2016 Nobel Prize in Physics
By Rachel Gaal

This year’s Nobel Prize for physics was awarded on October 4, with one half to David J. Thouless of the University of Washington, Seattle, and the other half to both F. Duncan M. Haldane of Princeton University and J. Michael Kosterlitz of Brown University. The committee’s official citation reads, “For theoretical discoveries of topological phase transitions and topological phases of matter.”

In the early 1970s and 1980s, these three physicists explained phenomena in quantum states of matter, such as the quantum Hall effect and superfluid phase transitions, using the mathematical concepts of topology. They correctly predicted transitions in these unusual phases of matter. Moreover, their success has sparked an array of research with topological materials, which could be used in future quantum computers or in new generations of electronics and superconductors.

The collaboration of Kosterlitz and Thouless in the 1970s sought to challenge the theory that ordered phases and phase transitions could not occur in thin layers. With topology as a tool, they demonstrated that superfluidity can indeed exist in a thin layer as a result of a transition between topologically distinct phases of matter. Now recognized as a fundamental mechanism in condensed matter physics, topological phases have been identified in 1D materials, like chains of atoms, thin layers of matter (2D), and some 3D materials.

The applications of topology extended into Thouless and Haldane’s work in the 1980s, when they employed these concepts to unravel the magnetic properties of low-dimensional materials. They explained the study of magnetic atomic chains, and discovered that their topological nature supports quantum phases, which can indeed exist in a thin layer as a result of a transition between topologically distinct phases of matter. Now recognized as a fundamental mechanism in condensed matter physics, topological phases have been identified in 1D materials, like chains of atoms, thin layers of matter (2D), and some 3D materials.

From Quarks to Cosmos in the Nation’s Capital: 2017 APS April Meeting
By Rachel Gaal

Calling all physicists — it’s time to get ready to travel to Washington, D.C! The 2017 APS April Meeting will be held January 28 – 31, 2017, at the Marriott Wardman Park Hotel. The April Meeting (held next year in January to avoid the exploding cost of hotel rooms during the spring cherry blossom viewing season) will host exciting talks about quirky quarks, the vast cosmos, and much in between.

Expecting over 1,500 attendees, the organizers will welcome 130 invited speakers and offer three plenary sessions that cover topics of particle physics, astrophysics, nuclear physics, and gravitational physics. Government and political figures will speak on the theme of “Science Policy in the 21st Century” at Saturday’s plenary session. John Holdren, Director of the U.S. Office of Science and Technology Policy, and Cherry Murray, Director of the Office of Science, U.S. Department of Energy, will discuss the changing role of science within policymaking and their roles as physicists in the government. Rush Holt Jr., CEO of the American Association for the Advancement of Science (AAAS) will discuss the importance of promoting science among policymakers. Congressman Bill Foster, representing the 11th District of Illinois, will also join in the session to discuss his expertise in “physics on the hill” and as a U.S. representative.

The Kavli Foundation special plenary session, scheduled for Monday, will feature talks from Barbara Jack of Lawrence Berkeley National Laboratory...
An Election to Remember: Sex, Lies, and Videotape
By Michael S. Lubell, APS Director of Public Affairs

If you’re sick of seeing and hearing the presidential candidates do it over their indiscretions and worse, you’ve got plenty of company. But as a physicist, I am equally struck with the pendulum by which evidence has taken a back seat to the diatribe — or in the case of Donald Trump, the Tweet — of the moment. The debates, which have drawn record TV audiences, make a compelling case that facts no longer play the vital role they once did.

In years past, the debates were informed, albeit sometimes heated, discussions of the weighty issues facing the country. They were forums in which competing visions and political philosophies were on display. And if a candidate strayed too far from the question, it was the job of the moderator to intervene and get the dialogue back on track.

