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Physics

Dear Friends of the Department,

This newsletter arrives at your doorsteps many months later than usual. It has been a busy time!

We welcomed three new faculty members this year: Matt Graham, Weihong Qiu, and Davide Lazzati. Matt's Micro-Femto Energetics Lab focuses on photoexcited nanostructures, Weihong's single molecule biophysics group studies intracellular transport, and Davide's group does computational research on understanding the physics of gamma-ray bursts and cosmic dust. We are also pleased that Guenter Schneider and David Roundy have been promoted to Associate Professors with tenure.

In March we had our undergraduate program review, which turned out very well. We received plenty of recognition for what we have been doing very well and also some excellent suggestions on where to improve. In April we had four applicants visiting for our position as head of the department, and we are delighted to announce that Professor Heidi Schellman will join our department as Head next year. At the end of the Summer it will have been sixteen years for me as chair, plus an extra year as Acting Chair, which makes it time for a change. The department now has fifteen tenure-line faculty, five instructors, and three staff members, which is still small but is markedly different from ten years ago. A new head of department can therefore spend more time on focusing on new ideas and directions, which is wonderful.

We have just celebrated seventeen years of the Paradigms in Physics program, and in June, hosted a very successful workshop on upper division physics education. "Why seventeen?", one might ask. That was related to the organization of the workshop, even though some of us like to say that we waited for a prime number year! Our department is one of the leaders nationwide in research on upper division education, and we have learned much that can be applied directly to the lower division course reform. This is an area in which I am very interested, and which I plan to concentrate on after my chairmanship has ended.

We owe many thanks to Bill and Anne Hetherington, who have established a new scholarship in our department. In his work at OSU, Bill has always worked with many students who were focusing on developing excellent experimental skills that would lead them to employment in industry. Many of these students had to work as well as take classes in order to make their dreams a reality. The Hetherington scholarship will allow students to reduce their work load while taking classes, and hence will allow them to be more successful.

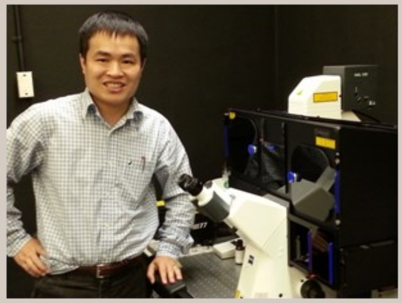
This year we awarded a record number of scholarships in the physics department. Our graduation dinner last week had the largest attendance ever, and over 90 people attended the Spring Picnic.

We wish you a great summer, and hope you will be able to attend our Yunker lecture on October 13. Our speaker will be the 2001 Nobel Laureate in Physics, Eric Cornell of JILA, who will be discussing: "Particle paleontology: looking for fossils from the early universe inside the electron."

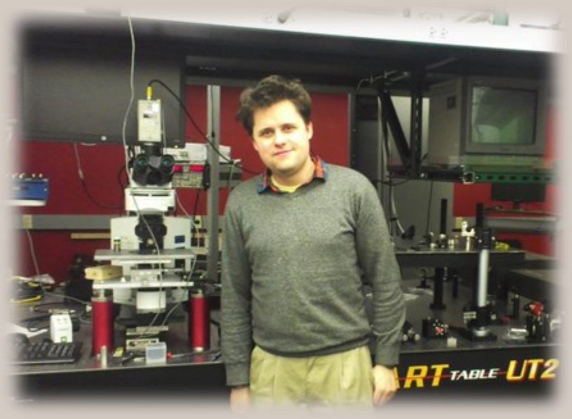
Henri Jansen, Chair

Physics

Introducing new faculty members



Dr. Weihong Qiu joined the Physics Department at OSU as an Assistant Professor in August 2013.Weihong received his B.S. in Physics and M.S. in Biophysics from Nankai University (China), and his Ph.D. in Biophysics from The Ohio State University. Before joining Oregon State, Weihong was an American Heart Association Postdoctoral Fellow at Harvard Medical School. Dr. Qiu's research at Oregon State University is at the interface of Physics and Biology, working on the mechanisms of a group of protein molecules called molecular motors. Within cells, these molecular motors utilize chemical energy to move along a filament-like structure called cytoskeleton for transporting cargos such as vesicles and other important proteins with remarkable spatial accuracy and temporal precision. To uncover the inner workings of these molecular motors, the Qiu research group uses a light microscopy-based method called single molecule fluorescence microscopy to study the behavior of individual motor proteins.



