SURROUNDING and RELATIVITY IN MOTION

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I. Introduction

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Relativity in motion: old versions

Old versions :

Gravitational model of the Three Elements Theory
Gravitational Model of the Three Elements Theory: Formalizing
Surrounding Matter Theory: First Mathematical Developments
Discrete Relativity

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II. Motivation

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Motivation

Possible caveats in relativity :

- Scale variation of Einstein equation
- Mach's principle
- Loss of information in a stress-energy tensor
- Retardation of gravitational interaction
- Speed of quarks not taken properly into account

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Motivation (following)

Speed of quarks not taken into account

- Mistake due to a too quick reasoning : $E = mc^2$

Consequences :

- No possible interaction retardation
- *G* is allowed to be constant
- *(Gravitational « dark matter » and « dark energy » mysteries)*

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III. Relativity in motion

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Correction

Let's take into account the speed of quarks

- $E = mc^2$ => their mass contain their energy of motion
- NOT THE END OF THE CONSEQUENCES !
  - Quarks generate microscopic gravitational waves (GW)
  - Space-time is full of such GW !

In details ?

- Retardation of gravitational interaction
- Cumbersome calculations in GR

→ Let's search for a simpler equation in GR

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Reminders about GR

First reminder : privileged frame of relativity

- Frame in which time elapses the most
- Generalization: frame in which there is matter attached to
- Interpolation: the privileged frame

Second reminder : boost transforming the privileged frame

A particle in motion at the *v* speed in a Minkowskian flat space-time gets a ***four momentum***

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

from which is deduced the *boost* describing the local space-time deformation

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

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Resulting equation

Resulting equation relating energies of the microscopic gravitational waves :

Equation:

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

where :

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

$$C^{\mu}(y_n) = \frac{E(y_n)}{c} \left(1, \frac{c_x}{c}, \frac{c_y}{c}, \frac{c_z}{c}\right)$$

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

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

and the evolution of the metric

$$g_{\alpha\beta}(x) = B_{\alpha}^{\rho} B_{\beta}^{\kappa} S_{\rho}^{\mu} S_{\kappa}^{\nu} g_{\mu\nu}(x')$$

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Features of this equation

This equation is an approximation of what is going on in GR after the correction :

- Mean space-time structure is given by this equation (...)
- This equation is
  - scalable,
  - does not use the *G* constant,
  - is much simpler that Einstein equation.

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GR after the correction: how to calculate

Different ways to calculate what is going on in GR under the correction:

- Using the equation relating the GW energies,
- Using Einstein equation and the value of *G* given by:

$$G_{new\ case} \simeq G_{solar\ system} \left(\frac{\sum_{n=0,solar\ system}^{\infty} 1_w(x, y_n) \sqrt{\frac{C^0(y_n)}{\|x-y_n\|_3}}}{\sum_{n=0,new\ case}^{\infty} 1_w(x, y_n) \sqrt{\frac{C^0(y_n)}{\|x-y_n\|_3}}} \right)^2$$

- Using GR lagrangian in vaccum for any complicated case.

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Back to motivation

The possible caveats of relativity mentionned above are solved:

- Scale invariance solved
- Mach's principle solved
- Loss of information in a stress-energy tensor solved
- Retardation of gravitational interaction solved
- Taking into account properly the speed of the quarks solved

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Consequence in gravitation

- This correction implies → microscopic scale
- Gravitation → macroscopic scale

  Many ways of constructing a gravitational model with **surrounding behaviour:**

  - Shape of the surrounding ?
  - Surrounding gravitational model:
    - shape is a 15 kpc ray sphere with a door profile

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IV. Surrounding

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Surrounding
(old name : Surrounding Matter Theory)

GR equation is modified using the **surrounding matter** at the location where the force is **exerted** :

Surrounding equation :

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \frac{8\pi G}{c^4} C^{\iota}_{\mu} C^{\varpi}_{\nu} T_{\iota\varpi}$$

What is this $C^{\iota}_{\mu} C^{\varpi}_{\nu}$ 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.

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Surrounding non relativistic equation of motion

$$\Phi = -\frac{MG}{x}\frac{\alpha_0\rho_0 + \rho_{u0}}{\alpha\rho + \rho_u}$$, ← an « equivalent G » arises

with $\alpha = \alpha_0 = 1.6\,10^{-5}$ inside of galaxies,

and $\alpha = 1$ outside of any galaxy.

