



Chairman's Report

The Physics Department had a very active and productive year with respect to both teaching and research.

FACULTY NEWS:

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

- **Jingbo Ye** (Assistant Professor),
- **Robert Kehoe** (Assistant Professor),
- **Stuart Wick** (Visiting Asst. Professor).

Ye works in the field of experimental particle physics on the ATLAS collaboration, and supervises SMU Opto-Electronics Laboratory. **Kehoe**, also an experimental particle physicist, is a member of the ATLAS collaboration and the D0 collaboration based at Fermilab. **Wick** is a theorist and studies Cosmology and Astrophysics. For further details, refer to their Faculty Profiles in this Newsletter.

We are honored to report that that **Professor Cas Milner** was elected to the American Physical Society (APS) Investment Committee; he is uniquely qualified for this committee as his background spans both physics research and institutional investment. Professor Milner, an SMU Adjunct Physics Professor and the Director of Ranger Advisors, worked at Brookhaven and Los Alamos National Laboratories, as well as the SSC lab in Dallas. For the last 10 years he has worked in a wide range of capacities in the investment industry, including managing

portfolios, trading stocks, and performing research. Presently Professor Milner manages a diversified portfolio of hedge fund investments totaling over \$300 million for Ranger Capital Group. At SMU, he has often taught our "Modern Physics" course.

UNDERGRADUATE PROGRAM:

We have a healthy and active undergraduate program with approximately 15 physics majors, and a dozen physics pre-majors. **Professors Robert Kehoe** and **Thomas Coan** direct the physics undergraduate program.

We graduated four undergraduate physics students in both 2003 and 2004.

Grads: 2003:

Alonso Gutierrez,
Michael Bligh,
Graham Averitt,
Reed Maxwell Johnson.

Grads: 2004:

Chantel Morris,
Joe Mahoney,
Brandon Reimer,
Michael Shearn.

These were very dynamic and talented classes of physics students. (Two of them were both SMU Presidential Scholars as well as Goldwater Scholars.) It will certainly be interesting to see how their careers develop; best wishes to all of you, and please keep in touch.

GRADUATE PROGRAM:

Professor Ryszard Stroynowski is the director of the physics graduate program, and **Professor Roberto Vega** is director of graduate recruitment. We have been fortunate to recruit and train top quality physics graduate students in recent years. Continuing this tradition, we accepted 6 new graduate students in Fall 2004. For more details, see the Graduate Profiles section of this newsletter.

In August of 2003, **Dr. Eliana Vianello** received her Ph.D. degree under the supervision of Professor Gary McCartor. She has taken a teaching position in Italy.

In December of 2004, **Mr. Matthew Knee** received his M.S. degree under the supervision of Professor Ryszard Stroynowski. He has taken a teaching position in Wisconsin.

RESEARCH PROGRAM:

The department continues its strong research programs in Experimental and Theoretical high energy physics. The experimental group is active in the CLEO, D-Zero, ATLAS, and BTeV experiments. The theorists work on a variety of topics including Quantum Chromodynamics, Astrophysics, and Cosmology. These programs are supported by external research grants, and our sponsors include the US Department of Energy, the National Science Foundation, the Lightner-Sams Foundation, the US ATLAS program, and the Fermilab QuarkNet program.

NEW COURSES: An update

The department continues to introduce new courses into the physics curriculum to match the interests and needs of our students. In the last newsletter, I told you about our new course: **Phys 3333: The Scientific Method**, which is taught by **Profs. Scalise and Cotton**. We are pleased to report that this course has been very popular—we have moved it to a larger room, and plan to add multiple sections in the future.

This course was inspired, in part, by recent lectures by Robert Park and James Randi. We expose scientific frauds, fallacies, and fantasies, and provide the students with an understanding

of the scientific method sufficient to differentiate experimentally verifiable scientific fact and theories from pseudoscience in its many guises. The course has a variety of guest lecturers including Prof. Louis Jacobs (Geology), Prof. Ron Wetherington (Anthropology), Prof. Daniel Orlovsky (History), Agent Flowers (US Secret Service), and I get to give a guest lecture challenging the students' beliefs in the "round earth theory."

DISTINGUISHED VISITORS:

The department is fortunate to have a number of distinguished visitors to campus every year. For a current listing of upcoming presentations, have a look at our Seminar web page linked from our Physics page: <http://www.physics.smu.edu>

One week, two Nobel Laureates

We did not realize it until the Nobel prizes were announced in November 2004, but the department succeeded in having two Nobel laureates speak at department seminars in the same week.

On Wednesday May 5, 2004, **Professor James Cronin** ('51) presented a seminar on his current project, the Pierre Auger Observatory based in Argentina, which studies the highest energy cosmic rays. Professor Cronin was on campus to receive the first Dedman College Distinguished Graduate Award. Cronin received the Nobel prize in 1980 for his discovery of CP (Charge-conjugation—Parity) violation.

(See following article for details.)



Photo by Martina Kolmeder

Professors Cronin and Olness during the May 2004 Dedman College celebration.

On Monday, May 3rd 2004 of the same week, the department hosted **Professor Frank Wilczek** (MIT) who spoke on the recent discovery of the Pentaquark. Six months later, in November, Wilczek received the 2004 Nobel prize for his work on uncovering the nature of the strong force that binds the nuclei.



Brian Greene:

Physicist, Best-Selling Author, & NOVA star.

Professor Brian Greene came to campus in September 2004 to give the Annual Allman Family Public Lecture, presented by Collegium da Vinci lecture series.

