# Link between Special relativity and general relativity

Hamid Bassera[1], Freelance.

*Rabat, Morocco*

*17 June 2014*

**Abstract**

**No doubt, there is a continuity of physical laws. Here I show a link between general and special relativity and especially a kind of gravitational trace or signature in a moving frame, means a memorising of initial process.**

Let $R'$ be an orthonormal frame in uniform translation with speed $\vec{V}$ along $Ox$ with respect to a referential $R$. We can consider that $R'$ has instantly gone from the speed $V = 0$ to $V \neq 0$ at certain time $t = 0$ which imply bearing an acceleration, $\vec{\gamma} = \vec{V}\delta(\tau)$ where $\tau$ is $R'$ proper time. At this time $R'$ is subject equivalently to gravitational field φ.

Let $m$ be a fixed mass in $R$, it is view as accelerating one from an observer of $R'$, which means bearing a force $\vec{f} = -m\vec{\gamma} = -m\vec{V}\delta(\tau)$ , which force is equivalently an expression of φ.

It then develops a power $\frac{dw}{d\tau} = \vec{f} \cdot \vec{v}$ where $\vec{v}$ is its velocity in $R'$ and $w$ is its mechanical energy, so

$$\frac{dw}{d\tau} = \vec{f} \cdot \vec{v} = -m\vec{V} \cdot \vec{v}(\tau)\delta(\tau) = -m\vec{V} \cdot \vec{v}(0)\delta(\tau) = mV^2\delta(\tau) \quad \text{for} \quad \vec{v}(\tau)\delta(\tau) = \vec{v}(0)\delta(\tau) = -\vec{V}\delta(\tau)$$

According to energy conservation principle,

$$\frac{dw}{d\tau} = -m\frac{d\varphi}{d\tau} \quad \Rightarrow \quad \frac{d\varphi}{d\tau} = -V^2\delta(\tau) \quad \text{then for any} \quad \tau > 0 \quad \frac{d\varphi}{d\tau} = 0 \quad \text{or} \quad \varphi = \text{Cts} = \varphi^+$$

But things are the same for the observer of $R'$ if the frame has gone opposite direction, in $ox^-$ sense. This case is simply equivalent to inverse time and put $-\vec{V}$ in place of $\vec{V}$ then

$$\frac{d\varphi(-\tau)}{d(-\tau)} = -(-V)^2\delta(-\tau) = -V^2\delta(\tau) = \frac{d\varphi(\tau)}{d\tau} \quad \Rightarrow \quad \text{for any} \quad \tau < 0 \quad \varphi = \text{Cts} = \varphi^-.$$

[1] bh4hamid@gmail.com

Elsewhere

$$\frac{d\varphi(-\tau)}{d(-\tau)} = -\frac{d\varphi(-\tau)}{d\tau} = \frac{d\varphi(\tau)}{d\tau} \quad \Rightarrow \quad \frac{d(\varphi(\tau)+\varphi(-\tau))}{d\tau} = 0 \quad \Rightarrow \quad \text{for any } \tau \quad \varphi(\tau) + \varphi(-\tau) = 0 \quad \Rightarrow \quad \varphi^+ = -\varphi^- = \varphi$$

Conclusion $\begin{cases} \varphi(\tau) = +\varphi & for \;\; \tau > 0 \\ \varphi(\tau) = -\varphi & for \;\; \tau < 0 \end{cases}$

$\lim_{\varepsilon\to 0} \int_{-\varepsilon}^{+\varepsilon} d\varphi = \lim_{\varepsilon\to 0} \int_{-\varepsilon}^{+\varepsilon} -V^2\delta(\tau)d\tau \quad \Leftrightarrow \quad 2\varphi = -V^2$ i.e. an uniform gravitational field $\varphi$ .

We learn from general relativity that for uniform and weak field .

$$\tau = \frac{x_0}{c}\sqrt{1+\frac{2\varphi}{c^2}} = t\sqrt{1-\frac{V^2}{c^2}}$$

This is the exact formula from special relativity of the relation between reference time and proper time.