PHYSICS

An occasional newsletter for alumni and friends. **Fall 2008**

Chairman's Report

There has been a four-year break in our newsletter and there have been many changes and many accomplishments during that time. This newsletter will highlight only some of them. The Physics Department had a very active and productive period that has seen an expansion of the number of undergraduate physics majors, graduate students and of the research scientists. A state-of-the-art electronics laboratory has been established under the leadership of Professor Jingbo Ye and the research funding has grown from $500,000 in 2004 to about $2,000,000 in 2008.

- Ryszard Stroynowski

FACULTY NEWS:

The department is very pleased to welcome our new faculty members:

- **Pavel Nadolsky** - Assistant Professor of Theoretical Physics.

Nadolsky received his Ph.D. degree in 2001 at the Michigan State University and had his first postdoctoral appointment with the Physics Department at SMU. He then spent several years at the Argonne National Laboratory near Chicago before returning to Dallas. Nadolsky's expertise is in the area of Quantum Chromodynamics. He works on precise descriptions of the structure of the proton and is one of the few world experts on the behavior of heavy quarks inside the proton.

- **William McElgin –** Visiting Assistant Professor of Theoretical Physics.

McElgin came to SMU immediately after receiving his Ph.D. at the University of Chicago. His interests lie in the area of string theory, conformal field theory and quantum gravity.

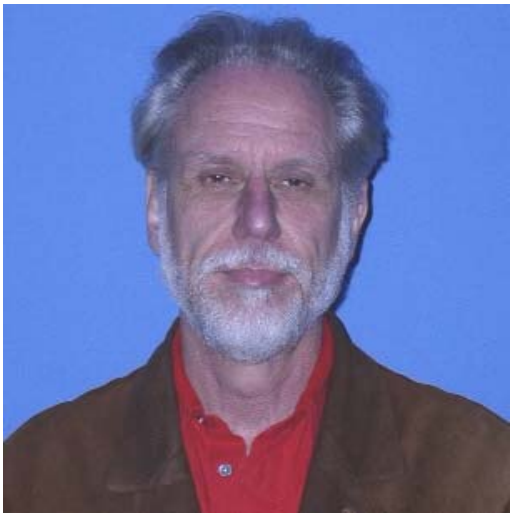
- **Simon Dalley** – Lecturer

Dalley received his Ph.D. degree in 1991 at Southampton University in the U.K.. After research positions at Princeton, Oxford, CERN, and Cambridge, he became a Lecturer at Swansea University before moving to SMU in 2006. His interests are in theoretical physics, especially light cone quantization.

- **Fredrick Olness** - elected President of the Faculty Senate

We are honored to report that that **Professor Fredrick Olness** was elected President of the SMU Faculty Senate for 2009-2010 academic year. In this role Olness will be able to shape the future of SMU academic activities.

In Memoriam: Gary Don McCartor



Gary Don McCartor, Professor of Theoretical Physics passed away on December 8, 2006 in Dallas. He was 63 years old. Gary received his A.B degree from Occidental College in Physics & Mathematics, and his Ph.D from Texas A&M in Theoretical Physics. He spent 20 years at Mission Research Corporation in California, where he worked on Nuclear Test Ban Treaty Monitoring and served as a Division Leader. His work covered both the Comprehensive Nuclear Test Ban Treaty (CTBT) and the Threshold Test Ban Treaty (TTBT). His algorithms and software help operate the International Data Center, the instrument of the United Nations Conference on Disarmament. In 1990, Gary moved to SMU where he helped build a High Energy Physics program. During his tenure here he published 45 scientific papers and supervised the school's first Ph.D. student in Theoretical Physics. He served two terms as Department Chairman in the 1990's.

At SMU Gary's research touched upon the most fundamental and difficult theoretical questions in Physics. His program was in the field of light-cone quantum chromo-dynamics and aimed to derive the basic properties of matter particles from first principles. He had collaborators in the USA, Japan, Russia, Italy and the United Kingdom. He was a founding member of the International Light Cone Advisory Committee, organizing one of the first annual conferences in the field. It was becoming clear in the last couple of years that he was close to a breakthrough and we hope that his student and their collaborators will bring this work to the expected successful conclusion. Gary was a greatly valued member of the SMU community. We miss him very much. He will live on, in our minds, by the students he taught, the programs he initiated, and the people he touched.

