Stanford University

Department of Physics newsletter

ANNUAL NEWS OF THE DEPARTMENT OF PHYSICS AT STANFORD UNIVERSITY

FALL 2011

PHOTO-ILLUSTRATION: SYMMETRY MAGAZINE

LETTER

From the Chair

STEVEN M. KAHN
Chair and Professor of Physics

Dear Physics alumni and friends,

I am happy to announce that our recent faculty searches have resulted in six excellent new faculty appointments in the past two years: Xiao-Liang Qi, Leonardo Senatore, Peter Graham, Sean Hartnoll, Sri Raghu, and Leo Hollberg.

In progress are faculty searches for positions in experimental condensed matter physics; astrophysics, particle astrophysics, and/or cosmology; and atomic, molecular, and optical (AMO) physics. See our department website for details: http://www.stanford.edu/dept/physics/jobs.html

This newsletter features two physics alumni whose stories illustrate the career options possible with a physics degree. We hope you enjoy reading about the interesting career paths these former students have taken.

We are proud to announce that a number of our Physics faculty and students received prestigious awards recently. The list of awards is too long for me to mention them all individually but they are on the back page of this newsletter. Congratulations to these faculty and students on their impressive awards!

We are very excited to report that Profs. David Goldhaber-Gordon and Shoucheng Zhang of Physics and Prof. Yi Cui of Materials Science and Engineering received a $1 million grant from the W. M. Keck Foundation supporting their work on the quantum spin Hall system, a newly discovered type of material inside which the laws of electricity and magnetism are dramatically altered. The Stanford team will be testing a new class of materials in an attempt to achieve the quantum spin Hall effect without external magnetic fields and at room temperature. We hope that this funding will enable significant advances in this interdisciplinary research at Stanford in the quantum sprin Hall effect and potential spin-based electronic devices.

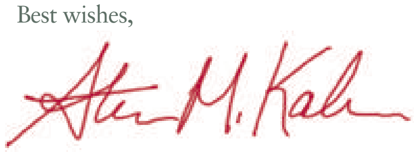
The 2011 annual Robert Hofstadter Memorial lecture was delivered by Cornell's Prof. N. David Mermin on the topic of "Spooky Actions at a Distance?" Our plans are in progress for the 2012 lecture.

In August 2010 we held a symposium honoring the career of Prof. Stanley Wojcicki, who became Emeritus last year. This day-long program featured talks by Pier Oddone (FNAL), William Foster (U.S. Congress), Robert Cahn (LBNL), Boris Kayser (FNAL), William Molzon (UC Irvine), and Roberto Peccei (UCLA). We also held a symposium on October 24, 2010 honoring Prof. Douglas Osheroff's teaching and research on the occasion of his 65th birthday, in connection with his becoming Emeritus. This was an all-day symposium entitled "From Superfluid 3He to Glasses: Snapshots of Matter at Low Temperatures." We were honored to have a number of distinguished speakers at this symposium, including Steven Chu (DOE), David Bishop (LGS), William Brinkman (DOE), David Lee (Cornell Univ.), Robert Richardson (Cornell Univ.), Philip Anderson (Princeton Univ.), Tony Leggett (Univ. of Illinois) and Christian Enss (Univ. of Heidelberg). Both of these events were very well attended and generated much excitement in the physics community.

Last October, we enjoyed hosting our annual Physics alumni reception during Homecoming Weekend. I encourage interested physics alumni to attend the reception this October 21, or feel free to visit whenever you are in the area! Our website will feature plans for the next reception and other upcoming events throughout the year: http://www.stanford.edu/dept/physics/index.shtml.

On behalf of the department, I sincerely thank you for your continued interest and support of our department. I also wish to convey the department's appreciation of our 2010 and 2011 donors, whose support has greatly enhanced the educational experience of our Physics students.

Best wishes,



STEVEN M. KAHN
Chair and Professor of Physics

On the cover
Stanford researchers have used data from the Fermi Gamma-ray Space Telescope to observe many astronomical phenomena including surprising flares from the Crab Nebula.

PHYSICS NEWS

Fermi's Large Area Telescope Sees Surprising Flares in Crab Nebula

The Crab Nebula, one of our best-known and most stable neighbors in the winter sky, is shocking scientists with its propensity for fireworks—gamma-ray flares set off by the most energetic particles ever traced to a specific astronomical object. The discovery, reported by scientists working with two orbiting telescopes, is leading researchers to rethink their ideas of how cosmic particles are accelerated.

"We were dumbfounded," said Stanford Physics' Roger Blandford, who directs the Kavli Institute for Particle Astrophysics and Cosmology. "It's an emblematic object," he said. The Crab Nebula, also known as M1, was the first astronomical object catalogued in 1771 by Charles Messier. "It's a big deal historically," Blandford continued, "and we're making an amazing discovery about it."

