Subject: Particle and Theoretical Physics
Posted by Javaxcx on Wed, 25 May 2005 18:06:08 GMT
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I'd like to open the ball park to those of us which are scientificially inclined. Myself and Doitle often discuss particle theories trying to come up with aspects of a unified theory that works liberally with String Theory as a basis.

We have as of late been discussing the nature of photons and how they can possibly exist at all. According to relativity, such things like solar cells shouldn't even work because photons are acclaimed to have a 0 mass.

E=mc^2 concludes that because of this, they have no energy, thus cannot give energy to the cell. But this is not experimentally true. We can quite easily turn on a light with a solar cell. This therefore entails that light, photons, carry some kind of apparant mass. Whatever that is, we don't need to really specify, because the mere fact that it is there is what it is important.

At any rate, the topic is open to discussion in the crowd, so share your thoughts.

Subject: Particle and Theoretical Physics
Posted by Jecht on Wed, 25 May 2005 19:28:36 GMT
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in order for me to believe in something scientifically, i would have to percieve it having mass. So if I had to choose a side, I guess it would be that light carries some form of mass.

However, science inclined I am not, therefore I cannot debate the issue too well.

Subject: Particle and Theoretical Physics
Posted by Hydra on Wed, 25 May 2005 20:16:31 GMT
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I always thought photons had a mass so extremely close to zero that it may as well be zero.

Let me ask you this: does pure energy have a mass?

Subject: Particle and Theoretical Physics
Posted by Dan on Wed, 25 May 2005 20:44:39 GMT
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It doesnt make sense that photons would have zero mass... If that was true, then light wouldnt be bent by black holes and other strong gravitational fields.

Apparently, mass is all down to these small particles called Higgs Bosons (I think?), which are found in atoms that have mass. I remember reading something about them, you could google about it to read more I suppose

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Subject: Particle and Theoretical Physics
Posted by Javaxcx on Wed, 25 May 2005 20:47:00 GMT
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Pure energy would have an infinite mass.

Remember, E=mc^2 always correlates energy and mass. If either is 0, then the whole equation gives garbage.

Subject: Particle and Theoretical Physics
Posted by warranto on Wed, 25 May 2005 21:12:19 GMT
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http://www.physlink.com/Education/AskExperts/ae180.cfm

Remember, photons may not have mass while moving at the speed of light, don't forget that the photon is an electromagnetic WAVE and has a frequency.

E=hf <-- Energy = Plank's constant x the frequency of the photon.

It explains it quite well in that link.

Edit: ignore the conclusion that mass is involved, just concentrate on the idea that I highlighted above.

This link also works.

http://physics.bu.edu/~duffy/PY106/PhotoelectricEffect.html

Subject: Particle and Theoretical Physics
Posted by DaveGMM on Wed, 25 May 2005 22:13:07 GMT
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It's the old "Is it a wave or is it a particle" question, because depending on the test, light is either.

Subject: Particle and Theoretical Physics
Posted by warranto on Wed, 25 May 2005 22:21:39 GMT

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It's both.

If you were able to stop a photon from moving, it does theoretically have a mass (though exponentially smaller than that of an electron). This woould contribute to it's idea of a particle. However, at the speed of light that it travels at, it also has a frequency, and no mass. Thus giving us the idea of a wave.

Subject: Particle and Theoretical Physics
Posted by DaveGMM on Wed, 25 May 2005 22:31:24 GMT
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I didn't think that there was a test that proved it was both.

It may be a simple enough assumption to think that since it is a particle in one test and a wave in another, but there is no practical evidence (that I am aware of) that it is both, just all this equation and theoretical stuff.

Just remember that at one time, people thought Newton was 100% right.

Subject: Particle and Theoretical Physics
Posted by Jzinsky on Thu, 26 May 2005 12:32:12 GMT
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DaveGMMI didn't think that there was a test that proved it was both.

Well you can't stop light, I figure at that speed it either bounces off (reflection) or gets absorbed into whatever it hit (causing colour) thus you cannot stop light, but I guess the theory is ifyou could, it would be a particle with a mass on a micro mathematical scale..

I dropped out of physics at 16..

Subject: Re: Particle and Theoretical Physics
Posted by Kanezor on Thu, 26 May 2005 16:07:56 GMT
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JzinskyDaveGMMI didn't think that there was a test that proved it was both.

Well you can't stop light, I figure at that speed it either bounces off (reflection) or gets absorbed into whatever it hit (causing colour) thus you cannot stop light, but I guess the theory is ifyou could, it would be a particle with a mass on a micro mathematical scale..If you could not stop light, then nothing would be absorbing light, correct? In a way, that's true... because the things that absorb light become hot. A black surface absorbs more light than a white surface, and a black surface will become equally more hot than a white surface.

Also, you're only partially correct when you say that absorbing light causes color; color is caused when one part of the spectrum is absorbed while the other part (the part you see; the color you see) is bounced off.