Professor Vigdor Teplitz retired

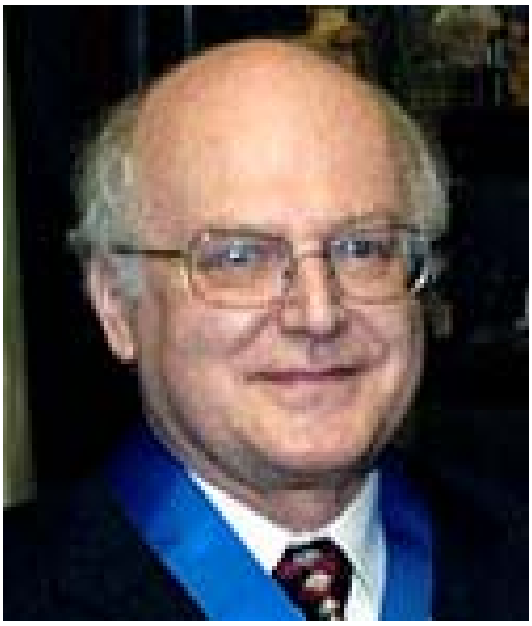
Professor Vigdor Teplitz, Professor of Theoretical Physics, has devoted almost his entire life to science and national security. He received his S.B. from Massachusetts Institute of Technology in 1958 and his Ph.D. from the University of Maryland in 1962. In earlier years, he has held positions at UC Berkeley and CERN (European Center for Nuclear Research) in Geneva, Switzerland, and has taught at M.I.T. and Virginia Polytechnic Institute where he also served as Chair. Professor Teplitz came to SMU in 1990 and was the Chairman of the Physics Department 1990-1995. His early work was important for the development of what became later known as the Standard Model of particle physics. Later, he was active in Arms Control negotiations and took part in preparations for the SALT I Treaty. He also worked on negotiations with the Soviets on satellite weapons, nuclear force missiles and strategic arms. He became interested in cosmology and initiated searches for remnants of objects created during formation of the Universe. At SMU, he collaborated with Professor Herrin in the Geology Department looking for seismic signals generated by such objects. Professor Teplitz continues to advise the US State Department on issues related to national security as a consultant of the U.S. Arms Control and Disarmament Agency. In recent years, he became a U.S. representative to the NATO Science Committee. On leave from SMU, he became Chief of University Programs for the NASA Goddard Space Flight Center.

Professor Teplitz retires in Maryland with his wife Doris who is also a physicist. They have a son Harry, a daughter Hilary and a grandson. We wish him good luck in his retirement and hope to keep in contact. We will miss the stimulation generated by his imaginative and creative ideas.

Cas Milner's patent

Professor Cas Milner's work with IBM company resulted in a patent for a process to teach foreign languages and has been recognized as one of the top 10% of IBM patents for 2006.

Ryszard Stroynowski received the 2006 Gerald J. Ford Research Fellowship. It allowed him to spend the summer working together with graduate students on the ATLAS project at CERN.



UNDERGRADUATE PROGRAM:

We have a healthy and active undergraduate program, which has grown to 18-20 physics majors, and a dozen physics pre-majors. **Professors Robert Kehoe** and **Thomas Coan** direct the physics undergraduate program, in which classes can be supplemented by research projects.

Recent graduates

2005:

Anna Stelzenmuller,
Christina Bowrey,
Robert Nordsell,
Clayton Mauldin.

2006:

Andrew Avalos,
Rozmin Daya,

Elisa Tomulet,
Zachary Parvin,
Michael Shearn.

2007:

Charles Taylor,
Paul Hartin,
Kristen Smith,
Salvador Jiminez.

2008:

Kelvin Varghese,
Tyler Gates.

These were very dynamic and talented classes of physics students. It will certainly be interesting to see how their careers develop; best wishes to all of you, and please keep in touch.

Awards and Honors

Congratulations to majors Kelvin Varghese and Amy Hand for being inducted into the honor society Phi Beta Kappa.

Kelvin Varghese has been our department's 2007-2008 recipient of the Robert Stewart Hyer Scholar Award and Alex Weckiewicz is the 2007-2008 recipient of the Frank C. McDonald Memorial Award for Excellence in Physics.

