Einsteinian kinetic energy: $E_\mathrm{k} = (\gamma - 1)mc^2$

rest energy: $E_0 = mc^2$

total energy: $\boldsymbol{E = E_\mathrm{k} + E_0 = \gamma mc^2}$

dimensionless specific total energy: $\boldsymbol{\mathcal{E} := \frac{E}{mc^2} = \gamma}$

The ***Lorentz factor*** ~~equals~~**is** the ***dimensionless specific total energy***.

The ***Newsteinian*** premise[1]: $\boldsymbol{\gamma - 1 - \frac{1}{2\varrho} = 0}$ (I pronounce ϱ "*crho*")

where: $\varrho = \rho/\gamma$ = ***proper radius***[2]

$\rho = r/r_\mathrm{S}$ = ***expanded radius***

$\gamma - 1$ = dim'less ***specif. kin. en.***

and: $-1/2\varrho$ = dim'less ***grav. potential***

actually is the ***conservation of energy*** during a ***free fall*** from ***infinity***.

From it, I derived: $\gamma = \frac{2\rho}{2\rho - 1}$

~~*Contracted*~~*Proper radius*: $\boldsymbol{\varrho = \rho\frac{2\rho-1}{2\rho} = \rho - \frac{1}{2}}$

We obtain: $\boldsymbol{\mathcal{E} = \gamma = 1 + \frac{1}{2\varrho}} = \frac{2\varrho+1}{2\varrho}$

which is the same as: $\boldsymbol{\mathcal{E} = \gamma = 1 + \frac{1}{2\rho-1}} = \frac{2\rho}{2\rho-1}$

& it equals the ***escape energy*** at: ϱ or ρ

Total energy of a photon: $E_\gamma = h\nu$

For *radiation pressure*, we essentially treat this as its *kinetic energy*, consistent with a photon having no *rest mass*, implying: $E_\gamma = E_\mathrm{k}$.

A photon cannot be at rest, so *photon rest mass* is a totally meaningless concept. It has no value at all, not even zero.

Hence, a photon's *relativistic mass*: $m_\gamma = \frac{E_\gamma}{c^2} = \frac{h\nu}{c^2}$

is the only *photon mass* that makes sense.

Actually, it is not *mass*, but *inertia*, which in fact applies to **any** *relativistic* ~~*mass*~~*inertia* ($m_\mathrm{rel} = \gamma m_0$), as well as to $m = E/c^2$, think about that.

Isaac Newton, Principia, page 1, Definitio I.: *mass* := quantitas materiæ = *amount of matter*. Me: does the no. of nucleons change with velocity?

His definitio III. mentions inertia massæ (*inertia* ***of*** *mass*) being a *vis insita* = *innate power* (of matter to resist change of state of motion), hence *inertia* is a property of *mass*, the latter being *matter*, which is *not* a property, but an entity.[3]

THE essential (non-quantum) differences between a photon and a body:

- a photon has finite *energy* ***at*** the *very speed of light*;
- a body having finite *energy* cannot ever have this *velocity* w.r.t. to whatever other body & it would require infinite *energy* in order to achieve it;
- a photon cannot ever deviate from $\boldsymbol{c}$ and a body cannot ever achieve it;
- *rest mass* is a **senseless** concept for a photon;
- a photon has no *rest mass* at all (not even zero!) and a body has a non-zero *rest mass*.

Because of the lack of any *rest mass* (*energy*), the *total energy cannot* differ from the *Einsteinian kinetic energy*:

$$\boldsymbol{E_\gamma} = E_{\mathrm{k},\gamma} = (\gamma_\gamma - 1)\boldsymbol{m_\gamma}c^2 = (\gamma_\gamma - 1)\tfrac{\boldsymbol{E_\gamma}}{c^2}c^2 = (\gamma_\gamma - 1)\boldsymbol{E_\gamma}$$

[1] https://henk-reints.nl/astro/HR-Newstein-corrected.pdf
[2] In General Relativity this would be called *contracted radius* as perceived from infinity.
[3] https://henk-reints.nl/HR-mass-vs-inertia.pdf (read it **thrice!**)

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hence: $\gamma_\gamma - 1 = 1$

THEREFORE: $\boldsymbol{\gamma_\gamma = 2.}$

The *Lorentz factor* of a photon equals 2! (note: this isn't a factorial, although...)

The *Lorentz factor* of a photon equals TWO!

TWO! Not more. Not less. TWO!

IT IS RATHER NAIVE[4] TO THINK[5]: $\boldsymbol{\gamma_\gamma = \lim_{\beta \to 1} \frac{1}{\sqrt{1-\beta^2}} = \infty}$

It is inapplicable to haphazardly and inapplicably apply an applicable equation applicably applying to bodies to an inapplicable other entity!

The *Lorentz factor* of a photon is a *universal constant*.
It equals TWO, independent of the photon's *energy* (*frequency*).

Now look at the *escape energy*: $(\mathcal{E}_{\text{esc}} = \gamma) = 1 + \frac{1}{2\varrho}$

which renders: $\varrho_{\text{esc}} = \frac{1}{2(\gamma-1)}$

For *light*, we easily obtain: $\boldsymbol{\varrho_{\text{esc},\gamma} = \frac{1}{2(\gamma_\gamma - 1)} = \frac{1}{2(2-1)} = \frac{1}{2}}$

which I call the *proper escape radius*.

The corresponding *expanded radius* is: $\boldsymbol{\rho_{\text{esc},\gamma} = \varrho_{\text{esc},\gamma} + \frac{1}{2} = 1}$

The *light escape radius* equals the *Schwarzschild radius*
as perceived from infinity.