Should a candidate utter something patently false, the moderator was expected to challenge the speaker’s logic and refer to the evidence. After all, it was famously in 1976 when President Gerald Ford said, “There is no Soviet domination of Eastern Europe, and there never will be under a Ford administration.” Max Frankel of the New York Times was moderating the debate and interrupted, “Did I understand you to say, sir, the Russians are not using Eastern Europe as their own sphere of influence and occupying most of the countries there and making sure with their troops that it is a Communist zone?”

The recovery from his factual error but only succeeded in digging himself an even deeper hole. His misfire, which Frankel highlighted, might well have cost Ford the election.

Scroll forward 40 years, and platforms for debates have been rewritten. The “gaffes” that made the headlines in this year’s high-stakes verbal jousting. Donald Trump wins the fairplay context hands down, but Hillary Clinton gets heat for tangling from the Pinocchio syndrome, although on a far smaller scale. More mud-slinging, moderators — and journalists more generally — have largely failed to hold the candidates’ feet to the fire. The truth-stretching or less, decorously, lying has become so common that it has birthed a new cottage industry — fact-checking. Evidenced-based arguments have become a vanishing expectation.

The post-debate TV analysis used to revolve around spin room dissection. But this year, it has focused on the pendulum by which scoring the candidates — particularly Trump — have been able to twist factual threads into whole cloth lies and get away with it.

The visceral response of an informed public has been to paint both candidates with a broad brush and reject the fact-checking juices really flow. Within days almost a dozen women surfaced, going on the record saying that Trump’s locker room banter was far more than banter. None of that dislodged Trump’s core supporters, who, polls showed, remained fixed on Hillary Clinton’s 33,000 emails that disappeared from the private server she had used when she was Secretary of State.

Which finally leads me to the issue of polling and some of the head-scratches that illustrate lack of scientific rigor. Let’s start with the easiest: one online voting that showed Trump thrashing Clinton in the second debate. In that instance, the sample was self-selected. It wasn’t really a poll, everyone who went to Trump and Fox News’ Sean Hannity claimed it was.

But what about the Los Angeles Times / University of Southern California survey? A poll that got consistently showed Trump significantly over-performing relative to other surveys? Trump and his supporters cited it repeatedly.

I did a little digging and found that Nate Cohn of the New York Times had beaten me to it. His October 16, 2016 “Upshot” analysis is a gem and worth a read for ELECTION continued on page 6
Ig Nobels 2016: The comical methods that makes you think

By Rachel Gaal

Dressed in old wedding gowns, tab, or coats, or maybe their daily work attire, a crowd showed up with ridiculous amounts of paper, and a note saying, "Scores of scientists were anticipating the countdown to launch paper airplanes at various human targets and keen to kick off the 2016 First Annual Ig Nobel prize ceremony in Cambridge, Massachusetts. Each prize winner was celebrated for producing research that "makes people laugh, then think.""

This year, an astounding 10 Ig Nobel prizes were given to the ceremony at their own expense to shake the hands of a group of gathering researchers. Nobel Laureates who presented the prizes. Among the distinguished guests was 2005 physics prize laureate Andrew Strominger of Harvard University, prior to discussing their work in "Quarks to the Cosmos." Jedidah Isler will discuss her role as the director of the Nuclear Science Division at LBL and as a lead member of the collaboration that built and operates the PHENIX detector at Brookhaven National Laboratory. Dvorkin will also discuss her experience as a Hubble Fellow at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. Cora Dvorkin of Harvard University, as a leading member of the collaboration, will discuss her work in "Quarks to the Cosmos." Jedidah Isler will discuss her role as the director of the Nuclear Science Division at LBL and as a lead member of the collaboration that built and operates the PHENIX detector at Brookhaven National Laboratory.