The way Carl Sagan popularized astronomy, physicist and mathematician Brian Greene is doing the same for theoretical physics. Author of



the best-seller *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*, Greene is considered one of the world's leading experts on string theory. The photogenic Greene, who hosted a 3-hour NOVA program

based on his book, is a rising academic and media star, with appearances on "Nightline" and profiles in *USA Today* and *Scientific American*.

COMMUNITY OUTREACH:

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

- **QuarkNet:** In Summer 2004, we held our 4th SMU QuarkNet program hosting 15 high school physics teachers for a one-week workshop on incorporating High Energy Physics topics into the High School classroom curriculum. This project is funded by the Department of Energy, the National Science Foundation, and Fermilab.
- **Science Fair:** Professors Wick, Scalise, and Olness are co-directors for the Dallas Science Fair involving high school and junior high school students throughout the Metroplex. Check us out at: www.DallasScienceFair.org
- **Physics Circus:** For a number of years now, the department has been presenting a "Physics Circus" to local area elementary and secondary school students to promote an interest in science. In November 2004, we presented the "Physics Circus" for 250 5th grade women for the Dallas Hispanic Concilio "Psyched About Science and Math" program.

Thank You For Keeping In Touch:

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

- Please use the enclosed information sheet to inform us of any address changes in the future so we can stay in touch.
- 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.

Fred Olness
Chair, Department of Physics

Nobel Prize winner receives first Dedman graduate award

Nobel Prize-winning physicist and SMU alumnus James Cronin ('51) received the first Dedman College Distinguished Graduate Award at a special ceremony on May 5, 2004.



Cronin met with students, including seniors Anand Sitaram and Michael Shearn

Cronin, Professor Emeritus of Physics at the University of Chicago, is leading an international collaboration of scientists studying cosmic rays.

James Cronin was born in 1931 in Chicago, Illinois, while his father, James Farley Cronin, was a graduate student at the University of Chicago. Cronin moved to Dallas, TX, in September of 1939 when his father became Professor of Latin and Greek at Southern Methodist University. He attended the Highland Park Public School System, and then received his undergraduate degree from Southern Methodist University with a major in Physics and Mathematics in 1951.

After graduating from SMU, he entered the University of Chicago in September 1951 as a graduate student. At Chicago, he took classes from many well-known physicists including Enrico Fermi, Maria Mayer, Edward Teller, Gregor Wentzel, Val Telegdi, Marvin Goldberger and Murray Gell-Mann. His thesis was in experimental nuclear physics under the direction of Samuel K. Allison.

After receiving his Ph.D., Cronin held positions at Brookhaven National Laboratory and Princeton University before moving to the University of Chicago in 1971.

In 1980, SMU graduate James Cronin shared the Nobel Prize in Physics for work done on the violation of time reversal invariance. Cronin is now at the University of Chicago working in cosmic ray physics. He is head of a large international collaboration that is building the world's largest cosmic ray detector. To read more about James Cronin's work, check out <http://www.auger.org>.

Education

- B.S., Southern Methodist University, 1951
- M.S., University of Chicago, 1953
- Ph.D, University of Chicago, 1955

Career

- National Science Foundation Fellow, 1952-1955
- Assistant Physicist, Brookhaven National Laboratory, 1955-1958
- Assistant Professor of Physics, Princeton University, 1958-1962
- Associate Professor of Physics, Princeton University, 1962-1964
- Professor of Physics, Princeton University, 1964-1971
- University Professor of Physics, University of Chicago, 1971-

For more information, check out the **The Nobel Foundation** at: <http://nobelprize.org>

Society of Physics Students goes to Fermilab

By Charles Taylor SPS President
December 2003

This holiday season the Society of Physics Students, along with our awesome guide, Dr. Olness, went to Chicago to see the wonder that is Fermilab. We express our appreciation to the Lightner-Sams Foundation for underwriting this trip. We arrived the first day and went straight to the Museum of Science and Industry for a little culture and a wide variety of science. While there, we toured the U-505 submarine that was captured on the high seas in World War II.



The SMU Physics SPS group posing with a model of the Fermilab accelerator.

The next day we went to Fermilab. When we entered the main building we took a brief tour that included a bird's eye view of the entire facilities. We then listened to a talk given by an accelerator engineer about proton anti-proton collisions. We ended the day with a great lecture given by Dr. Herman White about some of the projects going on and what they seek to

accomplish. He also gave us a brief intro into CP violation that was understandable at our present level (which was a great accomplishment in itself).

The final day we toured the magnet lab and the neutrino facilities. We ate lunch with Dr. Robert Bernstein who discussed some of the opportunities that are open to future physicists, and the discoveries that some of them might make. Eating lunch in the Fermilab cafeteria was awe inspiring. Although this might sound strange to the normal working physicist, I felt

almost overwhelmed by the brainpower that was sitting in a thirty-foot radius of me.

That afternoon we listened to a remarkable talk given by Dr. G.P. Yeh about neutrinos and some of plans for the educational expansion of physics around the world. Dr. Yeh's vibrancy made me want to go to graduate school in Okinawa as soon as possible. It is experiences like this that so many people need to have to push them into the sciences. These

physicists not only are on the cutting edge of science but many of them take time out of their days to give lectures and talks that are each unique and a once in a lifetime opportunity.

It is my hope that we are able to take another group to Fermilab as soon as possible. It is a tremendous place that reverberates with the sounds and feeling of physics.