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Surrounding

Appears to solve the following gravitational mysteries:

- Galaxy cluster virial theorem
- Galaxy speed profiles
- Ring galaxies
- Dwarf galaxies
- Bullet cluster
- Large scale structure
- Cosmology: exponentional (« de Sitter »...) universe : acceleration of expansion q=-1, space curvature k=0, fine tuning, horizon, age of the universe 100 Gyr
- Upper limits of matter densities
- ...

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galaxy structure using Surrounding

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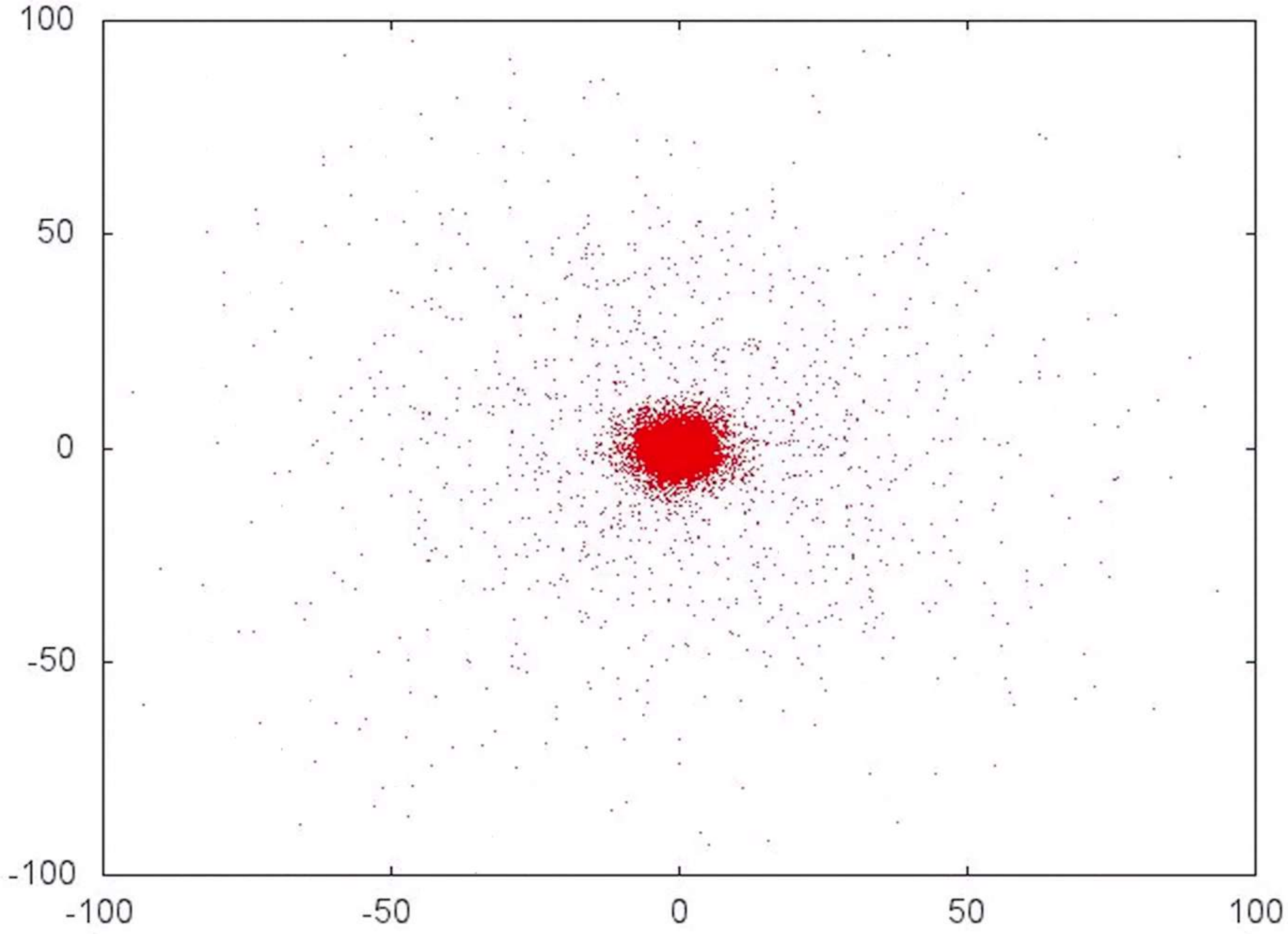

