Gravitational time dilation: $\Delta t_{\text{distant}} = \Delta t_{\text{grav}}\gamma_{\text{grav}} = \Delta t_{\text{prop}}\gamma_{\text{grav}}$

Kinematic time dilation: $\Delta t_{\text{stat}} = \Delta t_{\text{mov}}\gamma_{\text{kin}} = \Delta t_{\text{prop}}\gamma_{\text{kin}}$

Equivalence Principle: $\boldsymbol{\gamma_{\text{grav}} = \gamma_{\text{kin}}} = \frac{c}{\sqrt{c^2-v^2}}$

Precondition: $v_{\text{stat}} = v_{\text{distant}} = 0$

renders: $\Delta t_{\text{stat}} = \Delta t_{\text{distant}} =: \Delta t_{\text{inert}}$

Therefore: $\Delta t_{\text{inert}} = \Delta t_{\text{prop}}\gamma_{\text{kin}} = \frac{c\Delta t_{\text{prop}}}{\sqrt{c^2-v_t^2}}$ [$]

Acceleration[1]: $a_{\text{inert}} = \frac{a_{\text{prop}}}{\gamma_{\parallel}\,\gamma_{\text{tot}}^2}$

yields[2]: $\frac{v_t}{c} = \frac{a_{\text{prop}}t_{\text{inert}}/c}{\sqrt{1+a_{\text{prop}}^2 t_{\text{inert}}^2/c^2}}$

hence: $v_t = \frac{a_{\text{prop}}t_{\text{inert}}}{\sqrt{1+a_{\text{prop}}^2 t_{\text{inert}}^2/c^2}} = \frac{c\,a_{\text{prop}}t_{\text{inert}}}{\sqrt{c^2+a_{\text{prop}}^2 t_{\text{inert}}^2}}$

i.e.: $v_t^2 = \frac{c^2 a_{\text{prop}}^2 t_{\text{inert}}^2}{c^2+a_{\text{prop}}^2 t_{\text{inert}}^2}$

Using [$], this becomes: $v_t^2 = \frac{c^2 a_{\text{prop}}^2 \frac{c^2 t_{\text{prop}}^2}{c^2-v_t^2}}{c^2+a_{\text{prop}}^2\frac{c^2 t_{\text{prop}}^2}{c^2-v_t^2}} = \frac{c^2 a_{\text{prop}}^2 \frac{c^2 t_{\text{prop}}^2}{c^2-v_t^2}}{\frac{c^2(c^2-v_t^2)}{c^2-v_t^2}+a_{\text{prop}}^2\frac{c^2 t_{\text{prop}}^2}{c^2-v_t^2}}$

hence: $v_t^2 = \frac{c^4 a_{\text{prop}}^2 t_{\text{prop}}^2}{c^4-c^2v_t^2+c^2a_{\text{prop}}^2 t_{\text{prop}}^2} = \frac{c^2 a_{\text{prop}}^2 t_{\text{prop}}^2}{c^2-v_t^2+a_{\text{prop}}^2 t_{\text{prop}}^2}$

therefore: $v_t^2\left(c^2 - v_t^2 + a_{\text{prop}}^2 t_{\text{prop}}^2\right) = c^2 a_{\text{prop}}^2 t_{\text{prop}}^2$

or: $c^2v_t^2 - (v_t^2)^2 + v_t^2 a_{\text{prop}}^2 t_{\text{prop}}^2 = c^2 a_{\text{prop}}^2 t_{\text{prop}}^2$

flipping signs: $-c^2v_t^2 + (v_t^2)^2 - v_t^2 a_{\text{prop}}^2 t_{\text{prop}}^2 = -c^2 a_{\text{prop}}^2 t_{\text{prop}}^2$

renders: $(v_t^2)^2 - \left(c^2 + a_{\text{prop}}^2 t_{\text{prop}}^2\right)v_t^2 + c^2 a_{\text{prop}}^2 t_{\text{prop}}^2 = 0$

so we obtain: $v_t^2 = \frac{c^2+a_{\text{prop}}^2 t_{\text{prop}}^2 \pm \sqrt{\left(c^2+a_{\text{prop}}^2 t_{\text{prop}}^2\right)^2 - 4c^2 a_{\text{prop}}^2 t_{\text{prop}}^2}}{2}$

which is: $v_t^2 = \frac{c^2+a_{\text{prop}}^2 t_{\text{prop}}^2 \pm \sqrt{\left(c^2-a_{\text{prop}}^2 t_{\text{prop}}^2\right)^2}}{2}$

or: $v_t^2 = \frac{c^2+a_{\text{prop}}^2 t_{\text{prop}}^2 \pm \left(c^2-a_{\text{prop}}^2 t_{\text{prop}}^2\right)}{2}$

yielding: $v_t^2 \in \left\{c^2, a_{\text{prop}}^2 t_{\text{prop}}^2\right\}$

The first thereof is unachievable,

leaving us with: $\boldsymbol{v_t^2 = a_{\text{prop}}^2 t_{\text{prop}}^2}$

which seems a ***very trivial*** result of some nice mess I've worked myself through.

