The Physical Review Celebrates its 125th Anniversary

In 1893, the newly founded journal The Physical Review published its first research paper, one of five in the inaugural issue. Since then, the Physical Review family of journals has grown to encompass 14 high-quality publications.

This year, APS celebrates 125 years of excellence in physics publishing in the Physical Review journals. Throughout 2018, APS News will publish editorials, articles about the history of the Physical Review collection, and profiles of each of the Physical Review journals.

To kick off the anniversary, we start with a Back Page article by APS Publisher Matthew Saltier and APS Editor in Chief Michael Thoennessen.

Announcing Inaugural PhysTEC Fellows

By Thomas Hone, PhysTEC Project Coordinator

The Physics Teacher Education Coalition (PhysTEC) announces its inaugural cohort of PhysTEC Fellows: teams from five different institutions were selected from among many applicants to receive recognition and support to build and enhance physics teacher education programs. These Fellows come from Indiana University-Purdue University Fort Wayne (IPFW), Texas A&M University-Commerce (A&M-Commerce), University of Houston, Wright University, and Worcester Polytechnic Institute. Each of these institutions not only showcased a strong desire to grow and improve their physics education program, but also provided compelling plans to do so. Since 2001, the PhysTEC project, led by APS and AAPT, has worked to address the severe national shortage of qualified high school physics teachers. In July 2017, the project received a $3.375M from physics teachers. In July 2017, the shortage of qualified high school to address the severe national by APS and AAPT, has worked 2001, the PhysTEC project, led compelling plans to do so. Since 2001, the PhysTEC project, led

PHYSTEC continued on page 6

Physics: Highlights from 2017

The editors of Physics select their favorite articles from the past year (reprinted from physics.aps.org).

Multimessenger Astronomy Makes an Explosive Entrance

2017 was another sensational year for gravitational-wave detection. Days after the Nobel Prize in Physics was awarded to three leaders of the decades-long search for these spacetime ripples, the LIGO and Virgo collaborations announced the detection of a gravitational-wave signal emanating from the merger of two neutron stars (see the Viewpoint Neutron Star Merger Seen and Heard at physics.aps.org/articles/v10/114).

If this achievement wasn’t enough, multiple telescopes around the world also captured the myriad electromagnetic fireworks accompanying this merger. For the first time, electromagnetic signals and gravitational waves were detected from the same source, heralding a new era of astronomy in which scientists can both watch and “listen” to objects in the cosmos. Virgo coming online and adding one detector to LIGO’s two was essential.

Physics Next Workshops Topic Suggestions for August 2018

APS is currently soliciting ideas for a Physics Next workshop to be held in August 2018. This workshop series was launched in 2017 and is aimed at fostering new and emerging areas of physics research, focusing on topics that straddle traditional subject boundaries and are starting to “emerge from the noise.” Two workshops have been organized so far: “Material discovery and design” in May 2017 and “Quantum fields and condensed matter” in August 2017. A third one “Physics of living matter” will take place April 24-27, 2018.

If you want to suggest a topic for a Physics Next workshop, please send a short description of the workshop, including a proposed title, scope, and a preliminary list of top experts that might be interested in participating to physics-next@aps.org. The deadline to submit your idea is January 31, 2018. A committee of APS editors will review the suggestions and reach a decision by the end of February.

The goal of the Physics Next workshops is to provide small, relaxed gatherings to promote open and informal discussions and the exchange of information needed to help assess the promise and challenges of an emerging field. The workshops comprise a limited number of presentations and leave considerable room for informal conversations, round-table discussions, and social activities. Physics Next workshops strive to include a mix of senior-, mid-, and early-career physicists.

The workshops are held on Long Island (NY), in close proximity to the APS Editorial Office, to promote interactions with the editors of the Physical Review journals.

While the scientific program is the main focus of the event, organizers of the APS editorial and conference offices will provide logistical and financial support, including covering local expenses of the participants. Limited funds are also available for additional support in some cases. Further information on the Physics Next workshops is available at journals.aps.org/physics-next.
Indo-U.S. STEM Education and Research Center in India

By Sulaima N. Nahar

The Ohio State University (OSU), jointly with Aligarh Muslim University (AMU) in India, has established an Indo-U.S. Center of Excellence in Science, Technology, Engineering, Mathematics Education, and Research (STEM ER) center.