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V. Back to theory

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Back to theory: a reminder : process from Lagrangian to Einstein equation

Process from Lagrangian to Einstein equation :

$$\delta S_H = \int d^n x \sqrt{-g} \left[R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} \right] \delta g^{\mu\nu}. \qquad \frac{1}{\sqrt{-g}} \frac{\delta S_H}{\delta g^{\mu\nu}} = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = 0.$$

In vaccum : $S = \frac{1}{16\pi G} S_H + S_M,$ **This equation is an arbitrory assumption**

In the general case : $\frac{1}{\sqrt{-g}} \frac{\delta S}{\delta g^{\mu\nu}} = \frac{1}{16\pi G} \left(R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} \right) + \frac{1}{\sqrt{-g}} \frac{\delta S_M}{\delta g^{\mu\nu}} = 0.$

A constant G value is fitted to solar system experimental data.

Weather the process suggests a variable G. **First argument**

Equations extracted from S. Carroll, *Space time and geometry, An introduction to General Relativity,* San Francisco: Addison-Wesley, 2004.

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Comparison of the old « matter at rest » and new « matter in motion » assumptions

	Old assumption		New assumption
Regular matter if constant surrounding	Same macroscopic result ← **Second argument**		
G	A constant *G* is predicted		A variable *G* is calculated
Predicted universe	Different *G* values can exist, at distant locations without any theoretical contradiction		*G* is a calculated variable implying a surrounding effect
Calculations of *G*	Impossible		Required to be calculated, and actually calculated
Theoretical result	Inconsistent result ← **Third argument**		Consistent result

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Back to theory: conclusion

The process from Lagrangian to Einstein equation

Shows that « energy *must* be supposed to be at rest ».

This means that:

in GR local space-time deformations are fundamentally relative to something else more global.

By the way this is already the case in the Poisson's formulation of Newton's law from which Einstein is only the relativity version.

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VI. An insight into particle physics

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Particle physics is modified under 2 assumptions

Matter is composed of « amounts of energy » allways moving at the speed of light

Those « amounts of energy are NOT new particles

They do not interact with particles

Each particles of standard model are composed of them

Even quarks

The four forces are unified by gravitation

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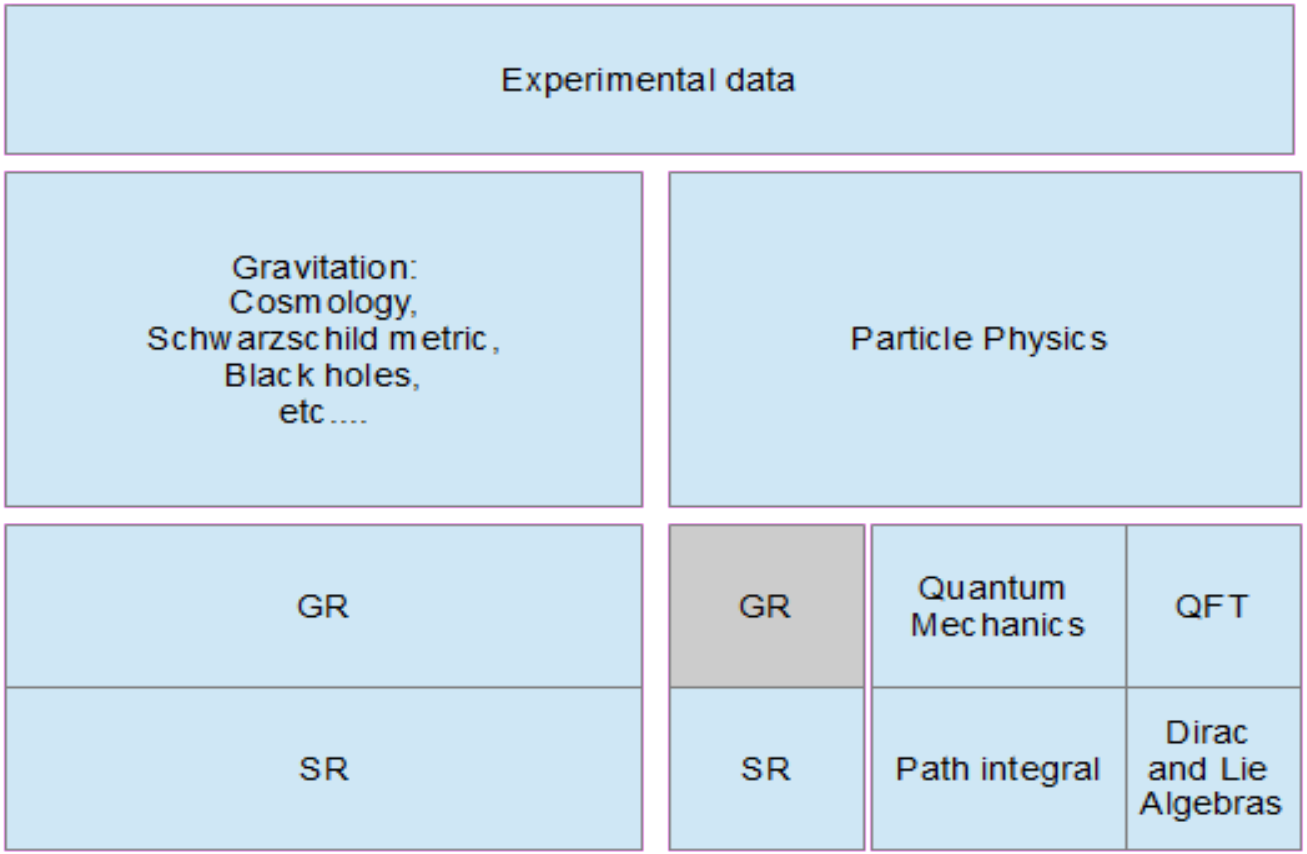
Consequence of those two assumptions in particle physics

