Physics; Watching the Game From the Outside

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It is a good thing to have two ways of looking at a subject, and also admit that there are two ways of looking at it.

James Clerk Maxwell, on addressing the question of two versions of electromagnetic theory, one due to Michael Faraday and the other to Wilhelm Weber

When the complete answer is not known,
In a sense everyone is a crackpot

Halton Arp

Abstract:

It is a known fact that, often, the perfect idiot who watches the game from the outside is the one who discerns the best move! I'm an assumed crank As an engineer I can perhaps be acquitted, however there are numerous examples of renowned physicists that, occasionally, slide to a striking eccentricity. It's not uncommon for them to seek a complex explanation where a simple one is at hand.

The daring intention behind this paper is to throw a fiercer light into three discreetly shadowed points which, in my opinion, appear hazy or misconceived.

To start with, I take it that zero and infinity are logical limits. Anything in between has to be a circumstantial limit. Light velocity is a circumstantial limit since it is determined by the permeability μ_0 and permittivity ε_0 which are circumstantial properties of the e/m propagation medium, perhaps related, in some way, to the zero point energy**;** no one knows for sure yet and, paraphrasing Halton Arp, in that case everyone is a crackpot **!**

In cases where such a limit is at stake, it seems best to make it explicit and used it as a starting point given that the underlying circumstances are not known. Otherwise we risk our reasoning to go astray and become unbound.

[1] Time and kinetic energy

Unless otherwise specified, all calculations further on will use **SI** system of units.

Take one second as a reference time and, from that, it follows:

$t_0 = 1 \cdot s$ <= reference time $E_{max} = \frac{kg}{\mu_0 \cdot \varepsilon_0}$ J   **(1)**   <= absolute upper energy limit

Eq.(1) is telling you that $E_{max} = M \cdot c^2$ **!**   or $\mathbf{E} = \mathbf{p_c}$ (momentum) x $\mathbf{c}$

$$E_{kmax} = \frac{kg}{2} \cdot \frac{1}{\mu_0 \cdot \varepsilon_0}$$ **(2)** <= kinetic energy limit or simply $$E_{kmax} = \frac{kg}{2} \cdot c^2$$ **(3)**

Taking **(3)** as the reference energy and starting point and **v** as the speed of a moving body

$$E_k = \frac{kg}{2} \cdot c^2 - \frac{kg}{2} \cdot v^2 = \frac{kg}{2} \cdot \left(c^2 - v^2\right)$$ **(4)** <= left over energy capable of accelerating that body

$$\frac{t_0}{\sqrt{\mu_0 \cdot \varepsilon_0}} = c \cdot t_0$$ **(5)** <= distance in meters traveled by light in one second

From Eq.(4) the implicit speed $\mathbf{v_i}$ must be

$$v_i = \sqrt{c^2 - v^2}$$ **(6)**

$$t = \frac{c \cdot t_0}{v_i}$$ <= time fraction relative to $\mathbf{t_0}$ where $c \cdot t_0 = 2.998 \times 10^8 \text{ m}$

substituting (6) above for $\mathbf{v_i}$

$$t = t_0 \cdot \frac{c}{\sqrt{c^2 - v^2}}$$

which may be written as

$$t = t_0 \cdot \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$ **(7)** length of time at speed **v** as related to reference time $\mathbf{t_0}$ **= 1 second**

[2] Mass increase or lack of thrust power?

Confronted with Newtons Law of force $f = kg \cdot \frac{m}{s^2}$ or $f = \frac{kg}{s} \cdot v$ that is: force equals mass versus acceleration and trying to accelerate a given mass, you have two independent variables and choices: postulate a mass increase with speed or a progressive lack of thrust energy.

Ask an aeronautical engineer which one he will chose. He will say a jet engine is only useful as long as the exhaust gases speed **u** from the engine are grater then the vehicle velocity **v,** as the net engine thrust is the same as if the gas were emitted with velocity (**u - v**). He will laugh in your face if you say that the aircraft mass increases with speed.

The law of conservation of energy and momentum precludes a jet aircraft of flying faster than the speed of the engine's exhaust gases and, for exactly the same reason, it precludes anything subject to electromagnetic propulsion of attaining a speed grater than the velocity light. And, please, do not try to attribute mystical properties to light! Remember that electromagnetic radiation also has momentum.