The center is the culmination of a five-year partnership of OSU with AMU under the Obama-Singh (now Indo-U.S.) 21st Century Knowledge Initiative award (2013–2017) to support faculty training of Indian postgraduate students in STEM disciplines. With the project, OSU has developed a unique two-year dual degree master’s in education program that trains Indian students to acquire world-class teaching skills at the undergraduate level (in contrast to high school) and carry out a research project with an OSU advisor in his or her discipline that constitutes a chapter in a Ph.D. thesis.

Such research experience is of crucial importance so that the student can begin long-term collaboration with colleagues in the U.S. and initiate and lead projects in India. Needs to train at least 300,000 faculty members for Indian AMU from the departments of mathematics, physics, chemistry, biotechnology, nanotechnology, mathematics, and zoology were trained at OSU during 2014-2017. Due to lack of funds, only four of them would have been able to enroll in STEM education classes.

The project founded a STEM ER center in 2013 to carry out various activities of the program under the Knowledge Initiative award. The center conducted online interviews and distance learning courses, organized an international conference at STEM ER in 2016, and collaborated on two nanotechnology conferences, Aligarh NANO IV and V.

Anil Pradhan and I founded the center, from the initial concept to securing the physical space at AMU with the support of the AMU administration led by the past Vice Chancellor Zameer Uddin Shah. In April 2017, the center was formalized with legal and financial structures that can bring funds to (i) continue the program on STEM education and research for the postgraduate students and extend it nationally to enroll students from other Indian institutions and (ii) carry out outreach STEM activities for underprivileged school students, for which we have now received funding.

The STEM ER center is now in operation and it has been named after the Indian scientist A. P. J. Abdul Kalam, who later served as a President of India. Activity is underway for a team of OSU-trained students to build an advanced STEM ER structure at the Jahangirabad Institute of Technology in Gorkakpur, with Indo-U.S. continued on page 7

This Month in Physics History

January 1, 1995: Confirmation of the Existence of Rogue Waves

For centuries, scientists believed rogue waves were a myth, despite eyewitness accounts from returning mariners. The 19th century explorer and naval officer Jules Dumont d’Urville made a name for himself as a botanist and cartographer, sailing around the world on various expeditions. Yet for all his fame and prestige, when Dumont reported seeing rogue waves over 100 feet high on his voyages, bolstered by three eye-witnesses who'd be with him, his claims were dismissed. Prime Minister François Arago publicly ridiculed him.

The skeptics based their doubt on the then-current scientific consensus that waves of such size simply did not exist. The standard model was that oceanographers, engineers, and meteorologists used to predict wave height largely ruled out giant rogue waves. And eyewitness accounts were few and far between, perhaps because most mariners who encountered such a wave rarely returned to tell the tale. With the advent of steam-hulled ships in the 20th century, the probability of survival increased dramatically—and so did the number of reported sightings.

A Scottish oceanographer named Laurence Driper wrote the first scientific account about rogue waves—he called them “freak waves”—in 1964, detailing efforts by the National Institute of Oceanography in Southampton to study rogue wave heights. Ironically, Driper—who trained as a physicist at Nottingham University—suffered from clinical seasickness, and initially feared it would derail his career. “I expect I had better resign... I am no good at sea,” he told his employer after falling ill on his first working expedition. Instead, he put his scientific talents to good use on dry land and made his name as an expert in wave analysis and prediction. He came by his fascination with waves after stumbling upon a newspaper article on how ocean waves can adversely affect military operations.

Driper based his 1964 analysis on records made by a British weather ship in the North Atlantic. At the time, the highest wave wave was reported to be about 67 feet. Most oceanography textbooks didn’t even mention the possible existence of rogue waves. “[F]ar from ridiculing the old sailors’ stories about enormous waves, modern research has confirmed that such monsters can occur, and that wave heights can exceed by an appreciable amount the maximum values which have been accepted in responsible circles,” Driper wrote in 1971.

The first real measurement of a rogue wave occurred on January 1, 1995. It was recorded by a laser detector on the Draupner oil-drilling platform, owned by Statoil, which was located 100 miles off the coast of Norway. Statoil built the platform to withstand a wave of 64 feet, with a probability of occurring once every 10,000 years. Yet the “Draupner wave” of 1995 measured a whopping 85 feet—21 feet taller than predicted—and its characteristics didn’t fit any previous wave model.