- Reminder of today's picture :



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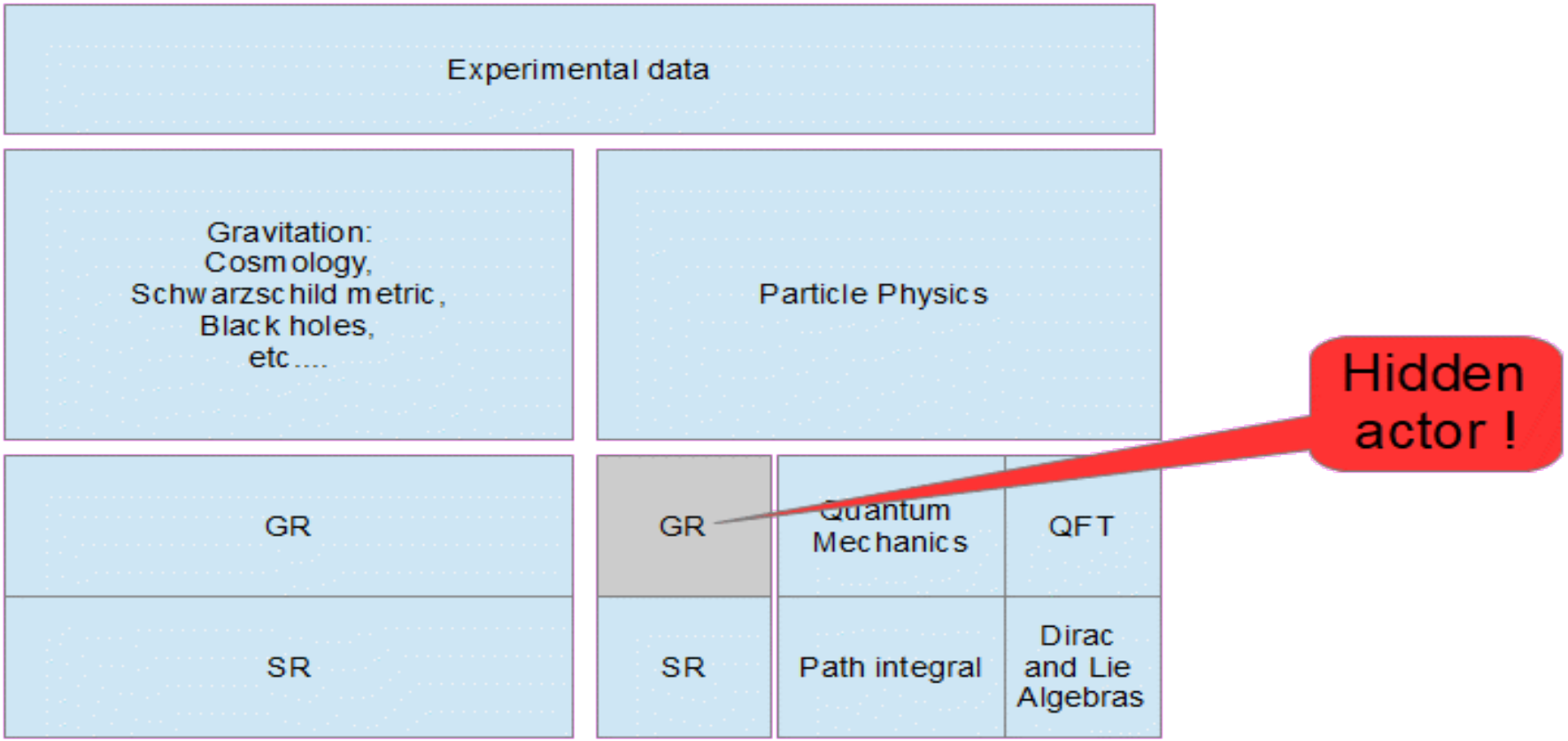
Consequence in particle physics