Particle Tracking Tunes Up Music

SMU Alumni in the news: Vitaliy Fadeyev (SMU Ph.D. 2000)

*Reprinted with permission from **Physics Today**,
Vol.57, Issue 7, p.27..
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By Paul Guinnessy

Thanks to particle physics, creaky old musical recordings can now be restored to pristine condition. The restoration technique, developed by physicists Vitaliy Fadeyev and Carl Haber of Lawrence Berkeley National Laboratory, is a modification of a method used to measure the alignment of silicon detectors on CERN's upcoming ATLAS experiment. "We heard about the problem of audio preservation from a report on National Public Radio. So we thought first, why not use the same optical methods with which we were familiar?" says Haber. "The concept is groundbreaking and we believe it will have a major impact on sound archiving and preservation," says Mark Roosa, director for preservation at the Library of Congress.

Traditional remastering involves playing records with a stylus or a laser. In both cases, the audio is degraded by the record's rotating on a turntable. The Berkeley technique avoids the problem by placing the record in an \$80 000 optical metrology system that takes images while moving a camera in a spiral pattern following the path of the groove. A single 78 rpm record results in thousands of two-dimensional snapshots---100 to 1000 gigabytes of data. The snapshots are cleaned up to compensate for scratches, dirt, and warping, and then converted to a pure audio signal. The method draws on decades of experience in finding elementary particle tracks buried in large noisy data sets from high energy experiments. "We thought these methods, which demand pattern recognition and noise suppression, could also analyze the grooved shapes in mechanical recordings," says Haber. The restoration technique works with vinyl, shellac, wax, acetate, and metal. "It also has the potential to

digitally reassemble broken discs," says Fadeyev. Examples of restored music are available at <http://www-cdf.lbl.gov/~ay>.

Last year, Haber and Fadeyev contacted the Library of Congress and discovered that archivists were particularly concerned about how to save deteriorating and damaged phonographic wax or metal "Edison" cylinders, the earliest form of grooved recordings. The library asked Haber to develop a three-dimensional technique to save those recordings, a request that turned into a research grant. "The Library of Congress really took the initiative to engage with us on this," says Haber.

Early this year, by processing images from a confocal scanning probe, the Berkeley-led team restored a 1910 Edison cylinder recording of George F. Root's "Just Before the Battle, Mother." According to Roosa, the library's holdings include more than 2.5 million music and spoken-word recordings. "A substantial portion of these are grooved media, which could potentially benefit from this new copying technology," he says.

The current prototypes take 40 minutes to scan 1 second of recorded sound. Haber and Fadeyev say that with a customized scanning machine they could reduce the time taken to copy and process a 3-minute recording to between 8 and 20 minutes; 3D imaging of Edison cylinders takes longer. "What we have done so far are just small experiments to prove that modern optical methods have sufficient precision and sensitivity to do that job and then show that image analysis methods can extract sound and improve the quality and reduce the clicks and pops," says Haber. "It's a good example of how basic research in the physical sciences can benefit other fields of science and culture."

<http://www.physicstoday.org/vol-57/iss-7/p27.html>

SMU Physics Student Awarded Prestigious Goldwater Scholarship

March 28, 2003 DALLAS (SMU)

Michael Shearn, a junior at SMU, has been selected to receive a prestigious Goldwater Scholarship for the 2003-2004 academic year.

The Barry M. Goldwater Scholarship and Excellence in Education Program was established by Congress in 1986 to encourage outstanding students to pursue careers in mathematics, the natural sciences and engineering. The Goldwater Scholarship is one of the premier undergraduate awards of its kind in these fields. The scholarships, which are given to sophomores and juniors, cover the cost of tuition, fees, books, and room and board up to a maximum of \$7,500 per year.

Goldwater Scholarship recipients are nominated on the basis of academic merit by faculty members from colleges and universities across

the country. Three hundred scholars were selected for 2003-2004 from a field of 1,093 mathematics, science and engineering students nominated nationwide. Shearn is one of only 17 students from Texas selected to receive the scholarship next year.

Shearn is a President's Scholar at SMU, triple majoring in electrical engineering, physics and mathematics. His career goal is to earn a Ph.D. in applied physics and create new types of computational and mechanical devices. This past summer he assisted in research at Stanford University, and this year he is studying mathematics in London, England.

Shearn is the son of Nancy and Michael Shearn of San Antonio and a graduate of Tom C. Clark High School in San Antonio.

Strange quark matter evidence published in journal

SMU Forum January 22, 2004

Faculty researchers have published their paper in the December issue of the Bulletin of the Seismological Society of America, suggesting that on November 24, 1993, a piece of bizarre matter raced harmlessly through the Earth and left nothing behind. The discovery, first reported last year, could be the first-ever detection of a strange quark nugget.

This form of matter, known as strange quark matter, is so dense that a ton-sized nugget would be about the size of a red blood cell. Physicists have suspected since 1984 that this very heavy form of matter might exist as the most stable form of matter in the universe, but no one has yet found evidence of it. If strange quark matter does exist, it would be relatively rare in the universe, passing through the Earth once every four years, according to the researchers. Shuler-Foscue Professor of Geological Sciences Eugene Herrin and Physics Professor Vigdor Teplitz led

the research team, which included computer specialist David Anderson and former graduate student Ileana Tibuleac.

After searching over one million records collected from the U.S. Geological Survey, taken by seismographs worldwide from 1990 to 1993, the SMU team discovered one event that couldn't be explained by an ordinary earthquake, but whose characteristics fit what might happen if a chunk of strange quark matter flew through the planet.

The nugget would have entered the South Pacific and left 16 seconds later near the South Pole. Despite the force of the strange quark matter, the impact of the nuggets on an inhabited area probably would be less violent than that of a meteor. It's very hard to determine what the effect would be, Herrin says. There probably would be a tiny crater, but it would be virtually impossible to find anything.

