Re: why lorentz transformation?

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2005−09/msg00085.html

- *From*: D.McAnally@i'm_a_gnu.uq.net.au (David McAnally)
- *Date*: Thu, 1 Sep 2005 16:38:39 +0000 (UTC)

"Sue..." <suzysewnshow@xxxxxxxxxxxx> writes:

>David McAnally wrote:
>> "Sue..." <suzysewnshow@xxxxxxxxxxxx> writes:
>>
>> >francisco wrote:
>> >> galileo's principle of relativity states that the laws of mechanics should
>> >> be the same for all inertial observers. and indeed, newtonian mechanics is
>> >> unchanged under galilean transformations. the problem is that maxwellian
>> >> electrodynamics is not the same in every inertial frame under that
>> >> transformation. so what to do? find a set of transformations under which
>> >> both mechanics and electrodynamics are the same for all inertial frames.
>> >> this leads to the lorentz transformation.
>>
>> >Since Maxwell's equations don't predict radiation either
>>
>> As the softrat points out, Maxwell's Equations do predict the existence of
>> electromagnetic radiation. What line of reasoning could possibly have led
>> you to believe that they don't? Seeing that you have made this
>> demonstrably false claim about Maxwell's Equations, how could anybody
>> trust your word on anything else?

>Science is not the business of knowing who to trust.
>The line of reasoning is in the two well considered
>papers offered

At no point in either of those papers was there any statement to the
effect that Maxwell's Equations do not predict the existence of radiation.
The first of the papers that you listed was connected to gauges for the
electromagnetic potential, and the fact that the physical properties of
the electromagnetic field are not affected by the choice of gauge.

>and you have offered nothing
>*demonstrable*.

I shouldn't need to demonstrate the fact that Maxwell's Equations predict
the existence of radiation. The fact is very well documented, and has
been known since the nineteenth century. If, in the twenty−first century,
this fact, which has been known for well over 100 years, escapes you, then

that says more about your incompetence than it says about Maxwell's Equations.

I will give a small part of the derivation, although, with your level of competence, I have no doubt that it will be a waste of time to explain it to you.

In vacuo, and in the absence of sources, Maxwell's Equations reduce to

@E_x/@x + @E_y/@y + @E_z/@z = 0,

@B_z/@y − @B_y/@z = (1/c^2) @E_x/@t,

@B_x/@z − @B_z/@x = (1/c^2) @E_y/@t,

@B_y/@x − @B_x/@y = (1/c^2) @E_z/@t,

@B_x/@x + @B_y/@y + @B_z/@z = 0,

@E_z/@y − @E_y/@z = − @B_x/@t,

@E_x/@z − @E_z/@x = − @B_y/@t,

@E_y/@x − @E_x/@y = − @B_z/@t,

where E_x is the x−component of the electric field, B_x is the x−component of the magnetic field, etc, c is a constant with the dimensions of speed (with known value 299 792 458 m s^{−1}), and for any field f, @f/@x denotes the derivative of f with respect to x, etc.

Upon differentiation of the first equation above with respect to x, the second with respect to r, the seventh with respect to z, and the eighth with respect to y, we get

@^2 E_x/@x^2 + @^2 E_y/(@x @y) + @^2 E_z/(@x @z) = 0,

@^2 B_z/(@t @y) − @^2 B_y/(@t @z) = (1/c^2) @^2 E_x/@t^2,

@^2 E_x/@z^2 − @^2 E_z/(@z @x) = − @^2 B_y/(@z @t),

@^2 E_y/(@y @x) − @^2 E_x/@y^2 = − @^2 B_z/(@y @t).

By an appropriate linear combination of these four statements, it follows that

@^2 E_x/@x^2 + @^2 E_x/@y^2 + @^2 E_x/@z^2 = (1/c^2) @^2 E_x/@t^2.

This is just the statement that E_x satisfies the wave equation. Similarly, E_y,E_z, B_x, B_y and B_z satisfy the wave equation. This immediately implies the existence of electromagnetic radiation which moves at a speed of c.

Alternatively, in vacuo and in the absence of sources,

div E = 0,

curl B = (1/c^2) @E/@t,

div B = 0,

curl E = − @B/@t.

It follows that

curl curl B = (1/c^2) @(curl E)/@t = − (1/c^2) @^2 B/@t^2,

and

curl curl B = grad div B − del^2 B = − del^2 B,

where del^2 is the Laplacian operator, i.e.

del^2 f = @^2 f/@x^2 + @^2 f/@y^2 + @^2 f/@z^2.

It follows that del^2 B = (1/c^2) @^2 B/@t^2. Similarly, del^2 E = (1/c^2) @^2 E/@t^2. So both E and B satisfy the wave equation, and so the existence of electromagnetic radiation automatically follows from these considerations.

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- ***Follow−Ups***:
  - ***Re: why lorentz transformation?***
    - *From:* Sue...
  - ***Re: why lorentz transformation?***
    - *From:* Androcles

- ***References***:
  - ***why lorentz transformation?***
    - *From:* francisco
  - ***Re: why lorentz transformation?***
    - *From:* Sue...
  - ***Re: why lorentz transformation?***
    - *From:* David McAnally
  - ***Re: why lorentz transformation?***
    - *From:* Sue...

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