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



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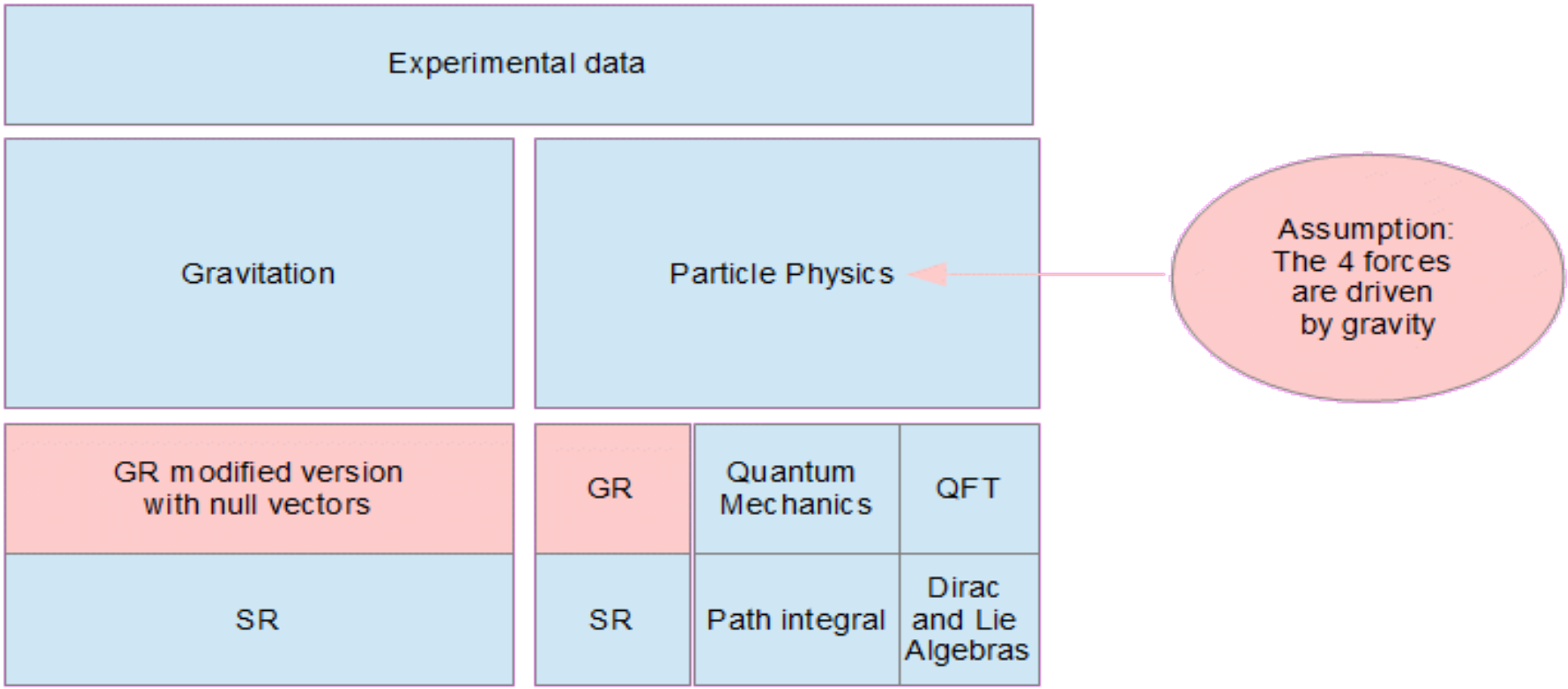
Consequence in particle physics

