

Re: Understanding SR – simultaneity

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- *From:* "Sue..." <suzysewnshow@xxxxxxxxxxxxx>
 - *Date:* 4 Jun 2006 01:39:19 -0700
-

Spoonfed wrote:

I snipped off the beginning and end for brevity.

Sue... wrote:

Spoonfed wrote:

Well, does light depend on the acceleration of an electron or proton?

Short answer—both. The proton and electron should both have an equal change in momentum perpendicular to the path of the photon; two momentum changes, two events. Two simultaneous events generate the photon, and two simultaneous events absorb the photon.

That seems reasonable but you might consult a QED text and how a Feynman diagram is discussed for that interaction. I just call it a standing wave.

The farther we are from the electron, the less Coulomb force/coupling we have to get it moving.

Beyond a short distance, the electron won't be in the atom to fall into a lower orbital shell. But antennas, transmitters, etc. generate photons too.

No they do not. They use the motion of loosely bound electrons.

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You won't detect any copper line spectra in the emissions of your favorite radio station tho' the coupling structure is likely copper.

And these photons are not emitted by falling through atomic quantum levels. But they ARE quantum levels, just the same... just not atomic.

No dice.

<http://www.eso.org/projects/vlti/>

Tie 3 meters of elastic cord to a roller skate.
Displace the free end 1 meter and measure the time lag for the skate to move 1 meter.
Stack the other skate (assuming you have two feet) to double the weight and repeat.
That looks like a good mechanism for retarded potential to me.
Somewhere down the skating rink we'll want to remember that Coulomb force and spring tension have an inverse relationship regarding the end to end distance. Forgetting that makes magnetism and permeability look whacked.

I am not getting the image or the analogy here.

<http://hyperphysics.phy-astr.gsu.edu/Hbase/waves/string.html>

<http://physics.nist.gov/cuu/Images/alphaeq.gif>

<http://physics.nist.gov/cuu/Constants/alpha.html>

Your Feynman article gets very close to the issue I'm getting at, but seems to veer off. Here is what Feynman says:

"...I learned what was wrong with the idea that an electron does not act on itself. When you accelerate an electron it radiates energy and you have to do extra work to account for that energy. The extra force

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against which this work is done is called the force of radiation resistance. The origin of this extra force was identified in those days, following Lorentz, as the action of the electron itself."

Now, another detail lies in an undergraduate text book that I have in my possession. Modern Physics (Bernstein, Fishbane, Gasiorowicz) Example 3–8. "From the point of view of quantum mechanics, light is carried by photons, symbolized, γ . According to the quantum mechanical rules of electricity and magnetism, a photon can be absorbed by a charged particle such as an electron. Show, by applying the laws of conservation of energy and momentum, that a truly free electron cannot absorb a photon; that is, show that the process $\gamma + e \rightarrow e$ is not possible."

Before reading this, I had long thought it very strange that electrons running in loops (thus undergoing constant acceleration) generate no photons, and yet photons are so often described as being caused by accelerating charges. But this example showed quite easily that an accelerating charge cannot by itself create a photon without violating conservation laws.

No argument from me.

Right, once again—you need both charged particles to create a photon. And not only that, I think you need a quantum change in momentum state

I don't recall inferring photons could be created. They are emitted and absorbed. They have to wear wrist watches, but have no arms, they have to explore all paths, but have no legs, they have to carry a magnetic monopole but magnetic monopoles do not exist.
http://www.physics.yorku.ca/undergrad_programme/highsch/Feynm4.html
{good thing you snipped some space above}

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<<Now, does not the prize to Einstein imply that the Academy recognised the particle nature of light? The Nobel Committee says that Einstein had found that the energy exchange between matter and ether occurs by atoms emitting or absorbing a quantum of energy, $h\nu$.

As a consequence of the new concept of light quanta (in modern terminology photons) Einstein proposed the law that an electron emitted from a substance by monochromatic light with the frequency has to have a maximum energy of $E=h\nu-p$, where p is the energy needed to remove the electron from the substance. Robert Andrews Millikan carried out a series of measurements over a period of 10 years, finally confirming the validity of this law in 1916 with great accuracy. Millikan had, however, found the idea of light quanta to be unfamiliar and strange.

