Has a New, Fifth Force of Nature Been Found?

By Mike Wall, Space.com Senior Writer | August 15, 2016 05:32pm ET

Galaxies such as this spiral, known as NGC 6814, are held together by mysterious dark matter.

Credit: ESA/Hubble & NASA; Acknowledgement: Judy Schmidt

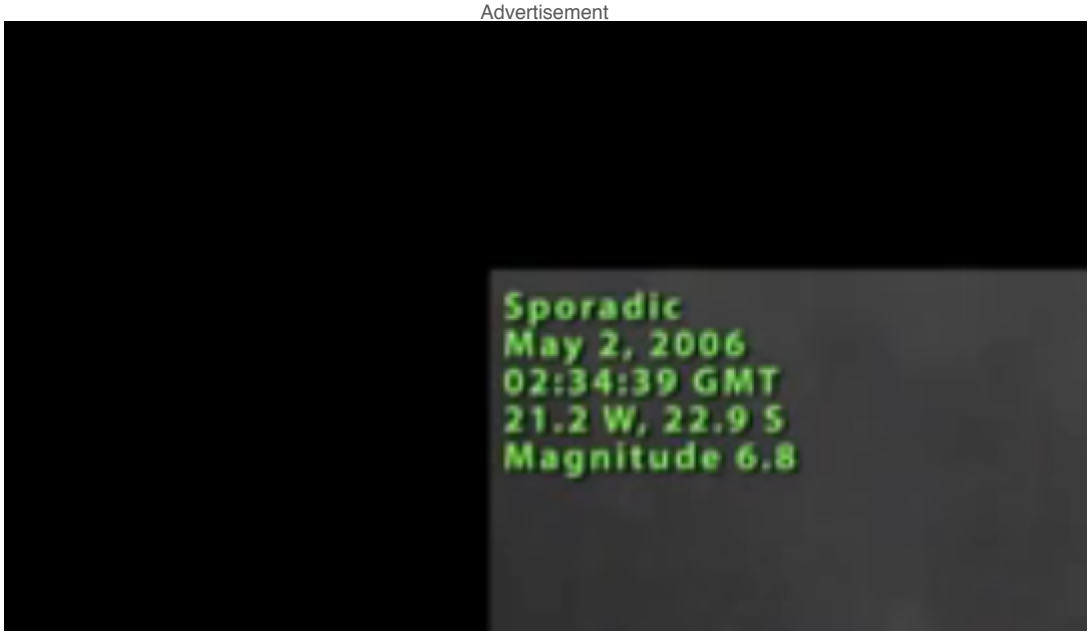
There may be a fifth force of nature, a new study suggests.

"If true, it's revolutionary," study lead author Jonathan Feng, a professor of physics and astronomy at the University of California, Irvine, said in a statement.

"For decades, we've known of four fundamental forces: gravitation, electromagnetism, and the strong and weak nuclear forces," Feng added. "If

confirmed by further experiments, this discovery of a possible fifth force would completely change

our understanding of the universe , with consequences for the unification of forces and dark matter." [8 Baffling Astronomy Mysteries]



Dark matter and dark energy are elusive, invisible phenomena scientists have long been hunting. Will dark matter and dark energy ever be actually seen?

- Yes, it's only a matter of time and technology to see these elusive targets.
- Maybe, but scientists may debate the discovery for years before it is accepted.
- No, there are some things in this universe humans are not meant to understand.

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Feng and his colleagues analyzed data gathered recently by experimental nuclear physicists at the Hungarian Academy of Sciences, who were trying to find "dark photons" — hypothetical indicators of mysterious dark matter. Dark matter is thought to make up about 85 percent of all matter in the universe, but it neither absorbs nor emits light, so it's impossible to detect directly. (Scientists have inferred its existence from its gravitational effects on "normal" matter.)

The Hungarians detected tantalizing evidence of a previously unknown particle just 30 times heavier than an electron — a result they published early this year.

"The experimentalists weren't able to claim that it was a new force," Feng said. "They simply saw an excess of events that indicated a new particle, but it was not clear to them whether it was a matter particle or a force-carrying particle."

The new work by Feng and his team suggests that the Hungarians found not a "dark photon" but rather a "protophobic X boson" — a strange particle whose existence could indicate a fifth force of nature. The known electromagnetic force acts on protons and electrons, but this newfound particle apparently interacts only with protons and neutrons, and then only at very short distances, researchers said.

"There's no other boson that we've observed that has this same characteristic," co-author Timothy Tait, also a professor of physics and astronomy at UC-Irvine, said in the same statement. "Sometimes we also just call it the 'X boson,' where 'X' means unknown."

The potential fifth force may be linked to the electromagnetic and strong and weak nuclear forces, as "manifestations of one grander,

more fundamental force," Feng said.

It's also possible that the universe of "normal" matter and forces has a parallel "dark" sector, with its own matter and forces, Feng added.

"It's possible that these two sectors talk to each other and interact with one another through somewhat veiled but fundamental interactions,"

Feng said. "This dark-sector force may manifest itself as this protophobic force we're seeing as a result of the Hungarian experiment. In a broader sense, it fits in with our original research to understand the nature of dark matter."

While such speculation is intriguing, the researchers stressed that their interpretations are preliminary, and that further study and experiments are needed. Indeed, particles supposedly observed in accelerators sometimes turn out to be statistical flukes.

The good news is that many scientists should be able to do the required follow-up work, Feng said.

"Because the new particle is so light, there are many experimental groups working in small labs around the world that can follow up the initial claims, now that they know where to look," he said.

The new paper has been published in the journal Physical Review Letters. You can read a copy for free at the online preprint site ArXiv.org: http://arxiv.org/abs/1608.03591

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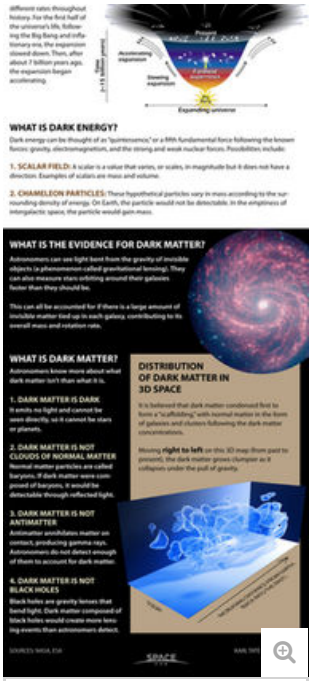

Astronomers know more about what dark matter is not than what it actually is. See what scientists know about dark matter in this Space.com infographic.

Credit: Karl Tate, Space.com Infographics Artist

EDITOR'S RECOMMENDATIONS

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- Wacky Physics: The Coolest Little Particles in Nature
- Twisted Physics: 7 Mind-Blowing Findings