Undergraduate Research

The involvement of the undergraduates in various research activities has seen a dramatic increase. Special funding from the Lightner-Sams Foundation, MATPHYS and SMU allowed us to purchase specialized equipment needed for such studies. This fall, students are pursuing seven independent projects, ranging from measuring pico-currents and fast optical data transmission to a search for yet undiscovered variable stars and the measurement of the magnetic moments of cosmic ray particles.

Undergraduates Amy Hand and Alex Weckiewicz are actively engaged in a research project to measure the "gyromagnetic ratio" of muons produced in Earth's upper atmosphere. They are designing and constructing a special solenoidal magnet and scintillation counters under the supervision of Professor Thomas Coan. The work was supported by SMU's Undergraduate Research Associates program and from corporate donor MATPHYS LLC.

Kelvin Varghese used the department's radio telescope to measure our galaxy's "rotation curve" via radio emission from neutral hydrogen, demonstrating the existence of dark matter in the galaxy. This work was supported by the Lightner-Sams Foundation.

Society of Physics Students

Thanks to the generous support of the Lightner-Sams Foundation, the Society of Physics Students organized each year a trip to one of the National Laboratories for several members. Past trips included Stanford Linear Accelerator Center in California, Brookhaven National Laboratory on Long Island, NY, and Fermilab near Chicago. The target of the most recent trip was the island of Maui in Hawaii. They visited the Haleakala High Altitude Observatory site, where their tour guide, Mike Maberry, explained the projects researched by the Mees Solar Observatory. At 10,000 feet elevation, Haleakala observatory is among the best ground observatory sites in the world, located above one third of the Earth's atmosphere. They also toured the Maui High Performance Computing Center, where their guide mentioned some of the projects that were being worked on at MHPCC, including tracking all shipments in the world and tracking everything in the sky. The observatories also used some of the MHPCC's computing power in their own projects. Certain areas of the facility were classified, so they were able to take neither cameras nor cell phones in those areas. The group also went snorkeling and were able to see the reefs around the island, not to mention the various fish and wildlife. All agreed that it was the best SPS trip to date. In the photo below:

Chris Christensen, Professor Simon Dalley, Mat Busby, Amy Hand, Alex Weckiewicz, Judy Garza, Mariam Ishaque, Ken Ueda, Angela Walker, Kelly Pearson on the summit of Mount Haleakala in Maui, Hawaii

The 2007 destination was the Physics labs around the San Francisco Bay area. We had 10 undergraduates, 5 graduate students, and two faculty members.

Monday was spent around Stanford. We started off having lunch with some young physicists who work at the Stanford Linear Accelerator Center (SLAC). They graciously spent their lunch hour conversing with us about their individual projects as well as the future of SLAC. It was a unique perspective to hear from both people who were working on upcoming projects and people who were working on experiments that were in the mature stages and perhaps were on their way out the door. After lunch, we were given a short lecture on the concepts behind the larger experiments going on at SLAC, followed by a tour of the facility. Luck was on our side that day, as the accelerator was actually powered down for routine maintenance, giving us the opportunity to go inside the actual building that houses the particle beams. We also were given the opportunity to have a question and answer session with two SLAC physicists where the discussion taught us about several topics but

focused highly on parity violation and the Higgs Boson and Higgs field. Tuesday it was off to Lawrence Berkeley National Labs on the UC Berkeley campus to tour an entirely different type of particle accelerator. This one was a circular accelerator that made use of the momentum of the particles inside it to shoot them out of the ring in key places along the circle. This allowed them to have up to about 35 experiments going on at any one time. Along with our tour of the accelerator we were also guided through other parts of the lab. We were allowed to view a clean room where they actually fabricate the detection strips for the ATLAS detector at CERN. On Tuesday night we met with some SMU alumni who are now at Stanford and Berkeley, and we were able to get to know our brethren over dinner.

For the December 2008 trip, students plan to visit CERN Laboratory in Geneva, Switzerland, to see the detectors of the Large Hadron Collider.

GRADUATE PROGRAM

The graduate program at SMU remains small and focused on high energy particle physics. We are happy to report major successes of recent Ph.D. recipients:

Igor Volobuyev is now Assistant Professor of Physics at Texas Tech.