The Nobel Committee avoids committing itself to the particle concept. Light-quanta or with modern terminology, photons, were explicitly mentioned in the reports on which the prize decision rested only in connection with emission and absorption processes. The Committee says that the most important application of Einstein's photoelectric law and also its most convincing confirmation has come from the use Bohr made of it in his theory of atoms, which explains a vast amount of spectroscopic data. >>

<http://nobelprize.org/physics/articles/ekspong/index.html>

My interpretation of this has been to assume that a photon can only be generated by the interaction of two charged particles. Feynmann seems to have gone a different direction because he is still trying to answer his question, continuing,

"The first term of this action, of the electron on itself, gave a kind of inertia (not quite relativistically satisfactory). But that inertia-like term was infinite for a point-charge. Yet the next term in the sequence gave an energy loss rate, which for a point-charge agrees exactly with the rate you get by calculating how much energy is radiated."

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Synchrotron radiation I presume.

...which I can't make any sense of at all, but he seems to come back to reality, with...

"So the force of radiation resistance, which is absolutely necessary for the conservation of energy would disappear if I said that a charge could not act on itself."

I think he is describing the electron moving near the speed of light wrt lots of neighboring positive charge urging it on.

Googling Synchrotron radiation, Smith Purcell radiation Wiggler undulator will probably yield some clarity.

Then, in the following few paragraphs, Feynman gets into the crux of the small part of the issue that I feel I have a tentative grasp of. Namely that the emission and absorption of a photon represents the interaction of four particles—two at the emitting end, and two at the absorption end. At the emitting end, an electron is dropping into a lower available quantum energy level, while at the absorbing end, an electron is popping out of an available quantum energy level.

For a four particle universe, that seems reasonable.

Two atoms. Four particles. One pair sends the radiation. The other pair receives. Sometimes it's not two atoms—it's anywhere where quantum momentum states can be established between pairs of particles.

....with some predictable degree of certainty? Causality? Probability?

Fundamental assumptions of QM are easy to forget when you interpret classically but that's no excuse for magic.

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The radiation was always there. No pairs have to send anything. Stretch a bungee cord from Giza to the Eiffel tower, Then release it. It does not have to wait for approval from Egypt to begin moving away from you. It is instant. A strain gauge in Egypt won't indicate that you have released the cord for some period time. A function of the cord's mass and tension.

The Coulomb gauge is sometimes called the radiation gauge.
<http://arxiv.org/abs/physics/0204034>

Now, the spacetime interval between the emission and absorption $\sqrt{c^2*t^2 - x^2}$ is zero, thus neither spacelike nor timelike. But there are also two events at each end of the photon—the acceleration of the source charges toward one another, and the acceleration of the absorbing charges away from one another. These events should also have some spacetime interval between them, which I would presume also calculates to zero.

The ~charge~ of the intervening volume of space becomes more positive or more negative. The absorber rotates CCW or CW appropriately. I see one cause, one effect.

The absorber is a dipole...Two independent charges acting simultaneously in reaction to one photon.

What makes them independent ? Coulomb's Law repealed ?
They can react to a photon. It doesn't exist 'till absorbed.
Before absorption the emission of many photons may contribute to the absorbed energy so it not ONE photon.

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Instead of considering collisions, we also need to consider closeness. A pair of hydrogen atoms and a pair of helium atom may have a different idea about what *close* means. So we represent fundamental charges as a density (of pseudo particles) and use superposition to determine what is *close*.

I think you've lost me.

Back up about three laps. I am right in the dust you left me in. :o)

"Time-independent Maxwell equations"
<http://farside.ph.utexas.edu/teaching/em/lectures/node26.html>
http://en.wikipedia.org/wiki/Multiple_integral
(shared volumes)

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What is
imaginary?
The psuedo
particles we
represented
the
electrical
field with.
They are
integrable
but not
countable.

Bodies
AND their
associated
fields share
space with
some
respect to
time.