Blandford was part of a KIPAC team led by Rolf Buehler and the Physics Department's Stefan Funk that used observations from the Large Area Telescope (LAT), one of two primary instruments aboard NASA's Fermi Gamma-ray Space Telescope, to confirm one flare and discover another. Their report was posted online today in Science Express alongside a report from the Italian orbiting telescope Astro-rivelatore Gamma a Immagini LEggero, or AGILE, which also detected gamma-ray flares in the Crab Nebula.

The Crab Nebula, and the rapidly spinning neutron star that powers it, are the remnants of a supernova explosion documented by Chinese and Middle Eastern astronomers in 1054. After shedding much of its outer gases and dust, the dying star collapsed into a pulsar, a super-dense, rapidly spinning ball of neutrons. The Crab Nebula's pulsar emits a pulse of radiation every 33 milliseconds, like clockwork.

Though it's only 10 miles across, the amount of energy the pulsar releases is enormous, lighting up the Crab Nebula until it shines 75,000 times more brightly than the sun. Most of this energy is contained in a particle wind of energetic electrons and positrons traveling close to the speed of light. These electrons and positrons interact with magnetic fields and low-energy photons to produce the famous glowing tendrils of dust and gas Messier mistook for a comet over 200 years ago.

The particles are even forceful enough to produce the gamma rays the LAT normally observes during its regular surveys of the sky. But those particles did not cause the dramatic flares.

Each of the two flares the LAT observed lasted a few days before the Crab Nebula's gamma-ray output returned to more normal levels. According to Funk, the short duration of the flares points to synchrotron radiation, or radiation emitted by electrons accelerating in the magnetic field of the nebula, as the cause. And not just any accelerated electrons: the flares were caused by super-charged electrons of up to 10^{15} electron-volts, or 10 quadrillion electronvolts, approximately 1000 times more energetic than the protons accelerated by the Large Hadron Collider in Europe, the world's most powerful man-made particle accelerator, and more than 15 orders of magnitude greater than photons of visible light.

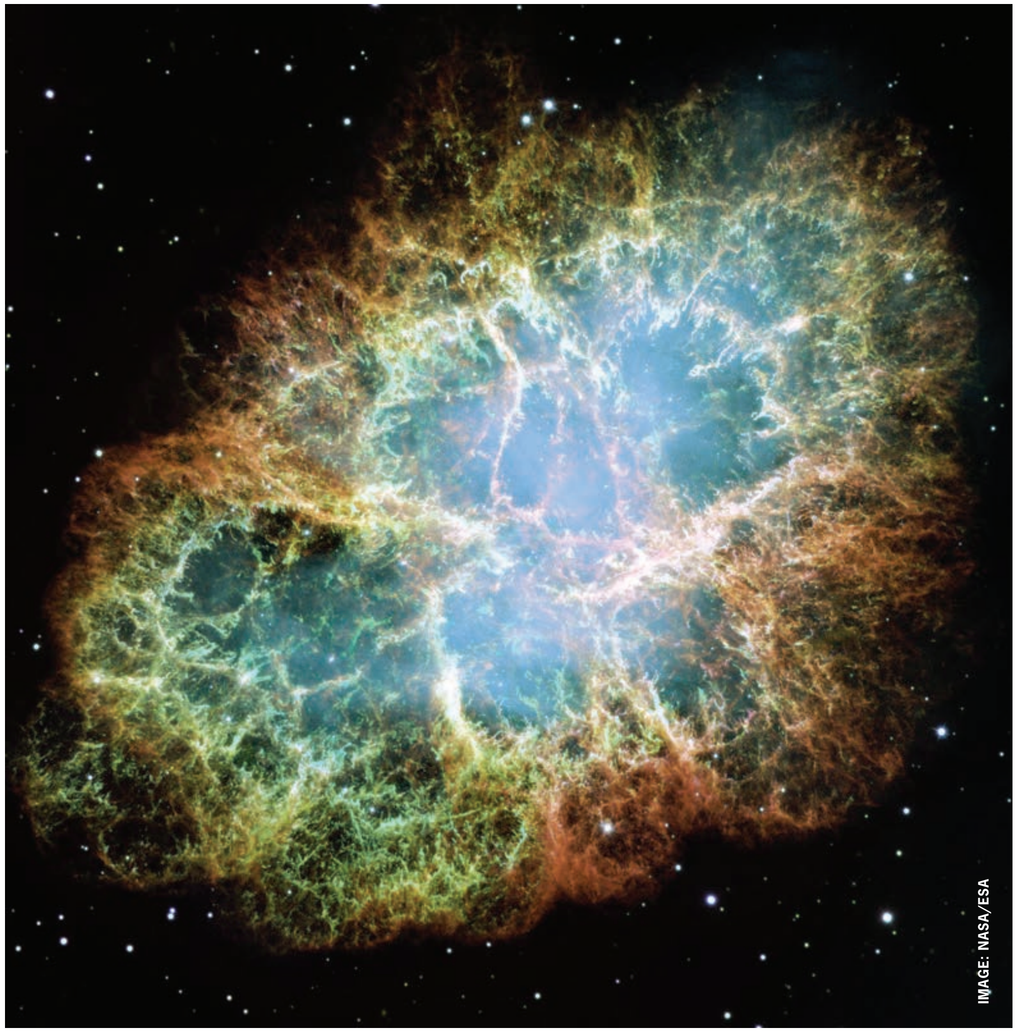
"The strength of the gamma-ray flares shows us they were emitted by the highest-energy particles we can associate with any discrete astrophysical object," Funk said.