Yuri Maravin is an Assistant Professor at Kansas State University. He recently received a prestigious Outstanding Junior Investigator award from the US Department of Energy.

Ilia Korolkov obtained a permanent position at the University of Barcelona, Spain.

Vitaliy Fadeyev accepted a senior research staff position at the University of California at Santa Cruz.

Liang (Gary) Lu opened an information web portal company in Beijing and remains its Chief Technology Officer. In 2007 the company employed 400 people.

Ilya Narsky is a Senior Research Associate at Caltech.

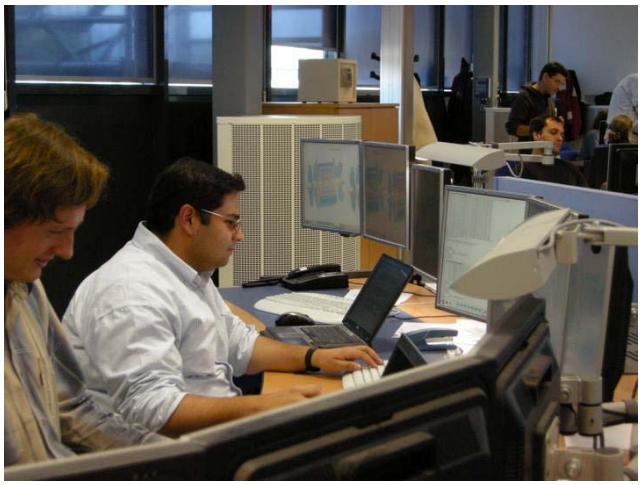
Physics Nobel Prize Winners meeting in Lindau, Germany

In July 2008, two SMU graduate students had the privilege of attending the annual meeting of Nobel Prize winners. This year's meeting was dedicated to Physics and 24 Nobelists met with about 400 physics graduate students from all over the world. In the picture below Rozmin Daya listens to one of the lectures.

Lightner-Sams Graduate Fellowships

In 2006 the Lightner-Sams Foundation established the Graduate Fellowship program of one-time awards for outstanding work in graduate study. The first recipients were Ana Firan and Renat Ishmukhametov. In 2007 the awards were given to Azzedine Kasmi and Yuri Ilchenko and in 2008 to Rozmin Daya, Kamile Dindar-Yagci and Ryan Rios.

The photo shows Ryan Rios in the ATLAS control room



RESEARCH PROGRAM:
The department continues its strong research programs in Experimental and Theoretical high-energy physics. The experimental group is active in several projects: D-Zero takes data at the Fermilab Tevatron, ATLAS is one of the main experiments at the Large Hadron Collider at CERN, and preparation for several future projects is well underway. The theorists work on a variety of topics. The main research area is Quantum Chromodynamics, where the precise understanding of the inner structure of the proton is urgently needed by the experimenters trying to discover new phenomena at the LHC. The 2008 report of the research activities listed about 150 publications and notes authored by SMU Physics Department scientists. These research programs are supported by the US Department of Energy and the National Science Foundation grants amounting to about $2 million this year.

The following article appeared in Boston Globe in May 2007

Scientists hope collider makes a big bang, physics questions are effort's focus
By Colin Nickerson, Globe Staff | May 12, 2007

GENEVA -- In a 17-mile circular tunnel curving beneath the Swiss-French border, scientists are poised to recreate the universe's first trillionth of a second.

The aim of the audacious undertaking -- whose centerpiece is the Large Hadron Collider, the largest, most powerful particle accelerator ever constructed -- is to solve one of the most perturbing puzzles of physics: How did matter attain mass and form the cosmos? Even Einstein couldn't nail that one.

The collider and its multi billion-dollar array of ancillary instruments are designed to recreate and identify the most in finitesimal of subatomic substances -- the material that built the galaxies -- as they blaze into existence with fantastic energy and disappear with such rapidity as to make the blink of an eye seem an eternity.

The project involves half the planet's particle physicists, drawn from 80 countries.

Roughly 800 American researchers, including a big contingent from Boston-area universities and labs, are participating with 7,000 other scientists in the $8 billion project overseen by the European Organization for Nuclear Research, better known by its French acronym, CERN.