Subject: Particle and Theoretical Physics
Posted by Javaxcx on Thu, 26 May 2005 19:49:10 GMT

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Remember, light can be characterized as both a particle and a wave. That being said, we can measure energy in two forms.

E=mc^2 works wonders for stuff with mass. But conversely, E=hf works pretty well for stuff with no mass. You can't use them interchangibly because you'll always get a 0 answer for your energy outputs.

For example, if you were to say that because E=mc^2 and E=hf, then mc^2=hf. But mass doesn't have frequency (for the sake of argument) and waves don't have mass. Therefore, since h and c are always constant, your overall answers are going to be 0 net energy.

What it really comes down to, with my understanding of the photon, is that it has an apparent mass when travelling at c. Now, I know what you physics geeks are thinking, "it's impossible to have a mass and travel at c". But you can presuppose an apparent one using momentum theory. Remember, when dealing with relativity, p = E/c. But p also is mass x velocity.

Because of this, we can rearrange the whole system and solve for the apparant mass of a photon. That is;

m = hf/c^2

This should look pretty familiar. It's the combination of E=mc^2 and E=hf.

The trick is: E=mc^2 relies on one thing. That the object with mass, m, is withOUT momentum. Have you ever seen a wavelength of frequency 0? Of course not. Now, since I'm fairly sure that all of you know that the speed of light is consistent regardless of frame of reference, we make the assumption that light always has momentum when travelling in spacetime. This means that light ALWAYS has an "apparent" mass because of the equation aforementioned. Now, if light weren't a wave either, then it wouldn't have a frequency, wouldn't have mass, and wouldn't have any energy. But light clearly does have momentum! That is important!

I'm sure all of you at one time or another saw those little motors that were driven by light's momentum. They were little cardboard fans, one side was black, one was white, and it was balanced on a pin in a vacuum that looks a lot like a lightbulb. When white (and just about only white light, I'm not sure about blue) was shot at the BLACK side, it started to spin. I'm also sure your teachers told you that the light is absorbed by the black and reflected off the white. This is a perfect model proving that light must have energy AND momentum in it. And thus, it has an apparant mass as well.

Of course, this is just my understanding of it. Feel free to critisize or clarify.

Subject: Particle and Theoretical Physics
Posted by Spoony_old on Thu, 26 May 2005 19:58:55 GMT
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JavaxcxRemember, light can be characterized as both a particle and a wave. That being said, we can measure energy in two forms.

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Of course, this is just my understanding of it. Feel free to critisize or clarify.
Remember, it's... actually, no, I won't go there.

Subject: Particle and Theoretical Physics
Posted by warranto on Thu, 26 May 2005 21:03:41 GMT
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Remember, to have momentum, you don't need a mass.
p - momentum
E - Energy
c - Speed of Light
h - Plank's Constant
f - Frequency

P=E/c
E=hf
p=hf/c

Subject: Particle and Theoretical Physics
Posted by Javaxcx on Thu, 26 May 2005 21:13:09 GMT
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Right. The momentum of an object can be given by its frequency. But again, this only really works with a wave definiately. That is why you can get an "apparent" mass. It seems to be there, but it really isn't.

It doesn't work the other way, because as mass cannot go at a velocity of c without becoming infinite. The frequency, subsequently, would also become infinite. Which is why there is no such thing as "apparent" frequency.

Subject: Particle and Theoretical Physics
Posted by Doitle on Fri, 27 May 2005 02:38:50 GMT
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Light is a particle. It behaves like a wave but it's a particle. I don't understand how THIS is a big debate, but if I said H20 is not a particle but a wave everyone would be up in arms.

Subject: Particle and Theoretical Physics
Posted by mrpirate on Fri, 27 May 2005 23:04:37 GMT
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Everything, light included, has wave-particle duality.

Subject: Re: Particle and Theoretical Physics
Posted by Jzinsky on Sun, 29 May 2005 15:09:43 GMT
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KanezorJzinskyDaveGMMI didn't think that there was a test that proved it was both.

Well you can't stop light, I figure at that speed it either bounces off (reflection) or gets absorbed into whatever it hit (causing colour) thus you cannot stop light, but I guess the theory is ifyou could, it would be a particle with a mass on a micro mathematical scale..If you could not stop light, then nothing would be absorbing light, correct? In a way, that's true... because the things that absorb light become hot. A black surface absorbs more light than a white surface, and a black surface will become equally more hot than a white surface.

Also, you're only partially correct when you say that absorbing light causes color; color is caused when one part of the spectrum is absorbed while the other part (the part you see; the color you see) is bounced off.

Well the point really was that you can't grab hold of a particle of light because the only way to actually stop that particle would be to absorb it into some other object and thus rendering it unremoveable.

Yeah it's both, but actually being able to prove it 100% for definate for all to see is in the realms of science fiction, unless there's something I don't know about?

Subject: Particle and Theoretical Physics
Posted by Javaxcx on Mon, 30 May 2005 03:16:16 GMT
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Think about what exactly gets reflected or absorbed and the duality works out much better.