DISCRETE RELATIVITY

An assumption is done, that matter is made of particles moving at the speed of light.
Then the consequences of this assumption are studied in the context of General Relativity (GR).
What follows is **another equation calculating space-time structure**.
It uses a four-momentum in place of the stress-energy tensor.
It appears that the surrounding effect prevailing in Surrounding [1] *(the other poster untitled « Surrounding: latest developments »)* is in the inner part of this new model.
Then a surrounding effect in the context of particle physics is tried.

Equation:

$$D^\mu(x) = \sum_{n=0}^{\infty} \delta(\|x-y_n\|_3 - x^0 + y_n^0) f(\|x-y_n\|_3) C^\mu(y_n)$$

Now, from $D^\mu(x) = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \frac{E}{c}\left(1, \frac{v_x}{c}, \frac{v_y}{c}, \frac{v_z}{c}\right)$

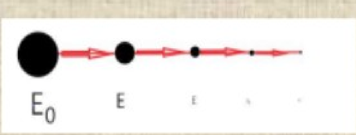
Then the boost is deduced

$$B^\mu_\nu(x) = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \begin{matrix} 1 & -v_x/c & -v_y/c & -v_z/c \\ -v_x/c & 1 & 0 & 0 \\ -v_y/c & 0 & 1 & 0 \\ -v_z/c & 0 & 0 & 1 \end{matrix}$$

and the evolution of the metric $g_{\alpha\beta}(x) = B^\rho_\alpha B^\kappa_\beta S^\mu_\rho S^\nu_\kappa g_{\mu\nu}(x')$

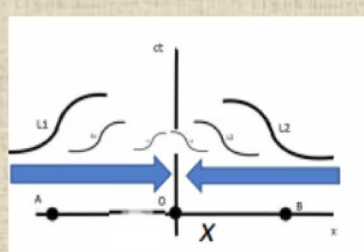
Four momentum of an IP (Indivisible Particle): $D_0^\mu(y) = \frac{E_0}{c}(1,-1,0,0)$

It propagates a *potential* space-time deformation



$D^\mu(y) = \frac{E}{c}(1,-1,0,0)$

Space-time structure is given at each encounter of waves:



what is going on at x location

$$\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \frac{E}{c}\left(1, \frac{v_x}{c}, \frac{v_y}{c}, \frac{v_z}{c}\right) = D_1^\mu(x) + D_2^\mu(x)$$

Invariance break

A boost is deduced at x location

$$B^\mu_\nu(x) = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \begin{matrix} 1 & -v_x/c & -v_y/c & -v_z/c \\ -v_x/c & 1 & 0 & 0 \\ -v_y/c & 0 & 1 & 0 \\ -v_z/c & 0 & 0 & 1 \end{matrix}$$

Privileged frame

$$g_{\alpha\beta}(x) = B^\rho_\alpha B^\kappa_\beta S^\mu_\rho S^\nu_\kappa g_{\mu\nu}(x')$$

When it comes to physics :

