Spotlight

Interview with Zoa Conner
Ph.D., 1997

By: Karrie Sue Hawbaker, editor

Recently, I had the opportunity to speak with Dr. Zoa Conner, 1997 graduate of the University of Maryland Department of Physics. She kindly offered me insight on her career experiences as well as her thoughts on issues facing women in physics today and what the field can do to attract more women scientists.

Dr. Conner began her higher education career at the age of 16 when she entered Carnegie Mellon University. While she excelled in her physics coursework, she also stood out as an active young woman in science. She established mentoring programs for fellow students and worked with the associate provost for academic affairs on several campus-wide issues, including attracting more women and minorities to the sciences. Upon earning her Bachelor of Science degree in 1991, she was awarded a six-year fellowship from the National Physical Science Consortium, a competitive fellowship for women and minorities in the physical sciences. The award granted her two summers of internship as well as tuition and stipend money for whatever university she chose to pursue a graduate education.

After a visit to the University of Maryland, where she says she was warmly received, Dr. Conner decided to join the Maryland Physics family. She wanted to study in an area that she found intellectually interesting, but would also provide her with a window to other related areas of science. These goals led her to the field of particle astrophysics. She originally had reservations about working with a group as large as the one at Maryland because she was concerned that a large group would not provide her with the opportunity to gain experience in the variety of tasks associated with an experiment that a smaller group would. However, Dr. Jordan Goodman, who would soon become her advisor, and Dr. Todd Haines, a postdoctoral associate in the group at the time, assured her that this would not be the case. Their assurances were enough to convince her to join them and, sure enough, their words rang true.

During her six years at Maryland, she worked on many aspects of the Super-Kamiokande experiment, which studies nucleon decay, solar neutrinos and supernovae neutrinos. She spent nearly one-fourth of her time each year on-site at the experiment in Japan. And her Ph.D. thesis on solar neutrinos was the first one written on the Super-K experiment from the U.S. collaboration.

She also gained teaching experience at Maryland. Though, thanks to her fellowship, she did not need to earn her tuition as a teaching assistant, she volunteered to work

Spotlight

Properties of the W and Z Bosons

By: Professor Sarah Eno

There are only four known fundamental forces: the strong force, gravity, electromagnetism,and the weak force. Electromagnetism is responsible for most of the forces we see in everyday life, from the binding of atoms into molecules, to static electricity and friction. The strong force binds protons and neutrons into nuclei. Gravity causes apples to fall onto people's heads. But, what does the weak force do? And why would the Department of Energy pay Professor Sarah Eno, of the University of Maryland, and the scientists in her group, to jet to Chicag and Geneva Switzerland to study it? And, why are the labs and experiments there soooc big?

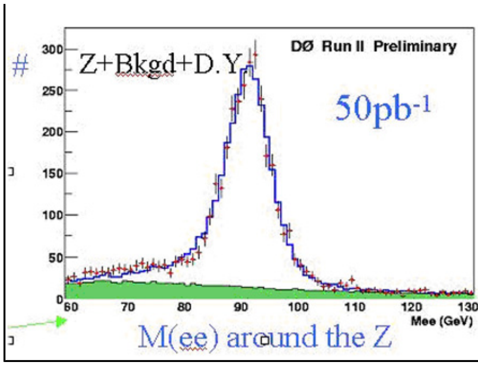
Aerial photograph of Fermi National Accelerator Laboratory (http://www.fnal.gov) , near Chicago, Illinois. The circumference of a ring is 4 miles.

Experimentalists in France near CERN (European Organization for Nuclear Research, http://www.cern.ch) in Geneva Switzerland start to assemble the CMS detector (http://cmsdoc.cern.ch). This detector will go into the beam line in 2007.

The answ lies in what people in her field, experimental particle physics, call the "Standard Model" c particles and their interactions. This theory attempts to be a complete theory of all possib particles and their interactions, though at this point does not include gravity. You may ha heard that there are 6 types of quarks, but electromagnetism only cares about the charg of the quark, and there are only 2 possible charges, 1/3rd of the electron charge, and 2/3rd s of the electron charge. To the strong force, there are only 3 charges, called "red", "green", and "blue". It's the weak force that "knows" there are 6 types, the up, down, strange, charm, top, and bottom quarks. It's the weak force that allows one type of quark to turn into another type (and thus the radioactive decays of atoms). It's also the reason that the mass of the top quark is about 200x that of the proton, while the masses of the up and down quarks, that make up the proton, are of order 1/3rd the proton mass. During the 1960's, there was a revolution in the study of the fundamental forces. Theorists such as Abdus Salaam, Sheldon Glashow, and Stephen Weinberg realized that electromagnetism and the weak force could be described with the same mathematics, unifying them in the sense that Maxwell unified electricity and magnetism in the 1860's. Some of the apparent differences between electromagnetism and the weak forces come not because of any fundamental difference in their mathematical description, but because the carrier of the force, the photon in the case of electromagnetism, the W and Z bosons in the case of the weak force, have very different masses. While the photon is massless, the W and Z bosons have a mass around 100x the proton mass. Because the W and Z are so heavy, very large accelerators are needed to accelerate "normal" particles (in the case of FNAL, protons and antiprotons, in the case of CERN, protons) to high enough energy to create these particles in their collisions.