Hopes are high that the CERN effort -- billed as the largest science experiment ever -- will yield astonishing glimpses into black holes, hidden dimensions, and other mysteries of space-time.

Any big result will provide a much-needed jolt to the stuck-in-the-mud field of particle physics, which has seen little in the way of major advances in the past three decades.

"There is a definite giddy sense that we're nearing a watershed," said George Brandenburg, a Harvard physicist involved with one of the major experiments soon to get underway at CERN. "At the very least, we should be seeing some very intriguing stuff when the protons start to collide. As to whether we can wrap up the universe with a nice pink bow -- well, who knows? But for sure this is a serious shot at it."

The Hadron Collider, named for the category of tiny matter that includes protons and neutrons, is scheduled to begin test runs later this year and should be revved to full strength in early 2008, according to CERN.

The collider, conceived in 1994, is designed to forge the blizzard of energies and particles unloosed in the first picosecond of the Big Bang, although on a much smaller scale. According to prevailing scientific theory, the cosmos was born in an instant roughly 13 billion years ago.

"It's basically a time machine," said Julia Hoffman, a particle physicist from Southern Methodist University in Texas. "We're going back to the birth of everything and doing it again."

Most of the action will occur in an enclosed underground track roughly the size of a subway tunnel, forming a 17-mile circle lying an average of 328 feet beneath a bucolic countryside of dairy farms and rustic villages set against the snow-capped Alps.

Using super-conducting magnets, the collider will accelerate two streams of protons -- positive-charged particles that are inside every atom -- to more than 99.9 percent of the speed of light, or about 186,000 miles per second. Then, earning its name, the contraption will shift the protons into a collision course, causing them to smash head-on.

The experimenters are especially intent on tracking down an elusive entity called the Higgs boson -- also known as the "God particle" -- a speck from the field of the same name that physicists believe somehow adheres to everything else. The Higgs boson and the Higgs field, for now, remain hypothetical constructs used to fill in a glaringly blank area of physics, much as medieval cartographers marked unknown regions with best guesses, "Here Be Dragons."

Many physicists believe the Higgs represents the key to the "standard model" of physics, the theory devised in the early 1970s that goes a long way toward explaining the most basic bits of the universe and how they interact.

"Either we find the Higgs and say, 'Yes!' because much of what we thought we knew about how the universe works is right," said Steven Nahn, a particle physicist from the Massachusetts Institute of Technology and one of the researchers. "Or we scrap the standard model and go back to the drawing board."

Scientists believe the high-speed crash of protons -- occurring at a rate of 600 million per second when the accelerator is running full-tilt -- will shed bits of elusive debris, such as the Higgs boson. Such bits flared into being at the dawn of time, but have been more or less invisible since. Scientists believe they can only be re-created under conditions similar to the Big Bang.

There may be no "Eureka" moment at CERN. Instead, some 3,000 computers will sift through boggling amounts of data, equivalent to 1 percent of all data on earth (that is, all content from newspapers, magazines, scientific studies, stock market indices, government record-keeping, and so on).

The scientists and their machines will be looking for peculiar bursts of energy or inexplicable pings of matter. According to physicists, the Higgs boson, if it exists, will follow a unique trajectory that will permit researchers to make a positive identification.

The subterranean course is broken by four vast chambers housing intricate machines with which scientists hope to monitor what they prosaically describe as "events" -- tinier-than-atom particles splintering into even tinier

shards; the near-instantaneous creation and decay of "miniature" black holes; and perhaps even rips in the space-time fabric that will allow a peek into dimensions beyond.

"Every collision will produce an event," said Joao Guimaraes, an experimental physicist from Harvard. "The huge challenge is to figure out which events are truly different or significant, which events may portend truly new insight into the universe."

Little of the research at CERN may be "useful" in the sense of immediately leading to nifty new consumer gizmos or finding hard cures for specific woes, whether climate change or cancer.

"These experiments are driven pretty much by pure curiosity, the human need to know," said Frank E. Taylor, a high energy physicist at MIT. "Particle physics doesn't necessarily translate into making better mousetraps."

Or bigger bombs, for that matter: Unlike some previous physics projects, the research has no goal of producing weapons -- although, of course, it's impossible to predict where future researchers might go with results from CERN. But the purpose is peaceful and discoveries will be shared with all universities and research centers.