Dr. Matthew Graham is an Assistant Professor of Physics who joined the Department in August 2013. He received a B.Sc. degree in Physics/Chemical Physics from University of Toronto and his Ph.D. from University of California, Berkeley. He was then named a Kavli Fellow at the Kavli Institute at Cornell for Nanoscale Science where he completed his postdoctoral work studying how electrons lose their energy in a 2D material called graphene. He developed new techniques enabling him to resolve electrons in these materials on the timescales of femtoseconds (10^{-15} s) with sub-micron ($<10^{-6}$ m) spatial resolution. He is continuing a similar research direction at OSU by building the Micro-Femto Energetics (μ*fE*) Lab in 120 Weniger Hall. The μ*fE* Lab is developing ground-breaking techniques that can effectively film the journey of electrons from initial excitation until current generation. The μ*fE* Lab will apply these unique measurement tools to a host of emerging materials including 1D/2D nanostructure, organic photovoltaics and biological systems. "Our goal is to understand what processes drive energy harvesting at the molecular scale in order to ultimately improve optoelectronics and solar cells."

Dr. Davide Lazzati joined the Physics Department at OSU as an Associate Professor in December 2013. Davide received his B.S. in Physics and Ph.D. in Astronomy from the University of Milan (Italy). Before joining Oregon State University he was a theory and PPARC postdoctoral fellow at the Institute of Astronomy of the University of Cambridge (UK), a senior research associate at JILA, University of Colorado, and an Assistant Professor of Physics at North Carolina State University. Dr. Lazzati's research focuses on astrophysics and in particular on the outcomes of stellar explosions. When stars bigger than our Sun run out of thermonuclear fuel they undergo a catastrophic explosion called a Supernova. Supernovae are fundamental events in the buildup of heavy elements and the formation of the first solids. Using supercomputer simulations, Dr. Lazzati's group tries to understand the mechanisms that power the explosion, how the light that we see is produced, and what are the microscopical products that are thrown back into the interstellar medium and can trigger a new generation of stars, possibly surrounded by planetary systems.

Physics

Degrees Awarded in 2013

Nicholas Kuhta, Ph.D. to Intel, Inc., Hillsboro, OR
Jason Francis, Ph.D. to Intel, Inc., Hillsboro, OR
Seongweon Park, Ph.D. to LBCC, Corvallis, OR
Whitney E. B. Shepherd, Ph.D. to Intel, Inc., Hillsboro, OR

Kati Bilty, M.S. to Radiant Zemax, Redmont, WA
Jessica McCartney, M.S.

Alex Abelson, B.S.
Marcus Cappiello, B.S. to graduate studies at UC Riverside
Elle Durkee, B.S.
John Elliott, B.S. to Lucidyne Technologies, Corvallis, OR
Thomas Ferron, B.S. to Intel, Inc., Hillsboro, OR
Ky Hale, B.S.
Casey Hines, B.S. to Intel, Inc., Hillsboro, OR
Kyle Hollis, B.S.
Timothy Mathews, B.S.
Bethany Matthews, B.S. to graduate studies at Oregon State University
Afina Neunzert, B.S. to graduate studies at the U of Michigan, Ann Arbor
Benjamin Norford, B.S.
Erika Ogami, B.S. to Intel, Inc., Hillsboro, OR
Teal Pershing, B.S.
Kyle Peters, B.S. to graduate studies at Case Western Reserve University
Keith Schaefer, B.S.
Michael Stovall, B.S.
Andrew Svesko, B.S. to graduate studies at Oregon State University
Sean Van Hatten, B.S.
Colby Whitaker, B.S.
River Wiedle, B.S. (Hon.) to Intel, Inc., Beaverton, OR
Thomas Windom, B.Sc.

Student Awards in 2013

The annual graduate awards in the department went to **Michael Paul** (Physics Graduate Research Award), **Daniel Gruss** (Peter Fontana Graduate Teaching Award), and **Andrew Stickel** (Peter Fontana Graduate Teaching Award).

Graduate student **Michael Paul** (Lee group) was awarded a Whiteley Fellowship in Material Sciences for the Summer of 2013.

Physics senior **Grant Sherer** was awarded a DeLoach Work Scholarship by the Honors College to work with Prof. Corinne Manogue.