Wouldn't the *speed **limit** of light*: $\boldsymbol{v_t^2 < c^2}$ also limit[2]: $\boldsymbol{t_{\text{prop}} < \frac{c}{a_{\text{prop}}}}$?

Isn't this similar to a free fall that ***will*** end after a finite time? Weather, you like it or not...

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[1] See https://henk-reints.nl/astro/HR-Deflection-of-light-and-NewsteinQuilidaTrajectory.pdf

[2] See https://henk-reints.nl/astro/HR-Twin-paradox-slides.pdf, p.106,113 (as of 2026-01-01)

Doesn't this imply the ***universe*** is ***finite***? You ***cannot*** keep accelerating.

Simply using: $s_{\text{prop,max}} = \frac{1}{2} a_{\text{prop}} t^2_{\text{prop,max}}$ yields: $\boldsymbol{s}_{\textbf{prop,max}} = \frac{\boldsymbol{c}^2}{2\boldsymbol{a}_{\textbf{prop}}}$.

Wouldn't this imply: $a_{\text{prop,max}} = \frac{F}{m}\Big|_{\text{max}} = \frac{c^2}{2 s_{\text{prop,max}}} = \frac{c^2}{2D_H} \approx 3.5 \times \mathbf{10^{-10}}$ [m/s² = N/kg]

where: D_H is the *Hubble distance*? 🧐 😲 🤔

Or might *proper distance* be able to *well exceed* the latter? Seems so, seemsn't it?

With [$], we can now say: $\gamma_{\text{acc}} := \frac{\Delta t_{\text{inert}}}{\Delta t_{\text{prop}}} = \frac{c}{\sqrt{c^2 - a^2_{\text{prop}} t^2_{\text{prop}}}}$

where $t_{\text{prop}} = \Delta t_{\text{prop}}$ is since the start of the acceleration (as well as Δt_{inert}).

From the fact that: $\boldsymbol{a}_{\textbf{prop}} = \frac{F_{\text{exerted}}}{m_{\text{prop}}} = \frac{\boldsymbol{F}}{\boldsymbol{m}}$

we obtain: $\boldsymbol{\gamma}_{\textbf{acc}} = \frac{mc}{\sqrt{m^2 c^2 - F^2\, t^2_{\text{prop}}}} = \frac{\boldsymbol{mc^2}}{\sqrt{(\boldsymbol{mc^2})^2 - (\boldsymbol{Fc\Delta t}_{\textbf{prop}})^2}}$

It is the ***mean*** *value* over the time that The Force May Be With You.

It clearly is an *energy* ratio: *rest energy* over the Pythagorean difference of the same and the *work performed* over the corresponding *light travel distance*.

It clearly **depends on** the **time span** during which the (constant!) **force** is **exerted**.

In https://henk-reints.nl/astro/HR-Newstein-corrected.pdf, I found:

$$\boldsymbol{\gamma}_{\textbf{grav}} = \mathbf{1} + \tfrac{1}{2}\sqrt{|\boldsymbol{\mathcal{F}}_{\mathbf{g}}|} = \mathbf{1} + \sqrt{|\boldsymbol{G F}_{\mathbf{g}}/\boldsymbol{c}^4|}\,.$$

Doesn't this indicate acceleration

is definitely not equivalent to gravitation?

Doesn't this *undermine* Einstein's *Equivalence Principle*

suggesting ***free fall*** would be ***equivalent*** to being ***inert***?

Your weight (which ***is*** a *true force*, damn!) is compensated by the resilience of your chair and anything underneath it.

According to **legem tertiam amici mei Isaaci Newtoni**,

a net force equal to *zero*, *nought*, *diddly squat*, *zilch*, *Sweet Fanny Adams* results from this *action & contrary reaction that's always equal* and then **lex eius secunda** says there is ***nullam*** *mutationem in motu*.

In free fall there's just nothing (*no thing*) that can counter the *action* called gravity, so you obviously can't feel any *reaction*. And you *never* ever feel your own weight!

The ***chair*** feels ***your*** *weight* & ***you****(r bottom)* feel(s) the ***chair***'s ***reaction*** *force*.

Standing on your toe, I feel only some hump, but ***YOU*** 👊 HAH HAH hah hah hah ROFL...

https://henk-reints.nl/astro/HR-acceleration-gravitation-geodesic.pdf

HR

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Cosmic truths:

https://henk-reints.nl/u/index.php

Gravitation without the use of tensors:

https://henk-reints.nl/u/notensors.php