Program For Physics Teachers: Sharing Knowledge

Note: Darren Carollo is one of the lead teachers in our SMU Physics QuarkNet Program



Darren Carollo, an American teacher taking part in CERN's programme for physics teachers stands in front of the circular accelerator being built with his colleagues

CERN Bulletin, Issue No.32, Aug.4, 2003

The 40 participants in CERN's program for physics teachers took home a host of new ideas for teaching physics at the high school level. This was the sixth of such programs and took place from June 29 to July 19. It gave high-school physics teachers the opportunity to discover the world of particle physics research and to share their teaching experience with others. After a tour of CERN at the start of the program, they attended lectures designed to bring their physics knowledge up to date and bring them into contact with CERN physicists. They also took part in project workshops supervised both by CERN physicists and by other physics teachers.

Practical exercises

This year, for example, two American teachers organized the building of two mini-accelerators, one linear and the other circular. "When I visited CERN three years ago, everything seemed huge and beyond the bounds of comprehension for high-school pupils. That was how I got the idea of designing a scale model that operates in the same way as an accelerator"

explains American teacher **Darren Carollo**. "Pupils are generally passive during lessons. With this kind of model, they are required to design, build, test and analyze and are faced with real questions. For example, what do I need to do to make my particle, a small metal ball in this case, go as fast as possible? And what happens if we increase the magnetic field?"

"This allows them to make lots of classical physics measurements to calculate parameters like acceleration, the magnetic field of a solenoid, the gravitational constant or a duration or a distance" adds his colleague, Phil Cooper.

This hands-on experience has the advantage of making the context more real for pupils and getting them used to working with computers and oscilloscopes, the essentials of practical physics in the high school. Anabela Martins, who teaches in Portugal, was very enthusiastic about this workshop, which she intends to recreate in her own physics classes. "Building a mini-accelerator will allow my pupils to put their knowledge about magnetic fields into practice. I think it will help them to focus their ideas."

Although particle physics may not be a component of high-school physics curriculum as such, it can serve as an example for the teaching of aspects such as fields and interactions in the Universe, oscillation, light and wave-corpucle duality, nuclear energy, etc.

Another very practical workshop during the program concerned the construction of a cloud chamber. "The main difficulty for high-school pupils is to visualize particles as real objects", says the Spanish teacher Francisco Barradas-Solas. "What could be more real than the tracks left by particles in a cloud chamber?" The aim of these practical exercises is to get pupils involved and motivate them by giving them things they can do and observe.

Reference: <http://bulletin.cern.ch/>

GRADUATE STUDENT PROFILES

Franz Aguirre completed his undergraduate studies at University of Trujillo in Peru and continued his graduate studies at University of Puerto Rico at Mayaguez. With an interest in experimental High-Energy Physics he attended XICFA School on Instrumentation in Elementary Particle Physics. He came to SMU in the Fall of 2004 to pursue a PhD. in High-Energy Physics.

Chris Burton attended the Ohio State University where he majored in Physics and Mathematics. He served 11 years in the active duty military, and is presently serving in reserve as the Executive Officer of Naval Air Base Support Unit Ft. Worth. His interests in Physics include Cosmology, Quantum Field Theory and Elementary Particles. Chris and his fiancée Bei enjoy running, camping and road trips to Austin.

Yon Cole began studying Experimental High Energy Particle Physics at SMU in August 2003 after receiving baccalaureate degrees in Mathematics & Physics from the University of Minnesota. He has participated in the CMS & ATLAS collaborations, most recently spending one month at CERN in Geneva, Switzerland helping with the ATLAS test beam. A hopeless romantic & idealist, he compliments his academic life with personal experiments into the meaning of life, and is one half of the self-proclaimed happiest marriage in the world.

Ana Firan received her Physics MS degree from the University of Craiova, Romania. She also worked as a research assistant in the Cancer Immunobiology Center at the UT Southwestern Medical Center.

Triston Dougall obtained a bachelor's degree in mechanical engineering from Michigan State University in 1990 and a master's degree in biomedical engineering from UTA/UTSW in 2004. Prior to his graduate studies, he worked in the auto industry as a manufacturing engineer.

Yuping He did her undergraduate work at China Agriculture University (CAU), Beijing China. She got her Masters degree at the University of Science and Technology Beijing (USTB), Beijing China. She came to SMU in Fall 2003 and she is studying experimental high energy physics. She is currently

working in the SMU Physics Opto-electronics lab designing and simulating a time-to-digital-converter (TDC). During Summer 2004, she successfully implemented a Production Quality Control Analysis and Test in Optical Transmitters for the ATLAS Liquid Argon Calorimeter readout system.

Liang Lu did his undergraduate work at the University of Science and Technology of China (USTC), HeFei China, and his Masters degree at the Chinese Academy of Science, Beijing China. He came to SMU in Spring 2001 and he is studying experimental high energy physics. In 2002, he spent a month in Brookhaven National Lab (BNL) working on the Atlas software, and two months at the European Organization for Nuclear Research (CERN) working on the Atlas test beam experiment. He published two books about Unix Network Administration, and he enjoys movies and swimming.

Renat Ishmukhametov received his Bachelor and Masters degrees in the Odessa National University, located in Odessa, Ukraine in 2003 and 2004. As an undergraduate student, Renat took part in different scientific competitions in physics and won high places: 3rd place in the Ukrainian Physical Student Olympiad and 2nd in the Ukrainian Physical Student Tournament. Now he is a PhD candidate in high energy physics at SMU. In his spare time Renat likes to play volleyball and tennis.

