

BUSINESS INSIDER

A possible hidden force could hold the key to unlocking the mysterious dark universe



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21H

The universe is governed by four fundamental forces.

There's gravity and electromagnetism, and then the lesser known weak and nuclear forces.

But a group of theoretical physicists at the University of California, Irvine (UCI) thinks there might just be a fifth fundamental force lurking in the shadows.

And this force could revolutionize our understanding of physics, unlocking the mysterious dark universe and potentially even leading to a holy grail of physics: [a Grand Unified Theory that merges all of the fundamental forces into one](#). The researchers explain their findings in a [paper published August 11](#) in the journal *Physical Review Letters*.

“The four known forces have very obvious jobs holding our universe together,” Jonathan Feng, one of the study's authors, told Business Insider. “That's how we discovered them. Gravity holds the planets in orbit around the sun. You see electricity and magnetism in lightning and magnets. The role of this force is going to be much more subtle. If it weren't, we would have found it a long time ago.”

On the hunt for dark matter

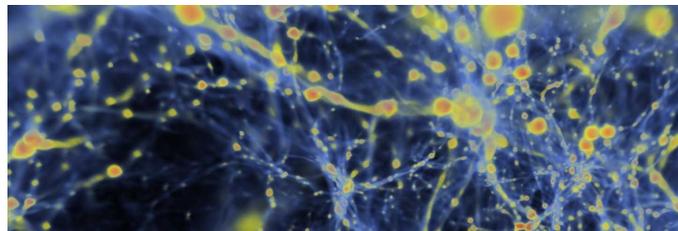
It all started in 2015 when a group of nuclear physicists at the Hungarian Academy of Sciences finished an experiment that involved hunting for a particle called a dark photon. This dark photon would signal the existence of the long-sought-after dark matter, which scientists believe could make up about 85% of the mass of the universe.

In the experiment, the scientists studied the radioactive decay of an isotope called beryllium 8. As isotopes decay, they disintegrate into other particles. But something funny happened when the beryllium 8

decayed into electrons and positrons (the electron's antimatter nemesis). They behaved in strange ways, disregarding our current understanding of elementary particle physics and shooting out in almost opposite directions. This weird behavior hinted at the existence of a new, undiscovered particle.



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A misbehaving particle

One interesting thing about this particle is that it would only be about 30 times heavier than an electron, which is extraordinarily light by today's physics standards. The fact that the particle is so light could mean it will be easier to confirm.

“Many people think if you're going to try to find a new particle you need to build giant enormous collider like the Large Hadron Collider because you have to get lots of energy and smash particles together very fast,” Feng said. “But this particle is so light that, in principle, it could have been discovered a long time ago.”

The particle would also be a sort of a backwards version of photons (particles of light). Unlike photons, which couple to protons because of their charge, this particle would interact more strongly with the neutral neutron. But the particle interactions would be extremely feeble, which is why it eluded detection until now.

A hidden force

Looking at the data, along with data from other experiments, the physicists at UCI came to an exciting conclusion. The particle, they said, could be a force-carrying particle. Just like photons carry electromagnetic force and hypothetical gravitons mediate gravity, this particle would carry a hidden, fifth force that the universe has kept secret until now.

The force, Feng speculated, might help scientists achieve something they've been dreaming about for decades — the unification of all of the forces. This dream, called the Grand Unified Theory, would give us a [simpler, more elegant understanding of the universe, showing that all the interactions we see are different manifestations of one unified force.](#)

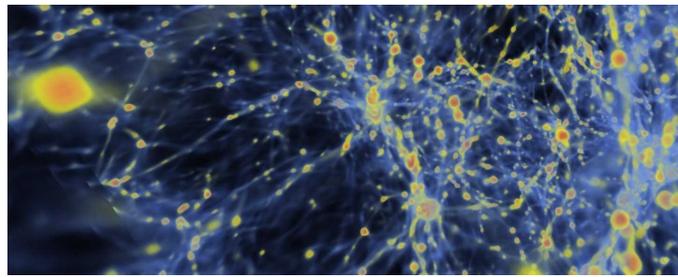
“It might be the tip of iceberg,” Feng said. “When we start digging down and understanding it more we might actually find that it's the key to unlocking the question of unification.”

The force might also be an entryway into understanding dark matter, mysterious particles making up the bulk of the mass of the universe that have yet to be observed.

“This force might be acting in a dark universe that somehow leaked over into our universe,” Feng said.

The next step, of course, is to figure out whether this force actually exists. In the paper, the physicists identified a number of experiments that could be used to follow up and either confirm or refute the existence of this force-carrying particle. Feng anticipates that, depending on how fast other experiments move, we could find out whether or not this mysterious force exists anytime within the next six months to three years.

“It's clear that if this discovery is real it's just mind blowing and revolutionary,” Feng said. “It's the kind of thing that, if it's true, is going to change the way that everyone in the field looks at elementary particles in the universe.”



Simulation of dark matter in the universe.

Argonne National Laboratory



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