River Wiedle was recognized as the 2012/13 Outstanding Undergraduate Researcher in the College of Science, and **Afina Neunzert** received the honorable mention in the same category.

Physics senior **Mattson Thieme** received URISC funding for his project "Low-temperature microscopy of organic semiconductors" under the supervision of Prof. Oksana Ostroverkhova. Physics senior **Heather Wilson** received URISC funding for her project " Real-Time Monitoring of Biocatalyst Conformational Transitions " under the supervision of Prof. Ethan Minot. Physics senior **Paho Lurie-Gregg** received an URISC award for his proposal "Hard Polyhedra Fluids" under the supervision of Prof. David Roundy.

OSU Physics students successful in the high tech market place - see our new LinkedIn page!

Our post docs, graduate and undergraduate students have been very successful in the job market! A few of the Oregon and Washington high tech companies lucky enough to employ our students are Intel, Jireh Semiconductor and SolarWorld in Hillsboro, WaferTech in Camas, and Vernier Software & Technology Vernier in Portland. Intel alone has employed 7 OSU Physics graduate students and 7 undergraduates in the last two years. We think this is a testimony to their excellent research experiences at the PhD, MS and the undergraduate levels (all of our undergraduates write a senior thesis), and it shows that physics deserves its reputation as one of the careers with the lowest unemployment rate!

Please browse our new LinkedIn page to see where our alumni are employed and to see the resumes of our current students. Search for Physics Oregon State on Linked In to find us, or click the icon at the bottom left of the department's home page. If you are an alum of our department, please join! We currently have more than 130 members on this professional networking site. Our goal is to help our students become even more competitive in their careers, and you can help. Prospective students can also find out where they might eventually find employment - our grads are everywhere, so take a look!

Research highlight: Self-organized criticality by communicating cells

By Bo Sun

Bo Sun joined Physics Department at OSU in March 2013 as an Assistant Professor. His research interests are in experimental biophysics.

While life is fundamentally a multiscale phenomenon, a colony of communicating cells is particularly intriguing. On the one hand, the decision made by each individual cell based on environment cues is highly stochastic. In fact, not only do the environmental perturbations fluctuate in space and time, but even for uniform stimulations, the responses vary significantly from one cell to another. Despite these uncertainties, multicellular systems, such as the heart, the brain, or even an embryo are capable of performing highly regulated functions under a wide range of external conditions, a crucial aspect that supports all complex life forms.

Achieving coordinated collective responses requires individual cells to exchange information with each other within a population. For example, in the process of quorum-sensing, bacteria synthesize and secrete signaling molecules into the extracellular space. Once the concentration of the molecules, which encodes information of cell density, reaches a threshold value, bacteria transform to a different state through an emergent behavior. Similarly, when a population of the social amoebae Dictyostelium discoideum is stimulated by external cAMP (cyclic adenosine 3,5-monophosphate), more cAMP is released by each cell into the extracellular space. Because Dictyostelium undergoes quiescent to oscillatory transitions as a function of external cAMP concentration, the collective response of Dictyostelium to cAMP can be dramatically different from the response of isolated cells – a group of Dictyostelium form spores this way.

Unfortunately, for mammalian cells, their collective response to chemical stimuli – collective chemosensing -- is much less understood. Part of the reason is that mammalian cells have a much larger biochemical toolbox to interpret environment cues as well as to communicate with each other. In order to look for general principles underlying the collective chemosensing of mammalian cells, we choose a model system that have the most representative features. Fibroblast cells, a cell type that synthesize collagen for wound healing is capable of sensing ATP with P2 receptors. P2 receptor is one of the most abundantly expressed receptors by mammals. In particular, most human cells are equipped with P2 receptors which bridge two fundamental signaling components: ATP and intracellular calcium. In addition, fibroblast cells can communicate with each other when they are in physical contact: two cells merge their membranes and assemble a special protein channel called gap junction to exchange ions and small molecules between the cells. Gap junction is a very efficient communication mechanism, and is responsible for many collective multicellular phenomena, such as heart beats and neuron activities. In our study, we explore the collective calcium dynamics triggered by environmental ATP within a fibroblast cell colony of varying gap junction activities.

