

A vision born at MIT will ride last space shuttle

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One man's idea comes to fruition

By Carolyn Y. Johnson, Globe Staff | August 2, 2010

CAMBRIDGE — In 1994, Nobel laureate Samuel C.C. Ting began to plan an ambitious experiment: launching a powerful instrument into space that could detect particles left over from the big bang and bring serious science to the International Space Station.

Now, with 16 countries, \$2 billion, and an act of Congress behind the 7.5-ton alpha magnetic spectrometer, the experiment that started with Ting's bold idea is set to be launched on the final flight of the three-decade-old space shuttle program next February, a month after the soft-spoken but deliberate MIT scientist turns 75.

Large-scale experiments are common in the world of physics, where massive accelerators or detectors are necessary to re- create the conditions of the early universe or detect ghostly particles that shower down from exploding stars. Many are designed and built by committee. But the alpha magnetic spectrometer, or AMS, bears the distinct imprint of Ting. He put together a team of 600 scientists and shepherded the project through political, scientific, and logistical obstacles.

"A lot of missions for NASA or experiments on accelerators happen through a whole process of scientific retreats, long-range planning, forming collaborations to do studies — all this kind of stuff. It's very democratic. And this came about as one man's vision," said Barry Barish, a physicist from the California Institute of Technology. "Sam Ting is unique, and the way it came about was somewhat unique."

Ting rose to international fame when he and Stanford physicist Burton Richter independently discovered a subatomic particle, evidence of a new elementary building block of matter. Ting named it the J particle, and the two shared the 1976 Nobel Prize for Physics. Last month, Ting sat down in a conference room in a building at MIT with a "J" sign over the entrance, to tell the story, or as he puts it, "the confession."

"I don't think in the next 30 to 40 years, anybody is [going to be] foolish enough to build an experiment like this, given the trouble we went through," Ting said, referring to the uncertainty that engulfed the experiment when shuttle flights were canceled after the Columbia disaster in 2003.

Years before he knew the hurdles that lay ahead, Ting was fascinated by the idea of creating a different kind of space telescope. Instead of detecting light, Ting was interested in measuring charged particles. He proposed using a powerful magnet and detector to try to find antimatter, dark matter, and cosmic rays, and answer basic questions about the makeup of our universe.

The NASA administrator at the time, Daniel Goldin, said he could fly the experiment to the International Space Station but could not fund the experiment. So Ting went to the US Department of Energy and built a massive international team, with 95 percent of the money flowing in from other countries.

In 1998, NASA flew up, as proof of concept, the AMS-01, which gathered data on a space shuttle flight. But after the Columbia disaster, the cancellation of shuttle missions and NASA's new emphasis on manned exploration of the moon and Mars cast the experiment's future in doubt.

Meanwhile, a smaller, rival experiment called PAMELA was launched in 2006.

"Many people asked me, 'Why are you working on that? It's not going to launch,' " said Trent Martin, the AMS project manager at NASA. "But I knew what we had was going to be something that was valuable. . . . I didn't underestimate Professor Ting."

Ting had built an impressive international collaboration and the project had earned backing from many scientists, but the unusual provenance and trajectory of the experiment also had critics.

A 2006 review chaired by Barish noted in its report, "The total project is clearly well managed by Professor Ting. In general, the committee had only praise and some wonder of this effort. One committee member however, felt that the structure of the overall project management, beyond the leadership of S. Ting, has not been made clear."

NASA had agreed to fly the experiment, but because of the unusual initial agreement and the fact that AMS was funded and built chiefly by international collaborators, AMS did not go through some of the usual reviews at NASA, according to Jack Burns, a member of NASA Advisory Council's science committee.

"I think the agency prefers, and those of us who serve to advise the agency prefer, that NASA have a role in defining the science and mission requirements, and not serving as just a trucking service," Burns said.

But supporters point out that Ting made the experiment possible. Jack Sandweiss, a physicist at Yale University, said it was Ting's ability to hold all the complex components of the instrument in his mind and to recruit a large group of talented collaborators and orchestrate their efforts that made it possible. He and Ting both worked to lobby members of Congress, and in 2008 an extra shuttle flight for AMS was written into law.

"After awhile, Congress realized we cannot build a \$100 billion space station without a single major science experiment," Ting said.

Over the past 15 years, the scientific expectations of the experiment have shifted. New findings have made it unlikely that the experiment will detect anti-earths and antigalaxies, mirror-image worlds made of antimatter. But to Jesse Thaler, a theoretical physicist at MIT, "The scientific case for it, especially now, is fantastic."

AMS could reveal more about the cosmic rays that shower down through the cosmos, the nature of the mysterious dark matter that scientists know must exist, and search for "strangelets," a theoretical type of matter. In some ways, scientists are most excited that they do not know exactly what to expect.

"He's put together something that works — an instrument that is far more capable than anything anybody's had the ambition or nerve to put together to put into space," Barish said. "I think, independently of what anyone thinks or predicts or expects, he's opening a new window, so I personally give it a chance of seeing some interesting things."

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