Dr. Isler's current research uses simultaneous measurements of neutrino and antineutrino activity, and superstring theory also will expand on what to expect during peer review. They can also stop by the "APS Poster Press" for their work on "discovering why black and brown color reflected highly and horizontally polarized light. This is bad news for any dragonflies that decide to lay their eggs on these attractive tombstones — the group saw that the bugs were fatally dragged away from their water-filled habitats, unable to relocate back to their homes. Also awarded was a psychology prize to Japanese scientists, "for investigating whether things look different when you bend over and view them between your legs," and a chemistry prize presented to Volkswagen "for solving the problem of excessive automobile pollution emissions by automatically, electromechanically producing fewer emissions whenever the cars are being tested." No one showed up to claim that prize. The winning team’s bizarre experiments, carried out in the vast farm valleys and graveyards in Hungary, looked at polarized light caused by reflection, whether off of an animal’s fur, or the surfaces of black polished tombstones. They found the darker the surface, the more polarized the light. And little bugs (in particular horseshoe and dragonflies) take a keen liking to surfaces that reflect horizontally polarized light, similarly to the way they are attracted to reflective surfaces of water. It was noted that the dark-horseted cows were targeted around the neck, backside, and hindquarters in their standing posture, usually due to the sunlight’s angle of incidence. And tombstones that were black in color reflected highly and horizontally polarized light. This is bad news for any dragonflies that decide to lay their eggs on these attractive tombstones — the group saw that the bugs were fatally dragged away from their water-filled habitats, unable to relocate back to their homes.

At least: Audience members throw paper airplanes at the stage during the 26th First Annual Ig Nobel prize ceremony at Harvard University in Cambridge, Massachusetts, September 22, 2016.

Related Information

See the Focus article "Topological Phases of Matter in Physics: physics.aps.org/articles/v9/116

Above: Nobel Laureate Dudley Herschbach presents the 2016 Ig Nobel Prize in Physics to Susanne Axesson of Sweden for work “discovering why white-haired horseflies are attracted to black tombstones,” and for discovering why dragonflies are fatally attracted to black tombstones.
The Beginning of Nanotechnology at the 1959 APS Meeting

By Katherine Kornei

The Cold War loomed large in Edwin Lyman’s experience as a physics graduate student in the 1950s. “[Ronald] Reagan’s Strategic Defense Initiative Program was getting into full swing then,” Lyman remembers, “and there was a lot of attention focused on the responsibility of scientists, particularly physicists, who engage in programs that might have moral implications.” When the time came for Lyman to select a thesis topic, he chose string theory and high energy physics, and he decided to minimize his potential military applications of his work.

As Lyman neared the end of his Ph.D. studies at Cornell, he became increasingly involved in discussions with colleagues at the nearby Huntington-Sheraton Hotel entitled “There’s Plenty of Room at the Top.” Feynman also talked about miniaturizing computers and creating perfect copies of miniscule devices.

Feynman also talked about miniaturizing computers and creating perfect copies of miniscule devices. He went on to discuss information processing and the problem of manipulating and controlling minute elements. “The lab I was working on … had all of the optics necessary,” Feynman said.

In 1985, Tom Newman was a graduate student at Stanford University in the electrical engineering department. His Ph.D. thesis work – which involved making very small lenses to observe quantum effects – was nearly complete.

When the bridge movement went into “torsional flutter.” “Torsional flutter” is a complex mechanism. “Flutter” is a self-induced vibration of a structure. This instability can grow to very large vibrations.

When the bridge movement changed from vertical to horizontal oscillation, the structure absorbed more wind energy. The bridge deck, which had been designed to control the wind vortex so the two were synchronized, the structure’s twisting movements became self-generating. In other words, the forces acting on the bridge were no longer caused by wind. The bridge deck’s own motion produced the forces. Feynman called this “self-excited” motion.

It was critical that the two types of oscillation, vertical and torsional, both occurred at relatively low wind speeds. Usually, vortex shedding occurs at relatively high wind speeds, 25 to 35 mph, and torsional flutter at high wind speeds, like 100 mph. Because of Feynman’s design, and others that followed, the Tacoma Narrows Bridge had a real passion for lithography.

When Pease was away at a conference on the east coast, Newman seized his opportunity to investigate Feynman’s challenge. “I decided to give it a big push for two days while he was gone. During that time, I was able to come up with the basis for how to do it.” Newman said. He made and tested a primitive, simple model and repeated the resolution and the size of the letters that contributed to increase. This formed a vortex, or swirling wind force, which further lifted and twisted the deck.