Particle physics, also known as high energy physics, ranks among the most rarefied realms of science. It studies the elementary constituents of matter and energy, the most basic building blocks of nature.

The research requires big brains, big money, and big equipment. One of the main particle trackers at the CERN project hunkers 82 feet high and 150 feet long. Its main purpose is to record the pathways of subatomic shrapnel flung when the protons collide.

Another major device will produce a magnetic field 100,000 times greater than that of the Earth to bend the trajectory of charged new particles, allowing scientists unprecedented scrutiny of the short-lived scraps and precise measurement of their momentum.

And if the research falls flat?

"That would be just as exciting to experimenters, it would mean we'd be looking into the face of something totally unexpected and new, instead of just confirming our expectations," said Christoph Paus, an experimental particle physicist from MIT.

He paused, then acknowledged with a sigh: "But it would also be a PR disaster. The sort of thing that people who don't understand science use to ridicule science."

NEW COURSES: An update

The department continues to introduce new courses into the physics curriculum to match the interests and needs of our students. The Scientific Method, which is taught by Professors Scalise and Cotton remains highly popular. The new course on Nuclear Power and Society, taught by Professor Milner, attracts the maximum number of students that can fit into the classroom and the Physics of Music taught by professors Olness and Tunks attracts large numbers of non-science majors. Other new courses address changing needs of the future graduates: computational physics and modern physics are designed to be useful in almost any future professional endeavor.

Teaching nuclear physics to a non-technical audience.

Cas Milner

Nearly everyone who has earned a Ph. D. in physics since World War II has benefitted, at least in some small way, from government support for nuclear science. In the U.S., it can be argued a large share of physics funding (presently administered by the Department of Energy) has its origins in support for nuclear weapons research and development. This has resulted in broad-based infrastructure development, encompassing university and government research laboratories, new university facilities and equipment, and also support for faculty and students, in areas as wide ranging and diverse as lasers, atomic physics, particle and nuclear physics and computing. For this reason, I have always felt it is the responsibility of all physicists to educate the university community and public at large about nuclear science and the influence it has on culture. I also believe anyone with a graduate physics education is qualified to engage non-scientific audiences on these topics, even if their area of expertise is not nuclear physics.

Therefore, with the encouragement of Professor Olness, in 2006 I proposed a new SMU undergraduate course entitled "Nuclear Physics and Society", offered as a "cultural formation" course in Dedman College. Two cultural formation courses are required for the liberal arts bachelor degree. Very little mathematics is used in the course – only basic arithmetic. The course scope is broadly defined. From the introductory note I distribute to students:

"Developments in nuclear physics have affected in some significant way nearly all important features of society, culture, ethics, science, medicine, health, literature, arts and politics. We will visit these topics in detail. My two primary roles in the course will be explaining nuclear physics to a level allowing you to understand many historical and policy issues (for example, "why did the Iraqi purchase of precision aluminum tubes lead to international criticism and contributed to the invasion of 2003?"), and leading the extensive discussions we will have in the class. As in other CF courses, the students do a lot of reading and writing and gain insight into the impact of nuclear science on culture.

SMU-in-Taos Courses

For more than 30 years, SMU has offered summer courses at its Taos campus, Fort Burgwin, in New Mexico. Most of the courses leverage the unique history and culture of northern New Mexico. New Mexico is also home to various sites associated with the development of nuclear weapons, including Los Alamos, Santa Fe, and Trinity where the first nuclear explosion was detonated on July 16, 1945. Because of this rich history, Professor Olness and SMU History Professor Hopkins developed a short course on the History of the Manhattan Project. This course, continued by Professor Milner continues to be popular at SMU-in-Taos.