Not only are the electrons surprisingly energetic, added Buehler, but, "the fact that the intensity is varying so rapidly means the acceleration has to happen extremely fast." This challenges current theories about the way cosmic particles are accelerated. These theories cannot easily account for the extreme energies of the electrons or the speed with which they're accelerated.

The discovery of the Crab Nebula's gamma-ray flares raises one obvious question: how can the nebula do that? Obvious question, but no obvious answers. The KIPAC scientists all agree they need a closer look at higher resolutions and in a variety of wavelengths before they can make any definitive statements. The next time the Crab Nebula flares, the Fermi LAT team will not be the only team gathering data. They'll need all the help they can get to decipher the mysteries of the Crab Nebula

"We thought we knew the essential ingredients of the Crab Nebula," Funk said, "but that's no longer true. It's still surprising us."

Adapted from a *SLAC Today* article.



Fermi's Large Area Telescope has recently detected two short-duration gamma-ray pulses coming from the Crab Nebula, which was previously believed to emit radiation at very steady rate. The pulses were fueled by the most energetic particles ever traced to a discrete astronomical object.

STANFORD NEWS

BOCO Gift Fund

Deng Wei, a well-known technology entrepreneur in China, has established the BOCO Fund, a gift of $1 million to support collaboration in physics between Stanford and the People's Republic of China. Dr. Deng's gift will provide funding for graduate students and post-doctoral fellows from the PRC to come to Stanford and for faculty exchanges between China and Stanford. Dr. Deng is pleased to support Stanford and his friend, Professor Shoucheng Zhang, whose work focuses on theoretical condensed matter physics and spintronics.

Dr. Deng is presently a member of the Chinese People's Political Consultative Conference (CPPCC), vice president of the Chinese Young Entrepreneur's Association, and vice chairman of the China Association of Young Scientists and Technicians. In 1999, Dr. Deng was honored as one of China's Top 10 Outstanding Youth of the Year.

Dr. Deng is the founder, chairman, and CEO of Bright Oceans Corporation (BOCO Group), which he started in Heilongjiang Province (north-eastern China) in 1988. The BOCO Group, which is mainly engaged in telecommunications, transportation, energy and capital investment, is part of the first group of enterprises recognized as "key national high-tech enterprises" by the Ministry of Science and Technology of China. In addition, BOCO Group's holding company, BOCO Inter-telecom, is part of the first group named by the State Ministry of Science and Technology, the State Council, the SASAC, and the All-China Federation of Trade Unions as "innovation-oriented enterprises." Its independently-developed innovation—a telecommunications network management system—holds a 90% market share at China Mobile and over 50% of the market share at China Unicom.

ALUMNI NEWS

Alumnus returns to observe rare decay

Stanford Physics alumnus Michael Moe was an undergraduate who went on to Case Institute of Technology for graduate work under Frederick Reines, discoverer of the neutrino. After a postdoc at Caltech, Moe joined the Physics Department at UC Irvine. While there, he was the first person to observe "two neutrino double-beta decay."

Moe has regained his connection with Stanford as a collaborator on the EXO-200 experiment, led by the Physics Department's Giorgio Gratta.

EXO-200 is the largest detector designed to measure the mass of the neutrino by attempting to detect the neutrino-less double-beta decay of Xe-136. EXO-200 was assembled on the Stanford campus between the fall of 2008 and the spring of 2009.

In the summer of 2009 electronics were installed and the detector was readout for the first time. The detector was shipped to the EXO underground site at the Waste Isolation Pilot Project in Carlsbad, New Mexico in October 2009. To reduce activation of the copper from cosmic radiation, the detector was shipped in a container, surrounded by some 30 tons of concrete.

The detector was installed in the cryostat in January 2010 and began taking data with liquid Xenon-136 in June 2011. After 2 months of data taking, the EXO team announced in late August the detection of two neutrino double-beta decay in Xe-136 with a half-life of 2.11×10^{21} years. "This represents the slowest Standard Model process ever measured," said Gratta. It is also a key stepping stone toward observing neutrinoless double-beta decay.