First we find when gap junction is unperturbed, the calcium dynamics between nearest neighbor cells are statistically correlated (Fig. 1A-B). The correlation immediately disappears when we reduce the gap junction activity – by diluting cell density or pharmaceutically blocking gap junction. The fact that direct cell-cell communication is manifested by the correlated calcium dynamics is surprising, because at single ion channel level, electrophysiological recordings show no sign of correlations between the cells, thus it is still an open question at which scale the gap junctions start to affect the intracellular calcium dynamics. To make sure there is no indirect, quorum-sensing type of communications through extracellular diffusing molecules, we embed the cells within a hydrogel thin film so that the diffusive signals will be protected from flow dilution. We do not see correlations between nearby cells in this case, suggesting gap junction is the major player in generating correlated cell calcium dynamics.

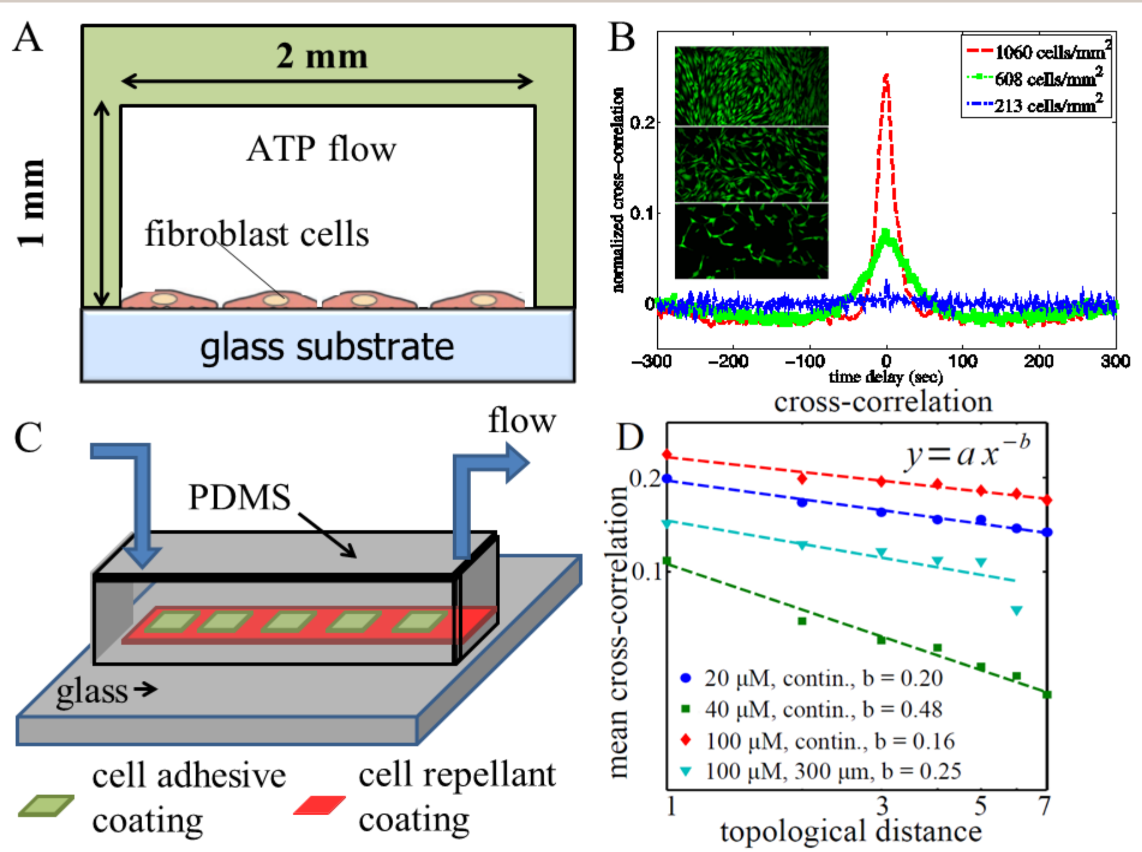


Figure 1. Combining microfabrication and fluorescent imaging to study the correlated calcium dynamics.

After examining the pair dynamics between nearest neighbors, we want to further investigate if these local interactions can lead to long-range orders to coordinate a large population of cells. We use photolithography to micro-print cell-adhesion proteins in cell-repellent coated substrates so that we can create isolated cell colonies of any sizes (Fig. 1C). When the cell colony is big (> 20 cells) and well-connected by gap junctions, the cross-correlation decays as a power-law with respect to topological distances (Fig. 1D). When the cell colony is small, or when the gap junctions are interrupted by unsaturated fat acid, we find the cross-correlation decay exponentially. These results are reminiscent of critical behaviors near second-order phase transition – such as the spin-spin correlation of Ising model near Curie temperature. However, the fundamental difference is that the cellular system are far from thermodynamic equilibrium. A cell colony dynamically tune their interaction strength until it reaches the critical point, presumably through an unknown feedback mechanism between spontaneous calcium fluctuations and gap junction conductivity. In other words, the cell colony self-organizes into dynamic criticality, a concept proposed in the late 80s to explain many power-law phenomena in nature that are far from equilibrium.

