Physicists Discover New Kind of Matter: Excitonium

By Simon Veazey, Epoch Times

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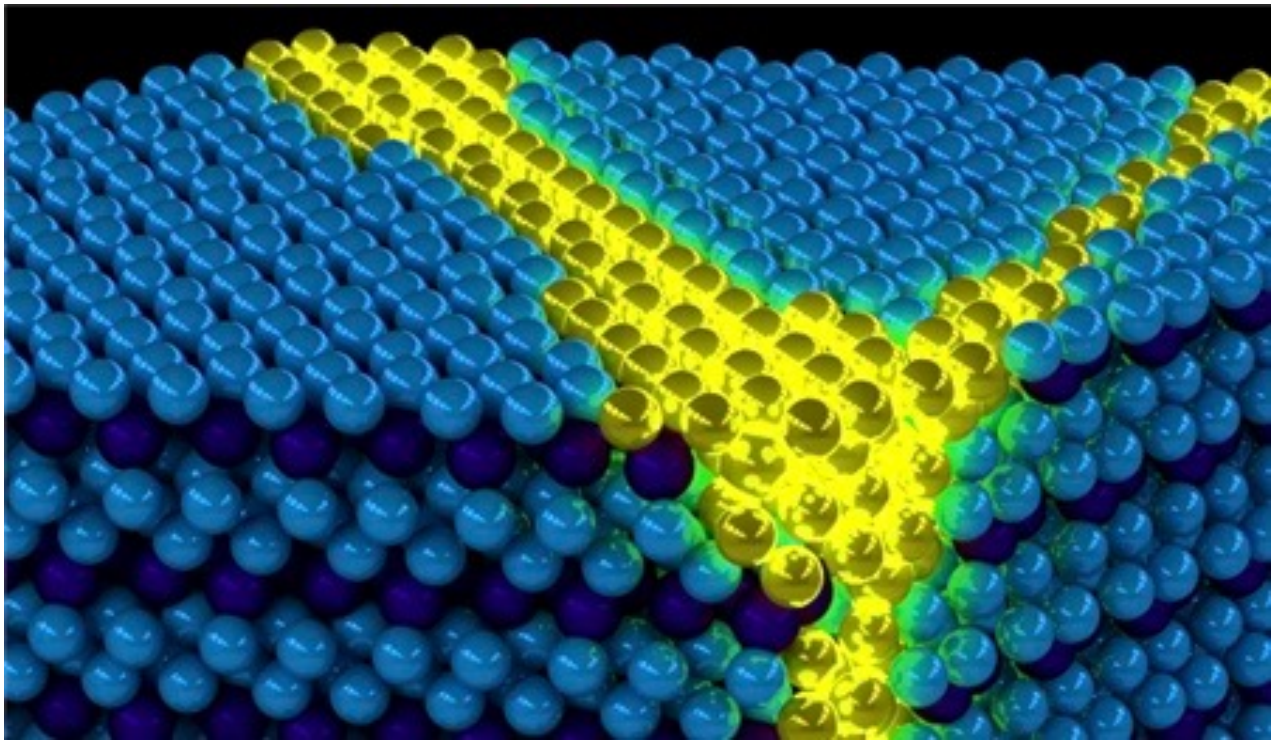


Artist's depiction of the collective excitons of an excitonic solid. These excitations can be thought of as propagating domain walls (yellow) in an otherwise ordered solid exciton background (blue). (Peter Abbamonte, University of Illinois Department of Physics)

Excitonium sounds like a made-up substance from a children's graphic novel.

But it is an actual scientific word, coined 50 years ago to describe new a type of matter, which scientists believed should exist, but weren't able to prove—until now.

Physicists at the University of Illinois said that they have now proven that excitonium really exists, describing the discovery as being of "cosmic significance."

In a paper published on Dec. 8, researchers reveal how they were

finally able to prove the existence of this new type of matter and begin to answer some long-standing questions by studying metal crystals with a special new technique.

But understanding what excitonium is like isn't as straightforward as coming to grips with the structures of molecules or atoms, which can be visualized with the ball and stick models in high school chemistry labs, or the diagrams of rings of electrons around atoms.

Excitonium is subject to the rules of the weird and wonderful world of quantum physics, where things like enigmatic "probability waves," can exist simultaneously as waves and particles, defying regular human logic and Newtonian physics.

A pendulum famously used to demonstrate certain laws of classical physics. (Pixabay)

According to the researchers, excitonium is made of the energetic "holes" made by electrons escaping from their positions.