For the winning presentation, “vortex shedding” occurred in the Narrows Bridge as follows: [a] Wind separated as it struck the side of Galloping Gertie’s deck, the 8-foot solid plate girder. A small amount twirled occurred in the bridge deck, because even steel cannot bend and changes form under high stress. [b] The twisting bridge deck caused the wind vortex to separate and increase. This formed a vortex, or swirling wind force, which further lifted and twisted the deck. [c] The deck structure resisted the wind forces, or torsional flutter. This produced a “lock-on” event. [d] The deck structure resisted the wind forces, or torsional flutter. The deck structure resisted the wind forces.
Neutrons Spiral into a Hologram

They may not just for photons anymore. Researchers now report their success in using neutrons to make holograms, which could open up new patterns of interference between two coherent beams. Sarenac et al. describe in Optica Express (doi: 10.1364/OE.24.002528) a neutron holography setup employing a neutron interferometer that is based on the same principles used in optical holography. Here, a neutron enters the interferometer and is separated into two paths by a beam splitter, generating two interfering beams. The object beam is altered with a spatially varying phase after passing through the object. It then interacts with a spiral-phase plate (a device that imparts helicity), while the refer- ence beam, as in optical holography, is unaltered. The two beams combine at another beam splitter, and the output beams from this are spatially incoherent. Using an integrating counter, built up from and the output beams from this are combined at another beam splitter, passing through a test object called Nambu-Goldstone boson — a particle that arises from a broken symmetry. The key particle in interference is, naturally enough, the interferometer. If the authors assume it to be a Nambu-Goldstone boson, they conclude that interferos can exist in a warm thermal bath despite the rapid cool- ing effects of inflationary expan- sion. Previous models of warm inflation have required an absurdly high number of coupled fields, but the new theory only requires six particles. Moreover, the authors present observational predictions about cosmic micro- wave background radiation resulting from warm inflation and show that these are in agreement with recent results from the Planck satel- lite. (For more, see the Synopsis Little Higgs Gives Warm Inflation a Hand “In Physics.”)

Oxygen Nuclei Lie Near a Quantum Phase Transition

Using state-of-the-art computer simulations, researchers have dis- covered that some light nuclei can exist near a quantum phase transi- tion between a liquid-like collec- tion of neutrons and protons and a clumpier state involving clusters of alpha particles. Everyday phase transitions like boiling water are thermally induced, but quantum phase transitions are driven by quantum fluctuations even at zero temperature. Such transitions may play an important role in determin- ing how subatomic particles are arranged in a nucleus. In a paper in Physical Review Letters (doi: 10.1103/PhysRevLett.117.132501), Elhatisari et al. report their results of using a lattice Monte Carlo approach to calculate these new quantum effects on the stability of a wider range of nucleon interac- tions than previous studies, they found that, indeed, the nuclei are close to a transition between a so- called Fermi-liquid configuration and another state. The results are encouraging for looking at quantum phase transi- tions in carbon nuclei, which har- bor four additional nucleons. Such states are thought to be essential to life. The results may also provide insights into the production of carbon in the uni- verse. (For more, see the Viewpoint Uncovering a Quantum Phase Transition in Nuclei” in Physics, physics.aps.org/articles/v9/106)

A team from the International Atomic Energy Agency surveys the damaged nuclear reactor at the Fukushima Daiichi nuclear power plant. On March 11, 2011, a magnitude 9.0 earthquake and subsequent tidal waves that swamped Fukushima Daichi, an aging power plant built on the coast in Fukushima prefecture, set off a chain of events that led to the loss of primary and backup power — a worst-case scenario known as a “station blackout.” Workers were unable to pump sufficient cooling water over the plant’s nuclear fuel rods to keep them cool. The fuel rods then reached a critical temperature at which they start to disintegrate. In three reac- tors, the fuel rods boiled away their protective water bath and began to melt through their confinement vessels, releasing harmful radioc- able materials into the environment. As the disaster in Japan unfolded, Lyman and his col- leagues worked around the clock in Washington, D.C. to provide expert analysis about potential radiation leaks and the structural integrity of the reactor buildings. “We put some early analysis … at that time, I think I was one of the only commentators to predict that there would be meltdown and hydrogen explosions,” he says. “The media interest was astronomical, like nothing we’ve seen before.”