Moe visited campus at an alumni reception with his granddaughter, Jamila. Moe and Gratta took them to see the detector in HEPL ESIII, where this photo was taken.

Michael Moe & his granddaughter Jamila are standing in the EXO clean room in HEPL ESIII in front of the completed EXO-200 detector. The detector was shipped to the WIPP underground site in New Mexico a few days after the photo was taken.

STANFORD NEWS

The Siemann Graduate Fellowships

Stanford University established two graduate fellowships in honor of the late Prof. Robert Siemann's scientific achievements and dedication to teaching. A gift from his widow, Hannah Siemann, will endow the fellowships to support outstanding physics PhD students who are conducting research at SLAC or in the fields of high energy, particle, or accelerator physics.

The School of Humanities and Sciences matches Mrs. Siemann's gift with funds from The William and Flora Hewlett Foundation. These graduate student fellowships allow us to support talented physics students. This photo was taken at a recent luncheon held to thank Mrs. Siemann for her generosity and support of our physics students.

Chris McGuinness, a graduate student in Stanford University's Department of Applied Physics who is conducting thesis work at SLAC, was named the inaugural Robert H. Siemann Graduate Fellow in physics. McGuinness' PhD work, which he began in collaboration with Siemann, focuses on designing ways to accelerate electron pulses with visible light. He's been developing methods for fabricating nano-structures made of silicon using semi-conductor processing equipment at the Stanford Nano-fabrication Facility. The end goal is smaller, less expensive particle accelerators on a chip.

PHYSICS NEWS

High-temperature Superconductor Spills Secret: A New Phase of Matter

Scientists have found the strongest evidence yet that a puzzling gap in the electronic structures of some high-temperature superconductors could indicate a new phase of matter. Understanding this "pseudogap" has been a 20-year quest for researchers who are trying to control and improve these breakthrough materials, with the ultimate goal of finding superconductors that operate at room temperature.

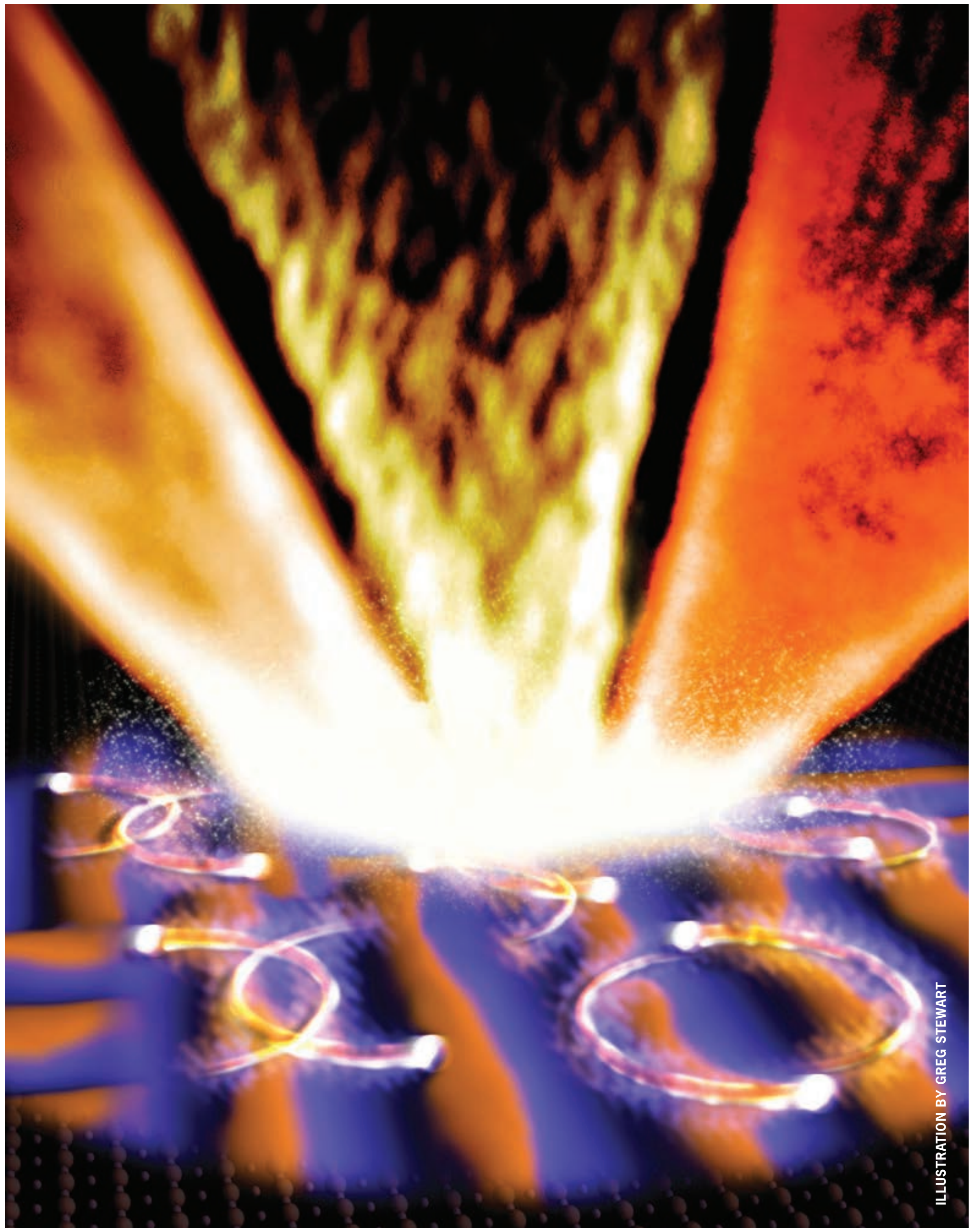
"Our findings point to management and control of this other phase as the correct path toward optimizing these novel superconductors for energy applications, as well as searching for new superconductors," said Zhi-Xun Shen of the Stanford Physics Department, Stanford Institute for Materials and Energy Science (SIMES), and SLAC National Accelerator Laboratory. Shen led the team of researchers that made the discovery; their findings appeared in the March 25 issue of Science.