Well, okay. I hear some
echoes of Tim's argument
here. I'm not quite
clear on it, though.

The best online example I know is the triple
integral to
derive magnetic force from coulomb force. It
is just
a 3D superposition of moving water
sprinklers. But
some of them squirt (+) and some of the
suck (-).

We can't
count the
pseudo
particles of
our
own
creation to
see if they
are

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simultaneously
in the same
place. They
are only
where we
imagined
them to be.

I would say this is all in
agreement with some
interpretation of
Quantum Mechanics.

I would say some of Quantum Mechanics is
in agreement
with this. :o)

Hmmm I would hope we could agree
that a roof shouldn't look like a door and 2
windows and
the front of a house should not look like
shingles.

QM and Classical fields are loosely
speaking,
orthogonal views.

So we need
a way to
represent a
degree
(the overlap
of
associated
fields) of
simultaneity
To do this
we put
space and
time on an
equal
footing.
(Lorentz
transform)

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The
interaction
in the
shared
volumes of
spaces is
evaluated
with respect
to their
separation
in space
or time.

What is
imaginary?
The
equivalence
of space and
time.

Time-dependent
Maxwell's
equations
(vector
imaginaries)

<http://farside.ph.utexas.edu/teaching/em/lectures/node41.html>

http://www.wolfram-stanek.de/maxwell_equations.htm

You've probably handed me
a perfectly good wheel, but I
don't know
exactly what it is. I may try
using it as a telephone while
I
re-invent it. Anyway, I
printed out wolfram-stanek.
Maybe I'll glean
something.

Great! I forgot that included:
"Maxwell's equations considering quantum
field theory"
which may speak more to you symbolically
than I can
with a thousand water sprinklers.

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The
gradient of
the
Coulomb
field,
equated to
the statistics
of a normal
distribution
is where a
link
between the
Hilbert
space and
Lorenz
space ~can~
have
validity.

Hilbert space is the
coefficients of one of those
Schrodinger
functions, right?

That is beyond me. Here is a more formal
statement also
over my head:

<< In mathematics, a rigged Hilbert space
(Gelfand triple,
nested Hilbert space, equipped Hilbert
space) is a construction
designed to link the distribution (test
function) and square-integrable

aspects of functional analysis. Such spaces
were introduced to

study spectral theory in the broad sense.

They can bring together
the 'bound state' (eigenvector) and
'continuous spectrum', in one

place. >>

http://en.wikipedia.org/wiki/Rigged_Hilbert_space

Ask me again a year from now. I'm going back to school for
a math
degree, hoping to penetrate what I currently perceive as a

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maze of
infinitely self-referential and circularly defined
mathematical jargon.

Indeed, you need both physics and a maths to sort it all out.
It HAS become a mess.

But you might consider this... If you have a box with a
particle in
it, at all times that you are not detecting the particle, you
know that
it is not actually hitting the sides of the box. During these
times,
you can say that the probability of touching the sides is zero,
and
anywhere else, you have no idea.

So you make up a *completely* arbitrary function. How do
you determine
a completely arbitrary function? With a series representation
with
unknown coefficients:

For instance $\text{Sum}(A_n x^n, \{n,0,\text{infinity}\})$

In fact, this is the only one you really need. Every other
function,
 $\text{Sin}(x)$, $\text{Cosine}(x)$, e^x , Bessel Functions, Legendre
Polynomials etc,
are representations of $\text{Sum}(A_n x^n, \{n,0,\text{infinity}\})$.

Once you know you have a particle trapped in a box, and set
the chances
of it hitting the side as zero, representing it in the form of
 $\text{Sum}(A_n$
 $x^n, \{n,0,\text{infinity}\})$ is going to look extremely messy, while
representing it in the form of $\text{Sum}(B_n \text{Sin}(\text{Pi} * x / L * n))$ will
look very
classy, because it is immediately obvious that every term will
evaluate
to zero at the two ends of the box.

How? I don't!

