The 2018 Nobel Prize in Physics

By Leah Poffenberger

On October 2, the Royal Swedish Academy of Sciences announced this year’s winners of the Nobel Prize in Physics. Recipients of the 2018 prize, awarded “for ground-breaking inventions in the field of laser physics,” are: Arthur Ashkin (formerly at Bell Laboratories), Gérard Mourou (École Polytechnique, France, and the University of Michigan, Ann Arbor, United States), and Donna Strickland (University of Waterloo, Canada). Strickland is the third female physicist to receive this award and the first to do so since 1963.

Half of the Prize goes to Ashkin for “optical tweezers,” a device for grabbing and manipulating small objects, and its application to biological systems. This work was first published in Physical Review Letters (PRL). The other half was jointly awarded to Mourou and Strickland for their method of generating high-intensity, ultra-short optical pulses. Both inventions represent major breakthroughs in the use of laser beams for practical purposes.

“Art Ashkin’s beautiful experiments at Bell Labs inspired his fellow physicists to pursue laser cooling and optical traps, which in turn has led to degenerate quantum gas physics, laser tweezers for

For Member Comment: Proposed APS Ethics Statement

Over the past year, a subcommittee of the APS Panel on Public Affairs has been reviewing, updating, and combining the existing APS statements in the areas of ethics and professional conduct into one comprehensive document that addresses expected standards of behavior and professional activity.

A draft of this revised Statement on Ethics is now available and has been approved by the APS Board of Directors to be sent to APS members for comment. Your comments are welcomed and suggestions for improving the statement are encouraged.

All comments will be read and will receive full consideration by the Panel on Public Affairs subcommittee as it prepares a final statement that will be forwarded to the APS Council for approval early next year.

Please review and submit any comments on the draft statement webpage no later than November 26, 2018.

Ethics Statement webpage: go.aps.org/stmtethics

Winners of 2018 Apker Award Announced

By Leah Poffenberger

This summer, six finalists for the 2018 APS LeRoy Apker Award traveled to Washington DC to present their undergraduate research to a panel of judges (APS News, August/September 2018). Now, the winners of the prestigious award have been announced. This year’s award recipients are: Nicholas Sherman (University of California, Davis) and Eric Cooper (Pomona College).

Every year, two awards are presented, one to a student from a PhD granting institution, and one to a student from a non-PhD granting institution. The award is accompanied by a $5,000 prize for each winner and another $5,000 for each of their physics departments. Sherman and Cooper will also both receive funds to travel to Boston for the 2019 March Meeting and present their research in an invited session. Thanks to the Apker selection meeting, they’ve both already gained valuable experience impressing a crowd of physicists.

In August, Sherman and Cooper went before the Apker selection committee, made up of physicists from a variety of backgrounds, for assessments of their research, their presentations, and their ability to field a barrage of questions.

“The questions were the hardest to prepare for—you can prepare for the talk, but you can’t predict what you’ll be asked,” says Sherman. His advice to future presenters: investigate how their

PHYSICAL REVIEW FLUIDS

Go With the Flow

By Gary Leal, John Kim, and Bradley Rubin

Physical Review Fluids (PRFluids) is one of the newest members of the APS journal family that grew out of the original Physical Review, which this year is celebrating its 125th anniversary. Following its first issue in May 2016, PRFluids has published more than 1,000 high-quality peer-reviewed papers—including more than 100 Rapid Communications, the shorter letter-style papers of special significance. PRFluids welcomes submissions in experimental, theoretical, and numerical research, from fundamental fluid physics of a wide variety of flows, to fluid mechanics with applications related to energy creation and harvesting, through biology, forensics, physics, and climate change.

The journal has made a great start and is firmly on track to becoming the fluid dynamics journal of choice. In achieving this, the journal has benefited greatly from the support of and collaboration with the APS Division of Fluid Dynamics (DFD), including the publication of the invited and prize lectures from the annual meeting, as well as the Gallery of Fluid Motion based upon the winning poster and video entries each year. In addition, the Francois Frenkkel Award of the DFD is awarded each year for the best paper by authors under the age of 40 published in PRFluids.

Although PRFluids is a relatively new journal, its roots date back more than 70 years. DFD has had a long tradition of close association with a journal in fluid dynamics. For many years the main venue for disseminating the work of DFD members was the journal Physics of Fluids, which is published by the American Institute of Physics Publishing. Indeed, the DFD was instrumental in founding Physics of Fluids in the first place.

The Physical Review, from the beginning, had included fluid mechanics in its coverage of physics, and especially since 1993, in a more broadly based APS journal, Physical Review E. However, in 2015 the DFD decided that it could better serve its members as well as the global readership by having a close association with a dedicated fluid mechanics journal published by APS. In support of the desire of the DFD, the entire editorial staff and the advisory board from Physics of Fluids moved to PRFluids in 2016.

