchase data acquisition units and electronic components that were loaned to students in these courses. Our lecture and recitation sections have employed a variety of novel online interactive techniques that will carry over to future courses. Our research programs remained quite active, as you will see in the faculty news section below.

We love to hear from our alumni and would like to share your news on our web page and in future newsletters. See the red boxes for info on how to contact us and for a notice of a special virtual physics homecoming event.

Best wishes for a healthy and prosperous 2021.

Steven Schwarz, Chair
718-997-3350
info@physics.qc.cuny.edu

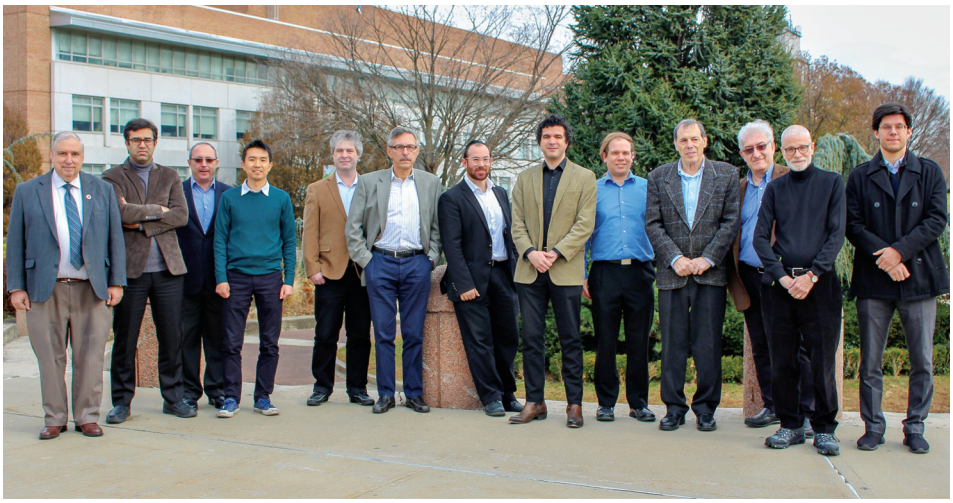
Make a Donation

To make a donation, please send a check *(designated to the Department of Physics)* to

Queens College Foundation
Kiely Hall, 9th Floor
65-30 Kissena Blvd.
Queens, NY 11367-1597

You can also donate to our department online at

https://qccommunity.qc.cuny.edu/pages/funds/physics



2021 Physics faculty (from left to right): Steven Schwarz (chair), Mohammad Ali Miri, Igor Kuskovksy, So Takei, Lev Murokh, Alexander Lisyansky, David Goldberg, Euclides Almeida, Timothy Benseman, Azriel Genack, Lev Deych, Larry Liebovitch, Matthew Civiletti

Faculty News

Timothy Benseman, assistant professor, and his group have demonstrated 0.13 milliwatt terahertz sources while operating at liquid nitrogen temperatures, which represents almost two orders of magnitude improvement over previously reported results at this temperature.

Lev Deych, professor, with Israeli collaborators, has described a spherical whispering gallery mode resonator that was demonstrated using droplets. He directs our photonics master's program and reports that graduates Thomas Gil and Mohammed Cisse have landed jobs at Lockheed Martin and NASA.

Azriel Genack, distinguished professor, and his group have recently described the conditions under which optical transmission in any structure may vanish, suggesting a new approach to ultrasensitive sensing.

Larry Liebovitch, professor, and colleagues at Columbia and UNC Greensboro, have published an article "How to live in peace? Mapping the science of sustaining peace: A progress report" in *American Psychologist*, a premier journal of the American Psychological Association. The abstract is posted at: **https://psycnet.apa.org/record/2020-84567-001**

Alexander Lisyansky, professor, and colleagues have recently reported significant theoretical results on three fronts. First is a new model describing the onset of lasing at low power, in which a "pre-threshold" is defined. Second is a description of the origin of background in surface-enhanced Raman spectroscopy (SERS). Third is a new approach to Rayleigh scattering.