For a ***body*** (which Newton defined as a *synonym* for *mass* = *amount of matter*) however, there exists **no** escape limit! Once again, it is rather naive[4] to think it would require a superluminal velocity if $r < r_S$. It is **wrong** to compare *velocities* if one of them equals the *speed of light*! Apples and oranges!
Isn't escape ***velocity*** based on escape ***energy***? One should **compare** the ***energies*** and ***not*** the ***velocities***! *Specific energy* to be precise. In its dimensionless form, this ~~equals~~**is** the very same as the *Lorentz factor*.

A ***body*** requires a superluminal *Lorentz factor* 👍 in order to escape from within the *Schwarzschild radius*, not a superluminal velocity 👎!

The *Lorentz factor* of *light* equals **2**.
The *Lorentz factor* of *light* equals **2**.
The *Lorentz factor* of *light* equals **2**.

The Large Hadron Collider at CERN is able
to acceleratatatatatatataRollerCoaster!
protons to roughly $\boldsymbol{\gamma = 6930}$.

Quite superluminal, right?
At a subluminal velocity!

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[4] If you don't know English understatements: It's completely absurd and totally wrong, stupid knob! That's how a Dutchman would say it. We turn there no dookies around and sag it right for his rape.

[5] Did ***YOU*** 👊 learn how to do that?

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Addendum 2026-07-13

Conventional view:

Because *Lorentz contraction* approaches *nought*
when a ***body***'s *velocity* tends to the *speed of light*,
light **would** — from its own perspective — perceive
a *travelled distance* equal to **diddly squat, zilch**,
implying it also perceives **zero** *travel time*.

BUT...

didnt we just derive that
the *Lorentz factor* of *light* equals **2**;
the *Lorentz factor* of *light* equals **2**;
the *Lorentz factor* of *light* equals **2**?

The *Lorentz factor* of *light* equals *TWO*!
The *Lorentz factor* of *light* equals *TWO*!

Shouldn't it then perceive **HALF** the *distance*
as measured at rest, hence **HALF** the *travel time*
of what a stationary observer observes when observing
the observed light he's observing in the observatory
where he's observing his observations of the
observable part of the observable universe?

In https://henk-reints.nl/astro/HR-Hubble-Lemaitre-slideshow.pdf ,
I **deduced from ascertained thruths**
(Newton's 1st & Einstein's 2nd to be specific)
we **CANNOT** ever look further back in
time than **HALF** the *Hubble time*
(in the stationary's frame; in the obs'd obj.'s *proper time*, the
proper lookback time is even less, having a maximum of $t_H/(3\sqrt{3})$).

However, I've not (yet) investigated if there might exist some kind
of connection between these two appearances of the same value.
Maybe it's one of those things that appear to be extremely obvious AFTER
having travelled a long and complicated path making many wrong turns...

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Addendum 2026-08-25

Time as perceived by light.

Suppose some light is emitted at: ν_{em}

& the ultimate observer and the light source have a mutual velocity of: $v = \beta c$

In this obs.'s frame, it'll oscillate at: $\nu_{obs} = \nu_{em}\sqrt{\frac{1-\beta}{1+\beta}}$ (rel. Doppler eff.)

Suppose a total light travel distance of: r
as perceived in the observer's frame.

Light travel time in observer's frame: $\Delta t_{obs} = \frac{r}{\nu_{obs}} = \frac{r}{\nu_{em}}\sqrt{\frac{1+\beta}{1-\beta}}$

Then the total no. of oscillations during the light's journey must be: $N = \Delta t_{obs}\nu_{obs}$

IF this light, in its own frame, continually oscillates at: ν_{em}

then it must perceive a travel time of:

$$\Delta t_{lgt} = \frac{N}{\nu_{em}} = \frac{\Delta t_{obs}\nu_{obs}}{\nu_{em}}$$
$$= \frac{1}{\nu_{em}}\frac{r}{\nu_{em}}\sqrt{\frac{1+\beta}{1-\beta}}\nu_{em}\sqrt{\frac{1-\beta}{1+\beta}}$$
$$= \frac{r}{\nu_{em}} = \frac{r}{\nu_{obs}}\sqrt{\frac{1-\beta}{1+\beta}} > 0$$

Hence, it would be the travel time as perceived by the observer, contracted by their mutual reciprocal Doppler factor.

It is totally **WRONG** that **light** would experience **zero travel time!**

Admittedly, the above ***presumes*** light keeps oscillating at the emitted frequency.

One might also say: No Henk, "a point of light" cannot & does not oscillate, since it is "surfing" the light wave and will continually stay in the very same phase, not perceiving any change at all, suggesting *full absence of the whole concept of time*, including ***any*** time span (be it zero or more). This obviously falsifies the derivation above.

One might also state it must perceive a time contraction by a factor of **TWO**, the ***Lorentz factor*** of **light**, which would **neither** yield **zero travel time!**

One might also recognise that **light** has nothing by which it could perceive itself, hence stop asking silly & irrelevant questions about meaningless & inapplicable things that merely are thoughts, fabrications, concoctions. Crotcheteer!

Does ***time*** apply at all to **light** itself, or only to **bodies** emitting/receiving it**?**

It certainly is totally **WRONG** to think **light** has an ***infinite Lorentz factor!***

Infinity has always been, currently is & will forever be **unattainable!**

The *Lorentz factor* (= dimensionless *specific total energy*) of **light** equals **TWO!**

This factor does not appear in the above calculation, which seems logical to me.

It is a **serious mistake** to handle **light** as if it were a **body!**

Apples & oranges!

The universe consists of protons, neutrons, electrons & astronomorons...

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