Sofia Tchabycheva did her undergraduate work at St. Petersburg State University, located in St. Petersburg, Russia. She came to SMU in the Fall of 2001, and is studying theoretical high energy physics (light-cone quantization). During Summer 2002, she attended the 2002 Light Cone conference at Los Alamos National Laboratory in New Mexico.

Pavel Zarzhitsky did his undergraduate work at the Belorussian State University located in Minsk, Belarus. He came to SMU in Fall 2001, and is studying experimental high energy physics. During spring 2002 he went to Boston for a beam-test testing read-out boards for liquid argon calorimeter in radioactive environment. Recently, he has been making frequent trips to Lawrence Berkeley Labs to collaborate with Atlas colleagues there to study SuperSymmetry signatures. Pavel also gave an invited talk at the North American Atlas Workshop in Tucson, Arizona.

Alumni Report: Where are they now???

*We report here on news we have received from our alumni.
Please send us your contribution to this section for future editions*

Eliana Vianello received her Ph.D degree from SMU in 2003 under the supervision of Professor Gary McCartor. She is now teaching physics in Italy. Eliana did her undergraduate work at the University of Padua, located in Padua, Italy. She came to SMU in Fall 1997, and studied theoretical high energy physics. In June 2000, Eliana went to the International Light-Cone Meeting on Non-perturbative QCD and Hadron Phenomenology in Heidelberg, Germany and gave a talk. Eliana also published: "The Schwinger Model in the Light-Cone Gauge," with A.Bassetto and G.Nardelli, Phys. Rev. D 56, 3631 (1997).

Matthew Knee received his M.S. degree from SMU in 2004. He is now teaching physics in Wisconsin. Matthew did his undergraduate work at Eastern Michigan University, located in Ypsilanti. He came to SMU in the fall of 2001, and studied experimental high energy physics. During Summer 2002, he attended the CTEQ Summer School on QCD and Phenomenology in Madison WI, and also went to Boston for a test of how some electronics performed in a radiation environment. In his spare time, Matthew enjoys listening to music, going to a movie, and watching hockey or football.

Alonso Gutierrez (Physics BS 2003) is currently a PhD candidate in medical physics at the University of Wisconsin-Madison Medical School researching at the University of Wisconsin Comprehensive Cancer Center. His research investigates new and innovative approaches in conformal radiation therapy. The goal of this research is to develop a new minimally invasive surgical technique that enhances conformal avoidance of normal tissue and allows an increase of irradiation to tumor volumes in the abdominal cavity. This technique once developed could become a vital treatment modality to increase palliation and

possibly induce remission of bladder, gastric, and pancreatic cancers.



Prof. Olness met with some physics alumni during a recent trip to San Francisco. From left to right are Prof. Olness, Joe Williams, Sam Williams, and Kevin Yarritu.

Kevin Yarritu received his B.S. degree in physics and electrical engineering from SMU in 1999. He is currently a PhD candidate at Stanford studying experimental high energy physics. He is currently on the BaBar project which attempts to understand the phenomenon of CP violation in the Standard Model by studying B decays. He also enjoys the San Francisco bay area, which includes trips to the city, hiking, and the occasional skiing trip.

Joe Williams, Physics minor SMU Class of 2001, received his M.S. Electrical Engineering degree from Stanford in 2003 with an emphasis in Digital Signal Processing. He is now working at Apple Computer, Inc. in Cupertino, Ca. on audio signal processing for the iPod and other Apple products.

Sam Williams received his BS degrees in Physics, Electrical Engineering, and Mathematics from SMU in 1999. He received his MS in Computer Science from the University of California at Berkeley after working on the VIRAM project under David Patterson. He is currently a PhD candidate working on intelligent memories with minors in Electrical Engineering and Astronomy.



The 2003 SMU Physics QuarkNet Group: June 2003



(Left-to-right) Fredrick Olness, James Cronin, and Robert Hyer Thomas (grandson of the first president of SMU) during the Dedman Celebration.



Randall Scalise blows off some steam during a performance of the Physics Circus

Jingbo Ye

Assistant Professor

Ph.D., 1992, Institute for High Energy Physics,
Swiss Federal Institute of Technology (ETH)
B.S., 1986, Univ. of Science & Technology of China

Related Experience:

- Coordinator for ATLAS Liquid Argon Colorimeter Front End Electronics Optical Readout System
- RICH inner radiator construction: CLEO-III
- Scientific Associate, CERN

Physics Research: In ATLAS, Jingbo Ye leads an international team (Sweden, France, Taiwan and the US) developing an ultra low error rate, radiation resistant optical data link for the Liquid Argon Colorimeter Front End Electronics Readout System. This project involves ASIC (application specific IC) design, identifying radiation resistant optical and electrical components, system tests and integration, interactions with research groups in the US and in France that are responsible for up- and down stream electronics systems. For this project, over years, Jingbo Ye has established an optical and electronics lab in the physics department that attracts attention both from the EE department in SMU and from local industries. He holds a research assistant professorship at the EE Department. This lab is also recognized by ATLAS and LHC other experiment collaborations. We recently are responsible for designing and constructing an ultra low noise test setup for radiation evaluation of an ADC chip (AD9042AST) from Analog Devices Inc. This ADC chip will be used by three LHC experiments: ATLAS, CMS and LHCb. On the Physics side, Jingbo Ye works with graduate students on test beam data analyses, Monte Carlo studies, in preparation for searching for Higgs and many other new physics in ATLAS.