Using statistical analysis we have further investigated the nature of the self-organized criticality. For instance, if we treat the fibroblast cell colony as a random network, the degree distribution is well beyond the percolation threshold. This means the whole colony, no matter how big they are, can be dominated by one giant cluster that are intra-connected by high gap junction activity.

Also, the probability distribution of the pair-correlations implies the formation of gap junctions between two nearby cells is a dynamic Poisson process, and the conductance of a single channel can be estimated to be $3 \times 10^{-9}\ \mathrm{mm}^3$ /s, well agrees with direct experiment measurements.

Our results pave the way to quantitatively understand how information is routed in a communicating cell colony, especially for complex cells that are highly differentiated. We have shown that a healthy fibroblast monolayer self-organizes into dynamic criticality, which may facilitate sharing calcium encoded information throughout the colony during wound healing, inflammation response and tissue remodeling, where coordination of large number of cells is necessary. However, there are many more open questions along the same direction. In particular, we are interested in the exact mechanism that drives the self-organization. We are also interested in applying similar approach to study other cellular systems, for instance, heart muscle cells that heavily rely on gap junction communications. Finally, we want to explore how diseases such as cancer may disrupt the fine-tuned criticality.

Research highlight: Nanosensors and Noisy Biomolecules

By Ethan Minot

Ethan Minot joined Physics Department at OSU in 2007. He received the NSF CAREER Award in 2012. He was promoted to the Associate Professor with tenure in 2012.

Researchers around the world are exploring the possible applications of nanoscale electronic materials. An exciting line of investigation focuses on interfacing these nanomaterials with biological systems. Recent progress includes sensor devices that register the voltage spikes caused by a single neuron, and even sensors capable of monitoring the movement of a single enzyme. The unprecendented sensitivity of these devices is derived from the electrostatic sensitivity of nanomaterials. Promising applications for these devices span the fields of medicine to molecular biology.

When electronic sensors enter the biological world at the microscopic level, they encounter new types of noise. The biological environment is filled with tumbling water molecules, wiggling proteins and non-stop association/dissociation reactions. The electrostatic noise generated by these processes has never been quantified, yet understanding these noise sources is critical to designing nanoelectronic biosensors; the utility of any sensor is set by the ratio of signal strength to background noise.

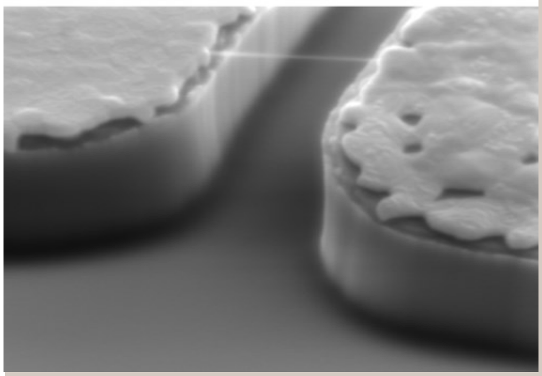
Experiments performed in the Nanoelectronics Lab in OSU's Department of Physics recently determined the dominant sources of electronic noise in biological environments. In work reported in Nano Letters, graduate student Tal Sharf manipulated the environment surrounding carbon nanotube biosensors and studied the resulting changes in noise level.

For these experiments to be successful, several challenges had to be overcome. Nanosensors are typically secured to a glass surface, but the noise from glass surfaces overwhelms the biological noise we wanted to study. It was critical to forego the standard glass support and leave the sensing material hanging, surrounded only by water, ions and proteins. Figure 1 shows the suspended carbon nanotubes that were fabricated for this study: tiny filaments of ultra-clean carbon connecting microscopic electrodes. It is an ideal structure for measuring the electrostatic noise generated by water, ions and proteins.