Although research over the past 25 years has developed "high-temperature superconductors" that work at warmer temperatures, even the warmest of them—the cuprates—must be chilled half-way to absolute zero before they will superconduct. The prospect of being able to dramatically increase that working temperature, thus making superconductors easier and cheaper to use, has kept interest in the cuprates at the boiling point. But to change something you have to understand it, and a puzzle called the pseudogap has stood in the way.

One hallmark of a superconductor is a so-called "energy gap" that appears when the material transitions into its superconducting phase. The gap in electron energies arises when electrons pair off at a lower energy to do the actual job of superconducting electric current.

When most of these materials warm to the point that they can no longer superconduct, the electron pairs split up, the electrons start to regain their previous energies, and the gap closes. But in the cuprates, the gap persists even above superconducting temperatures. This is the pseudogap, and it doesn't fully disappear until a second critical temperature called T* (pronounced "T-star") is reached. T* can be 100 degrees higher than the temperature at which superconductivity begins.

The electrons in the pseudogap state aren't superconducting—so what are they doing? That's the puzzle that's had condensed matter physicists scratching their heads for two decades.



An unprecedented three-pronged study has found that one type of high-temperature superconductor may exhibit a new phase of matter. As in all superconductors, electrons pair off (bottom) to conduct electricity with no resistance when the material is cooled below a certain temperature. But in this copper-based superconductor, many of the electrons in the material don't pair off; instead they form a distinct, elusive order that interacts with the electron pairs.

"A clear answer as to whether such a gap is just an extension of superconductivity or a harbinger of another phase is a critical step in developing better superconductors," Shen said.

In work done at Stanford University, Stanford Synchrotron Radiation Lightsource, and Lawrence Berkeley National Laboratory's Advanced Light Source, Shen's team looked at a sample of a cuprate superconductor from the inside out. They examined electronic behavior at the sample's surface, thermodynamic behavior in the sample's interior, and changes to the sample's dynamic properties over time using a trifecta of measurement techniques never before employed together.

The team's findings: electrons in the pseudogap phase are not pairing up. They reorganize into a distinct yet elusive order of their own. In fact, the new order is also present when the material is superconducting; it had been overlooked before, masked by the behavior of superconducting electron pairs.

Simply knowing the pseudogap indicates a new phase of matter provides a clear signpost for follow-up research. According to Makoto Hashimoto, a co-author on the paper and Stanford Synchrotron Radiation Lightsource staff scientist, their work "makes the high-temperature superconductor roadmap much clearer than before, and a good roadmap is important for any big science project."

Adapted from a *SLAC Today* article.

ALUMNI NEWS

Strings and students

As a visiting professor in the physics department at Reed College (Portland), Nelia Mann continues on the path of learning and exploration she began as an undergraduate student at Stanford University. Mann completed double BS degrees in mathematics and physics at Stanford, along with a minor in American history, in 2001. She then went on to study string theory, in particular applications of integrability to AdS/CFT, as a graduate student at UCSB. After completing her PhD in 2006, she earned a McCormick fellowship at the University of Chicago where she worked as a researcher from 2006 to 2010, before moving to Portland to begin a visiting faculty job at Reed College.

In addition to research, Mann has given a series of public lectures through the University of Chicago Compton Lecture Series, and she spends several weeks each summer teaching particle physics at the Education Program for Gifted Youth (EPGY) Summer Institute on the Stanford campus. She is also in the process of writing a textbook based on that course. During her undergraduate years Mann felt drawn to the formal aspects of theoretical physics. She recalls being particularly inspired by Lagrangian formalism and by Noether's theorem, and she enjoyed quantum mechanics a great deal. Although she enjoyed her mathematics courses and her laboratory experiences as well, by the time she graduated she knew theoretical physics was her home.