In CLEO, Jingbo Ye contributed in the construction of its RICH inner radiator.

In L3, Jingbo Ye contributed in Monte Carlo and data reconstruction software packages and was principal author for three L3 publications. Jingbo Ye was the first to prove that the famous 60 GeV hard photon events from L3 are only QED fluctuations.

Robert Kehoe

Assistant Professor

Ph.D., 1997, University of Notre Dame
B.A, 1989, Earlham College

Related Experience:

- Convenor, Top quark production cross section measurements
- Coordinator of jet energy calibration, D0 Experiment
- D0 Calorimeter Trigger Installation
- Discovery of early optical emission from gamma-ray bursts
- Development of robotic telescope system for ROTSE project
- Discovery of top quark, D0 Run I

Physics Research:

Kehoe's research is dedicated to the discovery of new particles or phenomena in nature. The main motivation for these searches has been to shed light on the generation of mass for fundamental particles, and to look for limitations of the standard model. Plus, it's fun! Primarily, Kehoe has been strongly involved in the discovery and study of the top quark, which is the newest fundamental particle. Establishing the clear indication of this state in all its observable decay modes helps to confirm the standard model expectations. Perhaps more importantly, it sets the stage for measurement of the top quark's mass. This is a key parameter in particle physics since a good measurement of this quantity allows a prediction of the Higgs boson mass. The Higgs is involved in the generation of mass for fundamental particles. It is the final particle expected from the currently accepted theory of fundamental physics and, if the theory is correct, its discovery is likely at the ATLAS detector at LHC. Kehoe has also been interested in the overlap between particle physics and cosmology and this has motivated his work in studying gamma-ray bursts. These are enigmatic, colossal explosions which may only have occurred in the early universe. Elucidating their nature has been difficult until optical emission was identified from them, an endeavor that Kehoe's work was integral to. More recently, this interest in particle astrophysics is motivating Kehoe to prepare for a search for dark matter at ATLAS when the detector starts collecting data in 2007.

Thomas Edward Coan Associate Professor

Ph.D. University of California at Berkeley, 1989.
B.S. Massachusetts Institute of Technology, 1980.

Related Experience

- Fermi National Accelerator Lab
- Laboratory for Elementary-Particle Physics at Cornell

Physics Research

Coan's research concentrates on the experimental study of "CP violation," the phenomenon that characterizes the subtle but clear differences in behavior between matter and antimatter. Noting the differences is preliminary to an understanding of why there is any matter - galaxies, stars, planets and people - in the universe at all.

Modern theories of the evolution of the universe predict that the very early universe, soon after the Big Bang, contained equal amounts of matter and antimatter. Yet today, we see around us only normal matter - protons that have positive charge and electrons that have negative charge. Where did all the antimatter go and why didn't it annihilate with normal matter and leave us a Universe filled exclusively with light? It is far from clear that current theoretical explanations are even approximately correct in their description of our curious state of affairs.

To better understand the differences between antimatter and matter, Coan has designed and constructed novel devices to measure their properties. He is now designing tracking instrumentation for the upcoming flagship experiment BTeV at Fermi National Lab that will study antimatter/matter properties with unprecedented precision.

Coan is also a cofounder of MATPHYS LLC, the department's first spinoff company. This newly minted educational effort produces physics teaching instruments for the advanced undergraduate lab and has instruments on 3 continents.

Yongsheng Gao Assistant Professor

Ph. D. U. of Wisconsin-Madison, 1995
M.S. Shandong University
B.S. Shandong University

Related Experience

- European Particle Physics Lab (CERN)
- Harvard University High Energy Physics lab
- Laboratory of Nuclear Studies at Cornell
- Coordinator of CLEO III Silicon Vertex Detector Assembly and Testing Project at Cornell University (1996-1999)

Physics Research

Gao's research concentrates on testing current theory of elementary particle physics and searching for new physics phenomena which can not be explained by current elementary particle theory. Why our universe is dominated by matter (CP violation) and what's the origin of mass (Higgs) are among the most important questions that Gao's research at CLEO and ATLAS is trying to address. Gao's recent work at CLEO includes several first observations and measurements of beauty and charm decays. GAO's current research on CLEO-c concentrates on exclusive semileptonic D decays. Significant improvements in our knowledge on the charm quark sector are expected through these efforts. Gao's research work on ATLAS has been focused on electron identification, ATLAS data challenges through US ATLAS Grid Testbed, and developing new analysis method for new particle searches. These efforts are in preparation for Higgs search with the first incoming ATLAS data at the LHC around 2007.

Kent Hornbostel
Associate Professor

Ph.D., 1988, Physics, Stanford University
B.S., 1981, Physics, Duke University

Kent Hornbostel works in the NRQCD collaboration, a group that does lattice calculations, including error estimates, suitable for comparison with data. The group has produced calculations of α_s and the mass of the b-quark, which are among the most accurate in the world. They have also produced a measurement of the mass of the c-quark. Currently they are working to improve their error estimates, to improve their methods for systematically improving Lagrangians, to improve their estimates of the mass of the c-quark and to devise methods to include light sea quarks in their calculations.

Gary Don McCartor
Professor

Ph.D. Texas A&M University, 1969
A.B. Occidental College, 1965

Physics Research

McCartor attempts to develop better ways to solve the equations which we think govern the behavior of our world at its most fundamental level. Theoretical work in High Energy Physics and Elementary Particle Physics is cast in a mathematical framework called Relativistic Quantum Field Theory. McCartor monitors both the Threshold Test Ban Treaty (TTBT) and the Comprehensive Test ban Treaty (CTBT). His algorithms and software help operate the International Bata Center, the instrument of the United Nations Conference on Disarmament which will monitor the CTBT if it enters into force.

