CCNY PHYSICS

The CCNY Physics Department Newsletter

Volume 13 Fall 2021

Features

CCNY physics

The City College of New York

Welcome to the Fall 2021 CCNY Physics Department Newsletter.

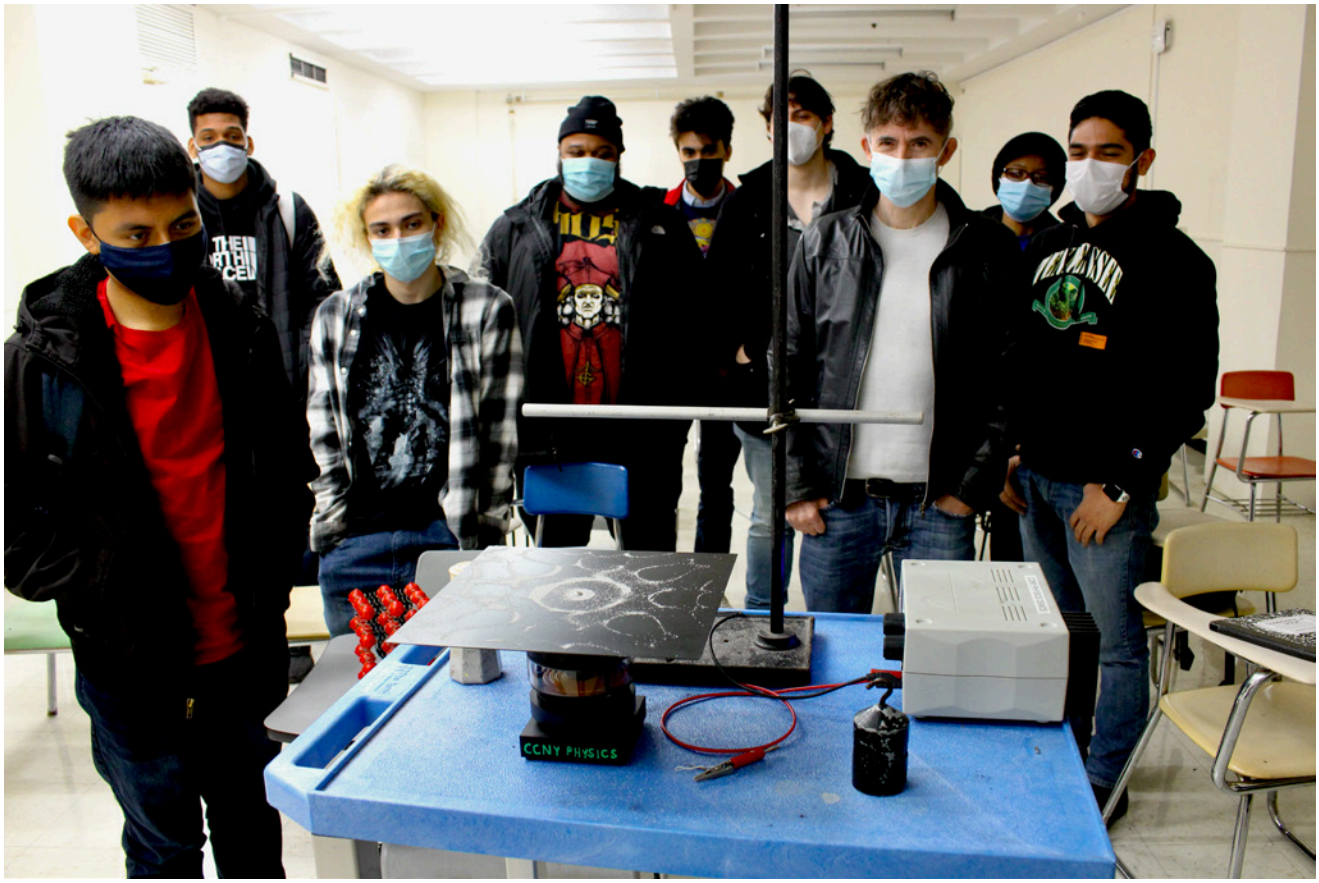
IN THIS ISSUE:

PHYSICS MAJORS BACK IN THE CLASSROOM

As the Fall 2021 semester approached, the physics department tried to offer as many in-person classes as possible. There was certainly some trepidation but after much deliberation, it seemed the right thing to do. From the first weeks of class, beginning in late August, when we all had to relearn how to ride the subway and recharge our long expired metrocards, our majors expressed excitement and delight to be back in the classroom after over a year of nearly exclusively remote instruction. It wasn't going to be easy given the state of things, but in these last weeks of 2021, we're happy to say that it largely proved successful. Sure, there were a few hiccups and difficult weeks when we had to be nimble and dance back and forth between blackboards and webcams. Yet, for most of our upper level major courses, the return to the classroom was a joy. The large intro lectures remained online, but the smaller lab sections returned to the bench. Office hours were once again, actually in an office! The physics club room has been a bustling study, snacking, and occasional napping area. The photocopier also managed to wake up after 12 months of hibernation. And, we've been setting up our great collection of physics demonstrations again.

There's no question that remote learning can offer exciting possibilities for new modalities of instruction. However, when it comes to seeing physics in action, the traditional classroom demos don't carry the same impact when delivered over Zoom.

Here is a group of Sophomores and Juniors in the Classical Mechanics class witnessing the always memorable Chladni Plate demonstration, which shows through sight and sound, the normal modes of an oscillating plate. The class also tried (unsuccessfully) to show the rotation of the Earth using a Foucault pendulum. It turns out the only one in operation in New York City is installed in the United Nations Visitor Centre. We've planned a field trip for winter break.



PHYS 35100 and the Chladni Plates

AN EXTRAORDINARY LIFE: MYRIAM P. SARACHIK

(1933-2021)

Myriam Sarachik, Distinguished Professor Emerita, passed away on October 7, 2021. Her colleagues, students, research associates and the physics-world at large mourn this great loss.