It is amazing that so few people have questioned such an outlandish idea. In this respect I must, with justice, cite an article by Musa Abdullahi* which makes a terse objection to the concept of mass increment.

Consonant with what was hitherto established

$$t_0 = 1 \cdot s$$

and kinetic energy is given by

$$J_k = \frac{kg}{2} \cdot \frac{c^2 \cdot t_0^2}{t^2} \quad \textbf{(8)} \qquad c \cdot t_0 = 2.998 \times 10^8 \, m \qquad \Longrightarrow \qquad J_k = \frac{kg}{2} \cdot \frac{m^2}{t^2}$$

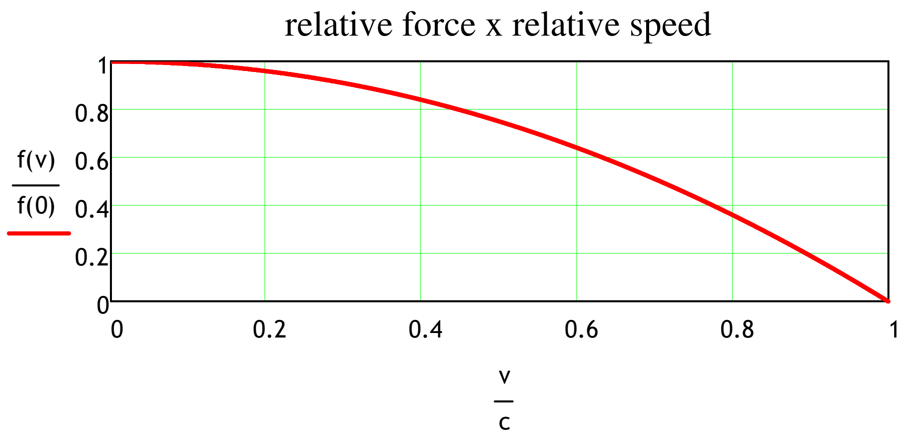
applying the just newly derived (7) Lorentz transformation for **t** in Eq. (8)

$$J_k = \frac{kg}{2} \cdot \frac{c^2 \cdot t_0^2}{\left(t_0 \cdot \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \right)^2} \qquad \text{reduces to} \qquad J_k = \frac{kg \cdot \left(c^2 - v^2 \right)}{2} \qquad \textbf{(4 bis)}$$

As you can see, we are obviously back to equation (4) when applying the gamma factor to (8).
The ubiquitous gamma factor lurks in several calculations involving (c^2 - v^2) **!**
The graph below shows how the thrust force decreases as the speed approaches the velocity of light.

$$f = \frac{kg}{2 \cdot m} \cdot \left(c^2 - v^2\right) \qquad \textbf{(9)}$$

<= remaining thrust force still available at speed **v**



$$a = \frac{c^2 - v^2}{2 \cdot m} \qquad \textbf{(10)}$$

<= maximum possible acceleration at speed **v**

[3] The much disputed transverse Doppler effect

c = light velocity vector

v_s = light source speed vector

v_r = receiver or observer speed vector

The terms receiver and observer will be, here, used interchangeably representing the same entity.

The complete Doppler equation for wavelength is

$$\lambda = \lambda_0 \cdot \frac{\vec{c} + \vec{v_s}}{\vec{c} + \vec{v_r}} \qquad \textbf{(11)}$$

$$\lambda = \lambda_0 \cdot \frac{\sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_s + v_s^2}}{\sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_r + v_r^2}} \qquad \textbf{(12)}$$

Including the newly derived γ factor **(7)** for source and receiver

$$\gamma_s = \frac{1}{\sqrt{1 - \frac{v_s^2}{c^2}}} \qquad \gamma_r = \frac{1}{\sqrt{1 - \frac{v_r^2}{c^2}}}$$

(12) becomes

$$\lambda = \lambda_0 \cdot \frac{\gamma_s \cdot \sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_s + v_s^2}}{\gamma_r \cdot \sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_r + v_r^2}} \qquad \textbf{(13)}$$

or

$$\lambda_r = \frac{\lambda_0}{\gamma_r} \cdot \frac{c}{\sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_r + v_r^2}} \qquad \textbf{(14)}$$

for source at rest

and

$$\lambda_s = \lambda_0 \cdot \gamma_s \cdot \frac{\sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_s + v_s^2}}{c} \qquad \textbf{(15)}$$