With her current projects Mann is bringing a more phenomenological viewpoint to her research, and attempting to use string theory to inspire models for the high energy scattering of mesons and baryons. Mann and her collaborators have used their models to make predictions for the Large Hadron Collider experiment at CERN, providing a forum in which string theory can be experimentally tested. While still at Stanford, Mann became involved with EPGY and with the Stanford University Mathematics Camp. There she developed a passion for making complicated material accessible to a broader audience. She believes that the challenge of finding a way to explain advanced physics concepts without advanced mathematics clarifies one's own thinking and pushes one to a deeper understanding of the subject matter.

She also finds it very rewarding to work with younger students, who are inspired by being exposed to more exotic subjects than they generally encounter. The experience of designing a particle physics course for EPGY and now of writing a textbook on the same subject has convinced Mann of the value of teaching the connections between experimental results and theoretical developments.

She believes that the most important thing a student should take away from a science course is an appreciation for the scientific method and for logical reasoning. Mann encourages current students in the physics department at Stanford to explore physics beyond their coursework and the assigned curriculum. Although what is taught in the classroom is important, it is only half the experience of being a physics student. She highly recommends that undergraduates become involved in research as a way to learn more about the aspects of physics that interest them most (not to mention that it helps with getting into graduate school.) She also believes that students should explore teaching and science outreach opportunities, because there is no better way to learn a subject than to try to explain it to someone else!

STANFORD NEWS

First Endowed Chair in Experimental Physics Honors Beloved Professor

Professor of Physics Stanley Wojcicki retired in August 2010 after 44 dedicated years at Stanford. His legacy as a scientist and educator will now continue beyond his emeritus status. At a celebratory dinner honoring his career, his daughter Anne Wojcicki, the Co-Founder of 23 and Me, a premier genetic testing service, and her husband, Google Co-Founder Sergey Brin, announced a $2.5 million gift for the creation of the first endowed chair in experimental physics at Stanford. As he presented the gift, Brin said he looked forward to watching the fundamental discoveries the future chair holder would make.

The professorship also provides an opportunity for teaching as well as discovery. "Dad, we all love science because of you," Anne shared, standing alongside her two sisters, Susan and Janet, as they paid tribute to their father. Wojcicki imparted that love of science not only to his daughters but also to thousands of students during his time at Stanford.

In addition to being recognized as an outstanding faculty member, Wojcicki also excelled as a scientist and was elected a Fellow in the American Physical Society in 1971. His recent research focused on neutrino oscillations—the change from one flavor into another as a neutrino travels through space—and how to measure oscillation parameters.

Wojcicki has traveled far to reach this culminating moment of his career. He fled from Poland with his mother when he was 12 with only the clothes on his back and eventually studied at Harvard, where he earned his BA. He then chose to do graduate work at UC Berkeley, where he obtained his PhD and met and married his wife Esther. He went on to hold positions at the Lawrence Berkeley National Laboratory and as an NSF Fellow at CERN and Collège de France before joining the Stanford physics faculty in 1966. He served as chair of the Department of Physics from 1982–85 and 2004–2007. During his professional career Wojcicki served in a number of advisory roles both to the US and foreign government funding agencies and to the directors of major high energy physics laboratories. For six years during the 1990's he chaired the High Energy Physics Advisory Panel, which is the principal advisory group to the Department of Energy and the National Science Foundation on particle physics issues.

"Stan was such an exemplary experimental physicist that it is appropriate that this chair will recognize current and future experimentalists," said then-Chair of the Physics Department Patricia Burchat during the dinner. The endowed chair guarantees, in perpetuity, that Stanford can offer full and permanent support to an experimental physicist and to his or her teaching and research. This is such a high priority to the university that the Dean of the School of Humanities and Sciences, Richard Saller, allocated generous matching funds from a gift from The William and Flora Hewlett Foundation grant. "An endowed chair in physics will help us retain and reward the very best experimentalists and will be a lasting tribute to Stan and his many contributions to Stanford," Dean Saller explained. Professor Blas Cabrera was appointed as the first Stanley G. Wojcicki Professor in February 2011.

PHYSICS NEWS

New method detects emerging sunspots deep inside the sun, provides warning of dangerous solar flares

Viewed from the technological perspective of modern humans, the sun is a seething cauldron of disruptive influences that can wreak havoc on communication systems, air travel, power grids and satellites—not to mention astronauts in space.

If disruptions such as solar flares and mass eruptions could be predicted, protective measures could be taken to shield vulnerable electronics before solar storms strike.