- **2 modifications :**



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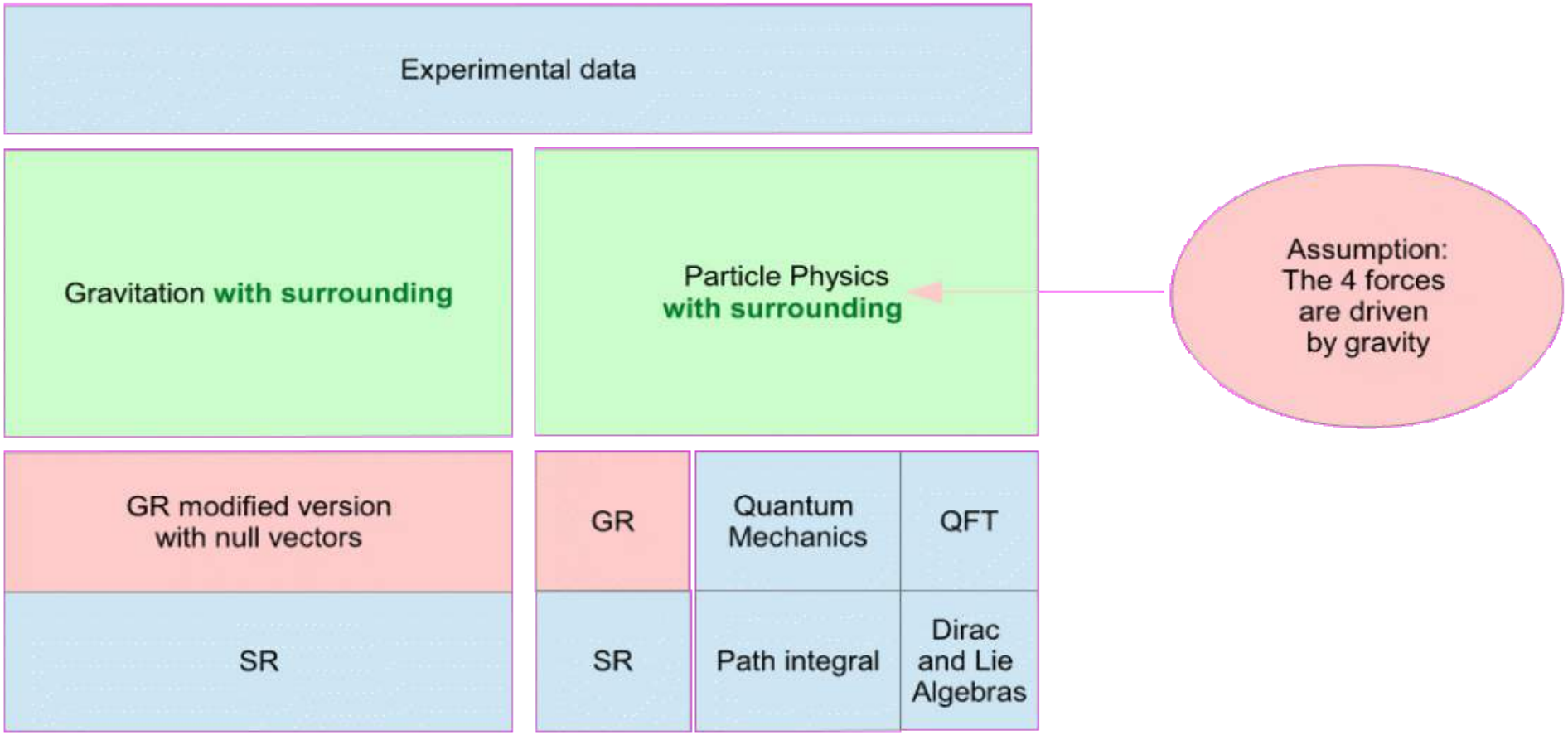
Consequence in particle physics

- **Consequences**



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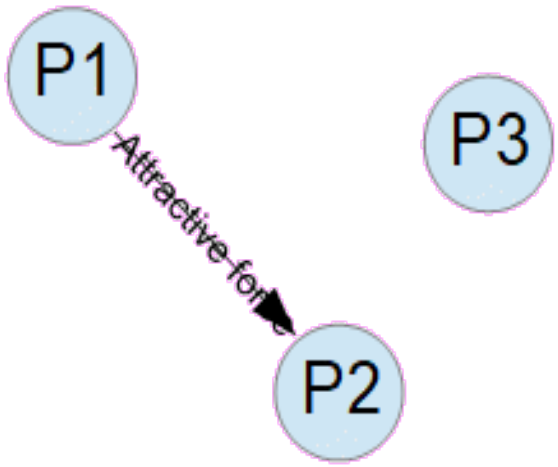
Consequence in particle physics