Myriam Paula Morgenstein was born in Antwerp, Belgium in 1933 to an Orthodox Jewish family. Although she started school in Belgium, the Nazi occupation in 1940 made life a stifling and increasingly dangerous experience. After a failed attempt to escape via Calais (France), the family succeeded in a second attempt, which included breaking out of an internment camp and desperate midnight runs through open fields, to reach Spain and eventually Cuba. They found a temporary home in Cuba, Myriam always talked fondly of her time there: sunny, idyllic, learning Spanish, playing the piano, away from chaos and carnage. But a US entry visa was granted in 1947, the family moved to New York and shortly thereafter Myriam was enrolled in the Bronx School of Science, just as they began admitting girls. This marked the beginning of what became an illustrious career in physics. She went onto Barnard College and Columbia University, earning a Ph.D. in physics in 1960.

In her doctoral work, Myriam (with fellow student Eric Erlbach) made measurements of the energy gap that characterized the newly formulated BCS theory of superconductivity. Despite this notable achievement, being a woman, she had difficulty obtaining a research position. She eventually managed, through the intervention of Polykarp Kusch (Nobel Prize, 1955), to get a postdoctoral position at the Bell Labs. Her work at the Bell Labs produced definitive experimental evidence for what would soon be known as the Kondo effect. Despite this, she had difficulty finding a suitable faculty position. The City College of New York (CCNY) was the only institution willing to offer a faculty position on an equal footing with male colleagues. Throughout her life, she expressed her gratitude for the fairness City College showed in making this offer. Myriam Sarachik joined the Physics Department at City College in 1964. Her husband, Philip Sarachik, who she married in 1954, took a job at NYU to allow her to accept the job at CCNY.

Over her long career, Myriam has made many major contributions in physics. One of the early notable achievements, already mentioned, was on the Kondo effect, which refers to a minimum in the electrical resistance of certain materials as the temperature is lowered. Jun Kondo postulated in his theoretical explanation that this reflects local magnetic moments, but he gave Myriam credit saying ``The most convincing evidence that the resistance minimum takes place only when the impurity atom is magnetic was due to Sarachik". It is worth recalling that the Kondo effect also played a key role in the early stages of the Nobel Prize winning work on the renormalization group by Ken Wilson.

The Sarachiks suffered a devastating tragedy in 1970 when their younger daughter was abducted by the housekeeper and was found murdered. Myriam was unable to do any research for about ten years, although she did manage to continue to teach at the college and to carry out some collaborative work on carbon materials with Professor Fred Smith.

She finally restarted her own program of research in the 1980s, focusing on metal-insulator transitions, measuring critical exponents on the approach to the transition for different universality classes. A paradigm-shifting major breakthrough was on the metal-insulator transition in two dimensions. Sergey Kravchen-

ko in Russia had obtained some suggestive, but not definitive, data indicating the possibility of such a transition. The physics community, by and large, did not believe it since there was strong theoretical prejudice (based on work by Nobel laureate Phil Anderson and others) against a transition to metallic behavior in two dimensions. To Myriam's great credit, as a truly great scientist, she was open-minded on this, invited Kravchenko to CCNY and together they carried out the most convincing measurements, establishing and exploring different features of this effect. This led to an explosion of research by many different groups, both theoretical and experimental, attempting to further elucidate this phenomenon. Myriam's election to the National Academy of Sciences (1994) and the L'Oréal/UNESCO Prize for Women in Science (2005) were two of the many recognitions for this work.

In the 1990s, Myriam started research on macroscopic quantum tunneling of magnetization. Collaborating with theorists and other experimentalists, the Sarachik group was able to show the existence of this phenomenon in molecular magnets. This work has helped initiate an entirely new area of research. The pertinent publication in the Physical Review Letters has garnered well over 2000 citations. Shortly afterwards, the Sarachik Lab also discovered and characterized magnetic deflagration, another associated and unusual effect in molecular magnets.

While the Kondo effect, the metal-insulator transition and the quantum tunneling of magnetization are clear highlights, Myriam has a lifetime of first-rate experimental work. This has led to many awards and recognitions. Highlights include the NYC Mayor's Award for Excellence in Mathematical, Physical, and Engineering Sciences (1995), the Sloan Public Service Award from the Fund for the City of New York (2004), and the Oliver E. Buckley Prize in Condensed Matter Physics (2005) from the American Physical Society (APS). Myriam was elected President of the American Physical Society for 2003, only the third woman in its history of more than a hundred years. In 2020, she was awarded the APS Medal for Exceptional Achievement in Research. This award was instituted in 2016 to recognize high level of excellence irrespective of subfields of research and Myriam was the first woman to receive it.

In addition to her research in physics, Myriam was active on issues of human rights as well as on concerns and problems for women in science. She served on the National Board of the Committee of Concerned Scientists, was a long-time member of the Human Rights of Scientists Committee of the New York Academy of Sciences, and was a member and chair of the APS Committee on the International Freedom of Scientists. As president of the APS, she emphasized a broader political, social, educational, and international role in its work.

Myriam was always a real colleague, easy to talk to, genuinely caring about her fellow faculty and students. Many of her colleagues speak fondly of the annual gatherings at the Sarachik residence, bringing the whole department together. She had a deep commitment to the Physics Department and CCNY. She served briefly as the Chair of the department, as the Executive Officer of the Physics PhD program at CUNY, as well as on many faculty committees. On hiring committees, excellence was the prime criterion for her and she mentored many of the younger faculty, helping them establish themselves and seeing them through tenure. Her passion for physics was extraordinary, vibrant even after she retired in 2019. Even the day before she died, from her hospital bed, she wrote to Professor Pouyan Ghaemi asking for an internet link to the upcoming colloquium so she could attend remotely (Alas!).

Myriam Sarachik had a full life. She faced many difficulties and personal tragedy. She had great triumphs and rose to exceptional achievement. Hers is a life to be celebrated even as we mourn her passing.