Oh, sorry, of course not. I'm writing like a textbook I get mad at.
Sorry. When $x=0$, you have $\text{Sin}(0)$, and when $x=L$, you have $\text{Sin}(n * \text{Pi})$

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which is zero as long as n is an integer. So no matter how many terms you have in it, it will always evaluate to zero at the ends.

Ya lost me. Or maybe your photons lost their watches and monopoles. You can clarify or snip when you decide which.

There comes a point where the abstraction of waves to particles to preserve an implausible propagation model I just use the classical field models and never contact that sort of dice game. In the sub atomic realm, that is all you have to work with so I am not discouraging your aspirations to higher levels of abstraction.

As you wish.

If I recall correctly, (and please don't take my word for it, because I was taking several very hard classes and my thinking was quite muddled) taking second derivatives of these functions with respect to position will lead you to the momentum as a function of position. Also, IIRC, these derivatives come out to real values if only one coefficient B_n is nonzero, but they come out to be imaginary if more than one coefficient B_n is nonzero. This momentum is associated with particular wavelengths, and then all of the deBroglie wavelengths coming out of the system turn out to be representable by single coefficients instead of sums of several coefficients.

I'll have to take your word for it because I surely don't know.

After doing all this complex mathematical work, it is easy to forget what is missing from the description is that this only describes the particle when it is **not** hitting the edges of the box, and we

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also
have no idea as to when it last hit the edge of the box.

Your ~failure~ to classically superposition the four charges above is probably a good example. You can probably drive an automobile if you have never seen one from the outside. You'll drive it much better if you have some image of wheels interacting with the road surface.

<http://farside.ph.utexas.edu/teaching/em/lectures/lectures.html> :-)
http://web.mit.edu/8.02t/www/802TEAL3D/teal_tour.htm

I can't usually identify a wheel unless I am lucky enough to reinvent it.

LOL

It seems to me that if we tried to describe the situation when the particle *is* hitting the edge of the box we have a probability of one-hundred percent at the collision point and zero everywhere else. This might be related to the go/no-go test you were talking about as a *go*, whereas the situation of not hitting the edge of the box described by QM would be a *no-go*

Charges don't have edges like automobile bumpers. So you integrate pseudo charges over space or you integrate a probability amplitude. The go/no-go test is an atomic oscillator. Either it absorbs or it does not. Some particular oscillator may respond to the light of the moon, only because a crack in the door of your microwave oven provided the final nudge. (bias lamp)

By the "classical" viewpoint, I think you are right. Charge is assumed to be a perfect fluid, infinitely divisible. But the go/no-go test you mention is an atomic oscillator, which is a quantum device. Use an antenna as your go/no-go test instead

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Perfect is in the eye of the beholder. Our discussion is cross discipline so ethanol the perfect fluid so long as you don't waste it as a motor fuel.

QM has enough warts you don't want to scale it up just to apply a threshold detector over a broader domain. QED strikes the best balance. You are suggesting a broader application of statistics (just like a maths nut). Feynman opted for more determinacy with his use of clocks and monopoles. So all the mirrors that QM broke, started working again when the clocks and monopoles restored phase information.

Remembering the Heisenberg uncertainty principle, try to identify what is determined by statistics and what is processed as a probability amplitude.

Of course, remembering the HUP, (and reference to external measuring devices or particles,) the accuracy of locating the exact position and time of the *go* event is related to our uncertainty in the momentum and energy of the event. Where, along the wavelength of a photon or deBroglie wavelength of a particle, is it absorbed? When along one oscillation of frequency is the photon (or deBroglie frequency of a particle) absorbed? Does this information exist as an unmeasurable quantity, or does it simply not exist? I've heard tell of a proof suggesting that the information does not exist, but most of my textbooks are at the undergraduate level, and consider this proof to be beyond the scope.

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AFAIK, no physical proof is necessary. It is mathematically fundamental just like the inverse square law or pi or normal distribution.

What you say is very strange. There are derivations to find Pi, normal distributions, inverse square law—they may lead very clearly from first principles, but they aren't first principles themselves—not that you can't start with them as first principles, necessarily.

I also can't offer you proof a coin will come up heads 50% of the time.