- Attractive force from P1 to P2 is weak because P3 is in the surrounding of P1



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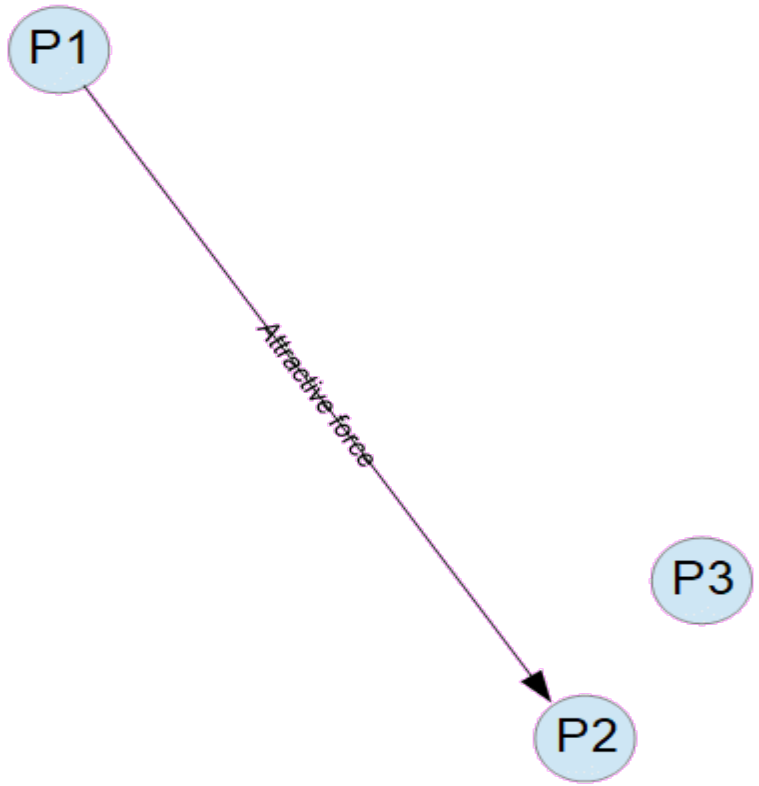
Consequence in particle physics

- Attractive force from P1 to P2 is stronger because P3 is no longer in the surrounding of P1



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Consequence in particle physics. Modification in the calculations

- The surrounding factor multiplies ***g***, the coupling factor

$\mathcal{L}_{\text{gf}} = -\frac{1}{2}\,\text{Tr}(F^2) = -\frac{1}{4}F^{a\mu\nu}F^{a}_{\mu\nu}$ unmodified $\quad (D^\mu F_{\mu\nu})^a = 0.$ unmodified

$D_\mu = I\partial_\mu - igT^a A^a_\mu,$ **Modified because *g* is modified** $\quad (D^\mu F_{\mu\nu})^a = 0.$ unmodified

$F^a_{\mu\nu} = \partial_\mu A^a_\nu - \partial_\nu A^a_\mu + g f^{abc} A^b_\mu A^c_\nu$ **Modified because *g* is modified**

- What remains to describe is this surrounding energy:
  - *ray R of the sphere ?* *R<nucleus_ray,* *but what more ?*
  - *Shape of the surrounding sphere (window, triangular, cos² shaped) ?*

Must be fitted to experimental data :