(Contributed by V. Parameswaran Nair, Distinguished Professor of Physics)

JOURNEY FROM GRAINS TO BRAINS

The Board of Trustees of the City University of New York resolved on May 3, 2021 to appoint Hernan Makse as Distinguished Professor of Physics at the City College of the City University of New York.

However, his journey through physics started way before with grains of sand. When he was a graduate student, he uncovered an effect while pouring grains of sand on his kitchen table to form a pile. He found that these grains would separate, regardless of how he poured them, into beautiful layers of different grain types. [For details, please consult, H. A. Makse, S. Havlin, P. R. King, and H. E. Stanley, Spontaneous stratification in granular mixtures, *Nature* **386**, 379-381 (1997).] His invention is displayed in a cell (the Makse cell) full of different types of sand showing how soft matter stratifies naturally based on the weight of each sand grain [see Fig. 1a]. This intriguing result attracted the interest of a Nobel laureate, Pierre-Gilles de Gennes and others. This order-out-of-disorder process is quite common in systems that are usually out of equilibrium, and statistical mechanics has a very hard time to describe these systems. And ultimately this became his quest to understand out-of-equilibrium systems in nature from social to biological complex systems including the brain [Fig. 1b].

Makse is an expert on influencers of fake news in social media with a longstanding interest in the analysis of election outcomes. His models and their generalizations have become indispensable tools not only for researchers, but also for politicians and businesses, who use those in capital markets and election predictions. Using artificial intelligence (AI), Makse's group predicted the outcome in the US election in 2016 and 2020 as well as the Argentinian election in 2019, long before the elections occurred. By collecting the opinions of millions of people from social media, particularly from Twitter and Facebook, he showed how a few influencers — not the traditional media— can change the outcome of an election. [Further details in: A. Bovet, H. A. Makse, Influence of fake news in Twitter during the 2016 US presidential election, *Nature Comm*. **10**, 7 (2019).]

Inherent to his work on influencers, coupled with machine learning, he developed an algorithm to stop the spread of COVID-19. In light of the massive lockdowns that were implemented globally, he leveraged upon the influencers work to develop a large-scale contact tracing system/app to effectively dismantle the chain of transmission of coronavirus with minimal disruptions to society. The app had the ability to halt the evolution of the contact network of disease transmission before and after the confinement was effectively monitored. [Ref: M. Serafino, *et.al.* Digital contact tracing and network theory to stop the spread of COVID-19 using big-data on human mobility geo-localization, *Plos. Comp. Bio*. (2021)]

Makse is also an avid student of how influencers have been generated organically to influence specific product campaigns. In marketing, social media has been pivotal to identify trends. From a machine learning-fed analysis coupled with anecdotal and qualitative evidence, the economic status of an individual can be

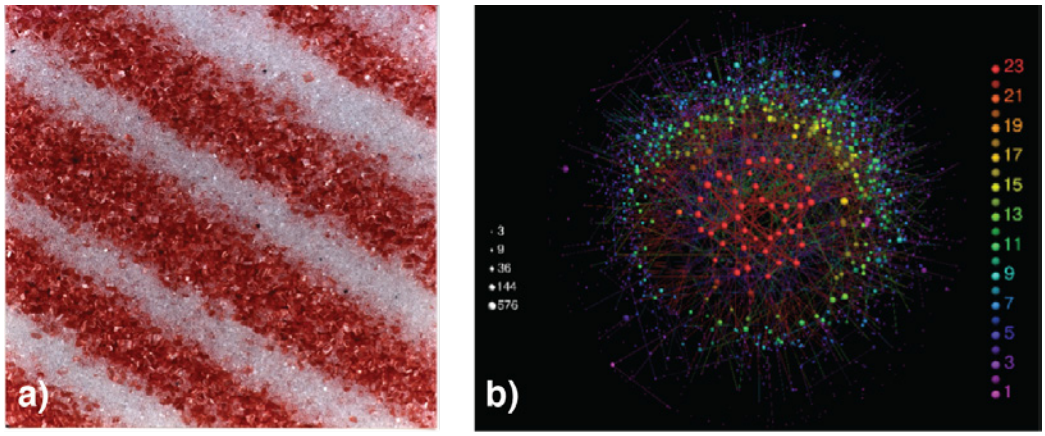


Fig 1: (a) Spontaneous stratification pattern of grains; (b) the k-core organization of a brain network; examples of emergent phenomena.

inferred. In one of his papers, he showed that an individual's collective influence to the structural integrity of the global social network can be used to infer their economic wellness. For validating this conclusion, his group carried out a targeted marketing campaign based on this idea, reporting a three-fold increase in response rate compared to random targeting.

Makse has also done considerable work on the causes for collapse and instability of dynamical systems and network infrastructures. His research has produced some innovative statistical methods to find influential nodes in brain networks or keystone species to predict the system collapse of mutualistic ecosystems [see Fig 2]. His network of networks theory has helped scientists predict the map of neural collective influence in brain networks and subsequently target nodes that are essential for global integration of neural activity during storage and retrieval of a memory [For details, see: G. Del Ferraro, et. al., Finding influential nodes for integration in brain networks using optimal percolation theory, *Nature Comm* **9**, 2274 (2018)]. In ecosystems, he developed a mathematical equation that could help scientists and decision makers pinpoint the key species that secure the balance, integrity and structure of the entire system. He accurately proved that if the species located at the maximum k-core of the mutualistic ecosystem go extinct, the system will reach the tipping point of its collapse. [Ref: F. Morone, G. Del Ferraro, H. A. Makse, The k-core as a predictor of structural collapse in mutualistic ecosystems, *Nature Phys*. **15**, 95 (2019).] Monitoring the k-core then proves to be a useful method to anticipate any catastrophic collapse of many ecosystems if keystone species are altered. If they disappear, the ecosystem collapses. His work has helped the financial community understand the financial risk associated with the loss of biodiversity in the world. [Ref: K. Burleson-Lesser, F. Morone, M. S. Tomassone, H. A. Makse, K-core robustness in ecological and financial networks, *Sci. Rep*. **10**, 3357 (2020).]