Mohammad-Ali Miri, assistant professor, and student Mostafa Honari-Latifpour, proposed an all-optical system that solves computationally-hard combinatorial optimization problems through self-organization of a network of oscillators.

Lev Murokh, professor, studies the charge and energy transfer processes at the nanoscale in both semiconductor nanostructures and living organisms. His 2020 publications address electron transport in graphene, proton pumping in mitochondria, and proton-pumping complexes on graphene oxide.

So Takei, assistant professor. Joshua Aftergood, a doctoral candidate in the Takei group, was awarded a prestigious $25,000 CUNY Graduate Center Dissertation Fellowship. Joshua's thesis explores quantum entanglement in an exotic phase of matter known as quantum spin liquids and how it may be leveraged one day for quantum information processing and computing.

Alumni News

Drop us a note at **info@physics.qc.cuny.edu** and let us know about your accomplishments and milestones that we can share on our webpage.

Physics Homecoming

Please join us on ZOOM for a special alumni gathering at 8 pm (EST) on Monday, March 15, 2021. Several faculty and emeritus faculty look forward to chatting with you.

RSVP at **info@physics.qc.cuny.edu** and we'll send you the meeting link.

Student Mentoring

If you are interested in chatting with our current students, to describe your experiences and provide advice, please contact us at **info@physics.qc.cuny.edu**

Physics Colloquia

To attend an online colloquium, visit **https://physics.qc.cuny.edu/colloquium.**

Below is a list of notable 2020 colloquia, followed on page 4 by a list of selected recent faculty publications and a description of four new courses.

Michael Lubell, City College, CUNY
Monday, February 10, 2020
Navigating the Maze: How America Became the World's Science and Technology Giant

Binlin Wu, Southern Connecticut State University - Monday, February 24, 2020
Optical Biopsy using Spectroscopy Techniques and Artificial Intelligence for Cancer Diagnosis

Igor Kuskovsky, Queens College, CUNY
Monday, April 6, 2020
Type-II II-VI Submonolayer Quantum Dots: Materials Science, Fundamental Physics, and Applications

Lev Murokh, Queens College, CUNY
Monday, April 13, 2020
Energy conversion at the nanoscale: physical models for biological and bio-inspired structures

Yuhao Kang, Queens College, CUNY
Monday, April 20, 2020
Wave propagation in disordered topological isolator systems

Alexey Burov, FermiLab
Monday, April 27, 2020
Why is the Universe Pythagorean?

Joshua Aftergood, Queens College, CUNY - Monday, May 4, 2020
Probing quantum magnets using Spin Current Noise

Euclides Almeida, Queens College, CUNY - Monday, May 11, 2020
Photonics tools to fight pathogens

Ksenia Dolgaleva, University of Ottawa - Monday, May 18, 2020
Materials and Structures for Nonlinear Photonics

Flaviano Morone, Memorial Sloan Kettering Cancer Center - Monday, August 31, 2020
Symmetry in biological networks

Christopher Wilson, Institute for Quantum Computing, University of Waterloo - Monday, September 21, 2020
Quantum Simulation and Computation with Microwave Photons

Can-Ming Hu, University of Manitoba, Canada - Monday, October 5, 2020
Unidirectional Invisibility in Cavity Magnonics

Demitry Farfurnik, The Quantum Photonics Lab, University of Maryland
Monday, October 19, 2020
Spin control of quantum dots toward quantum photonic applications

Hernan Makse, Levich Institute, CCNY - Monday, October 26, 2020
Superspreading k-core events at the center of COVID-19 pandemic persistence (can network science save a crumpling world from self-destruction?)