Stans’l scientists followed up in 2000 with a paper concluding that, from far being an ultra-rare phenomenon, rogue waves were likely more frequent than previously believed from prior models. (This has since been confirmed by various satellite radar studies.) That same year, a British vessel called the RRS Discovery recorded a 95-foot rogue wave off the coast of Scotland, which made headlines because none of the theoretical models predicted such a wave under the conditions at the time.

In fact, there could be as many as ten rogue waves forming in the world’s oceans at any given moment. This would explain the mysterious sudden loss of several ships, such as the cargo ship MS Münich in 1978 and the MV Derbyshire in 1980. Like the Titanic, the Münich was thought to be unsinkable, yet the ship and her crew were lost at sea, with a single starboard lifeboat recovered from the floating wreckage offering the first physical evidence of the force of rogue waves. The damage to the lifeboat was such that the wave that hit the ship must have been around 65 feet high.

The National Oceanic and Atmospheric Administration put together a catalog in 2007 listing 50 historical maritime incidents that were most likely due to rogue waves. Rogue waves may...
Physicist is not a profession most people routinely encounter. Even physics students may never have met a physicist outside of the classroom. Yet only a small fraction of Ph.D. physics graduates find careers in academia [1,2]. The APS Committee on Careers and Professional Development and the Forum on Industrial and Applied Physics (FIAP) endeavor to inform physicists of the many other career options open to them.

One communication channel is the Distinguished Lectureship on the Applications of Physics. Each year one Distinguished Lecturer is chosen to give a talk to a broad audience of physics students and others interested in how physicists productively interact with the wider world.

Rudolf tromp, a scientist at the IBM T.J. Watson Research Center in Yorktown Heights, NY, received the Distinguished Lectureship Award in 2017, for “exhaustive and significant contributions to the field of surface physics.” He delivered his inaugural lecture at the 2017 APS March Meeting in New Orleans, under the title “So you want to learn about the ocean? In his talk, which he has now given a half-dozen times in both the US and Europe, he discusses some of the challenges that today’s students experience, ranging from an extreme paucity of jobs in the academic sector (even though today’s students experience, ranking from an extreme paucity of jobs in the academic sector even though a majority of students expects to find employment there), to mental health issues and a lack of a compelling vision for the future.

Tromp reassures students that failing projects are a part of being a scientist, not a personal shortcoming. “You have a degree in physics. Now you are a scientist, not a personal shortcom...
The Harvard Computers

I enjoyed your “This Month In Physics History” article on Henrietta Swan Leavitt, which appeared in the December 2017 issue of the APS News. Some of the wording, however, helps to perpetuate a prevalent myth about the origin of the female Harvard Computers. The article could leave the impression that Williamina Fleming was the first woman to be hired at the Harvard College Observatory, and that Charles Pickering was the first to hire female computers there. As Dava Sobel’s book, which is cited in the article, details, the first female computer at Harvard was Anna Wintloch in 1875, hired before Pickering became director. The process accelerated quickly from there.

Pickering became director. The prevalent myth is that Williamina Fleming was the first woman to be hired at the Harvard College Observatory, and that Charles Pickering was the first to hire female computers there. For one thing, the prevalent myth places the idea for hiring female computers at the feet of Charles Pickering, solely as a way of getting better performance for less cost. Pickering did not initially pay female computers less than male computers, although he did favor a large staff of computers to reduce the expense of hiring professional astronomers, who at the time were all male. Over time, as the skills and duties of the women developed, they were doing the jobs of astronomers but paid at a much lower rate as computers, but that was not the case at their initial hiring.

Why are these details important? For one thing, the prevalent myth places the idea for hiring female computers at the feet of Charles Pickering, solely as a way of getting better performance for less cost. But Maria Mitchell, one of the most prominent American astronomers of the period (and herself a former computer for the United States Coast Survey) and someone who had worked closely with all of the previous directors of the Harvard College Observatory, gave a major speech in 1876 arguing in favor of women being hired into such roles. Pickering would surely have been aware of those views, and at times alluded to the ideas Mitchell expressed. Ironically, in leaving out Mitchell’s role in encouraging the hiring of female computers, the contributions of a key female scientist are inadvertently suppressed.