PRFluids is relatively unique within the APS family of journals in that the Lead Editors and Associate Editors are located at universities and research institutions and are active research scientists. The Associate Editors in particular are among the most distinguished individuals in their fields, and they are chosen so that there is broad representation for nearly all of the subtopics within the field of fluid dynamics. The editors are complemented by a very strong Editorial Board, broadly representative in terms of both research expertise and geographic location, with current members based in ten countries. Our authors and referees are also broadly distributed; about half of recently published papers are from outside the United States. PRFluids strongly encourages the submission of fundamentally oriented theoretical and experimental research contributions. PRFluids is relatively unique within the APS family of journals in that the Lead Editors and Associate Editors are located at universities and research institutions and are active research scientists. The Associate Editors in particular are among the most distinguished individuals in their fields, and they are chosen so that there is broad representation for nearly all of the subtopics within the field of fluid dynamics. The editors are complemented by a very strong Editorial Board, broadly representative in terms of both research expertise and geographic location, with current members based in ten countries. Our authors and referees are also broadly distributed; about half of recently published papers are from outside the United States. PRFluids strongly encourages the submission of fundamentally oriented theoretical and experimental research contributions.
Leon Lederman 1922-2018
By Daniel Garisto

Leon Lederman, an experimental particle physicist, director emeritus of Fermi National Accelerator Laboratory, and founder of the Illinois Mathematics and Science Academy in Rensberg, Idaho on October 3. He was 96.

A recipient of numerous accolades, including the Nobel Prize in Physics as well as the National Medal of Science, Lederman led teams that discovered two elementary particles: the bottom quark, and the muon neutrino. He was a Fellow of the APS.

“Leon Lederman embraced science broadly and deeply,” said 2018 APS President Roger Falcone. “He uncovered new physics, was a leader in educating students and the public, was a spokesperson for science, which is still burning a decade after I entered her doors. Thank you, Dr. Lederman. <3.”

Leon Max Lederman was born in New York City on July 15, 1922, to Minna and Morris Lederman. He graduated from the City College of New York in 1943 and enlisted in the Army, serving in France and Germany. Back in the States, Lederman learned to love physics at Columbia University, where he eventually became a professor and made prolific discoveries.

In 1956, he discovered the neutral K meson, which proved that charge is conserved in weak interactions. The next year, inspired by promising results from his colleague C. S. Wu, he performed his own experiment to observe parity violation, in typical Lederman fashion—by appointing a graduate student’s experiment.

“It was 6 p.m. on a Friday, and without explanation, we took the student’s experiment apart,” Lederman said. “He started crying, as he should have.”

Trying to violate parity in a weekend “overlooking nice-looking niceties”: a coffee can, wooden cutting board, orange juice bottle, and a can of Coca-Cola were all used as part of the apparatus, which was held together by Scotch tape. In 1962, with Jack Steinberger and Melvin Schwartz, Lederman discovered the muon neutrino, for which the trio would share the 1988 Nobel Prize in Physics.

But Lederman wasn’t always successful. In 1976, at Fermilab, he and his team thought they’d discovered a new particle with a mass of 6 GeV, publishing their results in Physical Review Letters. It turned out there wasn’t a particle there, so

LEDERMAN continued on page 3

This Month in Physics History

November 9, 1825: Public Demonstration of the Limelight

For centuries, stage lighting in the Western world was notoriously primitive, until a light was lighting its debut in the early 19th century and re- ventilized the theater. But it was the invention of the limelight a decade earlier by Sir Goldsworthy Gurney, the quintessential 19th century gentleman scientist, that dominated stage lighting for the next several decades. Although long since replaced by incandescent and LED electric lighting, the invention lives on when we say someone is “in the limelight.”

Born in Cornwall in 1743 to a reasonably well-off family, Gurney showed an early interest in science in his education, notably chemistry and mechanical science, even constructing his own piano. He was particularly impressed with a demonstration he witnessed of inventor Richard Trevithick’s steam road carriage, dubbed the “Puffing Devil.” But initially he trained as a surgeon, starting his own medical practice in 1813 and marrying a local farmer’s daughter the following year.

Seven years later the family relocated to London. Gurney still made his living as a surgeon, but the city also introduced him to the broader scientific community. He became a lecturer at the Surrey Institution, teaching chemistry, and invented a device capable of creating an intense hot flame by combining burning jets of oxygen and hydrogen. The latter provided the technological underpinning for the new kind of lighting that would come to be known as limelight. By trial and error, Gurney figured out that he could produce a brilliant light—bright enough to be visible nearly 100 miles away—by playing a flame on a chunk of lime. Historical records show that the earliest known use of limelight at a public performance occurred on October 3, 1825, when it was used to illuminate a masquerade ball performance in Kent. A contemporary leaflet used the word “koniphostic” derived from Greek, describing the effect as bathing the “whole pier with a flood of beautiful white light.”

Covent Garden Theater used limelight the following year to illuminate its indoor stage, and by the 1860s and 1870s, limelight was commonly used in theaters around the world, and introduced the spotlight to the theater.

Building on his successful invention of limelight, Gurney was able to produce even brighter white light by adding oxygen directly to the flame of an oil lamp. He even figured out how to light his entire house this way via an intricate system of pipes and lenses running through the hallways. He patented the invention in 1839. The British House of Commons purportedly replaced the 280 candles it traditionally used for illumination with three of Gurney’s tricked-out Bude lights (named after his town in Cornwall), which remained in place for some 60 years. It wasn’t until the invention of arc lighting at the end of the 19th century that limelight...
Looking for ways to improve your physics teacher education program? Emulate the best!

The PhysTEC program will be hosting a webinar to support physics departments in improving their teacher education programs. The webinar will show how to complete the new Physics Teacher Education Program Analysis (PTEPA) Rubric at physet.org/thriving. The PTEPA Rubric is a self-assessment instrument based on a study of "thriving" programs that routinely prepare at least five physics teachers per year and is designed to help departments analyze and improve their programs. During the one-hour webinar, the lead author of the study, Stephanie Chasteen, will introduce the Rubric, guide participants through one section of it, and answer your questions. The webinar will take place Tuesday, November 13, at 2:00pm ET. No signup is needed; just go online to go.ps.org/3WtAW at that time.