Physics

A clean carbon nanotube, surrounded by salty water, picks up a baseline noise of about a millivolt peak to peak. However, when the carbon nanotube is coated by protein the fluctuations increase substantially. We tested a number of adsorbates and found that molecular coatings are always the dominant source of electrostatic noise. In biological environments, the performance of an electrostatic-sensitive detector is ultimately limited by the molecular coating on the sensor surface.

While our study utilized carbon nanotubes, our results extend to a range of nanoelectronic sensors, from silicon nanowire biosensors to graphene biosensors. A better understanding of noise sources brings us one step closer to useful applications such as large arrays of single-neuron detectors and low-cost systems for electronically detecting cancer biomarker proteins.



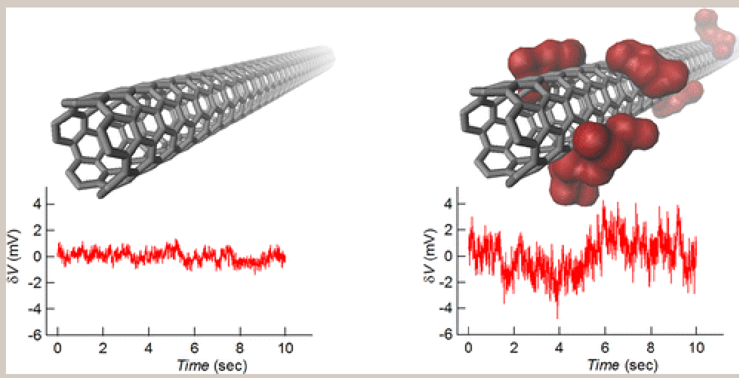
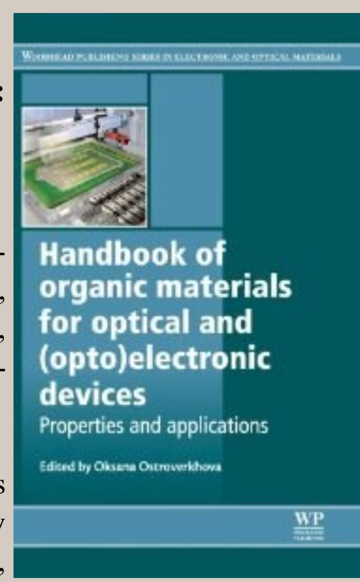


Figure 1. A single carbon nanotube (diameter 2 nm), bridging the gap over a 1 micrometer canyon.

Figure 2. The electrostatic fluctuations picked up by a clean carbon nanotube (left). The same carbon nanotube, now coated with proteins, picks up larger electrostatic fluctuations (right).

Details of this work can be found in Sharf et al., "Origins of Charge Noise in Carbon Nanotube Field-Effect Transistor Biosensors", *Nano Letters* **12**, pp 6380–6384 (2012).

Books by Faculty



Handbook of organic materials for optical and (opto)electronic devices: Properties and applications
(Oksana Ostroverkhova, Ed.), Woodhead Publishing Ltd., Cambridge, UK (2013)

Small molecules and conjugated polymers can be used in a number of applications including organic light-emitting diodes, photovoltaic devices, photorefractive devices, waveguides, and many others. Organic materials are attractive due to their low cost, the possibility of their deposition from solution onto large-area substrates, and the ability to tailor their properties.

The book contains 25 chapters describing materials used for organic (opto)electronics and nonlinear optics, their properties, methods of their characterization illustrated by physical studies, and applications. It is a technical resource for physicists, chemists, electrical engineers, and materials scientists involved in research and development of organic semiconductors and nonlinear optical materials and devices.

Historic perspective: Chung Kwai Lui, OSU's First Woman Physics PhD

by Prof. Emeritus Kenneth Krane

Chung Kwai Lui was born in Canton, China in 1909. In 1929, she enrolled at Lingnan University, which had been established as a Christian college in 1888 by American missionaries in Guangzhou. The reputation of the college grew quickly, and by 1918 the leading U.S. universities, including Harvard, Yale, and Stanford, were accepting its students for graduate programs. Miss Lui chose physics as her major and completed her undergraduate degree in 1933. In addition to the regular curriculum of physics courses, she also took courses in science teaching, and from 1933 until 1936 she taught physics at the middle-school level. At the same time she enrolled in graduate courses in physics at Lingnan University.