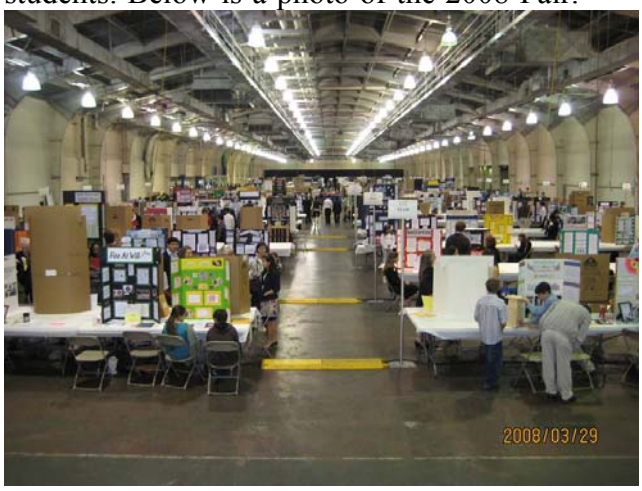
COMMUNITY OUTREACH:

The Physics Department is promoting a number of community outreach projects.

- ***QuarkNet:*** In Summer 2007 19 teachers and in Summer 2008 17 teachers from Dallas-area high schools participated in the 7th & 8th sessions of the SMU QuarkNet program. They learned about recent discoveries in physics through lectures and hands-on labs coordinated by professors Dalley and Scalise with the help of physics graduate student Azzedine Kasmi and undergraduate Ken Ueda. The teachers and the lecturers were equally enthusiastic about the experience. Dirk J. Preble from the Legacy Christian Academy in Frisco, Texas,

believes the program "assisted me to become a better physics teacher" and Jon Papp from the Skyline High School in Dallas says that "this is the only physics program in the region that gives teachers access to particle physics that we can use in the classroom". This project, funded by the Department of Energy, the National Science Foundation, and Fermilab, is highly prized by the teachers who often come back the following year. The photos show the classes of 2007 and 2008.

- ***Science Fair:*** Professor Simon Dalley became in 2006 the Director of the Dallas Regional Science and Engineering Fair, which attracts each year about 1000 high school and junior high school students from the Dallas area. Major sponsors of the Fair - Beal Bank, Toyota, and Texas Instruments - view it as one of the best ways to popularize science and engineering among young students. Below is a photo of the 2008 Fair.



Alumni news

Alonso Gutierrez (BS 2003) is now an Assistant Professor in the Department of Radiation Oncology at the University of Texas Health Science Center in San Antonio, Texas.

Matthew Knee (MS 2004) is teaching AP physics at the Tower Hill School in Wilmington, Delaware. "The school is really great and it's really nice to be finally teaching physics. Tower Hill is a private day school so I'm getting some of my life back after teaching in the boarding school."

Charles Taylor (BS 2007) won the "Genius Award" together with two other SMU students, Sam Khurana and Francis Goldschmid. They were the victors in the August 2006 final episode of NBC's reality show, Treasure Hunters. Known as "The Geniuses," they won $3 million by solving the contest's final clue — FSKEY — and opening the vault before the Southie Boys and Air Force could figure it out. Charles Taylor continues his studies at the University of Texas Southwestern Medical School in Dallas.

Paul Hartin (BS. 2007) completed his MsEE in Engineering at SMU in May 2008 and got married to Lauren in June 2008.

Franz Farro Aguire (MS 2006) married Blanca Cruz in July 2008.

Shannon Clardy (nee Thornton), started a tenure track position in physics at Henderson State University this fall. “I start as a full-time tenure-tracked prof this August! How exciting is that? I'm teaching Advanced Mechanics, online astronomy, online astronomy lab, and 2 other labs this fall. Yippy!”

Chris Myatt (BS 1991)
"We have a nearly two year old daughter, Elena Elizabeth Hatcher Myatt-- Between the business and Ellie, our time is taken. We have just signed a lease on 11,000 square feet of space, we move within two months. We have just started up an initiative in bio-photonics. We are swimming against the current, orienting our technology towards AIDS and diseases of emerging countries, to be extremely low cost and work with limited resources."

Parker Cravens received his PhD in particle physics from the University of California, Irvine in 2008.

Yon Vetter-Cole (MS 2006) and his wife Lisa became happy parents of twins Cadence and Melody in October 2007.

Thank You For Keeping In Touch:

Thank you to all of you who updated your contact information for our records.

- Please inform us of any address changes in the future so we can stay in touch.
- Please send us your Email address for the future Physics Department Newsletters.
- Please put us in touch with others who would like the Physics Newsletter.
  Please help us recruit both undergraduate and graduate students by putting us in touch with any prospective candidates.

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