In the financial and capital markets world he examined how the robustness and resilience of financial networks is important to determine any effect of external shocks. The relation between network structure and network stability is essential to understanding why some networks survive amidst global or local changes and other do not. In stock markets, by identifying the companies that are the most integral to network robustness, he is able to identify lock-step correlations that could lead to enormous disruptions in the financial system.

In his latest work from the physics theory, he has been able to explain the emergent properties of biological systems, particularly the information flow between building blocks of biological networks to decipher how cellular function emerges from their interactions. [F. Morone, I. Leifer, H. A. Makse, Fibration symmetries uncover the building blocks of biological networks, *Proc. Nat. Acad. Sci. USA* **117**, 8306 (2020).] He showed that a particular form of symmetry, called fibration symmetry explains the building blocks of biological networks and other social and infrastructure networks. In these symmetries, the input trees that deconstruct the network into functional building blocks are called fibers and thus process equivalent dynamics and synchronize the activity of genes in genetic networks as well as neurons in the brain (symmetries). He believes that this research could lead to his most interesting work thus far, where he is trying to use the laws of physics to explain the emergent properties of biology and the associated symmetries. In other words, assuming that life is an emergent property of physics, he is trying to elucidate why the same symmetry principles that explain physics cannot explain the organizing principles of life. He thinks that answering this question will unlock the secrets of how nature works.

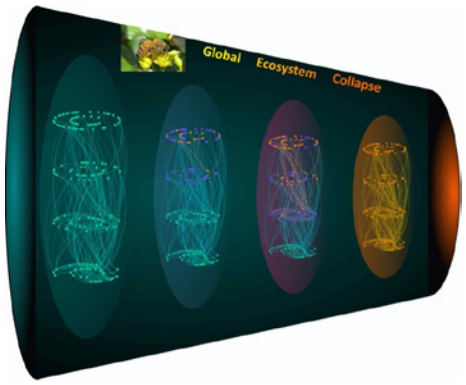


Fig 2: Collapse of ecosystems as emergent phenomena: The k-core of the ecological network vanishes at the tipping point providing an early warning signal for the eminent collapse of the ecosystem.phenomena.

(Contributed by Hernan Makse, Distinguished Professor of Physics).

PHYSICS CLUB NEWS

The year 2021 has been packed with exciting activities for the CCNY Physics Club! Here is a brief summary of everything we have done so far.

Programming in Python is increasingly becoming an essential skill for any physicist to have, from those interested in academia to those going into industry. As such, the Physics Club partnered with the Institute of Electric and Electronics Engineers to host a series of weekly Python workshops in March. On March 12, the club organized a game night on its discord server. This was a great opportunity to get to know fellow club members and destress in the middle of the semester. An industry talk featuring CCNY physics alumna Abigail Murphy was held on March 12 where she spoke about her industrial experience.

In the spring, the club held various online research talks aimed at undergraduates. On March 23, the club hosted a virtual luncheon with Professor Ken Olum of Tufts University, in which he discussed his experience as a cosmologist. On April 23, the club held a seminar by Professor Jaroslav Trnka, a renowned expert in scattering amplitudes in quantum field theory from University of California, Davis. Finally, on May 6, Professor Mark Vogelsberger of MIT gave a talk on "Simulations of Dark Matter and Galaxy Formation". He discussed some of the latest work on large-scale, supercomputer-based simulations of cold dark matter models, galaxy clusters, and galaxy formation.

On May 7, the club put together an LGBTQ+ in STEM event in collaboration with the Biomedical Engineering Society, CCNY Math Club, CCNY Association of Computing Machinery, and Harlem Launch Alliance. The invited panelists came from various STEM disciplines, such as computational biologist/chemist Dr. Natalia Sizochenko and physics lecturer Professor Jeremy Dodd. They shared their accounts on how being queer has (and/or has not) impacted their personal and academic journeys.

In the fall semester, the Physics Club transitioned to its new E-board: Dahkota Debold (President), Alexander Cernei (Vice-President), Johnny Basurto (Treasurer) and Tabitha Ramirez (Secretary). The term kicked off on September 2 with an event for the students to get to know each other and discuss the events they planned for the semester. Several activities were organized to celebrate the Physics Month. Professor Vinod Menon, the Chair of the Physics Department, hosted an introduction to the Physics Department on October 18. He then held a meeting with students on October 19, to discuss all their questions. On October 19, the club organized a virtual luncheon with Professor Emily Rice from the Macaulay Honors College, in which she discussed her research in Astrophysics. Another industry event took place on October 20, when CCNY alumnus Rob Davis talked about his experience working as a Senior Chemical Technician at Consolidated Edison Co.

We look forward to many more inspiring events!

(Contributed by Professor Sebastian Franco)

THE SURPRISE IN THE BOX!

On September 1, 2021 when I went to Marshak Building to teach my first in-person class since the COVID related lockdown, I decided to check my mailbox in the physics office (Marshak 419) where I usually get just magazines since most of my packages arrive at my lab address – the Center for Discovery and Innovation. Although I was back on campus since July 2020 to my lab, this was the first time coming to the Marshak building. To my surprise, I saw a cardboard box the size of a toaster sitting next to all my mail. The box felt heavy when I lifted it and opened it with my keys. Inside it was a note (see Fig.1) which indicated that the box was from an alumnus who received an excellent education at City College in the Physics and Math departments. The person wanted to donate to the department to support meritorious and needy students. The letter was not signed. Expecting to see a check, I looked under the note where bubble wrap covered whatever was inside. Upon removing the bubble wrap, I was shocked to see the box packed with fifty- and hundred-dollar bills (Fig. 2). I touched it to make sure that they were real! And then closed the box and called the Dean of Sciences – Dean Perkins and I told her that I would need her to come down to the physics office.