When Lyman provided testi- mony to the Senate Committee on Environment and Public Works on March 16, 2011 about the situation in Japan, he was asked whether a meltdown could also occur in the United States. His comments were sobering: “We have plants that are just as old, and we have had a station blackout. We have a regu- latory system that is not clearly superior to that of the Japanese. We have had extreme weather events that exceeded our expecta- tions and defeated our emergency planning measure[s], such as Hurricane Katrina.” In 2014, Lyman and his col- leagues at UC Berkeley published a book entitled Fukushima: The Story of a Nuclear Disaster. The book high- lights the events that preceded the meltdown at Fukushima Daiichi and argues that the regulations and safety protocols governing nuclear power plants in both Japan and the United States are not stringent enough. “Nuclear energy is hard. It’s hard to engineer, and it’s hard to go from a paper study to a func- tioning, reliable, operating plant,” Lyman cautions.

Lyman’s role as a communicator and spokesman of science continues to be a challenge. “[There has been] a shift away from fact-based rea- soning and an over-reliance of social media volume for actual facts,” he says. “In physics, there are plenty of controversies, but things do get set- tled with information. That is something that always happen in public policy.”

“[But] I do believe that persis- tence will pay off and facts and good analysis will ultimately prevail.”

Katherine Kornei is a freelance science writer in Portland, Oregon.

To tell you the truth, I don’t read them because I don’t have the time. It’s hard to engage in the academic system when you’re there to answer questions to help them meet a high scientific stan- dard. So I tell them, if you want my opinion, you’ll have to talk to me. Some of the people on my team will read the theories, though, and they’ll have opinions.

Do you think the large demand for these services means that the academic system is falling somehow? It’s not the academic system; it’s a problem with science communi- cation. These people are interested in topics like quantum gravity and foundations of quantum mechanics. But all they have is popular science writing on one side and textbooks on the other. If you start with popu- lar science, it’s very difficult to get to the other side. Physicists do it through ten years of education. I don’t think you can shortcut those ten years, but I’m trying to bridge that gap a little.

You’ve written that journalist- s make science seem too easy and can mislead readers to inter- pret their analysis too literally. How can science communicators improve on that? It’s difficult. Popular science articles often mislead the academic audience. They often end up target- ing the least common denominator and produce waffly, unnu- merical nuggets that don’t tell you much. I see nothing wrong with this, though. Many readers just want to be inspired or have something to talk about. But some readers want more and they’re the ones who get it badly wrong. One big misunder- standing is also about mathematics in theoretical physics. I find this very badly communi- cated in popular science. Because they don’t have the experience, they seem to think mathematics is optional and is something physi- cists do to offend other people. One way you can improve on this without scaring people away is to help them make connec- tion. You can have a flabby article that also includes options for the reader to choose different levels of detail. If someone is clear imagining clicking a button for addi- tional information. It’s not imposs- ible, but someone has to do it, and there’s no money and no interface for it right now.

What do you think is the responsibility of garden-variety physicists to communicate their work? They definitely need to com- municate their work within the community. But when it comes to communicating with the public, I don’t think scientists generally have an obligation to do this. Not every scientist is skilled at it, and I don’t see the point of forcing them to do it. But a current problem facing scientists who are good at science communication is that they’re not going to get paid for doing this. There are no points for teaching, for research, and for leadership positions, but public outreach isn’t really good for anything. Well, actually — you’ll get emails from people who want to share their theories with you. That’s what it’s good for.