Now Stanford researchers have developed a method that allows them to peer deep into the sun's interior, using acoustic waves to catch sunspots in the early stage of development and giving as much as two days' warning.

Sunspots develop in active solar regions of strong, concentrated magnetic fields and appear dark when they reach the surface of the sun. Eruptions of the intense magnetic flux give rise to solar storms, but until now, no one has had luck in predicting them.

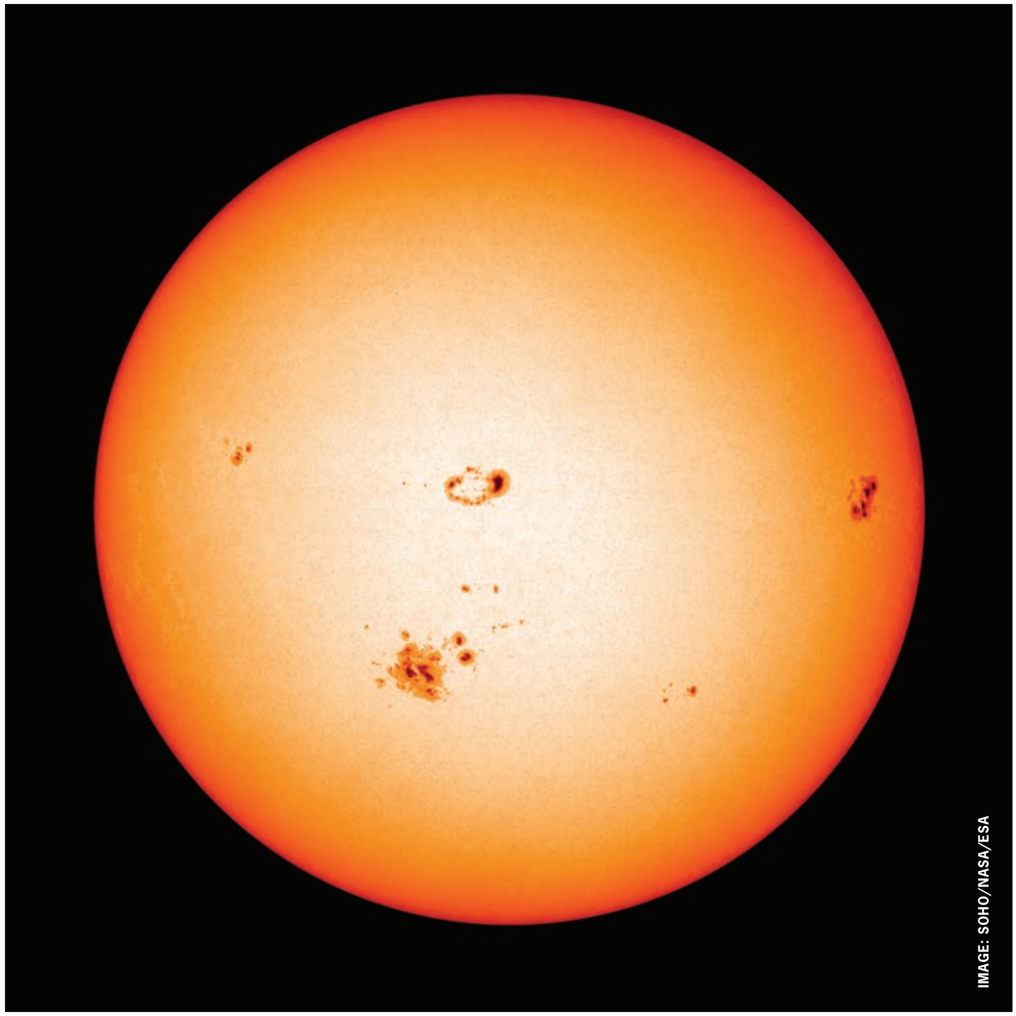
"Many solar physicists tried different ways to predict when sunspots would appear, but with no success," said Phil Scherrer, Physics Professor in whose lab the research was conducted.

The key to the new method is using acoustic waves generated inside the sun by the turbulent motion of plasma and gases in constant motion. In the near-surface region, small-scale convection cells—about the size of California—generate sound waves that travel to the interior of the sun and are refracted back to the surface.

The researchers got help from the Michelson Doppler Imager aboard NASA's Solar and Heliospheric Observatory satellite, known as SOHO. The craft spent 15 years making detailed observations of the sound waves within the sun. It was superseded in 2010 with the launch of NASA's Solar Dynamics Observatory satellite, which carries the Helioseismic and Magnetic Imager.

Using the masses of data generated by the two imagers, Stathis Ilonidis, a Stanford graduate student in physics, was able to develop a way to reduce the electronic clutter in the data so he could accurately measure the solar sounds.