Professional Skills Development Workshop

The APS, with NSF grant funding, will provide a workshop for senior women in physics with the goal of providing a framework and tools to be agents of change within their programs. In today’s world, change is a given, whether in the workplace, the lab, or within APS. Most people experience some level of stress or discomfort when encountering disruptions change can bring. Whether it is a change in priorities, budgets, direction of a project, or new team members, understanding how we react to change and how to lead others through change is critical to your professional success.

Senior women interested in learning a step-wise process to more effectively lead change initiatives in their institutions and organizations should submit an application by November 11, 2018. Nominations will also be accepted. The form to apply or nominate someone can be found at go.aps.org/2yA6sWA at that time.

Travel Support for Minority-Serving Institutions to 2019 PhysTEC Conference

We are committed to supporting minority-serving institutions that wish to become leaders in physics teacher preparation and are offering a limited number of stipends of up to $1000 to qualified institutions to support travel to the conference. Applications are now open. More information can be found at go.aps.org/2yMXLsj.

As physicists Tackle Big Data with Blockchain

By Sophia Chen

In 1999, researchers at the University of California, Berkeley, launched SETI@Home, a project that any curious person with an Internet connection could participate in. The scientists designed a program that people could download onto their home computers. When the machines were idle, the program would analyze radio telescope data for signs of extraterrestrial life. Since then, more than 4 million people have lent their computer power to the search for aliens.

Taking a page from SETI@Home nearly two decades later, Josh Peek is testing a new method to pool home computing power to analyze Hubble Space Telescope images. Peek, a researcher at the Space Telescope Science Institute in Baltimore, Maryland, wants to use a network of computers to classify terabytes of images depicting dark matter and other extraterrestrial structure. “As you look deeper and deeper, there are lots of diffuse structures in the sky that are very complex,” says Peek. He wants these computers to implement machine learning algorithms to signal other structures in the images. But his 2018 methods have a twist. To deploy his fleet of home computers, Peek has enlisted a new technology: the blockchain.

Blockchain technology, first invented in 2008 by a pseudonymous person known as Satoshi Nakamoto, is essentially a public ledger: Any retroactive change to a block would require tampering with an entry, all sub- sequent entries would point to a wrong hash. In theory, this format creates a permanent, self-regulating record that does not require centralized control. The technology is best known for its role in cryptocurrency, which allows people to securely exchange money anonymously without banks. Many blockchain proponents say that it could distribute the power currently held by financial institutions and large corporations such as Facebook or Google among users’ personal information.

But Peek’s blockchain ambitions don’t involve world economic reform. “I don’t see any interest in changing how finance works,” he says. “It’s not something I know anything about.” He actually just wants to use his data and the blockchain may offer an efficient solution. Although best known in finance, the blockchain doesn’t fundamentally involve money at all. The technology, it turns out, can help coordinate computing tasks across thousands or more computers. It’s a tool that allows multiple computers to work collectively in a decentralized way. The computers in Peek’s decentralized network collectively run machine learning algorithms to distinguish stars, galaxies, and other exotic blobs from each other. Each machine in the network takes a little chunk of the problem, analyzing a piece of an image at a time. And unlike SETI@Home, which used volunteers, Peek plans to use the blockchain to pay everyone who helps him process the images.

To execute this blockchain facilitated pipeline, Peek collaborated with Bay Area blockchain startups Aikon and Hadron earlier this year. The idea was born from a conversation Peek had with Aikon’s chief product officer, Marc Blinder, who is a childhood friend. “Josh is always looking for new ways to use new technology in astrophysics,” says Blinder. The two found another collaborator in Cliff Szu, the CEO of Hadron, which specializes in deploying machine learning algorithms on distributed networks.

They have yet to deploy their analysis pipeline at full capacity, but the plan is for it to essentially work like this: Hadron, collaborating with Peek, has developed a machine learning algorithm that classifies astronomical objects in Peak’s

Profiles in Versatility

“Failed” Physicist? From biologist turned Nobel Laureate to author.

By Alaina G. Levine

Venkataraman Ramakrishnan started as a physicist. Then he became a biologist. And then he helped elucidate the structures and functions of the ribosome, the molecule that turns genetic code into protein, for which he won the 2009 Nobel Prize in Chemistry. Now he’s an author too, and his book is The Gene Machine: The Race to Decipher the Secrets of the Ribosome (Basic Books, 2018).

Ramakrishnan did his PhD in theoretical physics but along the way, the questions he posed to himself and the answers he found were very different. As such universities were interested in taking someone who already had a doctorate. It was frustrating at first because while the terms, was unfamiliar with lab work, and had to take undergraduate courses to catch up. But as he once told a group of young scientists, “You have to be willing to go back-wards and start from the beginning.

Ramakrishnan did his PhD in theoretical physics but along the way, the questions he posed to himself and the answers he found were very different. As such universities were interested in taking someone who already had a doctorate. It was frustrating at first because while the terms, was unfamiliar with lab work, and had to take undergraduate courses to catch up. But as he once told a group of young scientists, “You have to be willing to go back-wards and start from the beginning.

You have to have humility.”

Ramakrishnan, who today is a senior scientist at the MRC Laboratory of Molecular Biology in Cambridge, UK and the president of the Royal Society, is a passionate advocate for science and science communication.

As I was explaining the nature of this article and the Profiles in Versatility column, concerning physicists in unusual career paths, he interrupted me, and shared his first gem of the day. “Most people would not call me a physicist,” he said. “You could think of me as a failed physicist if you like.”