Sophia Chen is a freelance science writer based in Tucson, Arizona.
On September 17, 2016, the APS Board of Directors approved the following two statements:

HEU Reactor Conversion

The Board of the American Physical Society supports the crucial need to reduce, with the goal of ultimately eliminating, the use of highly enriched uranium (HEU) fuel civilian research reactors for which the National Academies of Sciences, Engineering, and Medicine in its 2016 report Reducing the Use of Highly Enriched Uranium in Civilian Research Reactors has been enough to put Mr. Trump in double digits of support among scientists, need to be fact-checkers.

4. Political scientists, need to be fact-checkers.

5. Voting for Trump this year, it’s clear all of us, especially scientists, need to be fact-checkers.

On the contrary, most of the voters whom Trump managed to sway were people who...
**ANNOUNCEMENTS**

**The Kavli Microbiome Ideas Challenge** invites the broad scientific community to submit their ideas for groundbreaking experimental tools and methods for understanding microbial function. The Kavli Foundation has committed $1 million to this challenge. Grant proposals are due December 2, 2016 at 11:59 p.m. CST. The Kavli Ideas Challenge is led by the American Society of Microbiology, and carried out in partnership with the American Chemical Society and American Physical Society.

Learn more at kavlichallenge.org

---

**FEYNMAN continued from page 4**

Fortunately, Pease was enthusiastic about Newman’s pursuits, and the two men begin to repurpose their lab’s existing equipment. “The pattern generator that we had produced a square dot matrix of 512 x 512 pixels,” Newman explained. He determined how to convert a typed-in string of letters readable by humans into a string of bits readable by the pattern generator. Pease and Newman then used the pattern generator to scan a beam of electrons over a thin layer of poly(methyl methacrylate). When the electrons impacted the poly(methyl methacrylate), they broke bonds within the material’s organic molecules and rendered that area more soluble to a developer solution. “The developer solution eats away the area that's been exposed,” explained Newman.

Newman and Pease printed the first page of *A Tale of Two Cities* on a 200 × 200 micron square of poly(methyl methacrylate). The text occupied an area just under six microns on a side, which made it challenging to find on the square.

“I learned after the first time [of going to the microscope] to bring a map on a piece of paper,” said Newman. At this scale, the entire *Encyclopedia Britannica* could be printed on the head of a pin.

On October 12, 1985, Newman and Pease sent a telegram to Feynman at Caltech. The short message read: “Please advise if prize has been collected for reducing a page of text 25 thousand-fold to be readable in an electron microscope.”

“We had decided not to even bother him until we were certain that we could meet the spirit of the challenge,” Newman explained. Just a few weeks later, Newman was in the lab when a telephone call came through. “Someone said they were transferring a call to me from Professor Feynman. I was a little nervous taking the call,” said Newman. "The first thing Feynman said was something like 'Hey Newman, what are you guys doing up there?'”, Newman recounted. Feynman went on to say that the prize had not been claimed and that he was interested in seeing what Newman and Pease had produced.

On November 5, Newman mailed an envelope to Pasadena containing photos of his printing taken using a transmission electron microscope. “I didn’t have high hopes at that point that Feynman would agree that we met the challenge,” Newman said. “The image is kind of rough, and you’re seeing the resolution limit of this process.”

But Feynman was satisfied and considered his challenge solved, 26 years after it was first proposed. Within a couple of weeks, Newman received a congratulatory letter from the physicist and a check for $1000. “It was a well-earned amount of money,” Newman recalled. “I was thinking of getting a Macintosh computer. They had just come out and I was really fascinated by them.”

Newman defended his thesis in December, 1985, and his work would stand as a proof of concept that text could be substantially compressed. “Maybe I didn’t plan it this way, but there is some value in having people recognize this text,” said Newman. “The fact that they knew that first line — or at least the first part of the first line — probably helped a bit in terms of interpreting what I had done.”

Since graduating from Stanford, Newman has worked in the field of lithography. His job responsibilities have spanned engineering, project management, and marketing.

