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The Truth about Angels, Demons and Antimatter

By **Jeremy Hsu, Staff Writer**
 posted: 13 May 2009 06:01 pm ET

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An antimatter explosion threatens to level the Vatican in the movie adaptation of the thriller "Angels and Demons," but real-world physicists are unfazed by this plot.

The story features "Da Vinci Code" hero Robert Langdon racing to recover an antimatter capsule stolen from the [CERN particle physics](#) facility in Switzerland. Researchers first figured out how to create and trap antimatter particles at CERN, which gave author Dan Brown the inspiration for his story.

One physicist doesn't find CERN's unexpected publicity from the story upsetting. On the contrary, he's rather pleased.

"I always say that what Dan Brown did for the Roman Catholic Church in 'The Da Vinci Code,' he did for me and my research with 'Angels and Demons,'" said Gerald Gabrielse, a Harvard physicist who currently leads an international research team at CERN.

Antimatter is real, but it still represents a baffling presence in the universe – sub-atomic particles that are the [opposite of normal matter](#). When a particle and antiparticle meet, they mutually annihilate each other and release their entire mass as energy.

This bizarre but intriguing reality has prompted plenty of science fiction writers to dream of antimatter engines powering future civilizations or starships, such as Star Trek's [U.S.S. Enterprise](#).

"Angels and Demons" twists that dream of untapped energy into more of a nightmarish scenario, by suggesting what might happen if a relatively large amount of antimatter annihilated itself with matter all at once. A quarter of a gram of antimatter threatens to unleash the power of 5,000 tons of TNT and destroy everything within a half-mile radius – or so goes the fictional story.

The reality is that physicists can only wish they had so much of the stuff.

"If you take all the antimatter produced in the history of the world and annihilated it all at once, you wouldn't have enough energy to boil a cup of tea," Gabrielse told *LiveScience*.

Antimatter represents a [rare entity](#) in a universe dominated by matter, and scientists still struggle to understand why. What they do know is that creating antimatter requires tremendous effort, such as using particle accelerators at CERN to smash together particles at nearly the speed of light.

An occasional antimatter particle may arise naturally when a cosmic ray strikes Earth's upper atmosphere. But collecting man-made antimatter particles is much more practical for research.

Physicists have only slowed and trapped a small fraction of all the produced particles, in this case known as antiprotons. They use antimatter traps somewhat similar in concept to what "Angels and Demons" describes, with magnetic fields keeping the antimatter particles in a vacuum away from any matter.

"You need a container with no walls, that's the idea," Gabrielse noted. His former project, known as TRAP, successfully created and held charged antiprotons for months.



Physicist Vittoria Vetra (Ayelet Zurer) and symbologist Robert Langdon (Tom Hanks) look upon an antimatter trap in the 2009 movie "Angels and Demons." Credit: Sony Pictures

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Now physicists face the more daunting challenge of capturing neutral antihydrogen atoms. The newer international effort, called ATRAP, has put together an antihydrogen trap and is working on a second.

"We are trying right now to trap neutral antihydrogen atoms which we have produced, but no one has succeeded in proving that they've been trapped yet," Gabrielse said.

Such neutral antihydrogen atoms could theoretically be clumped together, whereas charged antiprotons are repelled by each other. Whether an antimatter clump would annihilate with all the power of a small nuke without blowing itself apart remains an open question – and that still assumes physicists can create and collect anything close to a quarter of a gram of antimatter.

One part of "Angels and Demons" may have come true, although unrelated to antimatter. The fictional plot includes retinal scanners guarding a CERN lab, and the real-life CERN happened to adopt such eyeball security after the book came out, Gabrielse explained.

So the plot of "Angels and Demons" doesn't quite annihilate upon contact with reality, but the real-life [mystery of antimatter](#) may still trump fiction.

"Why the universe is made out of more matter than antimatter? We don't know the answer to that question at all," Gabrielse said.

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church wrote:

posted 13 May 2009, 9:00 pm ET

this movie is probably made by a stubborn creationist that can stand the idea that a science experiment could potentially shatter the beliefs of all religions around the world

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Penman wrote:

posted 13 May 2009, 11:15 pm ET

I'm always amazed when I read these things about a piece of fiction work. I love it myself, when I have someone ask, "Did that really happen?"

It's like, "Gotcha!"

What part of the word, FICTION is hard to understand?

And Dan Brown is great at making the implausible, believable. The greatest kudos a fiction writer can get.