The Tevatron at FNAL is currently the highest energy particle accelerator in the world. Sarah and her colleagues Professors Hadley and Baden work on the DØ experiment (http://www-d0.fnal.gov) and travel there approximately every other week, to meet with their students and postdocs who live permanently at the lab. Sarah's postdoc, Marco Verzocchi, is the head of the group studying W and Z bosons at the Tevatron. We currently have a sample of approximately 30,000 Z's and 400,000's W's, and expect to collect a factor 4 more by 2007. We hope to measure properties of the W, like its decay width, mass, and production properties to high precision. This is important, because if we can measure the W mass to 0.3%, we can predict the mass of a particle that is predicted to exist by the standard model, but that as of yet has not been discovered, the Higgs boson. This particle is the only particle in the standard model predicted to have a spin of zero. In some ways, it resembles the old "ether" theory, in that the Higgs is supposed to create a field that permeates the entire universe. Through interactions with the standard model particles, the Higgs creates mass. Discovering (or ruling out) the existence of the Higgs particle is one of the primary goals of experimental high energy physics today, and is the primary goal of the CMS experiment, which Sarah also works on, along with Professors Skuja and Baden. Our group has sent undergraduate students to both labs during the summer to help us with our research.

This is an exciting time in high energy physics. The top quark was discovered (at the Tevatron, by DØ) in the early 90's. Neutrinos were unexpectedly found to have mass in the late 90's. With the Tevatron running now, and a new machine at CERN coming on line soon, we expect more exciting discoveries in the coming decade!

	
Its fun to work with researchers from all over the world.	The resonance at 90 GeV/c2 in the di-electron invariant mass spectra from D0 data is due to the Z boson.

Dr. Sarah Eno is an associate professor here in the Department of Physics at the University of Maryland. A member of our high energy physics group, she works on the Dzero experiment and the CSM experiment. For more information, she can be reached at eno@physics.umd.edu

Tel: 301.405.3401
1117 Physics Bldg.
University of Maryland
College Park, MD 20742

Contact the editor.
Contact the webmaster.

as a TA for several semesters, mostly for the sequence of physics courses that engineering majors are required to take. She also spent several summers teaching middle school girls the wonders of science through the Department's Summer Girls Program. She especially enjoyed this experience, as the summer day camp format provided her with the freedom to explore new and fun topics as well as less traditional teaching tactics.

Upon graduation, her excellent work at Maryland earned her the University of Chicago's Enrico Fermi Post-Doctoral Fellowship, which provided her with research funds and a stipend for two years to study in any group at the University of Chicago's Enrico Fermi Institute that she wished. She stayed in the field of particle astrophysics, but this time studied gamma rays among very energetic stars through her work on the STACEE experiment.

After two years in Chicago, she returned to the D.C. area to a position as the Program Director for the Women and Power: Science and Technology Program at George Washington University. This position, which was much different from her previous research work, provided new challenges. While she did miss the research, she was happy to have the opportunity to pursue her interest in working with women scientists and women students.

Dr. Conner managed a residential program for freshmen women interested in majoring in science. In this program, designed as an incentive for top-notch women to attend the university, the women students lived together in a dorm (with a female science graduate student as resident advisor), attended special seminars together and took several courses together, including some of the university's fundamental requirement courses and multi-disciplinary classes developed for the program - all in an effort to provide a supportive environment for women science students. Dr. Conner organized a weekly seminar for these students and taught a multi-disciplinary class on energy and power, which addressed the topic from several different science perspectives. The course allowed these science-savvy women to combine their own interests with new knowledge from other related disciplines. Dr. Conner's teaching assistant experience from Maryland also came into play at George Washington University, as she had a joint appointment with the physics department where she taught an astronomy course.

Given her extensive work both as a woman in physics and as someone working toward the advancement of women in physics, Dr. Conner was asked about some of the issues she feels women physicists face today. She replied that sometimes the field can still feel like a "boys club." While several of her experiences in physics, including her time in the particle astrophysics group here at Maryland, provided safe environments where people focus on ability instead of gender, there are still many places where women can feel isolated, even if it's only because of the poor representation of women in the field. She also says some women are still put in positions where they must prove themselves more than a man would have to. She encourages physicists today to make sure they disregard their colleagues' gender and simply value the scientists' contributions and accomplishments.

Dr. Conner also addressed the fact that so few girls and young women express an interest in science, especially physics. To remedy this, she feels that science teachers need to encourage all their students, including the young women, to explore science and be careful not to communicate, even accidentally, the negative experiences they may have had when they were earning their degrees. Physics can be a high pressure field where one is always striving to reach the next level. Teachers and mentors need to be sure that they do not assume that this is an atmosphere in which their female students would not excel.

At the same time, she feels that the field of physics needs to make sure that it provides supportive environments in which women can thrive. She feels that women often enjoy working more cooperatively than men do and that this work-style can be very beneficial, especially in research environments. She also recommends that universities and laboratories be flexible with women in their child-bearing years. Dr. Conner finds that even when couples take a "team" approach to child-rearing, parenthood is usually more demanding on a mother when the children are babies. If an employer can be flexible with a woman's schedule during these years, they can reap the rewards of her professional success in the years to follow.

Dr. Conner found working with women physicists and women students at George Washington University to be very interesting and enjoyable. However, she found the time that the position required to be a little more than she wanted to devote to work at this time, since she had just given birth to her first child. She is pursuing a different path now. She is currently home-schooling her two young children and looks forward to teaching both her son and her daughter the wonders of science.

The Department of Physics thanks Dr. Conner for taking the time to share her thoughts and experiences and wishes her and her family the best.

If you have any comments for Dr. Conner, please email the editor at karrie@physics.umd.edu. She will be happy to forward your inquiries to Dr. Conner.