“Tantalizing hint” of dark matter particles

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Courtesy of TAMU
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A new analysis of some old data has turned up what a scientist calls a “tantalizing hint” of particles theorized to make up dark matter, a mysterious component of the universe.

Physicists said they found with 99.8 certainty a particle of a type widely theorized to compose dark matter. They hope to go on working and attain 99.9999 percent certainty, meaning the chance of error is one in a million or less.

A 4-inch detector in its mount being fabricated by physicist Rupak Mahapatra and his team.

Dark matter is a mysterious substance that according to many studies floats in vast amounts throughout the universe—but is detectable only through its gravitational pull. It’s invisible.

Some astronomers dispute its existence altogether, and some newer studies seem to back up these skeptics.

Still, most mainstream astronomers subscribe to calculations showing that dark matter comprises about a quarter of the content of the universe. And although its nature remains unexplained, a widespread view is that dark matter consists of theoretical particles called weakly interacting massive particles, or WIMPs.

The new findings come from an international scientific collaboration known as Super Cryogenic Dark Matter Search, or SuperCDMS. A paper on the work is to appear in the research journal *Physical Review Letters* and is posted online.

WIMPs, whose existence is thought to make sense for separate reasons also, would be very hard to detect because they rarely interact with normal matter—hence their name. But scientists believe one of them occasionally bounces off the nucleus of an atom. This could leave behind a small amount of energy capable of being tracked by certain instruments, including one mounted on the International Space Station, called the Alpha Magnetic Spectrometer.

The SuperCDMS group makes use of a detector a half-mile underground at the Soudan mine in northern Minnesota, managed by the United States Department of Energy’s Fermi National

Accelerator Laboratory. The experiment uses sophisticated technology to search for the rare recoil of dark matter particles against extremely cold germanium and silicon.

The latest analysis represents data gleaned from the largest exposure with silicon detectors during a relatively early phase of the overall experiment, called CDMS-II, according to high-energy physicist Rupak Mahapatra of Texas A&M University, who fabricates detectors used in the work.

“This result is from data taken a few years ago using silicon detectors manufactured at Stanford [University in California] that are now defunct,” Mahapatra said. “Increased interest in the low mass WIMP region,” that is, in lighter WIMPS, “motivated us to complete the analysis of the silicon-detector exposure.”

“This is certainly very exciting, but not fully convincing,” he added, noting that in particle physics, a finding is called a “discovery” only if it meets the 99.9999 percent standard, also called five-sigma.

“At three-sigma,” the current certainty level, “you have a hint of something,” he explained. “At four-sigma, you have evidence. At five-sigma, you have a discovery.”

“In medicine, you can say you are curing 99.8 percent of the cases, and that’s OK,” he went on. But “when you say you’ve made a fundamental discovery in high-energy physics, you can’t be wrong. Given the money involved—$30 million in this case—it has to be extremely precise. With a 99.8 percent chance, that means if you repeated the same experiment a few hundred times, there is one chance it can go wrong. We want one out of a million instead.”

“We just need more data to be sure,” he added. “For now, we have to live with this tantalizing hint of one of the biggest puzzles of our time.”