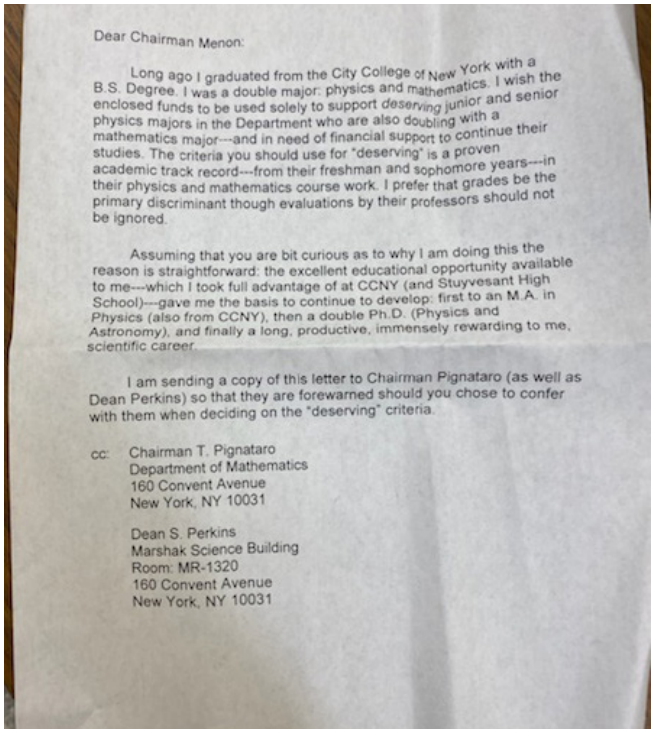
She was equally shocked at seeing the contents and we decided to count how much money was there. We

also called the Vice President of the Office of Institutional Advancement and Executive Director of the Foundation for City College, Ms. Dee Dee Mozeleski who arranged for a senior CCNY Security Staff to come by. Officer Anthony Laperuta arrived in the office with one of his colleagues, counted the money and asked us a few questions. Later we were informed that the FBI is looking into the origin of this cash. The name on the box – Kyle Paisely did not turn up on the alumni list of the department or the college. Around October first week we were informed that the cash can be deposited to our account and that we can start planning on how to spend it. On December 13, 2021, the CUNY Board of Trustees voted formally to accept this gift. "That is absolutely astonishing, $180,000 in cash in a box," said the board's chairman, William C. Thompson, in introducing the vote.

The funds will be used to support the full year tuition of two students in the department with preference given to students doubling majoring in physics and mathematics or with a minor in mathematics. This decision was made by the executive committee of the department. We hope to make the first awards in spring 2022 and the students will be able to avail this scholarship in Fall 2022.

The news of this mysterious gift garnered much attention from the media following the article in the NY Times which broke the news. The name and details of the donor remains anonymous. As the Chair of the Physics Department, I was proud to read that note which showed how much the education we offered at CCNY influenced positively the donor's life! We hope to continue this tradition of excellence and help train the next generation to think like a physicist – no matter what career choice they take up. And of course it goes without saying – box of cash or checks are always welcome to further this cause!

(Contributed by Vinod Menon, Chair, Department of Physics)



Dear Chairman Menon:

Long ago I graduated from the City College of New York with a B.S. Degree. I was a double major: physics and mathematics. I wish the enclosed funds to be used solely to support *deserving* junior and senior physics majors in the Department who are also doubling with a mathematics major---and in need of financial support to continue their studies. The criteria you should use for "deserving" is a proven academic track record---from their freshman and sophomore years---in their physics and mathematics course work. I prefer that grades be the primary discriminant though evaluations by their professors should not be ignored.

Assuming that you are bit curious as to why I am doing this the reason is straightforward: the excellent educational opportunity available to me---which I took full advantage of at CCNY (and Stuyvesant High School)---gave me the basis to continue to develop: first to an M.A. in *Physics* (also from CCNY), then a double Ph.D. (Physics and Astronomy), and finally a long, productive, immensely rewarding to me, scientific career.

I am sending a copy of this letter to Chairman Pignataro (as well as Dean Perkins) so that they are forewarned should you chose to confer with them when deciding on the "deserving" criteria.

cc: Chairman T. Pignataro
Department of Mathematics
160 Convent Avenue
New York, NY 10031

Dean S. Perkins
Marshak Science Building
Room: MR-1320
160 Convent Avenue
New York, NY 10031

Fig 1 (left): The letter from the anonymous donor.

Fig 2: The contents of the box.

A TRIP TO THE ARCHIVES

The first physics classes at CCNY were taught before the era of household electricity and lightbulbs, before Einstein's Relativity theories upended all of modern science, and obviously well before our current era of digital record keeping. Like any long standing institution, we are always confronted with the challenge of how to move forward and embrace changes in science, education, and society, while at the same time respecting and honoring our past.

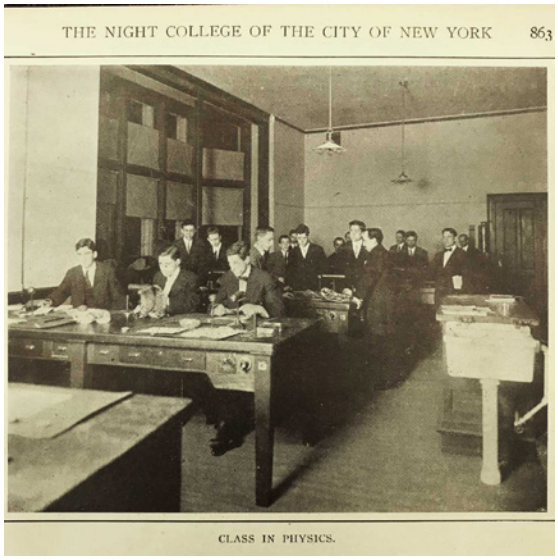


Fig 1. A photo from an early 1900's physics class at CCNY

As the years go on, we risk loosing the stories and traditions that helped make CCNY the unique and powerful institution it is today. (In September 2021, the Wall Street Journal ranked CCNY first in the nation in the criteria for Best Value. It's hard to imagine a better compliment than that!) Even seemingly trivial decisions, like setting the course schedule, can have significant implications for our students. CCNY was founded with the goal of educating the "the children of the whole people," not just those who happened to be free during normal business hours. In 1900, the college began offering evening classes (Fig. 1), thus making a formal education possible for those who perhaps had something else to occupy their time during the day. The physics department today tries to offer as many day and evening sections of our large introductory courses as our staffing permits, for this same reason.