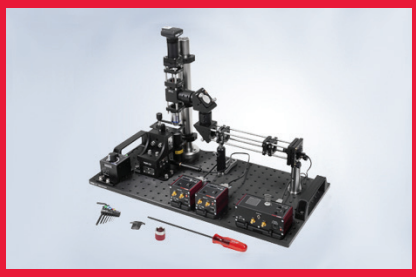
Ricardo Herbonnet, SUNY Stony Brook - Monday, November 2, 2020
Studying the Universe by weighing its biggest inhabitants

Danniel Brunner, FEMTO-ST Institute, France - Monday, November 9, 2020
Towards optical neural networks

Olivier Bournez, Department of Computer Science, Ecole Polytechnique, France - Monday, November 16, 2020
Continuous time models of computation. Computing with ordinary differential equations

Diego Porras, Institute of Fundamental Physics CSIC, Madrid - Monday, November 23, 2020
Topological Amplification in Photonic Lattices

Vincenzo Vitelli, University of Chicago
Monday, December 7, 2020
Non-reciprocity in collective phenomena: pattern-formation, synchronization and flocking



A generous donation from the **Sara and Michael Craig-Scheckman Foundation** made possible the purchase of a Thorlabs optical tweezers kit for student explorations in our Modern Physics Laboratory.

This tabletop apparatus allows demonstration of Brownian motion and particle trapping.

A Selection Of Recent Articles By Our Faculty

Optical Potts machine through networks of three-photon down-conversion oscillators; M. Honari-Latifpour and M. Miri, Nanophotonics 9 (29 July 2020) **https://www.degruyter.com/view/journals/nanoph/9/13/article-p4199.xml**

Physical model of proton-pumping Q-cycle in respiratory and photosynthetic electron transport chains, L. Mourokh and M. Vitadello; Chem. Phys. 530, 110638 (2020) **https://www.sciencedirect.com/science/article/abs/pii/S0301010419306275**

Microspheres with Atomic-Scale Tolerances Generate Hyperdegeneracy, Jacob Kher-Alden, Shai Maayani, Leopoldo L. Martin, Mark Douvidzon, Lev Deych, and Tal Carmon; Phys. Rev. X 10, 031049 (2020) **https://journals.aps.org/prx/abstract/10.1103/PhysRevX.10.031049**

Cascade Brillouin scattering as a mechanism for photoluminescence from rough surfaces of noble metals; V. Yu. Shishkov, E. S. Andrianov, A. A. Pukhov, A. P. Vinogradov, S. N. Orlov, Yu. N. Polivanov, V. I. Fabelinsky, D. N. Kozlov, V. V. Smirnov, and A. A. Lisyansky; Phys. Rev. B 103, 035408 (2021) **https://journals.aps.org/prb/abstract/10.1103/PhysRevB.103.035408**

Invariance Principle for Wave Propagation inside Inhomogeneously Disordered Materials; Yiming Huang, Chushun Tian, Victor A. Gopar, Ping Fang, and Azriel Z. Genack; Phys. Rev. Lett. 124, 057401 (2020) **https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.124.057401**

Recently Introduced Physics Courses

PHYS 8. The Science of Fractals and Its Application. Fractals are mathematical or physical objects with an ever-larger number of ever smaller pieces. This course shows how scientists use fractals to analyze and solve problems. It shows how mathematics can give new insights into understanding physical, biological, and social systems.

PHYS 270. Physics Applications of Machine Learning and Data Science. A practical introduction to using machine learning to analyze experimental data and theoretical models in physics, chemistry, biology, and earth sciences. Provides contemporary skills valuable for careers in technology, including an introduction to MATLAB and Python.

PHYS 275. Introduction to Scientific Computing. This course addresses numerical/computational methods as well as analysis and modeling of physical phenomena. Mathematical modeling is applied to classical dynamics and electromagnetism using finite difference and finite element methods, stochastic/Monte-Carlo methods, and matrix eigenvalues. Students will be introduced to scientific and engineering computing based on a high-level programming environment, with no prior programming experience required.

PHYS 280. Introduction to Cosmology. Topics include the thermal history of the universe; the cosmic microwave background radiation; cosmic expansion and its relation to matter and energy; and dark matter, dark energy, and the shortcomings of the standard Big Bang scenario. The course ends with a discussion of cosmic inflation. General relativity is not used.

Department of Physics
Science Building, Room B334
65-30 Kissena Blvd., Queens, NY 11367-1597
718-997-3350 • www.qc.cuny.edu/Physics

QUEENS COLLEGE CUNY