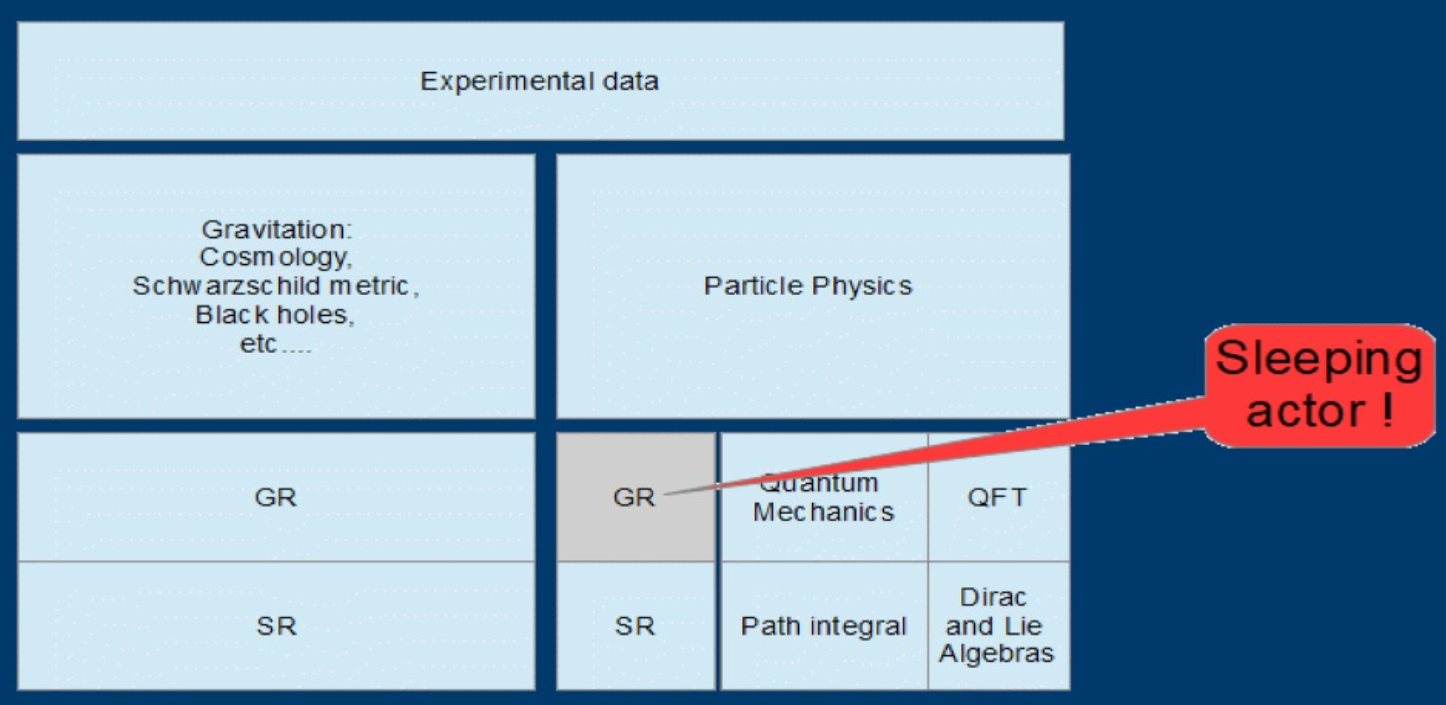
- The specification of the waves is tough
- A discrete model is mandatory
- Passing from the discrete model to the continuous macroscopic metric is
  - Complicated
  - Not completed yet
  - Similarities with the path integral

Nevertheless from a mathematical perspective,

- The **surrounding behaviour** of the model will remain the **fondamental behaviour** whatever the physics will tell.
- Because :

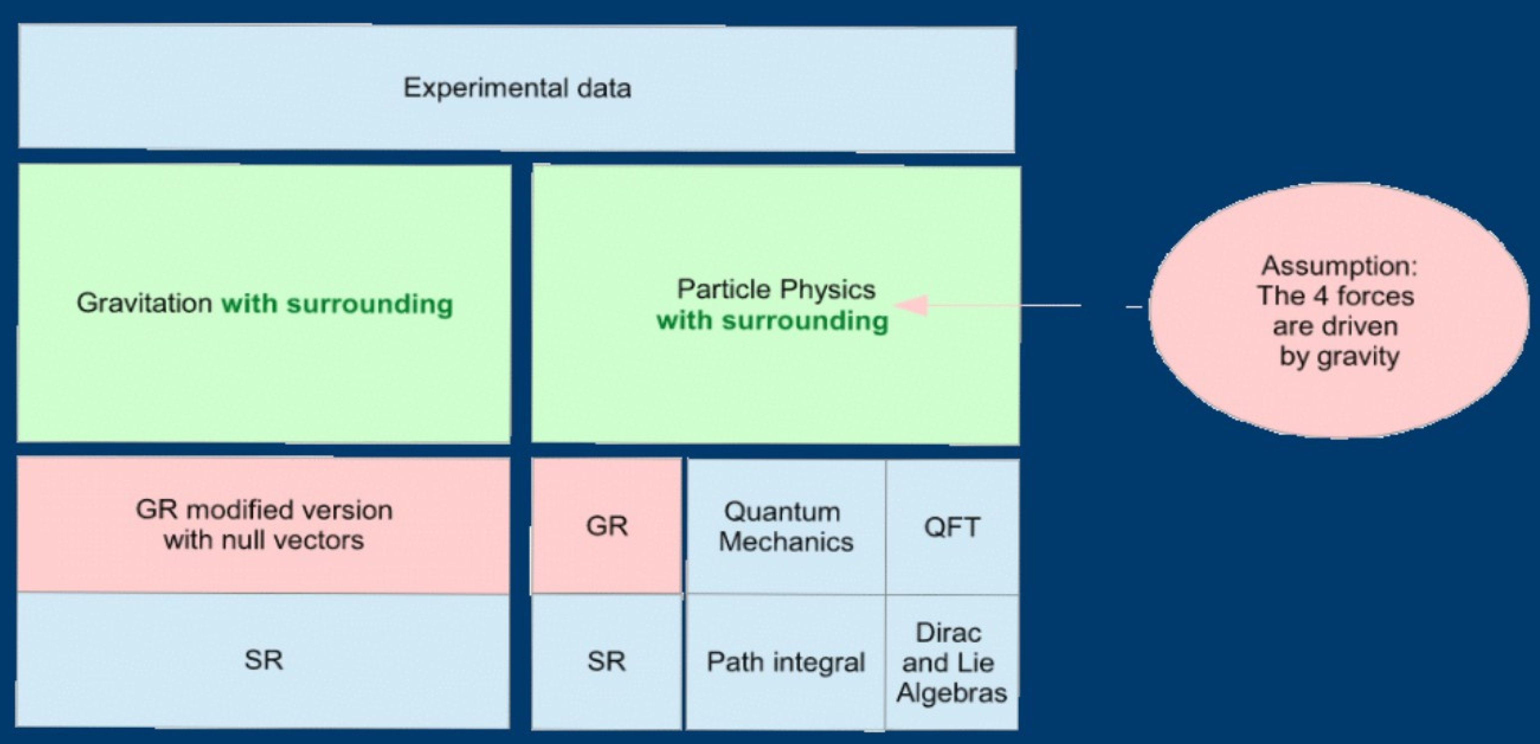
$$\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\left(1, \frac{v_x}{c}, \frac{v_y}{c}, \frac{v_z}{c}\right) = \frac{D^\mu(x)}{E/c} = \frac{\sum_{n=0}^{\infty} \delta(\|x-y_n\|_3 - x^0 + y_n^0) f(\|x-y_n\|_3) C^\mu(y_n)}{\sum_{n=0}^{\infty} \delta(\|x-y_n\|_3 - x^0 + y_n^0) f(\|x-y_n\|_3) E(y_n)/c}$$

