PHYSICS at SMU

A newsletter for alumni and friends. **Winter 2002-2003**

Chairman's Report

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

UNDERGRADUATE PROGRAM:

We have a healthy and active undergraduate program with approximately a dozen physics majors, and a dozen physics pre-majors. Professor Thomas Coan is the director of the physics undergraduate program, and Professor Vic Teplitz is director of undergraduate recruitment.

We graduated six physics students this past May: April Kramer Andreas, Eric Morgan, Chad Myers, Chris Oprazadek, Shannon Thornton Clardy, and Cliff Yapp. This was a very dynamic and talented class of physics students. (Four of them were Presidential 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:

We have been fortunate to recruit and train top quality physics graduate students in recent years. Professor Ryszard Stroynowski is the director of the physics graduate program, and Professor Roberto Vega is director of graduate recruitment.

In August of 2001, Dr. Ilya Narsky graduated and took a position at Caltech (California Institute of Technology) with the BaBar group. In May of 2002, Dr. Yurii Maravin graduated and joined the D0 experiment at Fermilab.

We are always actively searching for quality students for our graduate program, I will personally buy lunch for anyone who sends us a physics graduate student.

RESEARCH PROGRAM:

The department continues its strong research programs in Experimental and Theoretical high energy physics. The experimental group is active in the CLEO, ATLAS, and B-TeV 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.

Integrated Multidisciplinary Graduate Training
The physics department is one of seven SMU departments participating in a proposal to fund this project. The overall goal is to produce a new class of engineers and scientists who are experts in a particular area, and at the same time prepared to work in multidisciplinary environments solving multidisciplinary problems. The program is driven by the vision of preparing Ph.D. graduates capable of national and international leadership roles in either industrial, academic, or business settings

Published by the Department of Physics, Dedman College, Southern Methodist University

NEW COURSES:

The department continues to introduce new courses into the physics curriculum to match the interests and needs of our students.

Phys 3320: Music & Physics (Advanced Level)
(GEC Science requirement)

In Fall 2002, we offered an advanced version (Phys 3320) of our popular introductory (Phys 1320) "Music & Physics" course. We introduced this course because the Physics majors wanted a course on this subject, but the Phys 1320 level would not count toward their degree. We cover musical acoustics, wave phenomena, and survey the different families of instruments. The primary difference is that in the advanced version, we delve into the mathematics behind the physics, including differential equations and Fourier transforms.

Phys 3333: Scientific Method
(GEC Cultural Formations requirement)

Inspired, in part, by recent lectures by Robert Park and James Randi, we have introduced a new physics course (Phys 3333) entitled: "The Scientific Method - Critical and Creative Thinking." If you believe in astrology, flying saucers, or ESP you should take this course! We expose scientific frauds, fallacies, and fantasies. We provide students with an understanding of the scientific method sufficient to differentiate experimentally verifiable scientific fact and theories from pseudoscience in its many guises: paranormal phenomena; free-energy devices; alternative medicine; and many others.

This course is new for us in another way also: "Scientific Method" satisfies the General Educational Curriculum (GEC) Cultural Formations (CF) requirement. This is the first time such a course has ever been offered by the Physics department in this category. This course will be taught in Spring 2003 by Professors Scalise and Cotton.

DISTINGUISHED VISITORS:

The department hosted a number of distinguished visitors including the following.

James Randi:
Magician, escape artist, author, & NOVA star.

In September 2002, James Randi visited SMU for a public lecture as part of the Collegium da Vinci series. James Randi has an international reputation as a magician and escape artist, but today he is best known as the world's most tireless investigator and demystifier of paranormal and pseudoscientific claims. His work has been recognized internationally, and he has received many awards including a Fellowship from the MacArthur Foundation in 1986. He has a standing offer of $1,000,000 to anyone who can demonstrate paranormal abilities under test conditions. (It remains unclaimed.) Dr. Randi has written many books on the subject, and was featured in a PBS NOVA presentation of ``Secrets of the Psychics." The lecture was both educational and entertaining. Dr. Randi taught the audience how to melt metal spoons and change the time on a watch using only the power of thought (and some sleight of hand).

Professor Michael Turner:
University of Chicago, and Fermilab.

In October, the department hosted Professor Michael Turner of the University of Chicago and Fermilab. He presented a lecture on ``The Dark Side of the Universe: Beyond stars, and the star-stuff we're made of". He reviewed some of the recent discoveries that have revolutionized our view of the universe, and forced us to confront the existence of the ``Dark Energy" in Einstein's formulation of General Relativity. Professor Turner was also appointed by the National Academies to chair the ``Physics of the Universe Committee."