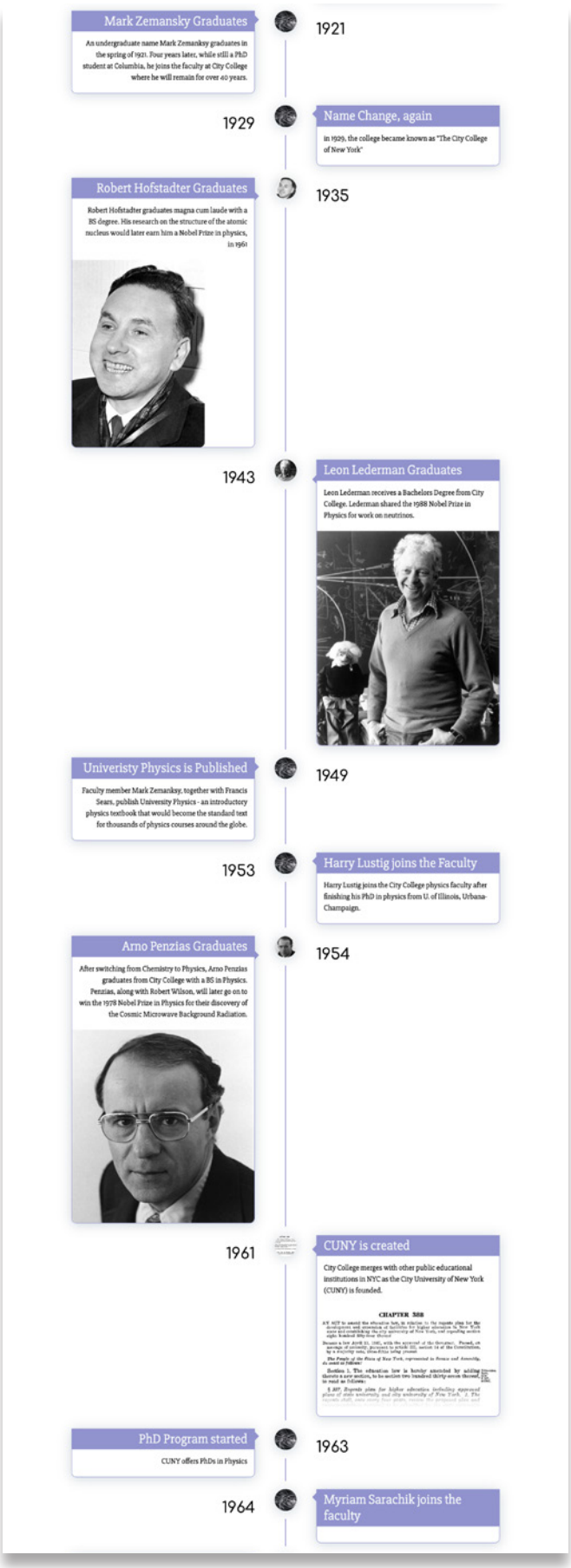
As new buildings on campus rise, and others are razed or renovated, we often have to make hard choices about which physical objects to keep, and which can be relegated to the winds of time. Being situated in Manhattan, an area not known for easy access to extra storage space, makes such matters very pressing at times. Despite this, we do try to keep important artifacts, records, and other pieces of history in the department and to display them in various ways. From hand crafted introductory physics lab equipment made out of real wood, to antique experimental apparatuses, to clippings and other documents that might be have slipped through the digitizing cracks, we love to see our origins in real life.

Thus the point of the current article. We'd love to hear from you, our Alumni, if you have records from your time in the Physics Department at City College. Maybe a polaroid from the 70's? Maybe you brought a Super-8 camera to campus in the 60's? Found an old syllabi from courses taught before Blackboard eliminated the paper syllabus? (See last year's issue of the physics Newsletter for a well preserved syllabus from a Quantium Information class offered before such words had ever appeared in the NY Times) We're sure these things are out there in closets and cabinets all around the world.

We've also begun collecting a brief history of the department on our webpage (Fig. 2). You can take a tour through our fascinating history here: https://www.ccny.cuny.edu/physics/history-ccny-physics-department , as well as check out some of the new things happening in the department.

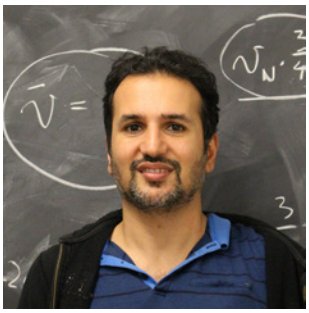
(Contributed by James Hedberg - reach out to him here: jhedberg@ccny.cuny.edu if you have something to share or are interested in more about CCNY Physics History)

Fig 2. Our growing timeline of the CCNY physics departement history, available on the physics department website.



FACULTY ACHIEVEMENTS AND HONORS

Pouyan Ghaemi Promoted



Dr. Pouyan Ghaemi has recently been promoted to the rank of Associate Professor with tenure. He joined the Physics Department as an Assistant Professor in January 2014. Professor Ghaemi's areas of research interest are: topological phases of matter, two-dimensional Dirac materials, high-temperature superconductivity in pnictides and cuprates, and strongly-correlated light matter systems. Since joining the City College Professor Ghaemi has widened his research efforts in topological phases of matter through collaboration with colleagues in diverse areas, from theoretical high-energy physics to experimental quantum optics. Motivated by recent advancements in quantum computing devices, he also started a new endeavor in developing quantum algorithms to study correlated electron systems.

While at City College, he published twenty papers and was awarded four different research grants from National Science Foundation. In addition, he was honored to receive Feliks Gross Award from CUNY academy of Arts and Sciences and the Quantum Innovation Award from Google Artificial Intelligence Lab.