The new method enabled Ilonidis to detect sunspots in the early stages of formation as deep as 65,000 kilometers inside the sun. Between one and two days later, the sunspots would appear on the surface. Ilonidis is the lead author of a paper describing the research, published in the August 19 edition of Science.



Stanford researchers have found a way to detect sunspots such as these two days before they reach the surface of the sun.

The principles used to track and measure the acoustic waves traveling through the sun are comparable to measuring seismic waves on Earth. The researchers measure the travel time of acoustic waves between widely separated points on the solar surface.

"We know enough about the structure of the sun that we can predict the travel path and travel time of an acoustic wave as it propagates through the interior of the sun," said Junwei Zhao, a senior research scientist at Stanford's Hansen Experimental Physics Lab. "Travel times get perturbed if there are magnetic fields located along the wave's travel path." Those perturbations are what tip the researchers that a sunspot is forming.

By measuring and comparing millions of pairs of points and the travel times between them, the researchers are able to home in on the anomalies that reveal the growing presence of magnetic flux associated with an incipient sunspot.

They found that sunspots that ultimately become large rise up to the surface more quickly than ones that stay small. The larger sunspots are the ones that spawn the biggest disruptions, and for those the warning time is roughly a day. The smaller ones can be found up to two days before they reach the surface.

"Researchers have suspected for a long time that sunspot regions are generated in the deep solar interior, but until now the emergence of these regions through the convection zone to the surface had gone undetected," Ilonidis said. "We have now successfully detected them four times and tracked them moving upward at speeds between 1,000 and 2,000 kilometers per hour."

One of the big goals with forecasting space weather is achieving a three-day warning time of impending solar storms. That would give the potential victims a day to plan, another day to put the plan into action and a third day as a safety margin.

Adapted from a *Stanford News Service* article.

Stanford University
Department of Physics

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2012
Upcoming Events

CONFERENCE FOR UNDERGRADUATE WOMEN IN PHYSICS
Stanford and SLAC
January 13–15, 2012
stanford.edu/dept/physics/events/2012/UGWP/

SYMPOSIUM HONORING BLAS CABRERA
2012 date to be announced
Check website for updates

PRIZES & AWARDS
Recent Faculty Awards

TOM ABEL
Terman Fellowship

ROGER BLANDFORD
Humboldt Research Award; Elected Fellow of the APS Division of Astrophysics

PHILIP BUCKSBAUM
Optical Society of America Vice-President

PATRICIA BURCHAT
Judith Poole award for mentoring young women in Science

BLAS CABRERA
Stanley G. Wojcicki Endowed Chair

STEFAN FUNK
Duggal Prize

PETER GRAHAM
Terman Fellowship

SEAN HARTNOLL
Sloan Fellowship

RENATA KALLOSH
Lise Mietner Prize

AHARON KAPITULNIK
Heike Kamerlingh Onnes Prize for Outstanding Superconductivity Experiments; Elected to the American Academy of Arts & Sciences; Humboldt Research Award

STEVE KIVELSON
Elected to the National Academy of Sciences

CHAO-LIN KUO
Sloan Fellowship

ANDREI LINDE
Elected to the American Academy of Arts & Sciences

HARI MANOHARAN
Terman Fellowship

PETER MICHELSON
Rossi Prize

KATHRYN MOLER
Richtmeyer Award for Outstanding Leadership in Physics Education

XIAOLIANG QI
Sloan Fellowship; OYRA Award from the Overseas Chinese Physics Association; Hermann Kuemmel Early Achievement Award in Many Body Physics; Packard Fellowship

LEONARDO SENATORE
Terman Fellowship

Z-X SHEN
APS Buckley Prize; E. O. Lawrence Award

STEPHEN SHENKER
APS Lars Onsager Prize

LEONARD SUSSKIND
LA Times Book Award in Science & Technology

RISA WECHSLER
Terman Fellowship

SHOUCHENG ZHANG
Elected to the American Academy of Arts & Sciences; Johannes Gutenberg Research Award; Europhysics Prize; APS Buckley Prize

PRIZES & AWARDS
Recent Student Awards

CAITLIN MALONE
Paul Kirkpatrick Award for outstanding physics teaching assistants

ANDREW LARKOSKI
Paul Kirkpatrick Award for outstanding physics teaching assistants

PAUL SIMEON
Paul Kirkpatrick Award for outstanding physics teaching assistants

RONNACHAI JAROENSRI
David Levine Award for an outstanding junior physics major

BYUNGWOO KANG
David Levine Award for an outstanding junior physics major

YU XIAN LIM
Jeff Willick Memorial Award for an outstanding physics student in Astronomy; J.E. Wallace Sterling Award for Scholastic Achievement

TEMPLE HE
Firestone Medal for Excellence in Undergraduate Research; Marshall Scholarship; Award from the Center for Teaching and Learning for Honors Thesis Presentation; J.E. Wallace Sterling Award for Scholastic Achievement