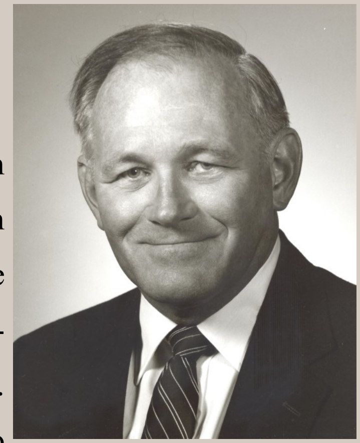
In 1936, the Oregon State chapter of Phi Kappa Phi (an academic honor society) offered Miss Lui an exchange scholarship, which covered her tuition and room. She moved into Snell Hall, which was then a women's dormitory. She was one of the first two students to enroll in the newly formed physics graduate program at Oregon State. Within one year, she had completed and defended her M.S. thesis, Diffusion Phenomena in Strong Magnetic Fields, under the supervision of Professor Willibald Weniger, who was also chair of the Physics Department. Her experimental work studied the magnetic field and temperature dependence of the time for the diffusion of aqueous dye solutions. She continued on to study for a Ph.D. in physics, which she completed in 1941 under the supervision of Professor James Brady. Her thesis, The Crystal Photoeffect in D-Tartaric Acid Single Crystals, concerned a process analogous the better-known photoelectric effect in metals, in which light shining on certain crystals causes a current to flow. She immediately published her Ph.D. thesis work in the *Physical Review* (vol. 60, pages 529-531) as a single-authored paper.

Following the completion of her Ph.D. she taught as an instructor at Oregon State for several years, and then she was hired by the Westinghouse Lamp Research Laboratory in New Jersey, where she studied phosphors and fluorescent lamps. Westinghouse was also investigating materials for use as filaments in incandescent lighting, among which was uranium. So during the Manhattan Project, which was the highly secret U.S. effort to develop the atomic bomb during World War II, the Westinghouse expertise in purifying microscopic quantities of uranium was instead applied to kilogram quantities, and Dr. Lui turned her skills to that project.

Although she had originally entered the U.S. on a student visa, which would normally have required her to return to China to apply for admission as a permanent resident (the path to citizenship), the U.S. government did not want her knowledge of the atomic research program to fall into the hands of the Communist Party, which had taken over control of China. So in 1949 the Congress passed, and President Harry Truman immediately signed, a bill "for the relief of Doctor Chung Kwai Lui," which read in part "the Attorney General is authorized and directed to record Dr. Chung Kwai Lui as having entered the United States in 1936 for permanent residence." This bill in effect retroactively changed the status under which she had entered the U.S. and thus permitted her to stay. Also in 1949 she married Mr. Hsin Hsu Wei, who had emigrated from China after the war, received a master's degree in electrical engineering from Columbia University, and also been employed by Westinghouse.

Dr. Lui remained at Westinghouse, mostly doing research into the properties of phosphors, until she retired in 1974. She published several papers in physics journals on her work with phosphors, and she is the holder of 2 patents, one in the U.S. and the other in Canada. She died in 2008 at the age of 98. She and her husband (who died in 2000) recognized the value that higher education had played in their lives, and they left their estate to establish the Wei Family Private Foundation, which supports scholarships for students of Chinese ancestry who are studying engineering or science at Oregon State or electrical engineering at Columbia.

Obituary



Professor Emeritus and former Department Chair Charles W. Drake died on November 29, 2013 in Bend, Oregon. Professor Drake was born and raised in Portland, Maine. At age 17 he joined the U.S. Navy and served for two and one-half years in the Pacific Theater as a radio technician. Following his discharge, he returned to Maine and attended the University of Maine on the G.I. Bill, graduating with a degree in engineering physics in 1950. He went on to earn a M.S. in physics at Wesleyan College, where he also met his future wife, Ellen Tan. He then worked for Westinghouse Corp. where he helped to develop the radiation shield for the reactor of the first nuclear powered U. S. submarine, an essential component of what was to become the "nuclear navy." He continued his education at Yale University, earning his Ph.D. in physics in 1958; his research, under the supervision of Vernon Hughes, involved the measurement of the magnetic moment of the metastable state of helium atoms using atomic beam magnetic resonance. He spent the next 8 years on the Yale faculty, teaching and continuing his research in atomic physics. In 1966 he moved his family (now including 3 children) to Corvallis to assume a faculty position in the Physics Department at Oregon State. He served as chair of the Physics Department from 1977 to 1984, guiding the department through a critical period of growth and stability. He retired in 1996 after a distinguished 30-year career at OSU, and in retirement divided his time between Oregon and his home state of Maine, eventually settling in a retirement community in Bend. He is survived by his wife of 62 years, his 3 children, and 7 grandchildren.