Look at some real world ~violations~. They really aren't, of course, they are just loopholes in the formalism.

<http://www.cco.caltech.edu/~qoptics/cqed.html>

QED's
successes in
the
subatomic
realm
exemplify
when a
marriage of
Lorenz and
Hilbert
space is on
sound
footing.

<http://nobelprize.org/physics/laureates/1965/feynman-lecture.html>

The twins
paradox
exemplifies
when it is
not.

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Goodness gracious, Miss
Dominatrix, you make me
read a lot.

Likewise. But you wern't suppose to read so
much of Feynman's
war stories.

But I like them! I have similarities to Feynmann as an
undergraduate
in that I am inspired "not by the parts in which everything
[is] proved
and demonstrated carefully and calculated, because I [can't]
understand
those very well," Unfortunately, I never developed his
attitude as an
undergraduate in Electrical Engineering that "since they
didn't get a
satisfactory answer to the problem I wanted to solve, I don't
have to
pay a lot of attention to what they did do."

Well... do try to form some image of wheels rolling on asphalt
before driving on ice or joining the Formula 1 circuit. The over
view of what you are simulating with statistics makes it much
easier.

As an undergraduate, I was continually beating my head
against the wall
trying to imagine things like *why* they thought an electron
should
repel itself, or *why* anybody expected there to be an
ultraviolet
catastrophe. And if I asked anybody, the usual response was
"Don't
worry about it. You won't use any of this crap once you're an
Engineer." After many years of further experience, I've
realized I'm
not an engineer.

LOL.. So focus on the subatomic where the tools are more
valuable.

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More of triple integrals so a flash of
brilliance
gives instant insight where probability
replaces "closeness"
or "earlyness". (Howzat for temporal and
spatial with a
down-home draw!)

I'll have to see if that flash is forthcoming.

For a little
railroad
gedanken,
all the
above, is
putting 10
possums
in a 2
possum
sack. So the
chapter
written by
Einstein
is to bad
writing, as
Shakespeare
is to good
writing.

Aye, he wrote inelegant
proofs, as well.

I almost forgot 'simultaneity'. Einstein
doesn't follow
with any development of probability so HUP
is not
an issue. The two postulates are resolved
formally
with time dependent Maxwell's equations.

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They are resolved without paradox in this:
Observer dependent...

<http://www.conformity.com/0102reflectionsfig3.gif>

<http://www.conformity.com/0102reflections.html>

<http://farside.ph.utexas.edu/teaching/em/lectures/node50.html>

I am finding an extremely challenging exercise (for me) in here.

I really like this near-field/far-field thing. However, I am trying to find a way to derive the equations given in here, and it took me a couple hours this morning, and will probably take me a lot more time because I am quite bad at getting $\text{Del } X$ and $\text{Del } \text{Dot}$ in spherical coordinates. Now that I see this near-field/far-field thing, I MUST see it to know how to believe it.

Yes. This is not an easy exercise. But it is worth as many attempts as it takes to grasp it. When you do. A light will go on in you head and you go "WOW that is how charged combs an pithballs keep the refrigerator magnet from falling" This may be easier to see that:
http://en.wikipedia.org/wiki/Multiple_integral

...Constant speed of light:

<http://physics.nist.gov/cuu/Images/alphaeq.gif>

<http://physics.nist.gov/cuu/Constants/alpha.html>

Is there a reason to be excited about the fine structure constant except its pretentious name? So it tells how fast the electron orbits a proton in the lowest Bohr orbital as a fraction of c , right? Am I missing something?

Free electrons have mass and Coulomb force too. They know when they they are moving 0.999 times the speed of light wrt an accelerator's cavity walls.

Read the roller skate gedanken and the music string page again.

Look at this:

<http://physics.nist.gov/cuu/Images/alphaeq.gif>

Can you find epsilon and mu in the roller skate gedanken?

(I hope so 'cause I forgot how) Blush

Sue...

This is better because it is links to particular articles rather than tables of contents.

Happy sums,

Sue...

Happy Products,

Jon...