PHYSICS

Tests Show Moon Not Quite as Strange As Some Physicists Had Hoped

The moon isn't made of green cheese and almost certainly doesn't harbor hypothetical particles called "strangelets," an analysis of lunar soil has shown. The result undermines a possible strangelet sighting a decade ago and strengthens the case that the bizarre particles, which protesters once feared might emerge from an atom smasher and consume Earth, don't exist.

"I'm not surprised," says Frank Wilczek, a theorist at the Massachusetts Institute of Technology (MIT) in Cambridge. "It would be a great discovery to find strangelets, but the theoretical case for them is pretty shaky." Still, he says, "it's not crazy" to look for them.

A strangelet would be a weird, extra-heavy atomic nucleus. An ordinary nucleus consists of protons and neutrons, each of which contains three particles called quarks. A proton contains two "up" type quarks and one "down" type quark; a neutron contains one up and two downs. A strangelet would be a single clump of roughly equal numbers of up quarks, down quarks, and "strange" quarks—heavier cousins of down quarks that appear fleetingly in particle collisions.

The existence of such "strange quark matter" would force a rethink of neutron stars, burned-out stellar cores made of pure neutrons. A neutron star would be able to reduce its energy by changing into strange quark matter, and all neutron stars would quickly become "strange stars."

If a strange star collided with an ordinary companion, strangelets would emerge as cosmic rays that would zip through space until they hit something, such as Earth. Earth's churning, however, would mix strangelets into the mantle, diluting them beyond measure. So Jack Sandweiss of Yale University looked for strangelets on the unstirred moon.

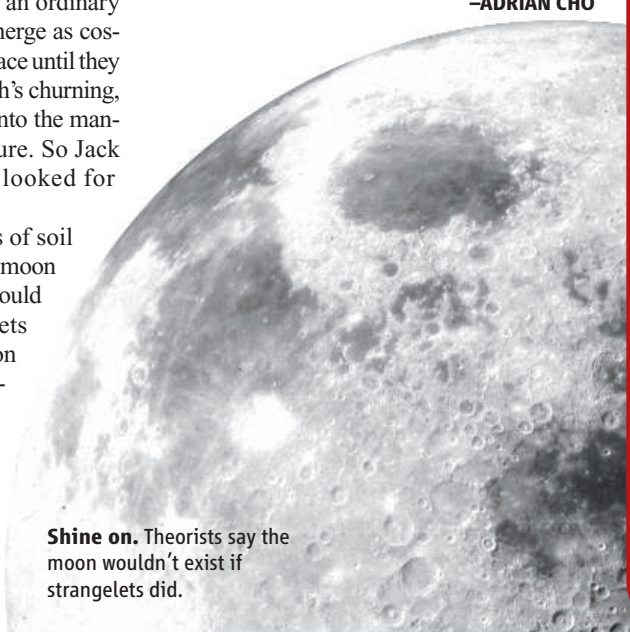
Sandweiss obtained 15 grams of soil NASA collected during the first moon landing in 1969. That smidgen should have picked up traces of strangelets in the 500 million years it was on the surface, according to theoretical estimates. Sandweiss and his team fed the stuff into a mass spectrometer to measure the nuclei in it. They found no strangelets with masses from 42 to 70 atomic mass units (from the mass of calcium to that of gallium) and charges from 5 to 11 (from boron to sodium), they reported 27 August in *Physical Review Letters*.

That null result casts doubt on an observation made by the Alpha Magnetic Spectrometer (AMS), a $1.5 billion, 7-ton instrument designed to monitor cosmic rays in space. In a 1998 test flight aboard a NASA space shuttle, AMS spied one particle that looked like a strangelet with the charge of an oxygen nucleus and the mass of a manganese nucleus. "It's 95% certain that it's not a real event," Sandweiss says. AMS is scheduled to fly to the International Space Station in September 2010.

Strangelets caused a stir in 1999 when a private citizen named Walter Wagner unsuccessfully sued to stop physicists at Brookhaven National Laboratory in Upton, New York, from starting their Relativistic Heavy Ion Collider (RHIC). Wagner argued that RHIC might create strangelets that would gobble up ordinary nuclei and convert Earth into strange quark matter.

But to do that, strangelets would have to be negatively charged to attract positively charged nuclei, and that's exceedingly unlikely, physicists argued. Moreover, if particle collisions could make killer strangelets, then cosmic rays should have already turned the moon into a jumbo strangelet. "The existence of the moon was one of our strongest pieces of evidence that negatively charged strangelets don't exist," recalls Robert Jaffe, a theorist at MIT. Now, the moon has nixed harmless strangelets, too.

–ADRIAN CHO



Shine on. Theorists say the moon wouldn't exist if strangelets did.

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Watch the Clock to Lose Weight
When we eat may be just as important as what we eat. A new study shows that mice that eat when they should be sleeping gain more weight than mice that eat at normal hours. Another study sheds light on why we pack on the pounds in the first place. Whether these studies translate into therapies that help humans beat obesity remains to be seen, but they give scientists clues about the myriad factors that they must take into account. http://bit.ly/IdNz6

Pigeon Wings Sound the Alarm
When birds make noise, it's not always with their throats. In hummingbirds and manikins, for example, special feathers flutter and vibrate to produce tones and whistles, which impress potential mates and scare off competitors. Now researchers have found that pigeons use wing noise to warn the flock about approaching enemies—the first example of a nonvocalized alarm call in birds. http://bit.ly/yrlm

Evolution's Little Helper: Copied Genes
A long-standing question in biology is how evolution tinkers with genes without mucking things up. The prevailing theory is that the genome has copies of critical genes, so that if mutations spoil one, there's a backup. Now researchers have new proof that evolution can work this way. http://bit.ly/4raLP

Mosquito May Complicate Malaria Control
A newly discovered species of mosquito may complicate malaria-control efforts in parts of Africa. Researchers have identified an insect that looks nearly identical to a species that carries the disease yet may or may not transmit malaria. If ongoing studies find that the mosquito does not carry the malaria parasite, vector-control teams could waste valuable resources, including insecticides and bed nets, fighting a harmless insect. http://bit.ly/3CIPNT

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Published by AAAS