I couldn’t let that go without inter- view immediately commenced.

AGL: Do you consider yourself a failed physicist?

VR: It’s a little difficult to say because I was not interested in the problems I was working on. I didn’t have a good sense of what to do in physics. I felt if I stayed on, I would have done some very bor- ing calculations that didn’t actually amount to anything. That was the negative part. Of course, the posi- tive part was that I found modern molecular biology extremely inter- esting, so I went into it.

AGL: What was it that drew you to physics in the first place?

VR: It was a straightforwardly a beautiful and elegant, and ability to take models and data to make inferences about what was happening in the universe. I think physics is very beautiful intellectually.
Many people helped make it possible. My father taught me hands-on problem solving through simple woodworking. My chemis-
try teacher taught me to marvel at the structure of a single atom, and my college professors helped me reveal its secrets. Building Kansas’ scientific and technical workforce requires opportu-
tunities and support for more stu-
dents to build on those formative moments.

Science, technology, engineer-
ing and mathematics (STEM) jobs pay on average $75,000 per year in Kansas and according to one prominent Kansas company, says Carly Hysell, Garmin’s public rela-
tions manager: “We need a steady supply of very talented engineers.”

Kristan Corwin
Standards and Technology (NIST), and other federal agencies. My former classmates are now leaders in industry, universities and govern-
ment laboratories, tackling the tech-
nical problems of our time.

Like me, many are training the next generation of scientists and engineers.

Training our students for careers in STEM is a win-win for Kansas — it gives our students opportuni-
ties and also enables us to carry out research that benefits our state. As a physicist at Kansas State University, I develop tools that may improve agricultural yields. The project uses lasers to measure the gases above fields of crops, helping

APKER continued from page 1

research relates to other fields of physics for a mixed-background audience. Sherman detailed his work modeling the dynamics of anyons, quasiparticles that might be harnessed to do quantum computations—that served as the subject of his senior thesis. Cooper, also a recent graduate with a degree in physics, demon-
strated the results of his research on the aerodynamics of exploding seed pods, showing how physical con-
cepts impact the biological world.

“This was the longest talk I’ve given,” Cooper said, “and I learned a lot about the process of presenting detailed research,” says Cooper. “It was interesting to present in front of judges and learn how to be con-
vincing. They asked a lot of ques-
tions to make sure I understood the research and that they did as well.”

Sherman and Cooper are con-
tinuing their physics careers, now at graduate school. Sherman is attend-
ing the University of California, Berkeley, and Cooper is a student at Stanford University. Sherman expects to continue in condensed matter theory, and Cooper has tran-
sitioned into atomic and molecular physics.

For more on the Apker Award visit aps.org/programs/honors/prizes/apker.cfm

FYI: Science Policy News From AIP

Scientists have also taken up activities to help craft their societies’ policies to address harassment.

Societies such as the American Geophysical Union and American Astronomical Society, have already implemented poli-
cies to combat harassment by their members. Many others are preparing their own response. For instance, APS is in the process of updating its ethics statement (go.aps.org/smethics) and is propos-
ing to form a standing committee on ethics that will address sexual harassment, among other topics.

Leaders from dozens of scien-
tific societies, including APS, con-
vened in October to discuss sexual harassment, the first time so many societies have gathered to discuss action on the issue. They intend to form a committee in the coming months that will develop model policies and a resource toolkit that societies can use to help craft their own policies.

The author is a science policy analyst with FYI at the American Institute of Physics.

FYI has been a trusted source of science policy and funding news since 1989, and is read by members of Congress and their staff, federal agency heads, policy

ECONOMY continued on page 5

The APS Office of Government Affairs

APS Members Attend State Meetings to Support F-1 Visa Dual Intent Provision

By Tawanda Johnson

APS members have been meet-
ning with congressional staff in

states to urge Congress to allow F-1 student visa applicants to express “dual intent,” — enabling international students to apply for permanent labor status in the US while they are students (see APS News, October 2018).

About 10 APS members have attended meetings in Alaska, New Hampshire, Illinois, Kansas, Vermont, New York, and West Virginia.

“The meetings have been going really well in the states, and APS leadership has been having meet-

ings with congressional staffers in Washington, DC to reinforce the strategy on the federal level,” said Greg Mack, grassroots advocacy manager in the APS Office of Government Affairs (OGA). OGA-OGA provided the APS member volunteers with information, mate-
rials and coaching, and arranged the meetings with the congressional offices in the states. This in-state strategy allows for more constancy to be able to tell their compel-

ing personal stories to the offices.

Historically, the United States has had an unrivaled ability to attract the best and brightest stu-
dents from around the world. Complementing the nation’s home-grown STEM talent, inter-
national students help provide the US innovation ecosystem with the next generation of scientists and engineers necessary for America to remain a global leader. But the 21st-century landscape is chang-
ing—international applications and enrollments to US-based STEM programs are declining. The National Science Board’s Science and Engineering Indicators 2018 showed a 6% decline from 2016 to 2017 in the total number of international graduate students at US institutions across all STEM fields.

Read more about the F-1 visa issue at go.aps.org/2Ockp41

The author is APS Press Secretary

Join Our Mailing List: visit the sign-up page at go.aps.org/2mGjTP

The American Association for the Advancement of Science recently established procedures for revo-
kings the status of elected fellows in response to breaches of profes-

fair and harassment.

Seminor ethics, including sexual mis-

conduct and harassment.