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Certainly, this is a large topic, so he assembled an appropriately large committee. Professor Turner presented an overview of the committee report; this report is available on the web at: **`www.nationalacademies.org`**

For a current listing of upcoming presentations, have a look at our Seminar web page, which is linked to our main web page at: **`www.physics.smu.edu.`**

COMMUNITY OUTREACH:

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

- ***QuarkNet:*** In Summer 2002, we continued our SMU QuarkNet program by hosting 15 high school physics teachers for a 1-week workshop on incorporating High Energy Physics topics into the High School classroom curriculum. This project was funded by the Department of Energy, the National Science Foundation, and Fermilab.

- ***Science Fair:*** Professors 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 October 2002, we presented the "Physics Circus" at the SMU Retired Faculty meeting, and are scheduled to make a presentation for the Dallas Hispanic Concilio program, "Psyched About Science and Math" (PASM) in November 2002.

THANK YOU FOR KEEPING IN TOUCH:

Thank you to all of you who updated your contact information for our department 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 should be receiving the Physics Newsletter.

- Please help us recruit both undergraduate and graduate students by putting us in touch with any prospective candidates.

Fred Olness
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SMU Scientists Cite Ghostly Evidence Of `Strange Quark Matter'

The Dallas Morning News

By ALEXANDRA WITZE
04/10/2002

Astronomers may have discovered a new and exotic form of matter whose existence had only been suspected until now. A tiny, ultradense star in the constellation Corona Australis may be made of a loose collection of quarks, the building blocks of matter, scientists announced Wednesday. The conclusion is startling because the vast majority of matter in the universe, from planets to people, is made of quarks confined in sets of three inside every atom's nucleus. New observations of the star suggest that it is too small to be made of anything but a jumble of quarks, the astronomers said.

"If so, this star is in a class quite by itself and will be an astonishing discovery of fundamental significance," said Norman Glendenning, a senior scientist emeritus at the Lawrence Berkeley National Laboratory in California, who was not involved in the work. The discovery of such a quark star would be the first evidence of a form of matter that is more stable than everyday matter, he said at a NASA news conference. An ordinary atom's nucleus contains protons and neutrons, which in turn are made of trios of quarks. By shattering atoms in particle accelerators, physicists have found evidence that six types of quark exist; only two of those - the up quark and the down quark - make up everyday matter. The quark star would involve a third type, the strange quark. Because the idea is so unusual, the work is already controversial.

"I don't see the evidence here," said Fred Walter, an astronomer at the State University of New York in Stony Brook who discovered the star. "It’s a great data set and there's a lot of interesting physics, but jumping to the conclusion that it's a quark star is just jumping."

NASA/Chandra Observatory photos of object 3C58, which could represent a new class of star and contain a new form of matter. Jeremy Drake, of the Smithsonian Astrophysical Observatory in Cambridge, Mass., led the team that used NASA's Chandra X-ray satellite to study the star, known as RXJ1856. The star, which lies 400 light-years (2.4 quadrillion miles) away, is a neutron star, the ultradense, ultratiny star left after some stars die. Neutron stars pack a mass greater than the sun's into a space the size of a city. The new observations suggest that RXJ1856 is about 7 miles across, rather than 10 to 20 miles across for a typical neutron star. After rejecting alternate explanations, such as the possibility that bright spots on the star's surface could skew the measurements, the team concluded that the star was probably made of loose quarks.

"Every theorist ought to be celebrating a little," said physicist Vigdor Teplitz of Southern Methodist University. He and SMU seismologist Eugene Herrin have been searching for "nuggets" of strange quark matter that may have zoomed through space and struck Earth. The scientists have submitted their results for consideration by a peer-reviewed journal.

In related work, other scientists reported Wednesday on a second neutron star that also may be made of a strange form of matter. Chandra observations show the star 3C58Ö to be far cooler than would be expected for a neutron star of its age, said David Helfand of Columbia University. So 3C58 may also be made of an exotic form of matter. The star is 10,000 light-years (59 quadrillion miles) away in the constellation Cassiopeia.

E-mail: awitze@dallasnews.com

The Romance of Physics

This past year was very special for a number of our physics students who got married this past spring

Sasha Lenzen & Chad Myers:

Chad and Sasha were married on June 29, 2002 in Bismark, North Dakota. Chad is now studying Electrical Engineering at Princeton.

Shannon Thornton & Michael Clardy:

Michael and Shannon were married on June 22, 2002 in Dallas. They now reside in Little Rock, AR where Michael is studying aviation mechanics, and Shannon is continuing her physics studies.

April Kramer & Derek Andreas:

Derek and April were married on March 9, 2002 on the SMU campus in the Perkins Chapel. Derek is completing his engineering degree at SMU, and April is working toward an MS in Mathematics at SMU.

April spent the summer in Washington DC working at NIST. She and her mentor, Dr. Isabel Beichl, developed a way to estimate the time required to partition a set of integers into two groups with the same sum and the same number of elements; and in the process, the pair may have happened upon a new test for random number generators.

Their wedding was truly a “unique” event. As evidence, we reprint an excerpt from their wedding program.

"So what's up with the decorations? (If you don't understand the meaning of this question yet, don't worry you will.) Well, it seemed only appropriate. If you know Derek and April at all, you'd suspect they didn't just meet at a party and happen to hit it off. They met doing the thing they do best: homework. They were both taking Classical Mechanics and Advanced Math together and both the professors, who join us today, seemed to delight in making everything as complicated as possible. So it was that over a partial differential equation, the two of them realized they would spend the rest of their lives together. Their relationship grew through Cosmology and Dynamical Systems, then through Data Structures, Programming Languages, and Partial Differential Equations. It thrived through Bessel's Equation and Fourier Transforms and faltered only once over an infinite while loop. Hence, they have decided to make this event a tribute to the academia that brought them together. The Society of Physics Students, of which they are both proud members, even helped to make the reception possible. They are both looking forward to next semester's bi-annual meeting, the only place on campus where six people can eat fifteen pizzas."

Back to Basics:

SMU Physicist Is At The Forefront Of The Search To Learn More About The Structure Of Matter

SMU Research Magazine

By Ellen Mayou

For Ryszard Stroynowski and other physicists, the federal government's 1993 cancellation of the Superconducting Super Collider in Texas did not end their search for answers about the fundamental structure of matter. It simply meant that they had to find another way to answer their questions.

For Stroynowski, professor of physics in Dedman College, this has meant relying on a project more than 5,000 miles away to participate in the research of his dreams.

Since 1997 Stroynowski has been involved with the construction of a large particle accelerator, known as the Large Hadron Collider (LHC), beneath the ground in Geneva, Switzerland. The LHC project comes under the auspices of CERN, the European Center for Nuclear Research and the world's leading particle physics research laboratory.

Originally planned as a competitor to the Superconducting Super Collider project, the LHC is now the focus for thousands of physicists worldwide who are hoping to learn more about the fundamental structure of matter.

The collider comprises a large underground tunnel that is 26 kilometers around and has two rings. Protons will be accelerated around the rings in opposite directions and will smash into each other at energies seven times higher than any existing collider. When they collide at an estimated rate of a billion collisions per second, new particles are expected to be released. Two large detectors – each of which is the size of SMU's Fondren Science Building – will capture and process the information generated by these collisions.

From this information, physicists hope to create a more accurate picture of how the universe works. "Among the debris from the collisions there should be some interesting material that no one has seen before," Stroynowski says.

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Probing the fundamental structure of matter has been Stroynowski's quest for more than 30 years. A native of Poland, Stroynowski says he was drawn to science at an early age because of the opportunities it offered to discover new things.

"Physics was – and still is – one of the most exciting fields of discovery," he says.

Stroynowski began his scientific career as an assistant professor at the University of Warsaw. He left Poland in 1969 for political reasons and took a position as a staff physicist at CERN, where he studied the structure of protons.

Stroynowski left CERN in 1975 and moved to the United States, where he spent six years as a researcher at the Stanford Linear Accelerator Center (SLAC) and 11 years as a senior research associate and lecturer at Caltech. Among his colleagues at SLAC was Marty Perl, who received the 1995 Nobel Prize for his 1975 discovery of the tau lepton, a fundamental particle that is a superheavy cousin of the electron. Stroynowski has added to current knowledge about the tau lepton, one of 12 fundamental particles now known.

Like many other members of SMU's Physics Department, Stroynowki was drawn to Texas in the early 1990s by the opportunity to work on the Superconducting Super Collider being built near Waxahachie. He joined the SMU faculty in 1991 because he wanted to work on the project, but remain in a university environment. Stroynowski led a program to develop one of the collider's two detectors. As part of this project, he helped design the biggest magnet at the time in the world.

Although the United States began contributing to the LHC project after the Superconducting Super Collider project was cancelled in 1993, Stroynowski was unable to immediately work on the LHC project because it did not offer his graduate students an opportunity to get timely results.

"The LHC is not going to be ready until 2007, and graduate students need projects they can complete in five to six years," he says.

Stroynowski takes particular pride in his graduate students, some of whom now work with top physics programs at universities such as Caltech and UC-Berkeley. Many came to SMU for the opportunity to study under Stroynowski.

"Ryszard has a great name in the physics community," says Vasilii Shelkov, who received his Ph.D. from SMU in 1997 and now works at SLAC. "He really loves science and, moreover, he is able to share his passion with people around him. This makes him a great researcher and a great teacher."

After the super collider project in Texas was cancelled, Stroynowski and his graduate students began working on an electron-positron collider project at Cornell University. The circular accelerator has a detector called CLEO that analyzes the electron-positron collisions. Using this detector, Stroynowski has been able to map the properties of the tau lepton with a high degree of precision. His work at Cornell also led to the discovery of information about another fundamental particle known as the b quark. A paper he co-authored on the b quark is considered one of the top physics discoveries of 1995.

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Stroynowski became involved with the LHC project in 1997 while spending six months on research leave in Paris, working with a French lab that was participating in the project. During this period, he identified a portion of the LHC project to which SMU could contribute. This portion of the project was one of the LHC's two detectors, known as ATLAS. The ATLAS – 60 feet tall and 90 feet wide – is the largest detector ever built.

Several faculty members from the SMU School of Engineering worked with Stroynowski and other members of the Physics Department to develop some of the complicated electrical and computer systems for the ATLAS detector. For example, SMU physicists and engineers developed a modem that is 20,000 times faster than the standard 56k modem.

"The LHC represents an enormous technological challenge in terms of electronics and computing," Stroynowski says. "It is going to produce one billion events per second and we need the ability to select one event out of a billion that will provide new information. We also need electrical and computing systems that can survive extremely high levels of radiation."

Because of SMU's high-quality work on ATLAS, Stroynowski was asked to play a larger role in the project. In early 2001 he was named leader in the United States of the largest sub-project in ATLAS – the Liquid Argon Calorimeter, a huge device that measures the energies of particles emitted in the interactions. Stroynowski is responsible for ensuring that construction of the calorimeter stays on time and on budget, while ensuring that its performance meets the needs of scientists who will use it.

"Ryszard is doing a fine job in this very challenging task," says William Willis, project manager for the U.S. portion of the ATLAS experiment. "He is successful at this formidable task because he is respected for his knowledge of physics and the technology involved and because of his tact and good personal relationships with our European collaborators."

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While his responsibilities on the ATLAS project involve more administration than research, Stroynowski says he accepted the position because it is important that the project stays on schedule.

"I want to participate in those great discoveries before I retire," he says. The ATLAS detector is expected to be completed in 2005. The entire LHC collider is on schedule to be operating by 2007.

"Just getting the pieces down the shaft and assembled will take two years," Stroynowski says, noting that the accelerator is situated from 60 to 250 meters underground.

Although the ATLAS project management office is located at Brookhaven National Laboratory on Long Island, Stroynowski is conducting his work at SMU, making frequent trips to Switzerland. Now that the LHC project is closer to completion, Stroynowski has involved several SMU graduate students in the project.

Stroynowski hopes that the LHC will help answer why each elementary particle has a different mass and why the universe is not symmetric in time. "If you run a movie forward and backward it looks the same, but time looks different moving backward than it does moving forward," Stroynowski says.

In addition to expanding our understanding of physics, Stroynowski notes that there probably will be other important byproducts of the LHC collider project. After all, he says, the World-Wide Web was developed at CERN to help scientists communicate with one another.

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Promoting Science for Peace

In addition to making frequent trips abroad to help build the Large Hadron Collider project in Switzerland, SMU Physics Professor Ryszard Stroynowski travels throughout Eastern Europe as a member of the Steering Group of the NATO Science Committee's Science for Peace Programme.

The program brings together scientists from NATO countries and former communist countries to develop projects that have economic potential or application to environmental problems in former communist countries. Steering Group members help the Science for Peace Programme assess the hundreds of proposals it receives for funding and conduct site visits of projects that have been funded.

"The Science for Peace Programme represents one of the few opportunities to educate young people in these poor countries, to give them contacts with NATO partners in the United States and elsewhere, and most importantly, to provide them with incentives to stay and work within their systems," Stroynowski says.

For more information:
Contact: Professor Ryszard Stroynowski
Email: ryszard@mail.physics.smu.edu
Web site: www.physics.smu.edu/~ryszard/

Psych out Investigator James Randi debunks the 'paranormal'

SMU Daily Campus

By Dana Walia, Contributing Writer
October 01, 2002

Magicians are deceiving us, but we already know that they are and expect it. However, psychics, evangelists and even some common products are liars and fakes, and many people believe them. That's the topic psychic investigator James Randi brought to campus Sunday night. Randi captured the attention of the packed Bob Hope Theatre in the Owen Art Center. Known as a "professional skeptic," Randi has made a career of investigating and demystifing paranormal and pseudoscientific claims. "James Randi has made a career in answering the question 'What are we really dealing with?' He asks what we all wish we had the tenacity and cleverness to ask," said Jasper Neel, dean of Dedman College.

Randi likes to say he's in the business of travelling across the world and telling people things they should already know. He says that a magician is the "most honest liar in the world." Randi mentioned a video of psychic John Edwards. In the first 50 seconds of the video, Edwards asked a man in his audience about himself. Of the 26 guesses, Edwards only guessed three correctly. The three he guessed correctly were basic questions that could be easily answered, such as "Are you younger than your deceased father?" The man was still astonished by the psychic power of Edwards. Randi claims this is because people like this man are in need of people like Edwards to be right. It makes them feel more assured. It is not, however, true psychic power, but merely a guessing game. A video shown during the lecture that Randi called "Reverend Popov exposed on the Johnny Carson Show" revealed how Popov and other evangelists who claim to heal people on television find out information about their audiences. They have them fill out a "healing card" prior to the show. During the show someone backstage reads the card and tells the evangelist information about his audience

"He is wearing a device in his ear that picks up a radio frequency. The reverend then talks to that person and claims that God is speaking through him. This is a hoax. He is ripping people off," Randi said. But even the government sanctions some of these hoaxes. "I'm shocked, annoyed, amused to a certain extent, but more than anything angry," said Randi in regard to some of the outrageous products that are given U.S. patents. Some absurd patents include the one given to Dunkin Donuts on the peanut butter and jelly sandwich and a patent given to toast.

"We can make peanut butter and jelly sandwiches and toast, but we better not try to sell them," Randi said. People don't have to believe in these things, he said. They can test and investigate them. "Just give us a chance to get into it, and sit still long enough," he said.

Randi has received numerous awards and recognition for his work. He is the author of many books, including Flim-Flam! Psychics, ESP,Unicorns, and Other Delusions. In 1996, the James Randi Education Foundation was established to further his studies. This foundation offers the "$1 Million Prize," given to anyone who can show, under proper observing conditions, evidence of any paranormal, supernatural or occult event. "Scientists really do reveal a great deal about this world to us," Randi said. "I have great respect for these people and I want you to know that."

For more information on James Randi and his foundation visit his Web site www.randi.org.

GRADUATE STUDENT PROFILES:

Matthew Knee did his undergraduate work at Eastern Michigan University, located in Ypsilanti. He came to SMU in the fall of 2001, and is studying 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 preformed in a radiation environment. In his spare time, Matthew enjoys listening to music, going to a movie, and watching hockey or football.

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

Sofia Tchabycheva did her undergraduate work at St. Petersburg State University, located in St.Petersburg. 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 in Los Alamos National Laboratory, NM.

Eliana Vianello did her undergraduate work at the University of Padua, located in Padua, Italy. She came to SMU in Fall 1997, and is studying 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 has published: "The Stewing Model in the Light-Cone Gauge", with A.Bassetto and G.Nardelli, Phys. Rev. D 56, 3631 (1997).

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.

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.

Kevin Yarritu (Graduated 1999):
”Right now I am still attending Stanford University studying particle physics. I am working on the Babar experiment (at SLAC) with the DIRC group and my advisor is named David Leith. I have gotten through my “core” classes and my qualifying exams are behind me. I am in my third year of graduate studies and am just basically doing research. The bay area is a beautiful place and I have explored much of it, however, there is always room for more fun.”

