

Physicists see new hints of a fifth force of nature hidden in helium

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By [Stuart Clark](#)



The NA64 experiment at CERN has looked for signs of a fifth force

Brice, Maximilien © 2016-2019 CERN

A new clue to the existence of a fifth fundamental force of nature may have emerged from a Hungarian laboratory.

Attila Krasznahorkay at the Atomki Institute of Nuclear Research, Hungary, and his colleagues have spent years studying the radioactive decay of beryllium-8, an unstable isotope. In 2016, they published details of an odd finding, suggesting it was being caused by a [previously unknown particle](#).

Now the same researchers have found another anomaly, this time in an energy transition involving an excited state of the helium nucleus, and say that it points to the same particle.



They calculate that the new particle has a mass of around 17 megaelectronvolts, or about 33 times that of an electron, and have called it X17 as a result.

The particle appears to carry energy away from an atomic nucleus, and then decay into an electron-positron pair, which the team's experiment can detect.

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Normal physics predicts that the electron and positron should be emitted in roughly the same direction. But in the beryllium-8 experiment, the two particles diverged at an angle of 175 degrees, while the new helium result gives a similar detection bump at an angle of 115

155 degrees, while the new helium result gives a similar detection bump at an angle of 115 degrees.

This difference is crucial because the helium transitions take place at a higher energy to the beryllium one. The higher the energy, the smaller the expected angle.

“If the bump is produced by a new particle, it has to move in exactly this way,” says Jonathan Feng, a theoretical particle physicist at the University of California, Irvine, who investigated the original claim in 2016.

He proposed that the X17 particle must only be capable of interacting with neutrons, otherwise it would have been detected already in previous lab experiments. But for this to be true, the particle can’t be using any known force of nature. Instead it must be interacting through a force unrelated to gravity, electromagnetism or the two [nuclear forces](#) we know about.

Feng says that this latest result corroborates the first and has got people excited. “I sent a one-line email to my collaborators with the link and one word: ‘Wow’,” he says.

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For his part, Krasznahorkay is now looking to other, independent groups to confirm whether the particle really exists. “If the existence is settled, that would open up a new avenue in particle physics,” he says. X17 could be the link between ordinary matter and [dark matter](#).

But that independent corroboration is yet to come. The NA64 experiment at CERN looked for evidence of the X17 in 2017 and 2018. Although it has [seen nothing so far](#), Sergei Gninenko, the experiment’s spokesperson, told *New Scientist* that the search hasn’t been exhaustive and that they will look again in light of this new result.

The Positron Annihilation into Dark Matter Experiment (PADME) in Frascati, Italy, is also on the hunt for the X17. Researchers there collected data this year and will run their experiment again next year with improved performance. PADME spokesperson Mauro Raggi says to expect the analysis around spring 2021.

“The beryllium-8 anomaly is a result published by a very qualified journal and the helium will soon have the same destiny,” says Raggi. “We need to seriously consider these two results. The question is whether it is connected to a new particle or not and this is what PADME may help to clarify.”

Reference: arxiv.org/abs/1910.10459

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