Fredrick Olness Professor & Chair

Ph.D. U. of Wisconsin, 1985
M.S. U. of Wisconsin, 1982
B.S. Duke University, 1980

Related Experience

- "Most Cited Paper" in HEP-PH for 1999
- Dallas Science Fair Co-Director
- 2000 SMU President's Associates Outstanding Faculty Award
- Organizer/Lecturer at 10 International Summer Schools
- "Mathematica for Physics" textbook now translated in Japanese. Second edition published in 2002.
- Popular public lectures on "The Physics of Music" and "Physics Circus"

Physics Research

A theoretical particle physicist, Professor Olness is at the forefront of the search for the fundamental building blocks of matter. He analyzes newly proposed theories, and compares them with the latest precision experimental data. Such discriminating tests allow us to discover signs of new phenomena such as SuperSymmetry, Higgs Bosons, and SuperStrings.

Ryszard Stroynowski Professor

Ph.D. University of Geneva, Switzerland, 1973
M.Sc. University of Warsaw, Poland, 1968

Related Experience

- Field of Specialization; Experimental, accelerator based particle physics, physics of the Tau lepton, searches for new phenomena
- Taught at: Stanford, Caltech, UCLA, Warsaw, Lausanne
- Liquid Argon Calorimeter Project Leader, US-ATLAS, LHC
- American Physical Society Fellow

Physics Research

Stroynowski is searching for new phenomena in the fields of elementary particle physics where current theoretical descriptions of the particle's interactions are inadequate.

At SMU since 1991, Stroynowski worked on several experiments. He studied the properties of the tau lepton and heavy quarks with the CLEO detector, designed experiment to study the birefringence of vacuum by measuring velocity of light in magnetic field and designed the largest solenoid magnet. Since 1998, he leads the US collaboration constructing a major component of the ATLAS detector for the Large Hadron Collider (LHC) in Geneva, Switzerland.

ATLAS will search for effects responsible for differentiation of particle masses and possibly for origin of the dark matter and dark energy in the Universe. ATLAS construction is well advanced. It is expected to begin operations in 2007.

Vigdor L. Teplitz Professor

Ph.D. University of Maryland, 1962
S.B. Massachusetts Institute of Technology, 1958

Related Experience

- Senior Analyst, White House Office of Science and Technology Policy (OSTP), 2000-02
- Senior Advisor, Supercollider, 1991-93

Physics Research

There may exist matter in a form much different than that of ordinary matter: “nuggets” with the density of nuclei, about a trillion times denser than, say, dirt. These would be hard to find because a ton would be the size of a blood cell. Such would be the case if matter made of what are called Up, Down, and Strange quarks were stable and did not decay to ordinary matter, which is made of just Up and Down quarks condensed into protons and neutrons. Teplitz and Geology colleagues searched for the seismic signals that would be heard if a ton-sized nugget of this “strange quark matter,” passed through earth. They found a strong candidate event.

Suppose the universe were filled with enough neutral, strongly-interacting, massive particles (SIMPS) to solve the so-called “dark matter problem.” Strongly-interacting means the particles can feel a force from the protons and neutrons that make up the nuclei of atoms. This means they can be captured by nuclei. Three years ago, Teplitz and a colleague from Maryland showed that such particles could be captured by large nuclei. Two years ago, with Olness, and Stroynowski, they calculated, for gold which has a large nucleus, what the abundance would be, if such particles exist, of anomalously heavy (gold) nuclei. Teplitz then worked with an experimental group at Purdue. Their experiment failed to find any anomalous gold nuclei, giving new limits on SIMP abundance.

Teplitz has now begun to think about the “dark energy problem” that has arisen from supernova data and other observations in the past 5 years.

Roberto Vega Associate Professor

Ph.D., 1988, Physics, University of Texas at Austin
M.S., 1982, Georgia Institute of Technology
B.S., 1978, Physics, University of Puerto Rico

Related Experience

- Research Associate, Stanford
- The Next Linear Collider Working Group

Physics Research

Perhaps the most compelling question is that of the origin of mass. In the current particle physics paradigm, the question is intimately connected to a very general principle, called the *electroweak symmetry*, a symmetry in an internal abstract space. One consequence of this principle is that the physics of a system of particle will not be altered if we replace a particle of a given species with a particle of a different species. Theoretically then, this symmetry in an atom would allow us to replace a proton with a neutron without changing the physical characteristics of that atom. This is obviously not true; if you replace the proton with a neutron in a hydrogen atom, you would no longer have a stable system. Nevertheless, there is other experimental evidence that gives definitive proof that the electroweak symmetry is indeed a symmetry of nature. How this apparent paradox is resolved is inextricably connected to the origin of mass of the elementary particles.

Some time ago Peter Higgs (a British physicist) discovered that when you impose a particular structure in the dynamical equations describing the interactions of massless elementary particles, the original equations are transformed into those describing the interactions of massive elementary particles. This approach required the existence of three particles, the W and Z particles which were discovered at CERN in 1983, and the Higgs particle which remains elusive, waiting to be discovered.

Vega researches the ways in which the Higgs particle (or particles) can be detected at future supercolliders, such as the Large Hadron Collider (LHC) scheduled for completion in Geneva Switzerland during 2007.