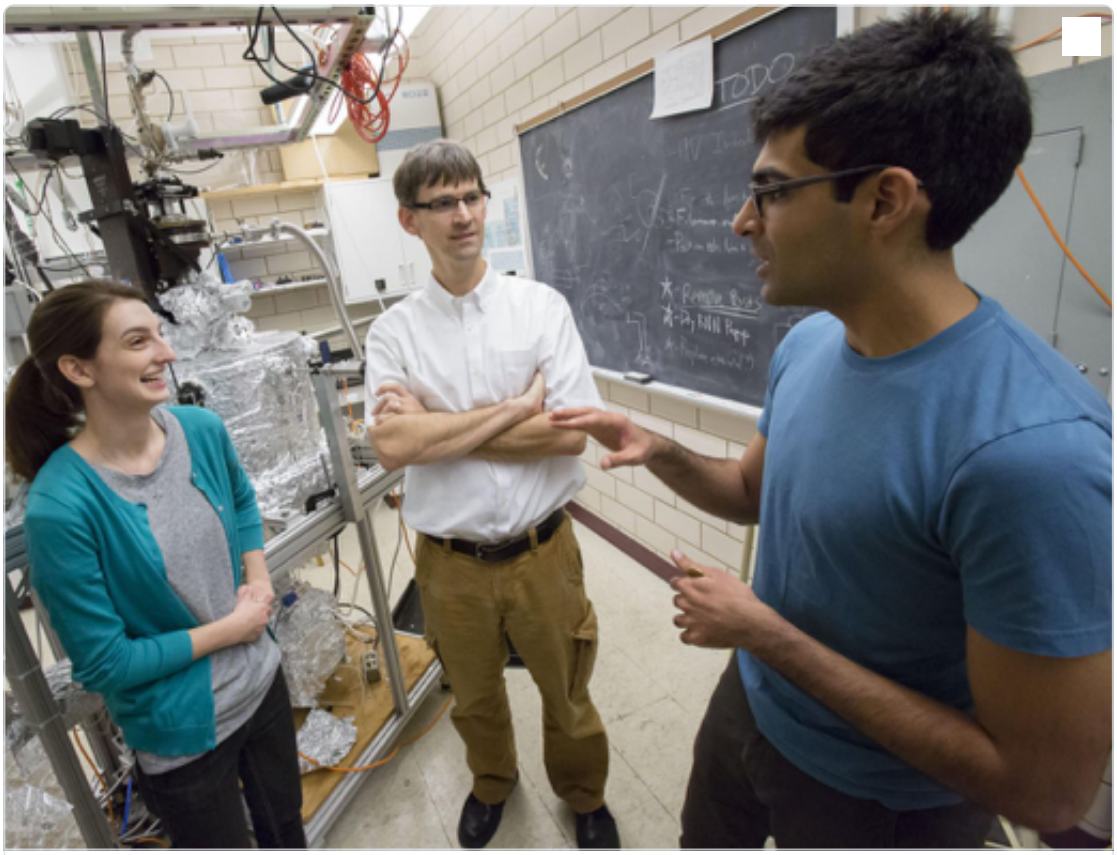
The oddities of the quantum realm are not usually directly seen in

this world, confined to the atomic level, and are only able to act out in the realms of tiny particles such as electrons.

However, in certain situations these oddities can break through to the physical levels, breaking the laws of physics taught in high school.

Superconductors and superfluids are examples of these phenomena where the regular laws of Newtonian physics seem to look the other way and we can see the quantum world bubble up to our own.

Excitonium is what is known as a “condensate,” which like the superfluids or superconductors is subject to quantum effects.



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“It’s made up of excitons, particles that are formed in a very strange quantum mechanical pairing, namely that of an escaped electron and the hole it left behind,” wrote Siv Schwink, a spokesman for the Department of Physics at Illinois University.

The researchers had developed a technique for studying metal crystals, which enabled them to measure paired electrons and their “holes” in a new way. They were able to detect something known as “a soft plasmon phase” five times—which they said is the “smoking gun” that proves the existence of the excitonium, and has never been observed before.

“This result is of cosmic significance,” said physics professor Peter

Abbamonte, in charge of the project, in a university press publication. “Ever since the term ‘excitonium’ was coined in the 1960s by Harvard theoretical physicist Bert Halperin, physicists have sought to demonstrate its existence.”

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