The Re-Physicalization of Physics

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Hamburg, Germany

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Contents

Problems of Present Physics

- **Quantum Gravity**
  String theory? → ~ 10^{500} solutions
- **Cosmological constants:**
  ~ 10^{100} Uni-(Multi)verses necessary?
- **Inflation**: Increase of scale by ~ 10^{50}
- **Gravity**: Dark Matter, Dark Energy, Pioneer anomaly

L. Susskind (2006):

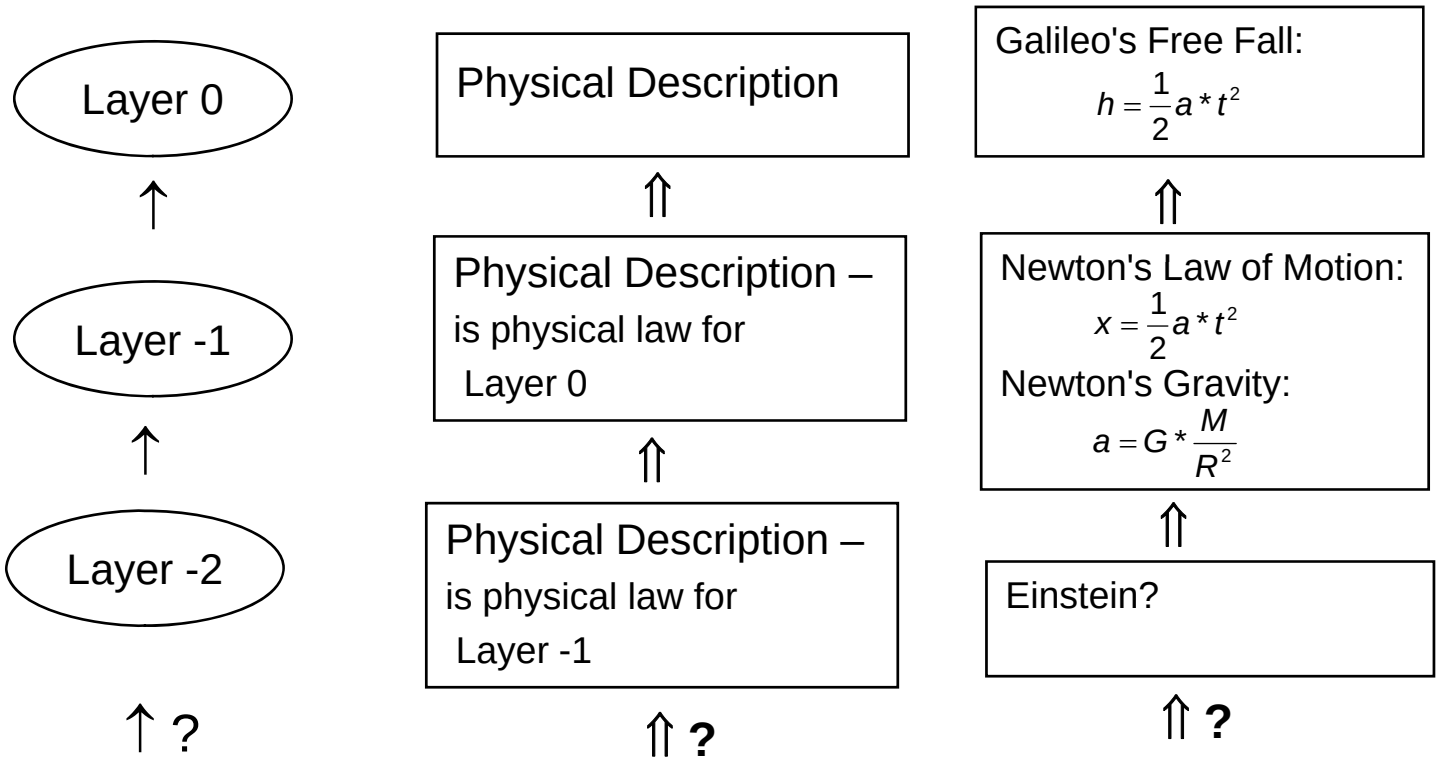
Present physics is at a dead end to such an extend,