The main focus of his research in the near future will be on the designer quantum systems where novel quantum physics could be realized. Such systems include twisted multilayers of graphene and other two-dimensional materials, strained two-dimensional materials, and quantum computing devices.

Hernan Makse appointed a Distinguished Professor

The Board of Trustees of the City University of New York appointed Professor Hernan Makse as Distinguished Professor of Physics at the City College of New York citing him as "an internationally renowned scholar of complex systems, soft condensed matter physics and network theory." He joined the CCNY Department of Physics and the Benjamin Levich institute as an Assistant Professor in Physics in 2000, and was promoted to an Associate Professor with tenure in 2005 and to a full Professor in 2008.

Professor Makse's research interests are in the general areas of complex systems, soft condensed matter, and statistical physics. He brings together concepts of statistical mechanics, network and optimization theory, machine learning and advances in big data science to develop a unified theoretical approach for studying diverse complex systems, such as brain networks, cell differentiation, social networks, ecological networks, urban planning, and patterns of online interactions. Research from his group has been published in renowned journals such as Nature, Nature Physics, Nature Communications, Physical Review Letters, Proceedings of the National Academy of Sciences, and Science, among others. An overview of his research activities appears in an article in this issue. His research is supported by federal agencies such as National Science Foundation, National Institute for Health, National Cancer Institute, Army Research Laboratory, Department of Energy, and industry such as Exxon-Mobil and Schlumberger-Doll Research

Professor Makse is a Fellow of the American Physical Society (2012); and a recipient of the Cesar Milstein Award, Secretar´ıa de Ciencia y T´ecnica, Programa Ra´ıces, Argentina (2007); and the New York City Mayor's Young Investigator Award for Excellence in Science and Technology, New York Academy of Sciences (2005). He is an Associate Editor of the Journal of Computational Social Science and serves on the Editorial Boards of Europhysics Letters, Nature Scientific Reports and Heliyon. He is an avid soccer player and enjoys dancing tango.

Menon receives the Division of Science Excellence in Research Award

Professor Vinod Menon was one of two recipients of the 2021 Excellence in Research award by the CCNY Division of Science. He was recognized for his work on light-matter interaction that lies at the interface of condensed matter physics and optics. Optical Society of America (now Optica) previously recognized him by conferring him the fellow status in 2020. Menon leads a vibrant research group (www.lanmp.org) consisting of post-doctoral researchers, graduate students and undergraduate students. The research in his group is funded through federal grants from the National Science Foundation, Army Research Office, Department of Energy as well as industry. Recent work from his group has appeared in high-impact journals such as Nature Nanotechnology, Nature Photonics, Science Advances, Optica, and Nature Communications. Students from his group have gone on to positions at the premier academic labs, national labs and industry.

Marilyn Gunner wins the Faculty Service Award

Professor Marilyn Gunner received the Division of Science Faculty Service Award. In addition to her high-profile research involving theoretical analysis of intra-protein electron and proton transfers in mitochondrial and photosynthetic proteins and teaching of biophysics courses, Professor Gunner has a track record of providing commendable service in various capacities. She served as the Chair of the Physics Department, Acting Dean of the Division of Science, as well as on different college committees. She was the Chair of the Division of Biological Physics of the American Physical Society in 2006. Professor Gunner is a member of the Editorial Board for both the Journal of the Royal Society Interface and Biochimica et Biophysica Acta – Bioenergetics.

Robert Alfano's Patents

Distinguished Professor Robert Alfano enjoys a distinguished record for patenting inventions by his group at the Institute for Ultrafast Spectroscopy and Lasers. With the award of US Patent 10,962,751 B2 on a Supercontinuum Microscope in March 2021, the total number rises to 132. These patents cover a wide array of inventions including light-based methods for cancer detection and diagnosis, optical biomedical spectroscopy and imaging for disease detection, ultrafast supercontinuum generation and applications, tunable solid-state lasers, laser tissue welding and wound healing, free-space optical communication, laser mode-locking techniques, etc. When asked about commercialization and product development, Professor Alfano mentioned that some of these patents such as optical detection of caries in teeth, cancer detection using luminescence and second-harmonic generation, optical coherence domain reflectometry were licensed to different companies.

STUDENT AWARDS

The Physics Department gives out several awards and scholarships to undergraduate students every year. The following students won the awards for the 2020-2021 Academic Year.

Sidney Millman Scholarship *presented to the junior Physics major demonstrating high potential*	Nipun Koshy
Sonkin Medal *for the best performance in the Physics laboratory course(s) and/or in experimental research.*	Maria Francesca Soddu
Ward Medal *presented to the graduating physics major with the highest GPA in physics and mathematics courses*	Aidan Subrahimovic
Bernard Hamermesh Scholarship *recognizes the outstanding graduating Physics major, who has demonstrated some of the skills, knowledge, technique and imagination necessary for a successful Experimental Physicist and who shows promise of being an active contributor to the research efforts in some branch of Experimental Physics.*	Maria Francesca Soddu
Dr. Jerry A. Gelbwachs Scholarship *awarded to the Physics major demonstrating academic excellence and high potential to benefit society*	Polina Belousova
Martin A. Tiersten Scholarship *the students with the highest performance in Mechanics (Physics 35100)*	Jhoan Espinal Alexander Cernei
Harry Soodak Scholarship *given to the outstanding junior physics major who wants to pursue a career in Physics*	Christopher Shen
Michio Kaku Award *recognizes the outstanding graduating Physics major who has demonstrated some of the skills, knowledge, technique and imagination necessary for a successful Theoretical Physicist.*	Aidan Subrahimovic

Zemansky Introductory Physics Prize

recognizes outstanding scholarship in Introductory Physics 20700 or Physics 20800 courses

Suprio Bhattacharjee
Stefan Tan
Christopher Shen
Georgios Ioannou
Georgiy Abdurahmanov
Segundo Chimborazo
David Diop
David Fede

RECENT GRADUATES

Annual Commencement exercises are festive occasions in academic institutions that recognize and celebrate students' academic achievements culminating from years of dedicated work. What follows is a list of students who earned their BS, MS and PhD degrees recently.