He never kept in touch with Feynman, however. “Maybe I was a bit reticent to contact the great man,” he said.

Katherine Kornei is a freelance science writer based in Portland, Oregon.
New terrorism reveals new physics

By Neil Johnson

I t is ten years since I wrote a Back Page article--The Mother of All Wars—which pointed to a connection between the physics of complex systems and human conflict, including terrorism (APS News, November 2006). A lot of things have changed in the world since then, one of which is the expansion of the Internet to 3.5 billion users—that’s nearly 1 out of 2 of the world’s population. An immediate impact of this Internet expansion has been an increase in availability of information about individual violent events related to conflicts and terrorism at the daily level. This has enabled a thorough testing of the conjecture reported in that 2006 article, that modern conflicts including terrorism follow an approximate power-law distribution for the severity of events, with a universal exponent near 2.5. That approximate “2.5 law of war” has now been confirmed using new databases from multiple recent and pre-existing conflicts including insurgencies, as well as updated terrorism databases [1]. Also thanks to Internet reporting, a power-law trend has been identified in the timing of attacks in conflicts that is interpreted as a non-Markovian stochastic walk between a Red Queen (i.e., small but agile state opponent) and a Blue King (i.e., large but more sluggish state). This mechanism represents a dynamical generalization of the Red Queen hypothesis [2] from evolution. Also, the availability of Google maps has led to better understanding of how casualty data should be collected—in particular, it led to the introduction of “main street bias” in casualty data collected from epidemiological surveys during the most recent Iraq war. In that study [3], a network model from physics was used to identify the likely source of bias as being due to clustering along major thoroughfares owing to surveys being concentrated there.

But the impact of the Internet on human conflict goes much further than a convenient reporting outlet for daily events. As shown by the world’s ongoing anti-ISIS (the so-called Islamic State), it can serve an extremist entity as a primary tool for recruiting, organizing, and inspiring attacks across the globe. Yet this also means that there are likely digital footprints available to researchers for developing a dynamical model of such collective human extremism. As a result, much work has focused on data from Twitter to identify influential online individuals. However, such “single-particle” approaches have met with only limited success, in part because removing #1 from any extremist network automatically leads to #2 becoming #1, #3 becoming #2 etc. The reason for this is that the individual-based approaches make sense from a physics perspective, since it is akin to attempting to single-particle approach to understand many-body physics, as in practice-minded quantum superconductivity. Instead, we know from physics that the power behind such collective phenomena lies in the correlations between aggregates of particles, not single-particle behavior. And it turns out that the same is true for online extremism, with social media groups playing the role of collective quasiparticles.

Social media groups are now a big feature of networking websites, since they allow individuals—including any of us—to get together virtually and share information, opinions, etc. Supporters of ISIS around the world do the same. But instead of, for example, sharing more mundane news or ideas concerning a social event or sports team, they exchange operational information concerning ISIS. Their discussions cluster along major thoroughfares owing to surveys being concentrated there. But the impact of the Internet on human conflict goes much further than a convenient reporting outlet for daily events. As shown by the world’s ongoing anti-ISIS (the so-called Islamic State), it can serve an extremist entity as a primary tool for recruiting, organizing, and inspiring attacks across the globe. Yet this also means that there are likely digital footprints available to researchers for developing a dynamical model of such collective human extremism. As a result, much work has focused on data from Twitter to identify influential online individuals. However, such “single-particle” approaches have met with only limited success, in part because removing #1 from any extremist network automatically leads to #2 becoming #1, #3 becoming #2 etc. The reason for this is that the individual-based approaches make sense from a physics perspective, since it is akin to attempting to single-particle approach to understand many-body physics, as in practice-minded quantum superconductivity. Instead, we know from physics that the power behind such collective phenomena lies in the correlations between aggregates of particles, not single-particle behavior. And it turns out that the same is true for online extremism, with social media groups playing the role of collective quasiparticles.

By Neil Johnson

The Back Page is a forum for member commentary and opinion. The views expressed are not necessarily those of APS.

References: