

A NEWSLETTER FOR ALUMNI,

FRIENDS, STUDENTS,

FACULTY, AND STAFF

OF DEDMAN COLLEGE

winter 2003



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Dedman College

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Physics with a heart: student pursues medical applications of field

Senior Alonso Gutierrez considers physics the most practical of sciences, “because it’s the basic building block for every science,” he says. A physics and mechanical engineering major, Gutierrez plans to pursue a Ph.D. in medical physics after he graduates in May.

“I would like to apply the principles of science to things people need,” Gutierrez says. Medical physics uses the concepts and methods of physics to diagnose and treat disease using tools such as magnetic resonance imaging, ultrasound imaging, and radiation therapy.

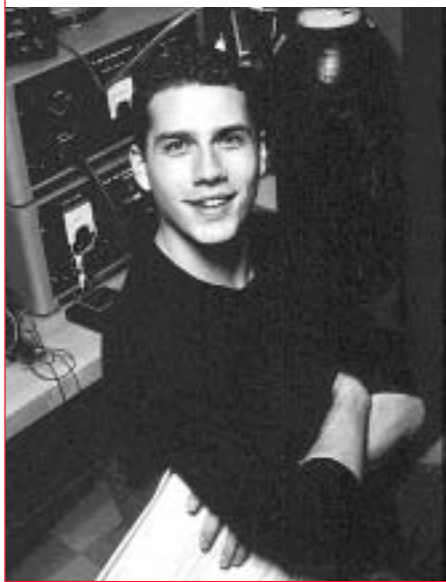
A student engineering project that he helped develop for the Kent Waldrep National Paralysis Foundation confirmed his goal. Gutierrez participated on a team that designed modifications to adapt an all-terrain vehicle for paraplegic drivers. “We designed back, leg, and side supports for an ATV so a paraplegic driver would have the ability to go off-roading,” he says.

Gutierrez was one of 16 Texas students awarded the Barry M. Goldwater Scholarship in 2001, established by Congress in 1986 to encourage outstanding students to pursue careers in mathematics, the natural sciences, and engineering. In addition, Gutierrez is a President’s Scholar and the recipient of the Frank C. McDonald physics scholarship.

The summer after his first year at SMU he was among 15 students worldwide selected for an internship at Fermilab near Chicago. Fermilab contains the world’s highest-energy particle accelerator. A consortium of 89 universities oversees its research.

Gutierrez was the youngest intern at Fermilab in summer 2000, but that did not prevent him from participating in research. He expected a “don’t touch” mentality at the lab, which operates on a \$277 million annual budget funded by the Department of Energy. Instead he was paired with a mentor and given the opportunity to conduct research.

Gutierrez developed an interest in physics in high school and decided to attend SMU after meeting with its physics faculty members. Gutierrez has appreciated the opportunity to get to know his professors at SMU. “They are top physicists educated at Caltech, Duke, Wisconsin, and Penn State,” he says. “But they’re available to sit down, drink coffee, and talk about physics for two hours.”



Alonso Gutierrez

THE BEST OF THE BEST

SMU's only Nobel Prize winner, James Cronin ('51), is a physics and mathematics graduate who received the Nobel Prize for Physics in 1980. Cronin and co-researcher Val Logsdon Fitch were awarded the prize for a 1964 experiment proving that certain subatomic reactions do not adhere to fundamental symmetry principles.

Now a professor of physics at the University of Chicago, Cronin leads an international collaboration, the Pierre Auger Project, which studies the energy masses of cosmic rays that continually strike Earth. Each second 200 cosmic ray particles strike every square meter of Earth. In 1991, however, a detector in Utah recorded a cosmic ray with energy six times greater than the scientific theory at the time. Cronin's project analyzes the properties of these rare, high-energy rays. To enable further study, two 1,000-square-mile detector arrays are being built in the Northern and Southern hemispheres to capture high-energy particles.

Cronin serves as a resource to SMU physics faculty members, says Fred Olness, associate professor and chair of the Department of Physics. "He has returned to campus to speak to faculty and students and is supportive of the department, particularly on an individual level."



James Cronin

Solving the puzzle

By Fred Olness, associate professor and chair of the Department of Physics

The universe is the biggest puzzle imaginable, and physicists are trying to solve it, one piece at a time. From the large scale structure of the universe to the smallest constituents of matter, SMU physicists are at the forefront of the field. Through research, leadership in international physics and government, and by shaping the education of our exceptional students, the Physics Department at SMU plays an integral role during a revolutionary time.

For research, the Physics Department receives more than \$1 million a year in external funding from agencies such as the U.S. Department of Energy and the National Science Foundation. Faculty specializations include particle physics, cosmology, and astrophysics. Our faculty members frequently are drafted for major leadership positions in their fields. We operate a world-class optical-electronics laboratory, as well as a state-of-the-art parallel computer farm for experimental data analysis.

What are the benefits of this research to society and our students? Solutions to fundamental scientific questions often lead to useful applications, from telecommunication technology to transportation to medical imaging.

*"Chance favors only
the prepared mind."*

— LOUIS PASTEUR

With the upcoming renovation of Fondren Science Building, the department will gain significantly improved teaching and research facilities to further expand its activities. The renovation, scheduled for summer 2003, includes lecture hall refurbishments and lab improvements.

Exposure to the basic sciences provides the key to understanding technology, educates students in the logical thought process of the scientific method, and provides the analytical tools students need to chart their own futures.



Fred Olness, associate professor and chair of the Department of Physics

Students at all levels are interested in learning how their studies relate to the real world. Exposure to a first-rate international research program inspires our students and demonstrates the relevance of what they are learning in class.

The department consistently has attracted talented students. Since 2000, six were President's Scholars and one was a national Goldwater Scholarship winner. Our graduates have joined companies such as Texas Instruments and General Dynamics, and entered graduate programs at schools such as Princeton, Stanford, Berkeley, Caltech, and Columbia.

With a physics education, our students are prepared to solve a wide range of problems, from the Schroedinger equation of quantum mechanics to the Black-Scholes equation of options pricing. These students will be among those who will solve the challenges of tomorrow.

For more information about the Physics Department at SMU, see the Web site at www.physics.smu.edu. To support the Physics Department or renovation of Fondren Science Building, call Tricia Barnett at 214-768-2691 or visit the SMU giving Web site, www.smu.edu/giving/online_giving.asp.

Professor helps leaders weigh balance between science and national security

The most powerful space telescope in the world, the Hubble Space Telescope, continues to transmit information that has revolutionized scientists' understanding of the universe in almost every area of astronomy. Conversely, military officials say satellite surveillance technology played a critical role in the war on terrorism in Afghanistan, allowing precision targeting and preventing casualties among allied troops.

For officials who ponder the role of science in the political process and national security, a delicate balance exists between openness and secrecy about new scientific developments. "Science thrives on unfettered communication – national security, however, requires confidentiality," says Physics Professor Vigdor Teplitz, who returned to SMU last fall after a two-year appointment as a senior policy analyst to the White House Office of Science and Technology (OSTP).

Teplitz, a theorist who specializes in astrophysics, walked that tightrope when he led an OSTP-chaired interagency effort to help the State Department draft new international traffic in arms regulations. He spent months securing interagency agreement on one paragraph that enables scientists to continue to share information about space scientific equipment that studies the universe without compromising national security.

"Astronomy research is entirely peaceful," Teplitz says. "The same technology that is really good at pointing up at galaxies, however, also is really good at pointing down at the position of U.S. troops."

The importance of one paragraph in a 100-page document may outweigh half a dozen published papers, he says. "As a scientist I may be able to make a bigger difference in Washington than I can writing equations by myself."

Teplitz has contributed to physics as a researcher as well. Most recently, he and SMU Geology Professor Gene Herrin found the first evidence of a previously undetected postulated form of matter passing through Earth. Known as strange quark matter, it is extremely dense.

If it exists, a ton-sized nugget is the size of a red blood cell. Teplitz and Herrin studied millions of seismic records to isolate nine that indicate a strange quark nugget may have passed through Earth at 250 miles per second.

A member of the SMU faculty since 1990, Teplitz was a member of the U.S. Arms Control and Disarmament Agency from 1978 to 1990 and the agency's Scientific and Policy Advisory Committee from 1995 through 2000. He recently agreed to serve for three years at the NASA Goddard Space Flight Center in Washington, D.C., as chief of university programs. In addition, he will participate in planning and research for a proposed satellite series to investigate black holes and the early universe.

"Astronomy research is entirely peaceful. The same technology that is really good at pointing up at galaxies, however, also is really good at pointing down at the position of U.S. troops."

Having served the White House under the Clinton and Bush administrations, Teplitz witnessed the shift in OSTP direction after September 11, 2001. Since then, the office has provided President Bush and the Department of Homeland Security with technical support for areas such as airline security, building design, and bioterrorism preparation.

Technical and scientific support play a critical role in presidential decision-making, Teplitz says. "There is not enough money to do everything. Scientists can shine a light on major scientific directions that are likely to have important applications to technology or to science."

IN HARMONY: MUSICIANS STUDY THE PHYSICS OF SOUND



In a "Music and Physics" class last fall, instead of rehearsing Bach six student cellists analyzed the science behind the sound of the Baroque artist. The interdisciplinary course was taught by Fred Olness, associate professor of physics, and Tom Tunks, associate provost and professor of music (above).

In the course, developed for non-physics majors to fulfill their science requirements, they study the sound of musical instruments, and electronic production and reproduction of sound in the classroom and in the laboratory.

In the weekly lab one student group analyzes water wave patterns made by a small wave machine. Another group blows a horn into a PC microphone to study fast fourier transforms. Other students bounce a laser beam off mirrors attached to two speakers and on to the ceiling to create a laser show.

"The experiments let students see the properties of water and light waves that they can't see in sound waves," Olness says.

When the class studied resonance, sophomore Jill Johnson (above) brought her cello to class. As she drew the bow across the strings, the deep tones of her instrument were frequency analyzed by a computer and graphed on a large screen behind her. Johnson, who has played the cello for 10 years, is majoring in cello performance and business and is a member of the Meadows Symphony Orchestra.

"I have always been told how to play the cello," she says. "Now I understand why certain techniques work."

1+1=2

In many ways the wedding of physics minors April Kramer ('02) and Derek Andreas ('02) March 9, 2002 was a traditional SMU wedding. They met in class, Derek proposed to April in front of the fountain on the main quad, and the bride looked lovely in white at their wedding at Perkins Chapel and reception at Umphrey Lee Ballroom.

On the nontraditional side, however, the couple featured aspects of their interests in their wedding. "I love math," April says, "and Derek loves Mars."

Instead of "love" stamps, wedding invitations carried postage commemorating the space program. At the reception, tables were decorated with candles, flowers, and their favorite math and physics texts. The guests, which included many of their professors, were given spiral notebooks, pencils, and bookmarks commemorating the day.



April and Derek Andreas

A mathematics graduate with minors in computer science, physics, and art history, April is completing a Master's degree in math at SMU while working as coordinator of the University Honors program. She plans to pursue a Ph.D. in industrial engineering. Derek graduated in December with a double major in mechanical engineering and mathematics and minors in computer science and physics. A mechanical engineer with Raytheon Company, he is pursuing a Master's degree in astronautical engineering through a distance-learning program at USC.

With plans for careers in academia, the Andreas' March wedding anniversary serves a practical purpose as well. "We'll always celebrate our anniversary over spring break," April says.

Scientist prepares for physics' future, seeks understanding of fundamental questions about matter

Five stories underground near Geneva, Switzerland, construction is under way on a \$1 billion particle detector. When the ATLAS detector of the Large Hadron Collider is completed in 2006 and begins colliding protons, it will produce 40 million collisions per second, says Physics Professor Ryszard Stroynowski.

"We are dealing with an amount of data unparalleled in human history," he says.

The ATLAS detector at CERN, the European Laboratory for Particle Physics, will determine the energies, direction, and identities of particles produced in collisions of two proton beams. Scientists expect the data produced by the collisions to answer fundamental questions about matter. They will search for a proposed Higgs particle to explain why different particles have different masses and for new physics phenomena like supersymmetry, extra dimensions, and dark matter candidates.

Stroynowski, who has worked on the preparation and design of the detector since 1997, is the U.S. coordinator of the liquid argon calorimeter, a device inside the detector that measures the energy of tiny particles of matter. The calorimeter is one of three major components of the detector. He is responsible for ensuring that its design satisfies the challenging technical requirements and that its construction stays on time and budget.

More than 2,000 physicists and engineers from 148 institutions have collaborated to build the enormously complex ATLAS detector. "Just getting the pieces down the shaft and assembled will take two years," Stroynowski says.

Stroynowski contributes more than 30 years of research experience to the task. For the past 20 years he has studied the properties of heavy quarks and leptons using colliders at Stanford University and Cornell University. He is an expert on the physics of the tau lepton – a heavy analog of the electron.

He joined the SMU faculty in 1991 for the opportunity to remain at a university while working on the Superconducting Super Collider that was being built near Waxahachie. When the project's funding was cancelled in 1993, he remained at SMU.

Born in Poland, Stroynowski began his career at the University of Warsaw. He left Poland in 1969 for political reasons and joined CERN as a staff physicist. He moved to the United States in 1975 and became a researcher at the Stanford Linear Accelerator Center, and later a research associate and lecturer at Caltech. In 1980 he became a U.S. citizen.

Although Stroynowski's current role with ATLAS is mostly organizational, he says he remains a scientist at heart. "The hours are long, but my curiosity drives me."



A new particle detector in Switzerland will produce 40 million proton collisions per second.

Smashing protons: High school students exposed to high energy physics

Lincoln High School junior Sherika Davis adjusts her safety goggles then aims a fire extinguisher nozzle through a plastic tube. Her classmates cover their ears anticipating the blast of the extinguisher as it shoots a piece of bubblegum through the tube and smashes it inside a plexiglass box. The experiment, designed by physics teacher Darren Carollo, demonstrates high-energy physics collisions.

"I have to see things to understand how they work," Carollo says. "High school students are the same way."

The experiment illustrates the proton-smashing work of physicists at one of the world's leading high-energy physics research centers, CERN, in Geneva, Switzerland.

Each student in Carollo's class in Dallas constructs an accelerator, then uses the air pressure from a fire extinguisher to shoot a round piece of bubblegum 450 mph through a tube and shatter it into hundreds of pieces.



Darren Carollo's physics students demonstrate their linear accelerator, a model of the high-energy particle accelerator at Fermilab in Chicago.

Carollo developed the project after visiting CERN with SMU Physics Professor Ryszard Stroynowski through QuarkNet, a national program that connects high school physics teachers and physicists. SMU's Physics Department is one of 44 QuarkNet centers in the United States. Each summer about 20 high school teachers participate in a one-week program on campus taught by physics professors.



Lincoln High School students prepare to blast a piece of bubblegum through a particle accelerator they built in class as their teacher, Darren Carollo, (left) looks on.

"One of QuarkNet's goals is to interest high school students in high-energy physics," says Fred Olness, associate professor and chair of physics. "The high school teachers work with the kids all the time; they know how to translate the most current physics information to interest them."

The physics taught at the high school level is most often the classic physics of Newton and Einstein, Carollo says. "QuarkNet provided me with a strategy to introduce new physics concepts to my students."

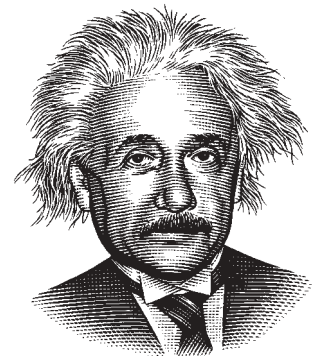
Carollo has participated in QuarkNet since it was created by the National Science Foundation and the Department of Energy three years ago. He was among the first physics teachers to take part in SMU's program in 2000 and now teaches other teachers during summer QuarkNet programs at SMU and other universities. Next July he will present the experiments he developed at SMU to European teachers.

The true measure of QuarkNet, however, can be found in Carollo's classroom at Lincoln High School, a Dallas Independent School District magnet school located in a low-income area. Carollo's expectations for his students are high. "I want students to understand the advances that physics has brought the world, such as CT scans, and PET scans," he says. "This is all about developing the global student who can use technology, work with a team, speak in public, and write."

SEARCHING FOR MORE PHYSICS?

STRANGE MATTER: UNDISCOVERED IDEAS AT THE FRONTIERS OF SPACE AND TIME by Tom Siegfried (Joseph Henry Press, 2002) The first chapter of the new book by *The Dallas Morning News* science editor Tom Siegfried discusses the work of SMU Physics Professor Vigdor Teplitz and Geology Professor Gene Herrin. The SMU scientists study strange quark nuggets, a previously undetected postulated form of matter that is extremely dense. If it exists, a ton-sized nugget is the size of a red blood cell. Seismic records show a strange quark nugget passed through Earth at 250 miles a second.

COPENHAGEN Michael Frayn's play, which won the 2000 Tony Award for best drama, portrays two famous physicists: Werner Heisenberg, a young German scientist, and his mentor, Niels Bohr, a Dane. During World War II, they found themselves on opposite sides in the race to build the first atomic bomb. Now playing in theaters from Dallas to Cincinnati to London. Check your local theater listings.



"THE INNER EINSTEIN" NOVEMBER 15, 2002-AUGUST 10, 2003 A new exhibit at the American Museum of Natural History in New York takes visitors into the mind of Albert Einstein, the most famous physicist of the 20th century. The exhibit examines Einstein's legacy, theories, and often tumultuous personal life. Visitors may experiment with physics concepts presented throughout the exhibit in a hands-on lab. See www.amnh.org for more information.

Inventive science creates ‘gizmos’ to support research

When the American Association of Physics Teachers met in Austin in January, among the displays in the exhibit hall was an invention by two SMU physicists. Thomas Coan, associate professor of physics, and research scientist Jingbo Ye designed an experiment for science teachers.

“Science teachers told me they wanted experiments that demonstrated high-energy physics but they didn’t have the technical support to design the experiments,” Coan says.

Coan and Ye created a prototype detector, the “SMUon,” that enables students to observe and measure the lifetime of muons, tiny particles created when cosmic rays strike Earth’s upper atmosphere. The prototype includes electronic circuitry and software easily used by students and teachers.

Coan, who describes himself as a “hardware” physicist, compares the intricate process of physics research to constructing a building. “In physics we determine what we want to measure and why, then we build a gizmo to measure what we want.”

As a physicist with experience at CERN, the world’s largest particle physics laboratory in Geneva, Switzerland; the Los Alamos National Laboratory in New Mexico; and CLEO at Cornell University, Coan has collaborated with other scientists to build detectors that distinguish

between matter and antimatter.

At CLEO, he constructed a key piece of a particle detector that identifies the kind of particles produced in collisions. “The particles we are interested in live for a minute amount of time then decay into other particles,” Coan says. “It’s like learning about the grandparents by studying the children and grandchildren.”

Coan is developing an experiment to measure the energy, trajectory, and charge of particles produced in collisions at a new detector proposed for Fermilab in Chicago.

A member of the SMU faculty since 1994, Coan is director of undergraduate physics research. He encourages students to consider summer research positions and lists opportunities on his Web site.

“When students can work uninterrupted for 40 hours a week, they learn debugging skills, persistence, and develop the self-confidence they are not going to learn in a lecture hall,” he says.

Coan became interested in physics as a high school student because “it requires a tremendous amount of creativity,” he says. “Physics is a very human activity that requires an appreciation of mystery, beauty, and excitement.

“Our motivational goal is lofty – we are trying to determine why the universe is organized the way it is.”

STARTING OVER: ENTREPRENEUR RETURNS TO HALLS OF KNOWLEDGE

A self-described “early Internet guy,” Bruce Sidlinger created a business in 1985 that brought Internet infrastructure technology to rural telephone companies. To provide the necessary customer service Sidlinger relied on another passion, flying. His business used his fleet of four aircraft to quickly reach remote areas.

Sidlinger’s ability to fly commercial aircraft ended abruptly in 2001, however, when he was diagnosed with Type I diabetes. Because of potential health complications that could occur while flying, commercial pilot’s licenses aren’t granted to Type I diabetics.

“I always had a plan B,” he says. “If I couldn’t fly, I wanted to be a physicist.”

In January 2002 Sidlinger enrolled at SMU as an undergraduate majoring in physics and mathematics. He relinquished his business responsibilities to others, decided to sell his aircraft, and moved to Dallas from Manhattan Beach, California.

“I came to an absolute crossroads,” he says. “Can I go from the American mode of earning and consumption to the research community? Can an entrepreneur really transition to the academic community?”

Now in his third semester as a full-time student, Sidlinger answers his rhetorical questions with a visible enthusiasm for physics. “I am so excited about this,” he says. “For 28 years I was responsible for the continuous operation of critical computer resources. I went to bed every night with three cell phones by my head. I now realize I was thirsting for this knowledge.”

Sidlinger says he feels “surprisingly at home in undergraduate classes.

“I have an easy time with the concepts – I can see the real world applications, my study skills are good, my organizational skills are fine, but it’s very hard to complete math tests without the resources of a working engineer, such as a calculator.”

Sidlinger hopes his business experience will be an asset when he achieves his long-range goal of becoming a physics professor and researcher.

“The one chance I have to contribute to the bank of human knowledge is taking a multidisciplinary approach to physics,” he says. “I aspire to be an explainer of physics – but maybe my role is to ask the questions.”



Bruce Sidlinger

Physics: “The Greatest Show on Earth”

Fifth-grade girls visiting SMU are spellbound as physicist Fred Olness uses an electric current to make a pickle glow like a light bulb. They stand beside their desks to watch as he speeds across the front of the room on a four-wheeled cart powered by a fire extinguisher. And when the associate professor and chair of the physics department carefully sits on a bed of nails, the room fills with their applause.

For more than 10 years Olness and other physics faculty members and graduate students have demonstrated complex principles to school children through a program they developed called the Physics Circus. When presenting the circus, Olness uses the standard magic trick of snatching a tablecloth from under a place setting to demonstrate inertia. His audience giggles as he floats a styrofoam ball six inches above a blowing hair dryer to illustrate the properties of air flow.

“This is something we often do in science,” Olness explains. “If we don’t understand something

or can’t see it, we use a simple model to explain it.”

In November, more than 100 Hispanic students, parents, and teachers participated in the Physics Circus at SMU through the “Psyched About Science and Math” program coordinated by the Dallas Concilio of Hispanic Services. The program is designed to encourage students to attend college and pursue careers in math, science, and health, says Sybil Pietersz,

program support specialist for Dallas Concilio.

Olness’ lighthearted approach to physics is key to catching the girls’ interest, Pietersz says. “He made the concepts so easy for them to learn.”

Producing the Physics Circus is a natural byproduct of Olness’ family heritage. Two siblings are Broadway performers and his father and grandfather were physicists.

“My dad was a nuclear experimentalist at Brookhaven National Laboratory in New York. When I was a kid I thought of his lab as a magic show. I think the Physics Circus is an extension of that,” Olness says. “It’s fun to share it with others.”



Physicist Fred Olness demonstrates the properties of force and pressure as he comfortably sits on a bed of nails.



Students see the property of inertia demonstrated when Fred Olness pulls a tablecloth from under a place setting.



Fifth grade girls were encouraged to pursue scientific careers at the Physics Circus.

CALENDAR

MARCH 6 *Dedman College Book Club*

Dedman College Dean Jasper Neel shares his wit and wisdom as host of the new Dedman College Book Club. He will lead a discussion of *In The Beginning: The Story of the King James Bible and How It Changed a Nation, a Language, and a Culture*, by Alister McGrath. The review begins at 7:30 p.m. in McCord Auditorium in Dallas Hall and is followed by dessert. There is no charge to join. For more information call Tricia Barnett at 214-768-2691 or visit www.smu.edu/dedman/bookclub/.

MARCH 23 *Collegium daVinci Lecture Series*

The United States’ preparedness for bioterrorism is the subject of the March 23 Collegium da Vinci lecture. Robert Haley (’67) professor and director of the division of epidemiology at the University of Texas Southwestern Medical Center and Gulf War Syndrome researcher, will present the lecture. For more information, call 214-768-1177 or visit www.smu.edu/collegium.

SPRING *Godbey Lecture Series*

Poetry and performance are among the spring topics in the Godbey Lecture Series. English Professor Willard Spiegelman will lead “Four Poets and Four Poems: The English Romantic Ode.” The series “Who’s Playing and Who’s Listening” will be led by music historian Carol Reynolds. Spring and summer tours include “U.S. National Parks,” led by Geological Sciences Professor Lou Jacobs. For more information, call 214-768-2532 or visit www.smu.edu/godbey/.

International collaboration rewards physicist

Yongsheng Gao, assistant professor of physics, is among an international collaboration of 2,000 physicists preparing for an experiment that will help scientists understand the smallest building blocks of matter. In 2007 the ATLAS experiment will begin collecting data to help scientists find new quarks, elements of matter so small they have never been seen. The ATLAS experiment will be conducted at CERN, the European Laboratory for Particle Physics.

Quarks are the basic building blocks of protons and neutrons in the atomic nucleus. The ATLAS experiment will use the Large Hadron Collider at CERN in Geneva, Switzerland, to collide two beams of protons, producing particles – quarks – that physicists can identify and study.

Physicists expect the five-story detector to produce 40 million interactions per second, creating enough data in a second to fill a 12-inch stack of telephone books, Gao says. He is developing and testing technology to extract data as part of the ATLAS Challenge Data project. “We have to make sure we can handle the amount of data before the data-taking begins,” Gao says. SMU is one of 11 universities in the United States assigned to the first stage of the ATLAS Challenge Data project.

The most rewarding part of his research, Gao says, is the opportunity to collaborate and compete with physicists throughout the world. Physicists working on the ATLAS project meet in Switzerland every three months to discuss their findings. Gao describes each meeting as an intellectual challenge in a culture unique to experimental high energy physics.

In another collaborative project Gao was the first scientist to observe the hadronic transition of a beauty quark into an up quark. Using the Cornell Electron Storage Ring at the Wilson Synchrotron Laboratory at Cornell University, the scientists review data on new quark states and couplings.

In addition to his research, Gao teaches undergraduate and graduate physics classes at SMU, which he finds both challenging and rewarding. “Teaching helps you become a better physicist,” he says.

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