Clifford Yapp (Graduated 2002):
“Hi guys! Well, University of Delaware has turned out to be a very interesting experience. I'm doing the TA thing again this semester, so I haven't gotten to do a whole lot of research yet, but I've spent some time running some tests on thin film solar cells. Fairly interesting, but it will be more so once we get the equipment up and running. They just got done moving the Materials Science department into a new building a couple months ago, and everyone's equipment is still kind of wacked out.”

Thomas Edward Coan
Associate Professor

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

Related Experience

- Los Alamos National Lab
- European Laboratory for Particle Physics Geneva, Switzerland
- Group leader designing ring imaging Cherenkov radiator

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.

Coan has designed and constructed novel devices that measure the properties of antimatter and matter. One such device was recently built in the basement of Fondren Science building and was used to measure the speeds of sub-atomic particles. It was built from 120 square feet of specially grown lithium fluoride crystal tiles.

Yongsheng Gao
Assistant Professor

Ph.D. U. of Wisconsin-Madison, 1995
M.S. Shandong University, 1988
B.S. Shandong University, 1985

Related Experience

*European Particle Physics Laboratory (CERN)
* Harvard University High Energy Physics Lab
* Laboratory of Nuclear Studies at Cornell
* Coordinator of CLEO III Silicon Detector Assembly/Testing at Cornell University

Physics Research

Gao's research concentrates on searching for new physics phenomena which can not be explained by current elementary particle physics theory. Why our universe is dominated by matter (CP violation) and what's the 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 the first observation of hadronic b to u transition (B -> PiRho), B -> DK*-, and searching for FCNC decays in B and Charm. Gao's research at CLEO-c will concentrate on searching for new physics using rare or Cabibbo suppressed D decays.

Gao is leading the effort in setting up a dedicated Pentium processor computer facility at SMU for ATLAS simulation. This computer farm is participating the ATLAS Data Challenges under US GRID testbed.

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. Hornbostel is also performing calculations on the breaking of QCD strings using light-cone methods.

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
Associate 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 9 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.

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.

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.

Pavel Nadolsky
Research Associate

Ph.D., 2001, Michigan State University
Candidate of Physics & Mathematics, 1997,
Institute for High Energy Physics, Russia
M.S., 1992, Moscow State University

Pavel Nadolsky participates in the development of the state-of-the-art parton distribution functions within the framework of "The Coordinated Theoretical-Experimental Project on QCD" (CTEQ). He also searches for constraints on new physics from the analysis of global hadronic data.

Nadolsky develops methods for summation of large logarithmic terms through all orders of the perturbative theory, which are applied to control the immense Standard Model background in the search for Higgs bosons and supersymmetry. His computer program is used in precise measurements of the mass of the weak bosons and to reconstruct weak bosons produced in polarized proton interactions at the Relativistic Heavy Ion Collider.

Jusak Tandean
Visiting Assistant Professor

Ph.D. University of Massachusetts at Amherst, 1997
B.S., University of Indonesia, 1988

Tandean's research work concentrates on the theoretical study of a phenomenon called ``CP violation". The study of CP violation addresses the differences in behavior between matter and antimatter in nature. The source of this obscure phenomenon remains one of the unsolved mysteries in physics, and its resolution would reveal whether CP violation arises exclusively from presently known physics or whether new forces that are still unknown must also be present. Tandean explores possible new ways to observe CP violation, which would help improve our understanding of its nature and origin.

Ryszard Stroynowski
Professor

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

Related Experience

- Field of Specialization; Accelerator based Particle physics of Tau Lepton, Searches for new physics phenomena
- Taught at: Stanford, Caltech, UCLA, Warsaw, Lausanne
- Liquid Argon Calorimeter Project Leader-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, Coan, and Gao collected data with the CLEO detector. Stroynowski is presently leading a team that is studying properties of heavy quarks and tau lepton and tries to find time reversal violation in a system of "bottom" quarks.
Stroynowski also collaborates with scientists from around the world on ATLAS, a large detector under construction at the European Large Hadron Collider (LHC) in Geneva, Switzerland. He is leading the construction of a major component of the detector and is designing fast electro-optical data links for one of the detector subsystems.

ATLAS will search for effects responsible for the differentiation of particle masses and possibly for the origin of matter-antimatter asymmetry in the universe. ATLAS 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 2005.

Jingbo Ye
Senior Research Associate

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. 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 principle 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.

PHYSICS at SMU

A newsletter for alumni and friends. Winter 2002-2003

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