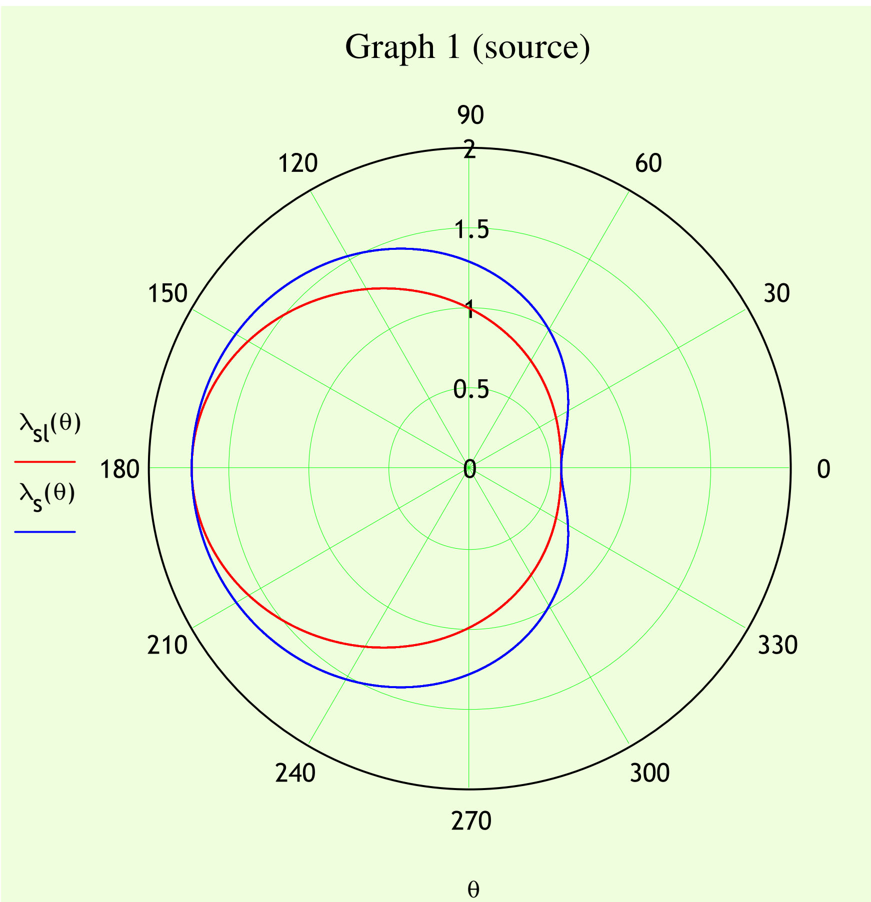
for observer at rest

Plotting (14) and (15) above as a function of theta for $\boldsymbol{\lambda_0}$ = one meter and speed $\mathbf{v_s} = \mathbf{v_r}$ = half the velocity of light: [The graphs are plotted against the simpler, and usual, in line Doppler formula (16)]

$$v_s = \frac{c}{2} \qquad v_r = v_s \qquad \lambda_0 = 1 \cdot m$$

$$\lambda_{sl}(\theta) = \lambda_0 \cdot \sqrt{\frac{c - v_s \cdot \cos(\theta)}{c + v_s \cdot \cos(\theta)}}$$ **(16)** <=== in line Doppler

$$\lambda_s(\theta) = \lambda_0 \cdot \gamma_s \cdot \frac{\sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_s + v_s^2}}{c}$$