Some scientific societies such as the American Geophysical Union and American Astronomical Society, have already implemented poli-
cies to combat harassment by their members. Many others are preparing their own response. For instance, APS is in the process of updating its ethics statement (go.aps.org/smethics) and is propos-
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agronomists better understand the interactions of plant genetics with fertilizer and water.

My federally funded research program has propelled students from Kansas into Ph.D.-level positions as senior scientists in small businesses and government labs, working on laser-based research for private industry and the U.S. government. Having world-class research available to Kansas high school graduates in their home state has given them excellent job opportunities. The hands-on, critical thinking skills they develop open many doors, and empower them to address the most pressing challenges facing our nation in areas such as agriculture, energy, health and national security.

Our project is one example of the unique, forward-looking research funded in Kansas by the National Science Foundation (NSF), which invested $36.7 million in research in the state during the past year. These projects allow the exploration of fundamental scientific ideas that underpin American innovation and train our students for careers that underpin American innovation.

These projects allow the exploration of fundamental scientific ideas that underpin American innovation and train our students for careers in STEM.

NSF research has transformed our lives here in Kansas—from the way we shop, to how we consume information, to how we receive daily weather reports. Specifically, NSF research has generated or improved barcodes, web browsers, fiber optics and Doppler Radar.

Furthermore, NSF pays dividends for the entire nation. Since the end of World War II, economists have determined that more than half of the nation’s economic growth can be traced to scientific discoveries, according to a 2014 report by the American Academy of Arts & Sciences.

My science career grew from natural curiosity, nurtured by engaging teachers. My training was made possible by federally funded research projects. Now I lead investigations using physics to improve agriculture, while in turn creating opportunities for Kansas’ students.

There are kids all across our state right now with similar desires and aptitudes, ready for a STEM career. Will similar opportunities await them?

Krista Conrath is chairwoman-elect of the APS Division of Laser Science and professor of physics at Kansas State University. This article first appeared in the Topoka Capital-Journal newspaper.

To learn more, please visit go.aps.org/dresselhaus or contact Irene Lukoff, APS Director of Development at (303) 208-2224 or lukoff@aps.org.

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Careers Report

“1 Graduated – What Now?”

By Hendrik Odlalog

On July 7, 2018 the APS Far West Section held a career workshop at SLAC National Accelerator Laboratory. After a similar event had attracted a rather large crowd in 2017, the section promised to make it a regular item on their meeting calendar. Career opportunities for physicists have become increasingly diverse and somewhat confusing over the past decade. Although the market for research jobs in academia or national labs has not significantly changed, there has been tremendous growth in opportunities for physics graduates in other sectors, e.g. the areas of data science, health science, general IT and so on. However, from conversations with students we learned that many are not aware of the variety of options and how to pursue them. They felt that an event providing not only some general information but also personal insight into the job market for physicists would be extremely helpful. Based on this feedback from the students, the section invited speakers and panelists to provide exactly this missing link.

The 2018 meeting was attended by close to 150 students from the region. The day started with a featured presentation by Peter Fiske and Bob, the imaginary characters. My training was engaging over the past decade. Although it has given them excellent job opportunities, the annual Conference for Undergraduate Women in Physics nanoscience and nanomaterials, encourage and pay tribute to Millie by supporting this endowment created by the American Physical Society to honor the remarkable scientific career and community legacy of the late Millie Dresselhaus.

Fans, friends, and former colleagues are invited to pay tribute to Millie by supporting this endowment that will recognize significant contributions in nanoscience and nanomaterials, encourage and fund the travel of women attending the annual Conference for Undergraduate Women in Physics (CWPW), support the activities of Women in Physics groups, and inspire future generations of physicists.

To learn more, please visit go.aps.org/dresselhaus or contact Irene Lukoff, APS Director of Development at (303) 208-2224 or lukoff@aps.org.

Moving the Story Beyond Alice and Bob

By Eran Moore Rea

Scientists are increasingly using comics as a way to move readers from bystanders to integrated participants in the dynamic action of physics. Too often, popularizers of science rely on clichés like Alice and Bob, the imaginary characters that physicists use to explain how quantum information is sent and received. But through conversations and stories, the three writers featured below move the stories in popular physics accounts beyond the familiar examples—beyond Alice and Bob arguing over entanglement.

Physicist Clifford Johnson welcomes readers into the universe, back and forth conversations between physicists. Philosopher Jeffrey Bub gives readers more say in how they experience theoretical physics by placing them in familiar thought experiments. And APS Head of Outreach Rebecca Thompson centers on creating a compelling story to draw middle schoolers into the conversations of characters who use physics to solve problems.

Clifford Johnson was looking for something beyond the Standard Model. The Standard Model of Physics Outreach Books, that is. Johnson, Professor of Physics and Astronomy at the University of Southern California, has been active in outreach at the national level since he began BBC radio broadcasts in the late 1990s. In Johnson’s view, there is a format for physics outreach books written by physicists for popular audiences.

Often, it’s an 11-chapter book, Johnson said. “Chapter one introduces classical physics, chapter two is a bit of quantum mechanics, chapter three a little bit of relativity. By chapter 10, everything is introduced, and then chapter 11 is what the author really wanted to talk about, what’s going on now in the field,” Johnson said.

This does not mean that Johnson sees the Standard Model of Physics Explainer Books as a bad thing. After all, in physics, the Standard Model has lasted as long as it has for a reason: it works. The 11-chapter model is an effective and quick way to explain some ideas in physics, and many prose books do it “beautifully,” according to Johnson.