- The ray of a windowed sphere first
- Then more complicated things if required

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VII. Final picture

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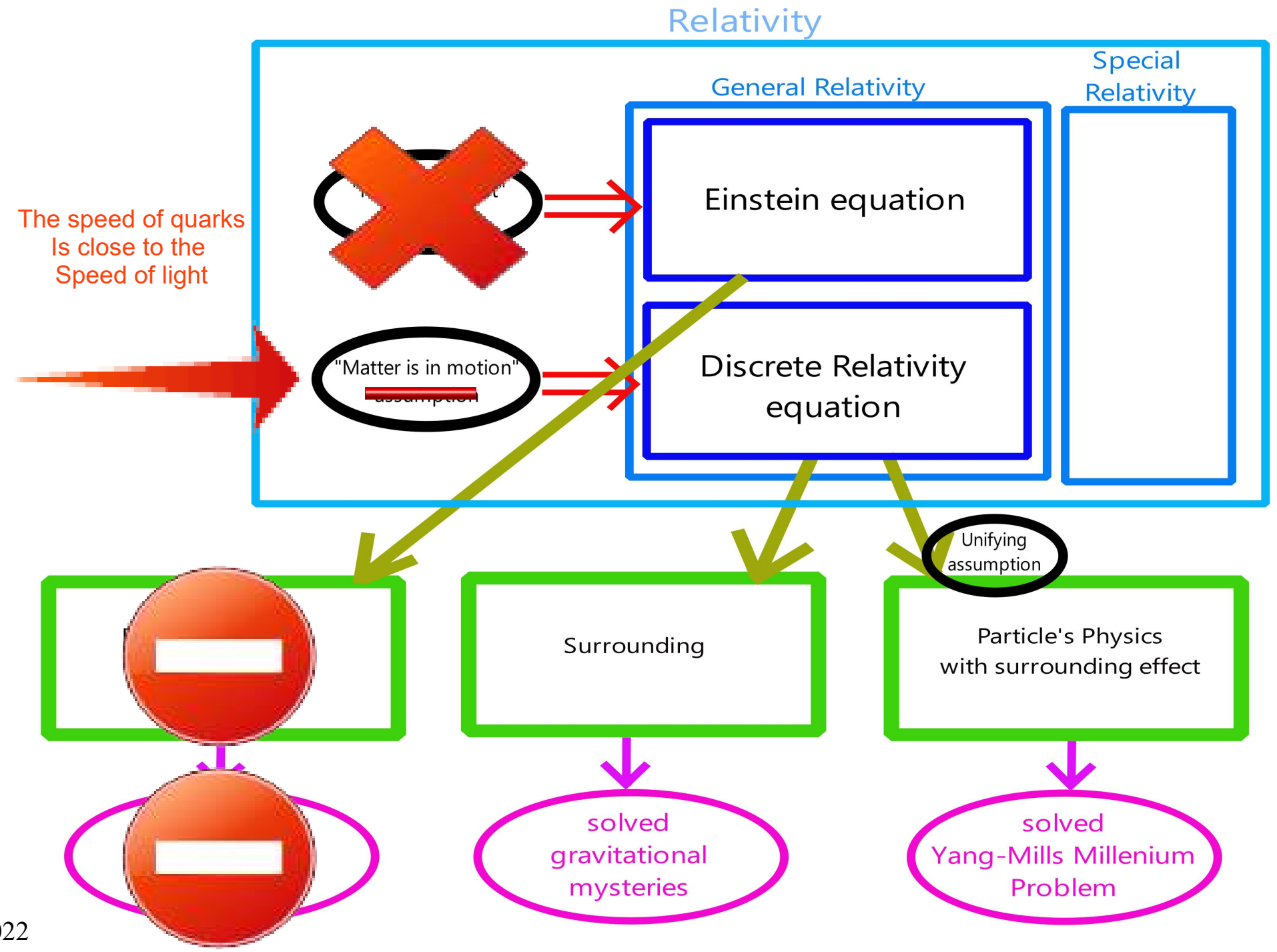
Final picture



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VIII. Next to come

Testing the Surrounding effect in collaboration with experimental physicists:

- Astrophysical scale : testing Surrounding,
- Microscopic scale : testing the surrounding effect in particle physics

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VIII. Conclusion

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Conclusion

Today energy of motion inside matter is discarded.

- But FACT: energy of motion is far greater than energy at rest
  - Speed of the quarks.
  - Are particles solid blocks of matter?
- $E = mc^2$ suggests that this FACT implies no modification
  - Wrong suggestion

Fixing this mistake:

- gravitational mysteries are explained
- Millenium Yang-Mills problem is explained under two coherent assumptions.

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Detailed conclusion

The speed of quarks must be handled specifically

- is required by 3 theoretical arguments
- The calculations in GR are handled by :
  - Conservation of GR lagrangian in vaccum when calculations are possible.
  - Einstein equation using *G* value given by energy equation in either cases.

Result:

- For gravitation, → **Surrounding** (Surrounding gravitational model) :

  appears to solve the « dark matter and dark energy » mysteries
- For Particle Physics, under two coherent assumptions:

  → **suggests a solution to the Yang-Mills Millenium Problem**

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Thank you for your attention !

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