Physics

Alumni update:

Undergraduates:

Connelly Barnes (B.S. 2006) began a new position as Assistant Professor of Computer Science at the University of Virginia. http://www.cs.virginia.edu/people/faculty/barnes.html

Cecilia Bitz (B.S. 1988) is the 2013 recipient of the University of Miami's Rosenstiel Award, one of the School's top honors. She is an associate professor in the Atmospheric Sciences Department at University of Washington.

Marcus Capiello (B.S. 2013) has started a Cognitive Psychology PhD program at UC Riverside. He will be focusing on finding novel models for how memory is retained in the brain and testing the models against experimental findings.

Briony Horgan (B.S. 2005) began a new position as an Assistant Professor of Earth, Atmospheric and Planetary Sciences at Purdue University. http://www.eas.purdue.edu/people/faculty-pages/briony-horgan.html

Derek Tucker (B.S. 2002) is a Senior Laser Engineer at JDSU in Milpitas, CA. He and his wife Jillian are proud parents of Emiliya, born February, 2013.

River Wiedle (B.S. 2013) is a Manufacturing Technician at Intel Corporation in Beaverton. He's enjoying looking at everything on the nanoscale!

Graduate Students:

Tom Swanson (Ph.D. 1995) is a staff scientist at the Naval Observatory in Washington DC. He continues to produce funny physics cartoons! Check them out at http://home.netcom.com/~swansont/science.html

Grant Eastland (MS 2003) received his PhD from Washington State University August 2012. He has a postdoctoral position as a Physics Research Scientist for NOAA NW Fisheries Science Center, in Seattle WA working in acoustics and advancing image processing.

Kurt Gaskill (Ph.D. 1984) is a research physicist scientist at the Naval Observatory in Washington DC. His group is seeking good researchers in metamaterials.

Jon La Follett (Ph.D. 2010) is a physicist at Shell Oil Company working in research and development. He and his wife have three children.

Faculty and Staff:

Liz Gire (post doc 2011) and her husband Ari welcomed daughter Olivia into the world in 2013 – congratulations! Liz is a professor at the University of Memphis.

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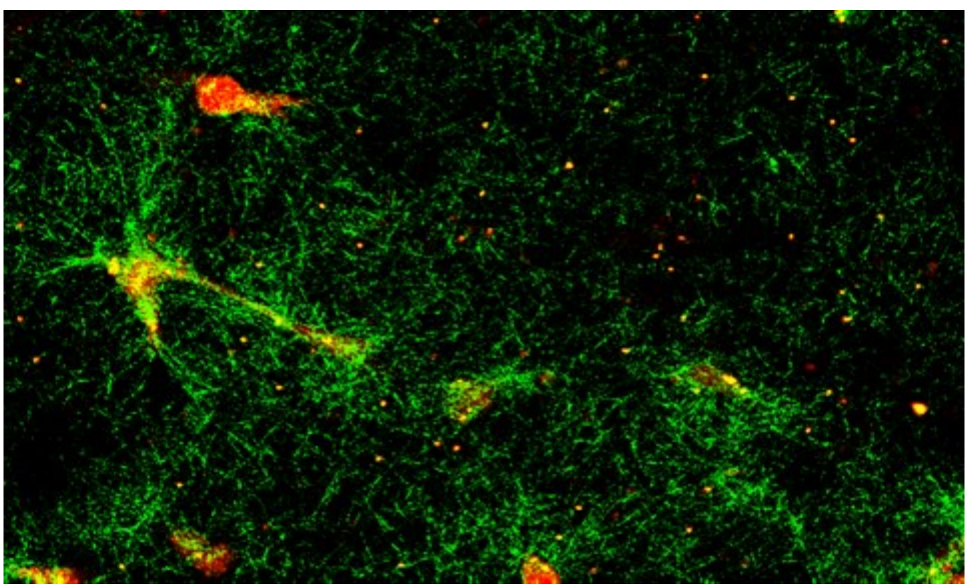
Oregon State University
College of Science



GFP-expressing fibroblast cells (red) in 3D collagen gel (green) imaged in a newly established Prof. Bo Sun's lab at OSU. The traction force generated by the cell creates inhomogeneity in their environment, which further feedback to their own physiology through mechanosignaling.