But Johnson decided he did not want to write a book explaining physics, per se. Instead, he wanted to write a book of conversations that might happen between physicists or other people in, for example, a café—casual, disjointed, real conversations.

If it’s a real conversation, people are going to say stuff that you don’t understand,” Johnson said. “[Eventually, ] it will make sense in context. In the book, the reader can get a sense of many of the ideas that are discussed in that conversation, without me having to join all the dots, pull [you] by the hand and take you through the whole thing.” Johnson’s book, a physics comic book entitled The Dialogues: Conversations about the Nature of the Universe, was published in October 2017. And

Styles of communication (L-R): Clifford Johnson, Jeffrey and Tanya Bub, and Rebecca Thompson

Peter Fiske opens the workshop by talking to students and postdocs about “how to put your science to work.” (Lawrence Berkeley National Laboratory), entitled “Put Your Science to Work.” Peter is a regular contributor to APS career events through his presentations and webinars. These events are crucial because “career development workshops at local and regional levels of APS have two advantages: they can be scheduled at any point during the year, and students don’t need to travel as far as the annual meeting to participate,” said Fiske. “It’s a great way for APS to show how it is concerned for the next generation of physicists.” Fiske pointed out that physics students obtain a unique skill set during their studies that will set them apart from other job applicants. However, being part of the team is as important as standing out.
In the next iteration of the comic, Alice and Bob became more realistic characters living in Oxford, England. The story, now post-doc, loses his funding in the first panel. He walks home and runs into a man selling a magic coin trick in the street. Bob buys it and discovers these are magically entangled coins that behave just like entangled particles. In a future white, though, “we couldn’t get our characters to do all the things we wanted, like thing that electrons and photons do. And if you could pull up Tanya and say why don’t they do blah blah blah, and she’d say Alice wouldn’t do that, or Bob wouldn’t do that,” Bob said. So they got rid of Alice and Bob, and put the reader in charge of the coins. “The main character is really the reader,” Tanya said. Bob said that always make sure that the story in the science comic is well-written in order to keep focus on teaching physics.

“—a lot of the time, educational comics suffer from a lack of plot. People read them to catch up on science stories; that’s what engages people,” Thompson said. “But a lot of [writers make] the educational piece the forefront of the comic… that’s when you draw up people in superhero outfits, and they say I’m going to tell you about what I do in science.”

Eleven years ago, Thompson wrote the first annual issue of Spectra, for middle school students. The newest issue, Spectra’s Energetic Escape, is about the latest adventures of Spectra, the laser-superhero after a go of medium-sized super heroes. Spectra is based on topics in engineering and physics, modeled after escape rooms (with the prize of tickets to a laser tag night) that you can buy at home. “Free (Radicals) goes awry and imperils Spectra and her friends. They are only able to save the day by exploiting conservation of energy, among other physics concepts, and using Spectra’s laser superpowers. For Thompson, her emphasis on plot goes hand in hand with an emphasis on character development. “Character development is a huge part of a lot of stories. That’s what Harry Potter and Lord of the Rings do, by the end you like feel you really know these characters, and conversation makes that happen,” Thompson said.

And Alice and Bob? “They make great names for pets,” Thompson said. “I knew physicists who have pets named Alice and Bob.”

ALICE & BOB continued from page 5

Johnson’s book is not alone; the science of physics. In 2016, he published a book entitled to “a few popular science books on the market. Johnson sees that any conversation is normally limited to “a few physicists.”

In contemporary physics books, or textbooks, Johnson knows that any conversation is normally limited to “a few physicists.” “And when I was a child, my parents would call up Tanya and say why don’t they do blah blah blah, but she’d say Alice wouldn’t do that, or Bob wouldn’t do that,” Bob said. So they got rid of Alice and Bob, and put the reader in charge of the coins. “The main character is really the reader,” Tanya said. Bob said that always make sure that the story in the science comic is well-written in order to keep focus on teaching physics.

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The author is a freelance writer based in Minneapolis.
Ashkin’s original experiments with laser light generate optical forces as Ashkin detailed in his 1970 PRL. The invention of CPA opened the field of laser physics to create increasingly intense beams for a variety of applications. "There have been several Nobel Prizes associated with the development and application of lasers," said 2018 APS President Roger Falcone, a laser physicist at the University of California, Berkeley. "This year it is wonderful to see recognition of Art Ashkin’s seminal work in using lasers to manipulate the motion of small particles, as well as Gérard Mourou’s and Donna Strickland’s impactful invention of a technique that enables the highest peak power lasers. The recognition of this year’s Nobel Prize, first awarded in 1901, is widely considered the highest honor in science, economics, and literature. The 2018 Nobel Prize in Physics was awarded to Art Ashkin, Donna Strickland, and Gérard Mourou for the development of CPA. This technique paved the way for higher-intensity, ultra-sharp laser beams now used in millions of corrective eye surgeries. Mourou was the winner of the 2018 APS Arthur L. Schawlow Prize in Laser Science.

The concept of using lasers or light to manipulate small objects, something from a sci-fi film, was as Ashkin detailed in his 1970 PRL paper, focused, narrow beams of laser light generated optical forces that can displace small particles. Ashkin’s original experiments with tiny transparent spheres showed that particles would move to the center of a laser beam, where the intensity was greatest. Using this concept, Ashkin demonstrated the use of laser beams for three-dimensional trapping of particles, now known as optical tweezers, in a 1986 paper, also published in PRL.