- The today's picture contain a **sleeping actor** :



2 modifications

Consequences



Consequences in the domain of gravitation

Surrounding equation :

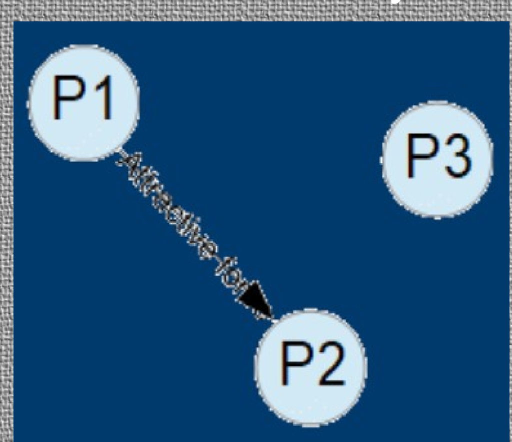
$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \frac{8\pi G}{c^4} C^l_\mu C^m_\nu T_{lm}$$

What is this $C^l_\mu C^m_\nu$ « surrounding » factor ?

- Matter density at the location where the force is exerted.
- It depends of the scale.
- Astrophysic scale → calculated in the 15 kpc ray sphere.

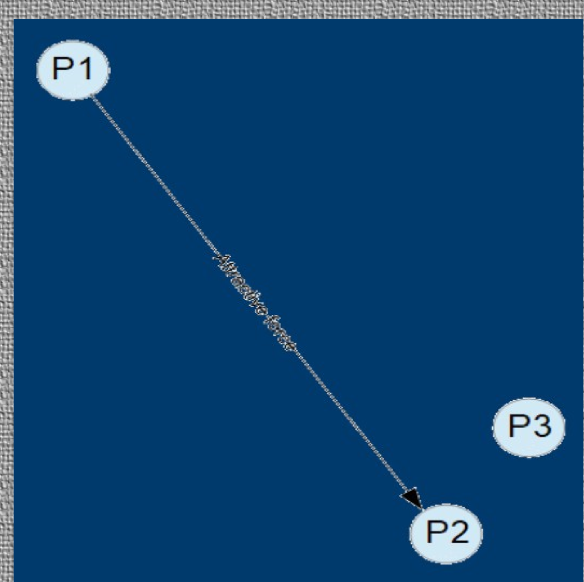
- **Consequences** in the domain of particle physics
  - Surrounding effect prevails.
  - It does **not** manifest itself in a **2 body (baryons)** interaction :
    - Electromagnetism
    - Weak interaction
  - It manifests itself **only** in a **3 body** interaction :
    - Strong force
  - The result is confinement and mass gap :
    - an increase of the strong force,
    - only this force,
    - with distance.

P1 is attracted by P2 :



P3 particle **is in** the surrounding of P1 : the surrounding factor is weak

The strong force is **weaker**



P3 particle **is NOT in** the surrounding of P1 : the surrounding factor is strong

The strong force is **stronger**

[1] Surrounding matter theory, Frederic Lassiaille, EPJ Web Conf., 182 (2018) 03006
See the other poster untitled « Surrounding: latest developments »

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