These ideas are covered in more detail in my recent book from Princeton, MIT, U. Texas and ORNL (Oak Ridge), PPL (Princeton), MIT, U. Texas and U. Wisconsin. Over the past three decades, all those facilities have been shut down, some because they were backing the wrong horse (mirrors, pinches, or multipole), and the others because of engineering inadequacies or severe managerial incompetence.

Today the large fusion facility at GA soldiers on alone in USA magnetic fusion, as far as large facilities are concerned. Was this outcome foreseen by the Doublet Dudes?

Daniel Jassby
Plainboro, New Jersey

Gravitational Waves

The article on the 2017 Nobel Prize (APS News, November 2017) states “Gravitational waves from distant cataclysmic events propagate as compressions and expansions of spacetime.” This is rather misleading, because suggests gravitational waves are locally isotropic compressions and expansions, as in sound waves in a gas. In fact, a better description would be “transverse shear strains.” Also, “spacetime” is like a medium because the metric is a dynamical field. So it would be more accurate to say “transverse shear strains of the spacetime metric.” Why not be more accurate when it’s so easy to be so?

Ted Jacobsen
College Park, Maryland
First Harry Lustig Award Winner Announced

By Andrea Palounek

Sarah L. Bromley from the University of Colorado, Boulder, emerged as the first winner of the APS Four Corners Section’s new prestigious Harry Lustig Award—and boy, what a competitive and exciting session it was!

If anyone had any doubts about the outstanding abilities of our young colleagues, the exciting, stimulating and thoroughly enjoyable award session put them to rest for good.

The three finalists were: Chandramouli Nyshadham (Brigham Young University), “Materials Prediction Using High-Throughput and Machine Learning Techniques,” Andrew Missert (University of Colorado, Boulder), “Neutrino Oscillation Measurements Using a Maximum Likelihood Event Reconstruction Algorithm,” and the winner Sarah L. Bromley (University of Colorado, Boulder), “Probing Many-Body Physics in an Optical Lattice Gas.” They were chosen from an impressive field of nominees whose topics spanned all of current physics, a testament in itself to the breadth of science being done in the Four Corners States.

The special Harry Lustig Award session during the annual Four Corners Section Meeting at Colorado State University in Fort Collins included twenty-minute talks from each of our three finalists in which they described their research. It was a difficult decision but eventually Ms. Bromley’s talk won the day.

The annual Harry Lustig Award recognizes exceptional graduate-level work done in one of our states, and consists of a $5,000 award and a certificate of acknowledgement. It honors Harry Lustig, who taught physics at CCNY, was APS Treasurer from 1985 to 1996, and was instrumental in the creation of the Four Corners section in 1997.

The deadline for nominations for next year’s award is July 10, 2018. For more information visit go.aps.org/2C6hPae or email lustigaward@aps.org. As the award is not yet fully endowed, anyone wishing to make a contribution to this important new award should send donations to Irene Lukoff, Director of Development, or through the “donations” tab on their APS member profile page.

The author is secretariat/treasurer of the APS Four Corners Section.
Being among the highest pro-
ducers of STEM teachers in the
state of Texas, A&M-Commerce
has shown an institutional focus
on teacher education. They are also
currently on track to becoming
a Hispanic Serving Institution
(as defined in the U.S. Higher
Education Act of 1965). Over the
past few years they have over-
hauled their physics teacher prepa-
ration program. Fellows William
Newton and Robynne Lock will
build on this by establishing men-
toring for pre-service teachers and
formalizing a track to becoming
a certified teacher through their M.S.
in Physics.

With 80% of its graduates
remaining in the Houston area,
the University of Houston seeks to
expand its role in addressing the
local shortage of physics teach-
ers. They are a UTeach replica-
tion site (uteach.utexas.edu) and
have established a high-quality
certification program for STEM
teachers. Fellows Donna Stokes,
Paige Evans, Rebecca Forrest, and
Shari Weaver will increase aware-
ness by encouraging their faculty
to promote the teacher prep program
in their freshman physics classes.
They will also develop informal
and formal teaching experiences,
including summer programs, out-
reach to local schools, and Learning
Assistant positions.