Ashkin and his colleagues first used optical tweezers to trap atoms, but the technique is now widely used to study biological systems. The researchers realized the potential for optical tweezers to capture and manipulate living cells and viruses without causing physical damage. The use of Ashkin’s invention has provided insight into fundamental bio-molecular processes, like the process of protein synthesis based on motor RNA transcripts.

Mourou and Strickland’s development of CPA has also led to a variety of applications from plasma physics to medicine—for example, the brief, intense light pulses created with CPA are used in eye surgery for vision correction. CPA also represented a turning point in laser science, allowing a dramatic increase in intensity of lasers after progress had been mostly stagnant. Between 1970 and 1985, the number of papers on laser pulses doubled, and CPA’s technique separates the frequency components in a short light pulse and spreads them out over a longer pulse, thereby reducing the peak power. This stretched and “chirped” pulse is amplified, and then the frequency components are compressed back together, now with much higher intensity. The invention of CPA opened the field of laser physics to create increasingly intense beams for a variety of applications. "There have been several Nobel Prizes associated with the development and application of lasers," said 2018 APS President Roger Falcone, a laser physicist at the University of California, Berkeley. "This year it is wonderful to see recognition of Art Ashkin’s seminal work in using lasers to manipulate the motion of small particles, as well as Gérard Mourou’s and Donna Strickland’s impactful invention of a technique that enables the highest peak power lasers. The recognition of this year’s Nobel Prize, first awarded in 1901, is widely considered the highest honor in science, economics, and literature. The 2018 Nobel Prize in Physics was awarded to Art Ashkin, Donna Strickland, and Gérard Mourou for the development of CPA.

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Additional Reading

WHAT NOW continued from page 5
out. His engaging presentation set the tone for the day noted Antonio Cuebas Rodriguez. “I really enjoyed Peter Fiske’s talk. It felt like I learned a lot about myself that I simply didn’t know before,” he said. “I am a rising junior at Stanford University, and I never really thought seriously about careers outside academia until this summer. Peter Fiske’s presentation especially spoke to me and helped me get an idea regarding what I could do after college.”

The students enjoyed a pizza lunch, which students enjoyed in the new courtyard on the SLAC campus, now with much more area. The afternoon session comprised two career panels, with panelists from diverse backgrounds ranging from national laboratories, companies, data science, government policy, patent law, national laboratories, publishing, and startup companies. After talking about their career paths and providing the students with lots of personal stories, the panelists were ready to take questions from the audience. There was not nearly enough time for all the questions so many conversations had to be continued during the break. After the official workshop program ended, the participants had the opportunity to tour SLAC National Accelerator Laboratory, which led them from the early days of SLAC, the construction of the linear accelerators, and the first North American web server, to state of the art research facilities like the Stanford Synchrotron Radiation Light Source and the Linear Coherent Light Source.

As with the 2017 workshop, many of the participating students pointed out the event has helped them to develop a better idea of what to do with their degree and which options are available to them. Based on the feedback, the section will try to organize another workshop at SLAC in 2019. In the meantime, if you are interested in the materials you can find them at the meeting webpage (go.aps.org/XX/xxx). In addition the APS career page (aps.org/careers/) contains useful information as well as links to various websites including Peter Fiske’s talk, "Putting Your Science to Work." The author is Staff Scientist at the Lawrence Berkeley National Laboratory and 2018 Chair of the APS Far West Section.

BRAZIL-U.S. EXCHANGE PROGRAM
NOW ACCEPTING APPLICATIONS

Opportunities for working physicists, Ph.D. students, and postdocs.

Professorship/Lectureship Program
Funding for U.S.-based physicists to teach a short course or lecture series in Brazil.

Physics Ph.D. Student and Postdoc Visit Program
Funding to pursue physics-focused professional development opportunities in Brazil.

DEADLINE: DECEMBER 7, 2018

NOBEL continued from page 1
LIMELIGHT continued from page 2

Center of a laser beam, where the...
There were far fewer women scientists if you go back 20 years. In 1900-1963: Period of Physics Pride with “Nobel” Women

The selection process is not entirely mysterious; a set of short videos [7] on how the selection process worked can be found [nobelprize.org/nomination/archive/]. In fact, the percentage of women physicists has decreased from 17% in 1903 to 2.5% in 1963 to merely 1.4% today. This trend and the long gap of 60 and 55 years for the last two women Nobel laureates must change.

We must move forward. First, the physics community will be intellectually much richer; second, it is the right thing to narrow the extraordinary gender gap; and third, it helps to give credit where it is due. And living women Nobel laureates will motivate more women to pursue physics.

References:
1. The Nobel prize committee explains why women win so few prizes (up.com): go.aps.org/2yDvDaO.
2. Women’s representation in national science academies: An unsettling narrative (sajs.co.za): go.aps.org/2O7IqY1.
4. AIP.org/exhibits/curiescandal.htm.

The Back Page

Wanted: More Nobel Prizes for Women Physicists

By Vijendra Agarwal

Each October, the world awaits the Nobel Prizes, bestowed for “the greatest benefit to mankind.” This year, Arthur Ashkin, Gérard Mourou and Donna Strickland won for their groundbreaking research in laser physics. The award to Strickland changed history, making her the third woman after Maria Goeppert-Mayer and Marie Curie in 1903. The physics community will rejoice and welcome all of the 2018 Nobel winners, and especially that we now have a living Nobel woman physicist.

However, we should ask why only 3 of 210 Nobel physics laureates are women. While we celebrate the accomplish- ments of Strickland, physicists should refrain from too much back-slapping. In fact, the percentage of women Nobel physics laureates has decreased from 17% in 1903 to 2.5% in 1963 to merely 1.4% today. This trend and the long gap of 60 and 55 years for the last two women Nobel laureates must change.

