

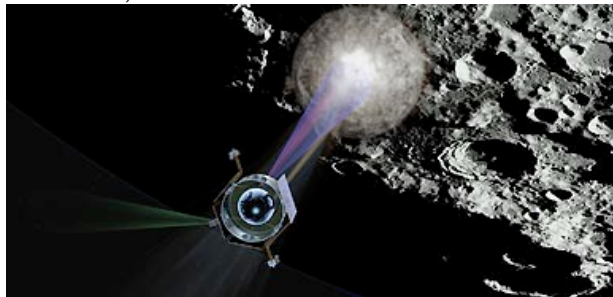
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## Two incredible scientific discoveries

Posted by [Michael Laprarie](#)

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Published: November 14, 2009 - 9:43 AM



Yesterday NASA announced that last month's LCROSS probe collision with the Moon [generated a debris cloud filled with tiny particles of ice](#). You may remember the LCROSS experiment as NASA's attempt to "bomb the Moon" (*no, blogger [Frank J.](#) was not involved*) that was visually disappointing, yet apparently rich in scientific data, once the results were compiled and analyzed.

After studying the debris blasted loose by the collision, NASA announced that about 80 liters of water was present in the dust cloud. The impact occurred inside a crater where the surface has been shielded from sunlight for approximately 2 billion years. The origin of the water is unknown, but NASA scientists are speculating that it might have been deposited during numerous collisions with comets during the Moon's lifetime.

NASA originally announced that the impact would create a massive 6 km high dust plume that would be visible from large earth-based telescopes. When such a cloud failed to materialize, scoffers dismissed the collision as a failure. NASA scientists now believe that the significant amount of ice present in the crater probably dampened the degree to which debris was dislodged by the collision.

The discovery of water on the moon establishes a number of important possibilities once thought to be exceedingly remote, particularly the fact that water could be much more widespread throughout the solar system (or the galaxy for that matter) than previously understood.

And a few weeks ago (I bookmarked this but never got around to writing about it) a group of English scientists [announced the discovery](#) of molecular structures known as "spin ice" that function as *magnetic monopoles*, that is, crystals with only "north" or "south" magnetic orientation. Incredibly, these scientists apparently succeeded not only in observing the phenomenon, but also in inducing magnetic monopole fields and currents in the spin ice material.

In 1931, physicist Paul Dirac, considered today to be the father of modern quantum theory, speculated that if light and electric charge both exist on the subatomic level as discrete "particles" or tiny localized packets of energy (as photons and electrons, respectively) then magnetic fields must also exist in a discrete quantum state. Magnetic monopoles have been [briefly detected as transient quantum states](#) in certain kinds of highly magnetized solids, but none had ever been observed in nature. This was to be expected, since the idea of a naturally occurring magnetic monopole contradicted the fundamental, well-known laws of electricity and magnetism.

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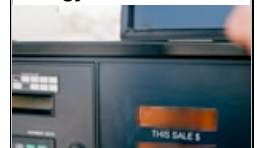
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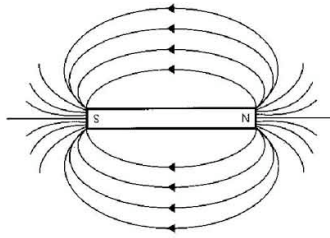


Ever since the mid-nineteenth century, physicists had understood that electricity and magnetism were inextricably linked together, and were believed to simply be different manifestations of the same phenomenon. In 1864 British physicist James Clerk Maxwell demonstrated this mathematically. [Maxwell's four equations](#) describing the link between electricity and magnetism were one of the great triumphs of nineteenth century science, and represented the first successful attempt to mathematically unify two different natural phenomena.

One of Maxwell's equations, known alternatively as [Gauss's Law for Magnetism](#) is simply:

$$\nabla \cdot \mathbf{B} = 0$$

which in plain English says that the divergence of the magnetic field is zero; in other words, magnetic fields do not radiate outward in straight lines -- they must always curve back toward each other. This directly implies that [there can be no magnetic monopoles](#), because the flux of magnetic fields must curve back upon itself, which in turn means that magnets must have north and south poles.



A discovery that challenges the accuracy of Maxwell's equations is similar in its implications to the discovery of theories that challenged Newton's laws of gravitation. Of course that is exactly what happened when quantum theory was discovered a century ago, and when Einstein opened up the world of space-time physics with the development of special and general relativity. In those cases, Newton's original laws of gravitation were found to be accurate, but were actually special cases of general gravitation when conditions were simplified. The same thing will probably happen in the case of magnetic monopoles -- a new quantum-level theory will be developed (or perhaps an existing one verified) and Maxwell's equations will be a special case, under simplified conditions.

To a physics graduate and life-long geek, this is pretty exciting stuff!

