UC SANTA BARBARA

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PHYSICISTS GET TO HEART OF MATTER

A major experiment in particle physics that explores differences between matter and anti-matter and which has implications for explaining the origin of the universe, was made public this week, in a paper submitted to the scientific journal, Physical Review Letters.

In the battle between matter and anti-matter, matter wins by a small margin, explain scientists involved in the experiments.

It took 600 scientists to complete the experiment, including a team of 21 physicists, students and engineers from the University of California, Santa Barbara, who built essential components and contributed to the data analysis. The components are part of the inner workings of a particle detector at the Department of Energy's Stanford Linear Accelerator, called "BaBar," which is housed in a two story building at the accelerator laboratory.

The results are the culmination of work started in 1993, with construction of the experiment starting in 1995 and completed in 1999. Data have been collected and analyzed for close to two years.

"It's always been a puzzle as to how matter dominates anti-matter," said Jeffrey D. Richman, professor of physics and principal investigator of the UCSB high energy physics research group. "Somehow matter won the cosmic battle."

"With the data we have generated, we are now poised to ask more questions," said Claudio F. Campagnari, associate professor of physics, also a member of the research group.

In the accelerator, a beam of electrons collides with a beam of positrons, the anti-matter counterpart to electrons. Where the beams collide, particles are created that allowed the experimenters to compare matter with anti-matter.

The experiment has yielded hundreds of thousands of gigabytes of data. "We are sifting through hundreds of millions of collisions," said Campagnari.

The inner layers of the detector had to be very sensitive to monitor the outcome of the collisions. UCSB engineers explained that much of the assembly and testing of these layers was done in UCSB's lab. For example, silicon wafers for the experiment were designed in Italy, made in England and connectors were produced in Switzerland. Each segment that was put together at UCSB into an instrument about the size and shape of a one foot ruler, is worth approximately $25,000. Fifty-two of these were required in all.

The wafers are connected together with tiny wire bonds that are so small, they must be manipulated by computer-controlled machines.

"All of this is custom-made," said Campagnari. "You can't buy this stuff at Kmart. It's unique."

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.