PhysTEC supports such activi-
ties to help these institutions grow
and improve their physics educa-
tion programs. They will be given
access to tools and strategies to
improve their programs, help to
build institutional support, and the
opportunity to learn from the entire
PhysTEC Fellow cohort. This pro-
gram will also demonstrate what
other external resources are avail-
able for physics teacher prepara-
tion and will help them increase
their competitiveness for funding opportunities.

(A) by and Mike Mayo (TX). Each
stressed a key message, including
the importance of federal invest-
ment in science and the nation’s
science infrastructure, as well as the
critical value of science, technol-
yogy, engineering, and mathematics
(STEM) education. The articles are
archived at: aps.org/policy.

The aforementioned authors
met with the local congression-
al offices, often with positive
results. For example, in the case
of Jessica Winter of The Ohio State
University, U.S. Sen. Rob
Portman’s staff in Ohio visited
the campus to meet with her and her
colleague Chris Hammel and tour
the physics department.

In most cases, the combination
of the op-ed, grassroots advocacy,
and a local meeting generated
favorable and demonstrable support
for science as the targeted member
of Congress.

Nationwide Advocacy
Campaigns

APS OGA ran 15 national,
unit-specific advocacy campaigns in
2017, which included activities during
several APS meetings. The staff
worked with unit executive
committees to craft messages and
with the APS Communications
Department to send emails to unit
members.

Campaigns for the Division
of Nuclear Physics (DNP) and
Division of Particles and Fields,
which involved members of the
Topical Group on Hadronic Physics
(THP), urged support for federal
science funding, with examples of
nuclear science and high energy
physics. The Forum on Education
(FED) addressed science education
funding, specifically for teacher
preparation and informal programs,
amplifying Karen King’s op-ed.

The Forum on Physics and
Society advocated for Congress to
increase the current caps on the
federal budget. APS OGA also
participated with the Society of
Physics Students to stress the
importance of federal funding that
enables undergraduate research,
such as the Research Experiences
for Undergraduate Program. The
Forum on Graduate Student Affairs
(FOGSA) advocated rejecting a pro-
sal in the House “Tax Cuts and
Jobs Act” that would tax graduate
students’ tuition waivers.

The various campaigns often
had substantial APS member par-
ticipation and produced results.
For instance, APS OGA worked with
FGSA to first encourage the
Senate to reject the House proposed
tax on tuition waivers, and then to
ask both chambers to not include
it in the overall bill—reaching out
especially to members on the con-
ference committee negotiating the
final version. The second phase also
involved the Forum on Early Career
Researchers (FECR) and about 2,500
people sent nearly 7,000 messages
to Congress in this two-stage cam-
paign. Receipts included 27 out
of the 285 members of the conference
committee—and this tax was ulti-
ately not included in the final tax
tax reform bill.

Physics Students Met with
Congressional Staffers During
Poster Sessions

During the 2017 APS March,
Division of Atomic, Molecular,
and Optical Physics, and DNP meet-
ings, APS OGA staff escorted con-
gressional staffers to the student
poster sessions to hear from local
students. In March, physics stu-
dents had opportunities to share the
impact of their research with staff-
ners representing Sens. Bill Cassidy
(R-LA) and John Kennedy (R-LA).
I’ve very much enjoyed the oppor-
tunity to educate Senate staffers on
Louisiana’s relationship to agencies
such as NSF and DOE, using my
personal experiences,” said Noah
Rhine, a Tulane University stu-
dent researching solar cells.

In October, students who
attended the DNP meeting in
Philadelphia were elated to discuss
their research with a staffer rep-
resenting U.S. Sen. Bob Casey
of Pennsylvania.

“This opportunity was surpris-
ing. Usually, the only people who
ask me about my research are the
other physics majors, graduate stu-
dents and professors,” said Morgan
Benninghoff, a junior at Duquesne
University whose research on
detectors could impact proton
therapy treatments.

APS OGA’s Government
Relations Specialist Greg Mack
said his office’s work with APS
units was an effective form of advo-
cacy through 2017. Francis Skiley,
APS Director of Government
Affairs added, “We’ve established
an effective partnership that we’ll
build on in 2018.

Additional Key Science Policy
Initiatives

Through APS OGA’s new
online Advocacy Dashboard, APS
members can be advocates at any
time on the Society’s main issues
of the federal budget, energy and
the environment, education, visas/
immigration, and critical resources.
APS OGA worked on these issues in
2017 through its lobbying efforts
and activities with the APS Panel
on Public Affairs (POPA).