We must move forward. First, the physics community will be intellectually much richer; second, it is the right thing to narrow the extraordinary gender gap; and third, it helps to give credit where it is due. And living women Nobel laureates will motivate more women to pursue physics.

It is very telling that today only 52% of 935 Nobel Laureates are women. Gordan Hanson [1], the chairman of the Royal Swedish Academy of Sciences (RSAS) admitted, “we are disappointed, … that there aren’t more women who’ve been awarded [the Nobel].” He went on to say, “There was an even larger bias against women then.” There were far fewer women scientists if you go back 20 or 30 years.

But even today, the RSAS is only 13% women [2], and this is the group that selects the physics, chemistry, and eco- nomics laureates. Is there an inherent bias against women? Is there a bias at the selection committee level? Are physicists and those in other disciplines not nominating deserving women, and why not? Those questions cannot be easily answered, but we do know that women have not been fully represented.

What many of us may not know or remember is that Madame Curie’s first Nobel Prize was not without hiccups. Reportedly [3], she was not even nominated by the French Academy of Sciences (FAS) in 1902. The Academy nomi- nated only Henri Becquerel and Pierre Curie. If the Swedish mathematician Magnus Goesta Mittag-Leffler, an advocate for women, had nominated Curie, she might have won.

In 1911, FAS rejected Curie’s bid to become a member and finally chose for the honor. Curie appears to be a victim of explicit gender bias whereas Goeppert-Mayer may have faced an unconscious bias by the universities in not making an exception to hire her.

Today, many universities go out of their way to solve the “two-body” problem in attracting scientific “power” couples. The available nomination database up to 1966 [4], however, reveals that Goeppert-Mayer was a nominee for the Nobel Prize 27 times between 1955-1963, before she was finally chosen for the honor.

1964-2017: Missed Opportunities

History should not be erased, nor should it be forgotten. Consider three deceased women physicists, all examples of missed opportunities for Nobel recognition. Their excellent research represents three subfields of physics with direct impact on the award of Nobel Prizes to many men. It is not known if they were nominated or if the arguments by their nominators were not persuasive enough to bestow the honor on them.

Mildred Dresselhaus (died 2017) was rightfully dubbed the “Queen of Carbon.” She predicted that a sheet of graphene could be rolled into tiny, cylindri- cal carbon structures called nanotubes. Her research work, at least partially, inspired two other Nobel prizes - 1996 Chemistry (for fullerene) and 2010 Physics (for graphene).

Astronomer Vera Rubin (died 2016) did connecting work on galactic rotation that supported the theory of dark matter. Rubin never won a Nobel prize for this work; although many physicists believe she should have.

In 2011, Nobel Prizes honored three men (S. Perlmutt, B.P. Schmidt, and A.G. Reiss) for the discovery of the accelerating expansion of the universe attributed to dark energy, perhaps as ground-breaking as Rubin’s work about dark matter.

Physicist Chien-Shiung Wu (died 1997) did experimental work that led to the Nobel Prize for Lee and Yang, but she was left out. The Wikipedia entry about Lee is very telling. "After the definitive experimental confirmation by C.S. Wu and her collaborators of parity non-conservation, T.-D. Lee and C.-N. Yang were awarded the 1957 Nobel Prize for the "unbreakability of parity" "Physicist Nina Byers has called Wu’s absence from the 1957 Nobel “outrageous” and the science historian at Brandeis, Prina Ahir-Am, did not mince words suggesting that Wu’s ethnicity also played a role.

2018 and Beyond: Period of Hope and Challenge for Action

The award to Strickland revives our hope yet again after 55 long years. However, we must not leave things to chance for the next woman Nobel physicist. We must move from hallway conversations to actively nominating our colleagues. Contrary to belief, the Nobel Prize process is not entirely mysterious; a set of short videos [7] from an interview with a member of the Nobel Committee for Chemistry is a good source of how the selection process works. While not every physicist can directly nominate candidates for a Nobel, the Nobel Laureate in physics are among the long list of those who can.

The selection process begins with the Nobel Committee for Physics (now chaired by a woman with five male mem- bers) followed by a discussion among the larger group of the “Class for Physics.” The members of these groups are not obvious but available with due diligence on the RSAS website [8]. The majority vote by the RSAS (with over 600 Swedish and foreign members) ultimately determines the Prize recipients each October. The RSAS members can also be contacts for nominations. Additionally, efforts by the science community to get more advocates for women on various committees will be needed. Remember that Mittag-Leffler’s advocacy in 1903 changed the course of history with Curie as the first woman Nobel laureate.

The most urgent and effective course of action is to get women physicists nominated. This year, RSAS’s Hanson said that the academy was taking measures to ensure more women are nominated [9] and “We don’t want to miss any- one.” Let us help RSAS in their stated goal and strive for 20 women physics Laureates by 2050. Our larger goal must be attracting and retaining more women in physics. We will be well served in the 21st century if the “Nobility” of Nobel Prizes has a narrower gender gap.

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1. The Nobel prize committee explains why women win so few prizes (up.com): go.aps.org/2yDvDaO.
2. Women’s representation in national science academies: An unsettling narrative (sajs.co.za): go.aps.org/2Q7iY1.
4. AIP.org/exhibits/curiescandal.htm.
10. The author is an emeritus professor and a life member of APS, having served in various academic leadership positions at several institutions.