MIT physicist's experiment pulls dark matter into the spotlight

Ivan Semeniuk - Globe and Mail

With the Higgs boson all but confirmed, there's an opening for a new hard-to-understand but vitally-important subatomic particle that can jump into the gap and grab the media spotlight.

Enter Sam Ting, the smiling but taciturn MIT physicist who has just become a person of interest to the particle paparazzi.

Dr. Ting, who already has a Nobel prize to his name, happens to run the Alpha Magnetic Spectrometer (AMS), a $1.5-billion piece of hardware currently whizzing around Earth on board the International Space Station.

Now Dr. Ting has let drop that his experiment has revealed something significant about dark matter, the invisible stuff that accounts for most of the mass in the universe. Exactly what he has found, he won't say, but today in a hushed room packed with journalists at the annual meeting of the American Association for the Advancement of Science, Dr. Ting promised to reveal all with the first publication of AMS results in the coming two or three weeks.

"There are many things you can learn... surprising things," from the space station data, Dr. Ting said, effectively resorting to zen-like responses after making it clear he was not yet ready to discuss his findings.

Keeping a lid on results until acceptance by a peer reviewed journal is par for the course in many areas of of science. But popular interest in the dark matter mystery will ensure Dr. Ting's experiment gets more than the usual amount of attention when the news is finally unveiled. The news may answer critics who say the experiment took too long and cost too much. What it will say about the nature of universe is far less certain.

"Finding out what dark matter is is at the top of the wish list for particle physicists and cosmologists," says Michael Turner a professor of theoretical cosmology at the University of Chicago.

Prof. Turner makes a compelling case. Dark matter is what holds our galaxy together and without it the universe would not likely be able to support life. Yet scientists can only guess at what it is, knowing that their theories of matter are incomplete without some better way of accounting for it.

Although dark matter is invisible to astronomers' telescopes its presence can be inferred because it exerts a gravitational pull. Current estimates suggest that the total mass of dark matter in the universe is five to six times greater than that of the ordinary matter that makes up all stars and galaxies. Previous studies have largely ruled out that dark matter is made of anything scientists have encountered so far in particle physics experiments like the Large Hadron Collider near Geneva, Switzerland.

"The tantalizing thing is that we have an airtight case that it's made of something new," Prof. Turner says.

Dr. Ting's experiment cannot detect dark matter directly. Instead, it uses a powerful magnet to measure and distinguish between whatever matter and antimatter come sailing through from deep space in the form of cosmic rays.

Since AMS was installed on the space station in 2011 it has registered some 25 billion cosmic ray particles, Dr. Ting says. Of those, some 7.7 million are electrons or positrons (the electron's antimatter counterpart). It is the ratio between the two that may ultimately reveal something about dark matter.

Other experiments have hinted that dark matter particles can occasionally interact to produce ordinary matter particles that conventional detectors can spot. AMS should be able to provide a stronger test of this idea, and possibly reveal whether a vast but unseen halo to dark matter thought to be centred on our Milky Way galaxy is actually giving off a faint signal. Alternatively, AMS may find that other sources of electrons and positrons can account for what it observes without having to resort to a dark matter explanation.

That case wouldn't rule out the existence of dark matter, but would suggest instead that it may be harder to find than many physicists hope. Either way, scientists are waiting to see what Dr. Ting and his colleagues have come up with.

As a measure of positrons, "AMS is going to just nail this completely," says Neal Weiner, a theoretical physicists at New York University, "They're going to see whatever's there."

But whether nailing it means that dark matter is finally about to step out of the shadows Dr. Weiner and others remain circumspect. There will likely be many ways to explain the AMS result, they say. The question is whether it will give more or less weight to existing ideas about dark matter.

Meanwhile, Dr. Ting keeps smiling. For the next couple of weeks, he knows a little something about the universe that the rest of us have yet to find out.

http://www.theglobeandmail.com/technology/science/mit-physicists-experiment-pulls-dark-matter-into-the-spotlight/article8783097/