Randall J. Scalise
Senior Lecturer

Ph.D., 1994, Theoretical Elementary Particle Physics, Pennsylvania State University
B.A., 1987, Cornell University

CTEQ is "The Coordinated Theoretical-Experimental Project on QCD". Randall Scalise created and continues to maintain the group's World Wide Web Page at <http://cteq.org>, which has accumulated over 18,000 hits since its creation on 23 February 1996.

This page is the primary distribution site for the CTEQ parton distribution functions, which are available in several formats. CTEQ Workshop and Summer School information, CTEQ Symposia transparencies online, and CTEQ preprints are also found there.

Scalise has reformatted the CTEQ Handbook of Perturbative QCD to make it available electronically. The Handbook is now accessible online, where it can be updated immediately to include the latest experimental and theoretical results without having to wait for the next printing of the paper edition.

Scalise will also contribute two sections to the next version of the handbook, one on the running of the strong coupling and one on selected integrals used in renormalization by dimensional regularization.

Stuart Wick
Visiting Assistant Professor

Ph.D. Vanderbilt University, 1999.
M.S. University of Illinois at Chicago, 1993.
B.A. Saint Olaf College, 1988.

Related Experience:

- National Academy of Sciences, National Research Council Postdoctoral Fellow.
- High-Energy Theory Postdoctoral Associate, University of Florida.

Physics Research:

Wick researches theoretical problems in dark matter and high-energy cosmic rays. His recent work, with collaborators at the University of Florida, predicts the modulation signature in terrestrial dark matter (DM) searches for WIMPS and axions incorporating current models of DM halos and the Solar gravitational field. Currently he is investigating indirect DM signals, e.g., via annihilation, within the context of a halo dominated by discrete DM flows. His work on high-energy cosmic rays (HECR) spans from the conventional—modeling astrophysical HECR sources such as gamma-ray bursts—to the exotic—developing search strategies for magnetic monopole primaries in current and future HECR detectors. His HECR work has been in collaboration with researchers at Vanderbilt University, University of Montreal, Naval Research Lab, and the University of Bonn.

John Cotton
Adjunct Professor

BSEE, 1964 SMU
MSSE, 1971 SMU
MSEM, 1990 SMU
MSCS, 1991 SMU

John Cotton has studied astronomy since before he made his first telescope mirror at age 13. His main interest is digesting astronomy and presenting it to students and the public. He has been working with the Planetarium in Fair Park and teaching at SMU for more than 25 years. He wrote and presented two television series on astronomy on KERA Channel 13.

John developed the lab course we now use and wrote the lab book. He enjoys developing classroom demos and his engineering training helps him to build them.

John wants to convey the wonder of astronomy as well as getting the students to think logically and scientifically.

Stefan Berge
Research Associate**Education:**

Ph.D., University of Hamburg, Germany, 2003
Diploma, University of Karlsruhe, Germany, 1999

Physics Research

Berge performs perturbative calculations of high-energy particle scattering at hadron and lepton colliders.

The Large Hadron Collider (LHC) will begin operation at CERN in Switzerland in 2007, and this facility will allow us to explore the physics of elementary particles in an entirely new energy regime. One of the most important discoveries of the LHC may be to find the last missing component of the Standard Model, the Higgs boson, and verify the source of the electroweak symmetrybreaking mechanism which gives the W boson its mass. To this end, the precise determination of the mass of the W and Higgs bosons (by measuring their transverse momentum distributions) will be essential. Some of Berge's recent work uncovered new effects that can yield large perturbative higher-order corrections to these important processes.

Another important topic at the LHC will be the verification of theories beyond the Standard Model. The minimal supersymmetric extension of the Standard Model predicts a large number of heavy particles that remain unobserved. Perturbative calculations to measure these particles are ongoing.

Beside the LHC, an international linear electron-positron collider is currently under preparation. The great advantage of this type of collider is the precision with which particle properties and interactions can be measured. It will allow physicists to extrapolate to energies not accessible by present machines, and test or exclude unification theories. An exciting feature of a linear collider is the possibility of a photon-beam option. By backscattering photons from the initial state electrons, photon beams of high luminosity and energy can be obtained. For the different operating modes of a linear collider, Berge is doing calculations in the Standard Model, and its minimal supersymmetric extension.

Michael Hosack
Research Associate**Education:**

PhD, Vanderbilt University, 2002
MS, Ball State University, 1995
BS, Case Western Reserve University, 1992

Experiments: BTeV, FOCUS, E687

Physics interests:

- CP violation in B decays (BTeV)
- D mixing in semileptonic decays (PhD thesis, FOCUS)
- Philosophical questions: causality, arrow-of-time, Bell's theorem

Current projects:

Straw detector development for BTeV:

- Gain measurement, acoustical techniques for wire tension
- Power bus design, environmental (pressure, temperature, humidity) monitoring

David Joffe
ATLAS Postdoc

- B.Sc. (Physics)
University of Toronto (1992)
- M.Sc. (Accelerator Physics)
University of British Columbia (1994)
- Ph.D. (Experimental Particle Physics)
Northwestern University (2004)

Projects and experiments:

- 1993-1996 Accelerator design at TRIUMF; designed and tested RF booster cavities as well as RF Quadrupoles for heavy ion accelerators.
- 1997-1998 Worked at Brookhaven on experiment E852, an exotic meson and glueball search at the AGS.
- 1999-2004 Worked at Fermilab on experiment E835, which was located in the Antiproton Accumulator and dedicated to charmonium spectroscopy.
- 2004- Recently came to SMU to work on ATLAS, specifically ATLAS analysis software and software validation.

PHYSICS

at SMU



A newsletter for alumni and friends.

Winter 2004-2005

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