BS Degree recipients

Fall 2020: Sihe Chen, Mohammad Khan, Matthew Kubikowski, Ayesha Lakra, Maria Francesca Soddu, Christian Torres

Spring 2021: Prince Avecillas, E'lon Hurry, Natascha Krishnanand, Taichi Murakami, Shaneil Samuels, Aidan Subrahimovic, Kelly Veerasammy

MS Degree recipients

Fall 2020: Vishal Bharadwaj, Rezlind Bushati

Spring 2021: Sung Soo Jang, Bryan Reed

PhD Degree recipients

The following individuals received their PhD degrees from the joint Graduate Center of CUNY and the City College of New York Doctoral Program.

Haiming Deng, Quantum Transport in Topological Magnets
(Advisor: Lia Krusin-Elbaum), June 2021

Matthew B. Weiner, Emulating Condensed Matter Systems in Classical Wave Metamaterials.
(Advisor: Alexander B. Khanikaev), September 2020

2021 Great Grad

Aidan Subrahimovic, a member of the Macaulay Honors College, is among the 2021 CCNY Great Grads. After graduating from The College of Staten Island High School for International Studies, the Macaulay Honors College student enrolled at The City College of New York, majoring in physics. At first, imposter syndrome and the lack of queer representation throughout the lecture halls took a toll, but the 21-year-old credits perseverance and the help of professors for continuing to pursue their dream honing mathematical skills and building an understanding of the physical world. "Within the four years I have been at CCNY, the knowledge I have gained has formulated the basis of my understanding of the natural world and will inform me throughout my career as an astrophysicist," they said. Aidan was president of the Physics Club, research intern at the American Museum of Natural History, and joined both the Brown Dwarfs in New York City (BDNYC) research group as well as the Sloan Digital Sky Survey (SDSS) Faculty and Student Team (FAST) at CUNY, where the research focus was stellar streams and populations of the Milky Way's halo. Subrahimovic is pursuing graduate studies in cosmology at New York University.

RETIREMENTS

Harold Falk

Harold Falk joined the CCNY Physics Department as an Assistant Professor on a CUNY Graduate Center line in the fall of 1966. He was promoted to Associate Professor with tenure in the CCNY Physics Department in 1970 and to Full Professor in 1975. Among his approximately fifty publications in refereed journals is a paper describing collaborative work with Professor Ludwig W. Bruch. The key result is referred to as the "Falk-Bruch Inequality." In 1982 he organized a "CCNY Physics Symposium in Celebration of Melvin Lax's Sixtieth Birthday," and edited the resulting proceedings.

Joel Gersten

Joel Gersten joined the Physics Department of the City College of New York in 1970 and continued his research, teaching and administrative activities until he retired in 2021. Professor Gersten's areas of research interest include theoretical condensed matter physics, surface physics, interaction of light and charged particles with solids, sonoluminescence and STEM (Science, Technology, Engineering and Mathematics) education. His work on enhanced Raman scattering by molecules adsorbed on rough surfaces, and spectroscopic properties of molecules interacting with small dielectric particles are highly cited. He was elected a fellow of the American Physical Society in 1977.

Professor Gersten served the Physics department, the CCNY Division of Science and the City University of New York in different roles. He was the Executive Officer of the Doctoral Program in Physics at the Graduate Center CUNY (1982 - 1990), Chair of the CCNY Department of Physics (1995-1999) and Associate Dean (Acting) of the of CCNY Division Science (2001 – 2004). He was a dedicated teacher and a caring and inspiring mentor of graduate students. He wrote a text book (with F. W. Smith) entitled The Physics and Chemistry of Materials (John Wiley and Sons, New York, 2001).

The College campus around the time when these young gentlemen started their careers here.

Daniel Greenberger

Daniel Greenberger moved to the City College of New York in 1964 as an Assistant Professor of Physics from a similar position at the University of California, Berkeley. He was elected to hold the Mark W. Zemansky Chair in Physics in 2009, and appointed a Distinguished Professor of Physics in 2013. Professor Greenberger started out his research career as a high-energy theorist, but soon developed an interest in gravity and proposed a neutron interferometry experiment to test the equivalence principle. This led to long and fruitful collaborations with Professors Cliff Schull (MIT), Albert Overhauser (Purdue University), Michael Horne (Stonehill College) and Anton Zeilinger (University of Vienna). However, it is his collaboration with Professors Horne and Zeilinger in the late 1980s that led to the discovery of the GHZ (Greenberger-Horne-Zeilinger) theorem, a much improved version of Bell's theorem in quantum mechanics. Since then he has been working on fundamental problems in quantum theory, mostly using quantum optics.

Professor Greenberger has been recognized for his contributions to quantum physics. A two-issue festschrift was published for him by the journal Foundations of Physics on his 65th birthday; and a conference on "Fundamental Problems in Quantum Mechanics" was held in honor of his 75th birthday at the University of Vienna in 2009. He was elected a fellow of the American Physical Society (APS), and a foreign member of the Austrian Academy of Sciences.

Together with Professor Zeilinger he founded the APS topical group on Quantum Information, which attained a division status in 2017 and has a current membership of 2400. He organized a number of meetings on quantum mechanics, including two large ones, one of which honored Eugene Wigner, and the other honored John Wheeler. He serves on the editorial boards of a number of journals, and continues doing research on entangled states in quantum mechanics.

On the cover: Physics department faculty from the 1967 Microcosm yearbook. (Archives and Special Collections Division)

Front Row (L. ro R.) H. Lustig, R. Randall, R. Wolf. Second Row: L. Wills, H. Falk, A Bachman, P. Baumel, H. Hart. Third Row: A. Montwill, M. Sarachik, R. Lea, V. Brown, W. Miller. Fourth Row: M. Arons, H. Soodak, H. Stolov, J. Aschner. Fifth Row: A. Tomazzo, M. Nessin

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