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mikkeeyyyy wrote:

posted 14 May 2009, 3:41 am ET

havent seen the movie yet but this is interesting

and yes dan brown is a great writer

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James12345 wrote:

posted 14 May 2009, 9:11 am ET

From the article: ""I always say that what Dan Brown did for the Roman Catholic Church in 'The Da Vinci Code,' he did for me and my research with 'Angels and Demons,'" said Gerald Gabrielse, a Harvard physicist who currently leads an international research team at CERN. "

What, exactly, does Dr. Gabrielse think 'The Da Vinci Code' did "for" the Catholic Church? It slandered the Church. It implied that it was founded on a lie. It said that the very Founder (Jesus) was nothing but a man who got on with a prostitute and faked his death and resurrection. Perhaps Dr. Gabrielse has not seen 'The Da Vinci Code' because, since the aforementioned things it "did for the Roman Catholic Church" would not be positive to his career.

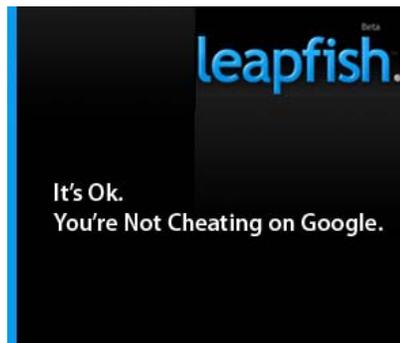
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DanFerr wrote:

posted 14 May 2009, 11:04 am ET



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church, et al,

Why do you guys always have to sock it to creationists in your comments to every article on this site? It seems like I read a comment bashing creationists in the comments of every article. There could be an article about food coloring and you guys will make a comment about how the article sticks it to creationists. Leave those guys alone...just because they believe in something strongly (just as strongly as the global warming fanatics believe in their cause, even though they're wrong too, I might add), doesn't mean they should be battered at every opportunity. I mean, think about it...if there is a God, and he/she/it is all-powerful, he can do anything he wants...including starting the world at any point he wants and leave clues that contradict that if he wants. No one will actually know for sure until they actually meet him. There are things in life that I think we will never understand or be able to explain. If people choose to attribute these things to a higher power, then let them! As scientifically minded as I am, there are somethings that I think just happen for no reason, or maybe actually for a reason, or that could only be explained by the existence of a higher power. How do their beliefs affect you? Ok, so they will never be swayed...so what! Let's try and keep the comments related to the actual topics in the articles.

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hugeskeptic wrote:

posted 14 May 2009, 11:30 am ET

Dan Brown is a marginal writer at best and a pitiful historian. I read "The DaVinci Code" and found errors on nearly every single page. And as a cryptographer he's completely lame. Really a five letter word for a password? Hint it deals with Sir Isaac Newton and is an "orb" not found at his place of burial? Apple maybe? Please. Even without the hints that wouldn't take long to crack at all. I'd figured out ever crypto before I turned the page.

Pitiful.

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The3Fury wrote:

posted 14 May 2009, 11:55 am ET

DanFerr "How do their beliefs affect you?" it does when they make ignorant comments like this one ..."JoelDooris wrote: James12345 - it's because everyone deep down inside knows Science is all based on a lie!"...

I agree with DanFerr, but sometimes is just too much B.S. my apologies for my language, but they need to come out the closet and stop being ignorant.

But we are to comment on the movies not creationists...so, they will be a good action packed movie like 'The Da Vinci Code' ...its ALL FICTIONAL which people need to realize that part..its a bit important ...

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redbert wrote:

posted 14 May 2009, 3:50 pm ET

"Antimatter represents a rare entity in a universe dominated by matter"

isn't the center of the galaxy loaded with antimatter?

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redbert wrote:

posted 14 May 2009, 4:01 pm ET

In April 1997 scientists discovered a fountain of antimatter erupting from the center of the galaxy, raising new questions about the structure of the Milky Way.

gamma-rays corresponds to ten billion tons of anti-matter annihilation per second <http://physics.uoregon.edu/~jimbrau/ast123/Notes/Chapter23.html>

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aarondistorted wrote:

posted 14 May 2009, 9:24 pm ET

Every one knows that religion has a great track record for dismissing things that are proven fact. In Africa the Pope says condoms are bad and a sin, so the Shaman (none medical trained voodoo men) tell the people of Africa to have sex with a virgin to get rid of the A.I.D.S virus. this fact is true. its also true that it doesn't work... at all. Maybe we shouldn't take anymore advise from the church.....ever.

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