Little things matter in Big Bang picture

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A device built at UCSB is helping scientists understand the evolution of the universe by measuring particle interactions that would have happened within a millionth of a second of the Big Bang.

"In order to understand the beginning of the universe, we have to understand small things," said Jeffrey Richman, professor of physics and head of the 25-member UCSB research team, including students, particle physicists and engineers. "As we construct this theoretical framework and we understand how it is that matter interacts with itself, then that framework is part of what it takes to understand how the universe came to be what it is."

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Scientists believe that matter in the universe was created in a giant explosion, or Big Bang, 10 billion to 15 billion years ago. They also believe that there was an equal amount of matter and its cousin

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Device shedding light on matter

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antimatter at that instant.

What they are still trying to understand is how those particles evolved into the universe as we know it today. Why, for example, is the universe today made mostly of matter and almost no antimatter?

One explanation is that antimatter behaves differently than matter and therefore reacted differently as the universe evolved. The Silicon Vertex Tracker designed and built by UCSB scientists beginning in 1994, helped to precisely measure the movements in the microscopic reactions that would have occurred again and again over fractions of a second.

The experiment showed that matter and antimatter reacted differently, a long-held theory. It was only the second time scientists were able to demonstrate the differences. The first was in 1964.

"It was used to detect the position of the particles as they go through the detectors and measure the trajectories as they travel through," Claudio Campagnari, an associate professor of physics who helped lead the UCSB team. "We have to measure that very accurately."

STEVE MALONE / NEWS-PRESS

UCSB Professor Jeffrey Richman shows the microscopic structure of one component of the Silicon Vertex Tracker.

The university was just one player in an international team of scientists that revealed its findings at an international conference in Snowmass, Colo., last week and at a press conference at the Stanford Linear Accelerator Center, where the experiments were held.

For the experiment, the UCSB tracker was embedded in a new, $177-million accelerator at the center, which is owned by the U.S. Department of Energy. The department also funded construction of the $3 million Silicon Vertex Tracker.

The completion of one phase of experiments is a vindication for engineers that helped design and build the tracker.

"It means this is a very successful piece of equipment, so, yeah, we're excited," said Susanne Kyre, a senior development engineer at UCSB.

The international team of scientists submitted its findings last week for publication in the Physical Review Letters, a respected journal.

UCSB engineers and particle physicists not only designed and assembled the tracker but also helped interpret the results.

The tracker will continue to be used in experiments in coming years. The research is supposed to improve understanding of the laws of physics that would have played an important role following the Big Bang, to test the theory again and again.

"We want real numbers to see if the theory of the universe can really give the right numbers," Mr. Richman said. "We want a pattern of numbers."