In February, POPA issued
its firstever report on an educa-
tion issue: “Recruiting Teachers
in High-Needs STEM Fields: A
Survey of Current Majors and
Recent STEM Graduates,” which
examined students’ attitudes toward
the profession to deter-
mine how more of them might be
encouraged to pursue it as a career.

In April, APS OGA hosted
a workshop examining the use
of neutrons in research and how to
meet those needs without the use
of highly enriched uranium.
This workshop was broadcast live
online to more than 50 participants
who were able to pose questions
to expert speakers and study com-
mittee members. The information
gleaned from this workshop will
inform an APS POPA report, to be
released early 2018. A story with
further detail is slated to be pub-
lished in APS News in March.

Regarding energy and the envi-
ronment policy, the APS Council
approved a new statement on
global energy in April, which was
shepherded through the state-
ment review process by the APS
OGA staff. Additionally, the office
recently completed its first portion
of the APS greenhouse gas inven-
tory, which is detailed in an article
in the December 2017 edition of
APS News.
Physics continued from page 1

AWARD continued from page 3

publications from the above list; and one video clip of the nominee giving a presentation, which need not be the proposed distinguished lecture, but any talk highlighting presentation skills. The recipients chosen in August 2018 will deliver his or her first talk at the March 2019 Meeting. More information is available on the Distinguished Lectureship homepage; female and underrepresented minority nominees are especially encouraged: go.aps.org/2DKHJ4G

References
1. go.aps.org/2pJ9v7K
2. go.aps.org/2BDDjVx

Prepared with contributions from R. Kleinberg, FIAP’s 2018 Distinguished Lectureship awardee, R. Tromp, 2017 awardee, T. Brandtlinger (focuslecture selection committee) and C. Bailey, APS Careers Program Manager.

InDO-U.S. continued from page 2

largely undergraduate students. For the outreach component, I have proposed the “Women in STEM Roadshow” program of the US-India mission, which has received a grant from the U.S. Department of State. We will be holding nine workshops (in Aligarh, Delhi, Hyderabad, Kolkata, Kurnool, and Patna) with

year-long follow-up activities to encourage and help female college students study STEM fields in the U.S. and in India.

Sultana Nahar is professor of astronomy at The Ohio State University, co-director for the Research and Liaison Office of the STEM ER Center, and adjunct professor of physics at AMU.

PHYSICS continued from page 1

rial to achieve this triumph (see the Focus Three-Way Detection of Gravitational Waves at physics.aps.org/articles/v10/1010). With three detectors running, the scientists were able to more accurately pinpoint the source of the gravitational waves, localizing it to a patch of sky small enough for telescopes to survey.

Cooking Up a Time Crystal

Time crystals are quarky states of matter whose structure repeats both in time and in space. The idea, theorized five years ago by Frank Wilczek (see the Viewpoint Crystals of Time at physics.aps.org/articles/v5/116), was that quarky particles proved that time crystals cannot exist in thermal equilibrium. But this year, a quartet of U.S.-based scientists exploited an open loophole in the argument against time crystals: such states can exist in nonequilibrium systems that are driven periodically by an external force. The researchers presented a recipe for cooking up a time crystal using a string of cold, trapped ions (see the Viewpoint How to Create a Time Crystal at physics.aps.org/articles/v5/105).

In their scheme, the ions are subjected to periodic spin-alignment pulses. The team predicted that the ions would evolve to form time crystals, whose signatures would be periodic oscillations in the spins’ magnetizations. Within three months of the proposal, time crystals were realized in two different systems: a chain of trapped atoms and spin impurities in diamonds.

Quantum Cause and Effect

Red suits and white beards are highly correlated this time of the year, and statistical tools can verify that they share a common cause (or Claus!). However, similar infer-

cences are tricky in quantum phys-

ics. For example, two entangled photons are by their very nature strongly correlated, but a com-

mon cause (or “hidden variable”) is ruled out by so-called Bell-test experiments. To deal with these quantum peculiarities, researchers from the UK and Canada reworked the definition of causality (see the Viewpoint Causality in the Quantum World at physics.aps.org/articles/v10/86). The team based their model of quantum cause and effect on unitarity, which says that quantum information is conserved as a system evolves. Under their new formalism, one can determine whether a quantum system A is the common cause of two correlated quantum systems B and C by relating the probability distributions of quantum variables in the different systems. This quantum causality model could help in predicting the effects of pecking at information in a quantum cryp-

tography system.