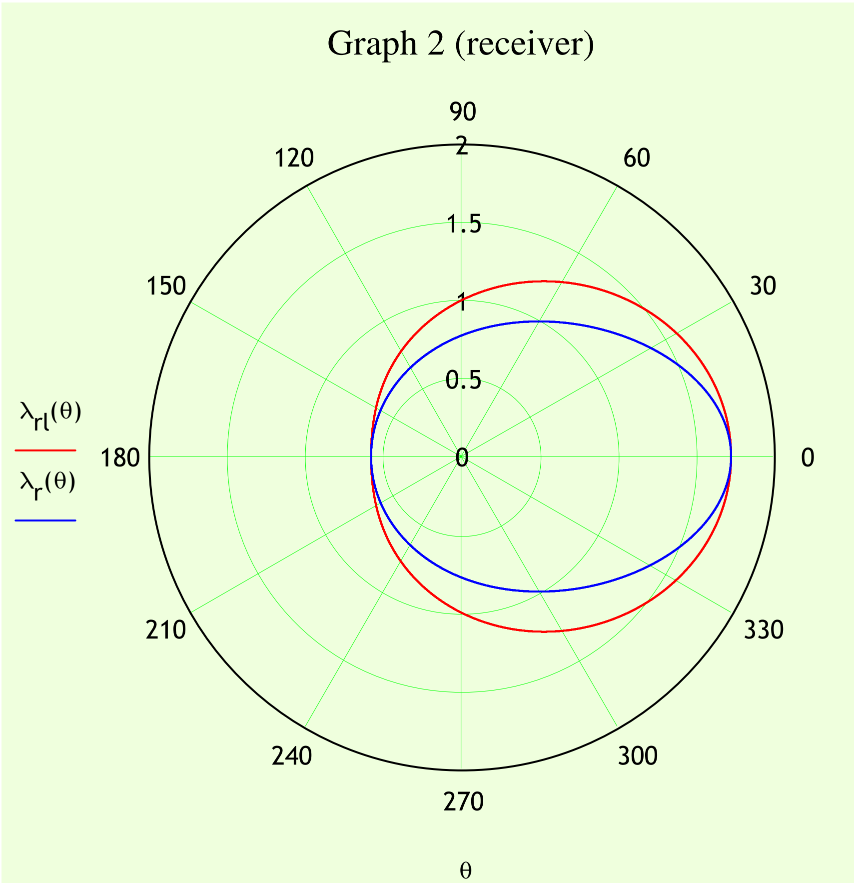
transverse Doppler =

$$\lambda_s\left(\frac{\pi}{2}\right) - \lambda_0 = 0.291\,m$$

$$\lambda_{sl}\left(\frac{\pi}{2}\right) - \lambda_0 = 0\,m$$

$$\lambda_{rl}(\theta) = \frac{\lambda_0 \cdot m}{\lambda_{sl}(\theta)}$$

$$\lambda_r(\theta) = \frac{\lambda_0}{\gamma_r} \cdot \frac{c}{\sqrt{c^2 - 2 \cdot \cos(\theta) \cdot c \cdot v_r + v_r^2}}$$



transverse Doppler =

$$\lambda_r\left(\frac{\pi}{2}\right) - \lambda_0 = -0.225\,m$$

$$\lambda_{rl}\left(\frac{\pi}{2}\right) - \lambda_0 = 0\,m$$

The equations background colors refer to the respective traces in the graphs.

If you solve Eq.(14) or Eq.(15) for θ making $\boldsymbol{\lambda = \lambda_0}$ you get the complement of the light aberration angle Eq.(17) for a star in the zenith. The solution is the same for both equations, indicating that only relative speed is at stake, independently of whether source or observer are considered moving. This only enforces the fact that there can be no light aberration for co-moving source and observer. For the data in the improbable example above, θ would be 60 degrees and φ = 30 degrees.
Putting "down to Earth" figures in it:

$$v_r = 29.78 \cdot \frac{km}{s}$$ <== Earth mean orbital speed

$$\theta = \text{acos}\left(\frac{c^2 + v_r^2 - \frac{c^2}{\gamma_r^2}}{2 \cdot c \cdot v_r}\right) \quad \textbf{(17)}$$

<= complementary angle for starlight aberration
when a star is on the zenith

$$\theta = 89.994308502 \cdot \text{deg}$$

$$\varphi = \frac{\pi}{2} - \theta \quad \textbf{(18)}$$

<== Angle of aberration

$$\varphi = 20.4893945 \cdot \text{arcsec}$$

comparing with the simple geometric calculation:

Maximum starlight aberration angle ==> $\text{atan}\left(\frac{v_r}{c} \cdot \gamma_r\right) = 20.4893945 \cdot \text{arcsec}$ **(19)**

both equations (18) and (19) expand in series equally to $\frac{v_r}{c} + \frac{v_r^3}{6 \cdot c^3} + \frac{3 \cdot v_r^5}{40 \cdot c^5}$ ...

Did you notice that only Newtonian physics have been used throughout ?

* **Musa D. Abdullahi**
Explanations of the Results of Roger's and Bertozzi's Experiments
Without Recourse to Special Relativity
The General Science Journal