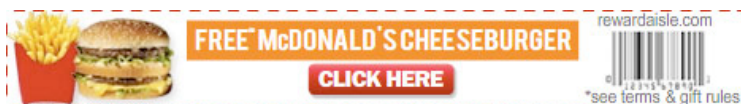
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Tags: LCROSS, magnetic monopole, moon, NASA, water



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1. Posted by [Patrick Scullin](#) | November 14, 2009 10:16 AM | Score: 0 (0 votes cast)

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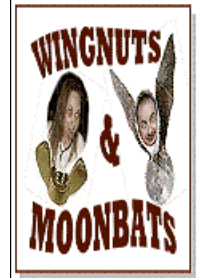
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<http://notionscapital.wordpress.com/2009/10/21/water-on-the-moon/>

2. Posted by [Mike Licht](#) | November 14, 2009 10:37 AM | Score: 0 (0 votes cast)

When is Obama going to apologize for violating space law, and to whom is he going to apologize?

Thanks for posting. That bit about magnetic monopoles is interesting. I had no idea. Though I am still not buying the 'billions of years' narrative.

3. Posted by [Jeff Blogworthy](#) | November 14, 2009 10:38 AM | Score: -1 (3 votes cast)

What next,  $2 + 2 = 4$  is also a special case? I read the article on magnetic monopoles, which then goes on to speculate how they would be used in quantum computing. I'm speculating we already have quantum computing, and in fact, it's being used to write this comment.

We know from research that geckos utilize the molecular level Van der Waals forces to climb nearly any surface. Is it so far fetched then to speculate the biological systems utilize quantum properties to enhance their computing ability? Such biological quantum computing would explain how nature is able to endow even tiny creatures with complex behaviors. When we get to the level of humans I use the term quantum thinking. It's not a perfect system, but then no one knows if science can ever do even as good. Look how long it's taking science to equal something like spider silk.

It could be that quantum computing will prove to be poor at doing exact and repetitive tasks that current computers are great at, but that it can be used to search for solutions far faster than any conventional computer. It may be that all solutions are available and the real difficulty is materializing a solution from the quantum domain into the non-quantum domain. I expect humans experience this quantum materialization when an original idea pop into their consciousness from seemingly nowhere. Some have learned how to better direct their innate quantum thinking ability and we think of them as being "creative".

Unfortunately, such creativity is rare in those with an aptitude for the hard sciences perhaps because, like quantum computing, quantum thinking is not all that good at doing exact and repetitive tasks. That would explain why science has to wait for an Einstein to come along to make real progress. It also explains why scientists haven't realized that they can use **more than one** nuclear warhead to divert any type of asteroid from hitting the earth. It's not like the damn things are in short supply.

4. Posted by [Mac Lorry](#) | November 14, 2009 11:00 AM | Score: 1 (3 votes cast)

All of this is well and good. I have done some reading on quantum physics over the years. I understand basic atomic structure and certain electro-magnamotive forces. I enjoy reading about this field and the accomplishments and people over the past few decades. Scientific discovery in the field of physics is nice, but to me one of the greatest accomplishments of the past few decades has been the addition of cheese to dog food. I can prove it with the following formula:

$CIDF * TLC + NPTS = OHL$

Where:  
 CIDF = cheese in dog food.  
 TLC = tender loving care.  
 NPTS = nice place to sleep(plenty of cedar shaving in a nice box in the garage.)  
 OHL = one happy Lab.

Science is nice, but my Lab could give a small rat's ass about quantum

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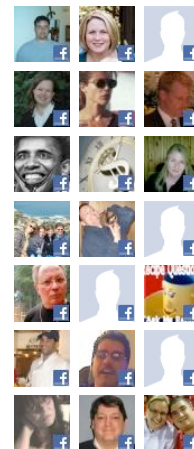
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physics.

5. Posted by Eneils Bailey | November 14, 2009 4:47 PM | Score: 0 (0 votes cast)

Very interesting -- especially the magnetic monopole discovery. I don't think however, that the discovery of magnetic monopoles challenges the accuracy of Maxwell's equations in any way. The existence of magnetic monopoles simply means that there can be a "magnetic charge" term on the right hand side of Gauss's law for magnetism that we didn't know was possible before. Where there are magnetic monopoles, Gauss's law for magnetism looks like Gauss's law for electricity.

You are indeed correct that this is pretty exciting!

6. Posted by SteveW | November 14, 2009 5:00 PM | Score: 0 (0 votes cast)

Interesting. Wow.

7. Posted by Michael | November 15, 2009 7:42 AM | Score: 0 (0 votes cast)

So since this discovery happened during Obama's administration, how are you going to blame him for fault for this discovery?

8. Posted by Jake McKee | November 15, 2009 2:56 PM | Score: -1 (1 votes cast)

*So since this discovery happened during Obama's administration, how are you going to blame him for fault for this discovery?*

You mean for raping and plundering the moon? Ravaging the pristine lunar environment with no thought of the intergalactic consequences? You tell me.

9. Posted by Jeff Blogworthy | November 15, 2009 10:30 PM | Score: 0 (0 votes cast)

-99'

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