Wi-Fi: The Radar That’s Everywire

A Wi-Fi router connects you to the world, but its microwave radiation can also be used to probe the makeup of its surroundings. According to researchers at the Technical University of Munich (see the Focus Imaging With Your Wi-Fi Hotspot physics.aps.org/articles/v10/50). This imaging is difficult because the router blasts radiation in all directions, which leads to multiple reflected images. The team solved this problem by processing Wi-Fi radiation data as though they were decoding a hologram—a 2D encoding of a 3D image. They placed a meter-sized cross between a router and a detector and scanned the detector across a 6-m² area, demonstrating that they could reconstruct an image of the cross. The team also simu-

lated the imaging of a small building’s interior, suggesting that the technique could be used to locate objects in a warehouse. Since the radiation penetrates walls, Wi-Fi imaging might eventually be used for law-enforcement purposes.

Cuprate Superconductors Not So Unconventional?

Copper oxide superconductors, or cuprates, hold the record for the highest critical temperature, but their behavior still defies theo-

erical explanation. It is generally believed that the standard theory of superconductivity, known as the Bardeen-Cooper-Schrieffer (BCS) theory, cannot adequately describe cuprate superconductors because it predicts certain signatures that have not been observed in these materi-

eals. Using a scanning tunneling microscope, a team of researchers in Switzerland and Germany found a hallmark of BCS supercondic-

vity in a cuprate compound: twirls of supercurrents containing pockets of nonsuperconducting elec-

trons (see the Viewpoint Cuprate Superconductors May Be Conventional After All at physics.aps.org/articles/v10/129). While the results don’t yet clarify the mechanisms that make cuprates superconduct at high temperature, they suggest that a BCS-based description may hold the key to solving this grand puzzle of con-

densed-matter physics.

Glouns Provide Half of the Proton’s Spin

The glouns that bind quarks together in nucleons provide a considerable chunk of the proton’s total spin. That was the con-

clusion reached by Yi-Bo Yang from the University of Kentucky, Lexington, and colleagues (see the Viewpoint Spinning Glouns in the Proton at physics.aps.org/articles/v10/23). By running state-of-the-art computer simulations of quark-gluon dynamics on a so-called spacetime lattice, the researchers found that 50% of the proton’s spin comes from its glouns. The result

contribution—which according to experiments is only 30%—through a quantum effect called the axial anomaly. The remaining 20% of the proton spin is thought to come from the orbital angular momen-

tum of quarks and gluons.

WIMPs Are No-Show, Again

Of the many theories about dark matter, the most popular describes it as composed of weakly interact-

ing massive particles (WIMPs). But this “favored” theory is now looking a little, well, less favored. In the last 16 months, the collab-

orations behind the world’s three largest dark matter detectors reported that they had observed no evidence for WIMPs in the theoretically expected mass range. The experi-

ments all use mammouth vats of liq-

uid xenon, which are scrupulously shielded to avoid false signals from cosmic rays, to spot a WIMP’s interaction with regular matter. Writing in January about the null results from the LUX experi-

iment in the U.S. and PandaX-II in China, Jodi Cooley said that some physicists suggest that the simplest WIMP model (see the Viewpoint Dark Matter Still at Large at physics.aps.org/articles/v10/129). But this “favored” theory is now looking a little, well, less favored. In the last 16 months, the collabora-


A Tale of Two Anniversaries: 125 Years of the Physical Review and 25 Years of Physical Review E

By Matthew Salter and Michael Thoennessen

In July 1893, Ernest F. Nichols, then a professor of physics at Colgate University and later president of Dartmouth College and MIT, published an account of fundamental research in spectroscopy entitled “A Study of the Transmission Spectra of Certain Substances in the Infra-Red.” The paper, which appeared 125 years ago this year was the first ever to be published in The Physical Review. [E. F. Nichols, Phys. Rev. 1 (1893) 1].

The first issue of The Physical Review, covering the months of July and August 1893 was a slender one. Nichols’s paper was one of just five articles published in the inaugural issue, which contained a mere 80 printed pages.

How times have changed; fast forward to 2017. In the same period—July and August—almost 3,500 original research papers and more than 33,000 pages were published in the Physical Review journals which had by then expanded to a portfolio of 13 peer reviewed general and specialist titles. The remarkable growth in volume and breadth of The Physical Review—publication of which was taken over by the American Physical Society (APS) in 1993—has tracked the increase in understanding and profile of physics, and has been made possible by the great vision of past leaders of the Physical Review and the APS.

The landscape of scientific publication has changed significantly in the 125 years since E. F. Nichols’ inaugural paper graced The Physical Review, but the Physical Review journals have proved equal to the challenge of meeting the constantly evolving requirements of the physics research community. An early innovation was the launch of Reviews of Modern Physics (RMP) in 1929 which fulfilled the demand for a high-quality journal offering authoritative accounts of the current state of the increasingly numerous and diverse fields in physics. Revolutionary at the time, RMP quickly established a reputation as the foremost reviews journal in physics, a position it has maintained for almost nine decades.

“The landscape of scientific publication has changed significantly over the past 125 years but the Physical Review journals have managed to meet the constantly changing requirements of the physics research community.”

Another challenge came with the research boom of the post-war period which brought with it a growing need for swift publication of high-profile results. This led to the creation in 1958 of Physical Review Letters—the world’s premier physics letters journal—which for 60 years has published short, high-quality reports of significant and notable results in the full arc of fundamental and interdisciplinary physics research.

Further growth in the number of papers published in The Physical Review led to its division into a number of individual topical journals—Physical Review A-D in 1970 and Physical Review E in 1993. In subsequent years a number of specialized journals focused on individual research fields were added. Other advances and challenges made possible by technology, such as online electronic publishing and most recently the demand for open access publishing have all been embraced by the Physical Review journals.

Over the 125 years since the publication of Nichols’ inaugural paper, the Physical Review portfolio has grown into the largest and most complete suite of physics journals in the world. As of 2017, this comprises 13 peer-reviewed journals—of which three are fully open access—publishing over 19,000 original research and review articles. Many of these were highlighted in the free APS online commentary journal Physics—just one way in which APS adds value to the high-quality research it publishes.

From Robert Millikan’s famous oil drop experiments to the discovery of gravitational waves, many history-making discoveries have been published in the Physical Review journals. To celebrate the 125th anniversary of The Physical Review, throughout 2018 APS will spotlight one paper of great importance per week from the journals that document the tremendous advances in physics as they appeared to our readers.

Choosing these articles, which will be made free to read, was a tremendously difficult task and resulted in much passionate debate among the editors. Many other worthy papers could easily have been included and even some papers cited in the awarding of a Nobel Prize did not make the final cut.

All selected papers are displayed on a timeline at the website journals.aps.org/125years along with landmark events in the history of the Physical Review. Throughout 2018 we will also highlight these papers on social media (#PhysRev125) and we hope and anticipate that this selection will spur lively conversations within the physics community. We encourage you to join the discussions either online or in person with the editors at one of the many meetings they plan to attend around the world. A list of these meetings can be found on the individual journal websites. Please take these opportunities to meet the editors who are always open for suggestions, criticism, as well as praise.

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In addition to the 125th anniversary of The Physical Review, 2018 also marks the 25th anniversary of Physical Review E. This landmark will be celebrated by spotlighting one article—25 in total—from each year of publication. Each of these seminal articles in statistical, nonlinear, biological, or soft matter physics will be marked as a PRE Milestone and will be featured on the journal’s website.

While reminding us of our history, anniversaries also provide a valuable impetus to look to the future. In their first 125 years the Physical Review journals have made significant contributions to the dissemination of science. As physics continues to grow and form synergies with other fields of science, the Physical Review journals will again need to adapt to the changing needs of this broad and expanding community to remain current, compelling, and relevant.

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The scientific publishing landscape itself will surely continue to evolve at increasing speed in the years to come. Input from all our stakeholders—authors, referees and readers—will as always be crucial to ensuring that the Physical Review journals anticipate and prepare for these changes so they continue to meet the needs of the community for the next 125 years and beyond.

Matthew Salter is APS Publisher. Michael Thoennessen is APS Editor in Chief. This article was reprinted from the Physical Review website (journals.aps.org).