that we ought to go back ~ 2500 years – before Aristotle

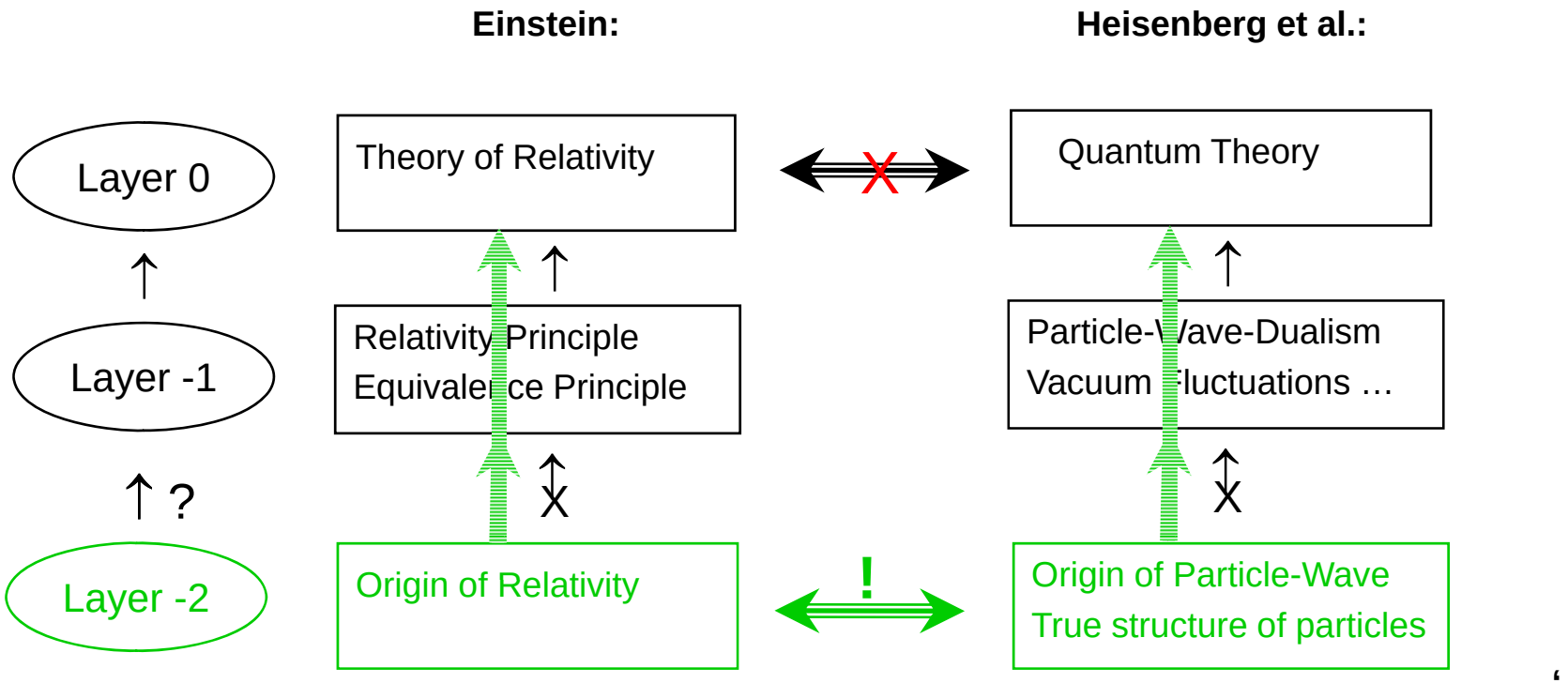
and start again from the beginning!

Contents

Reductionism

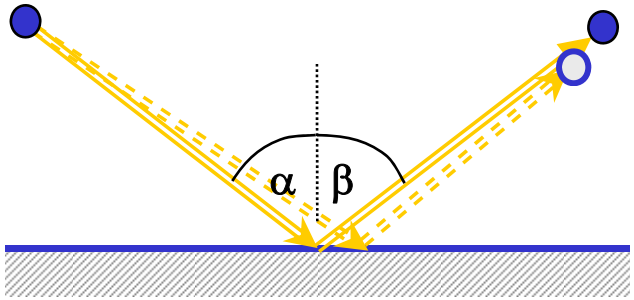


Reductionism truncated



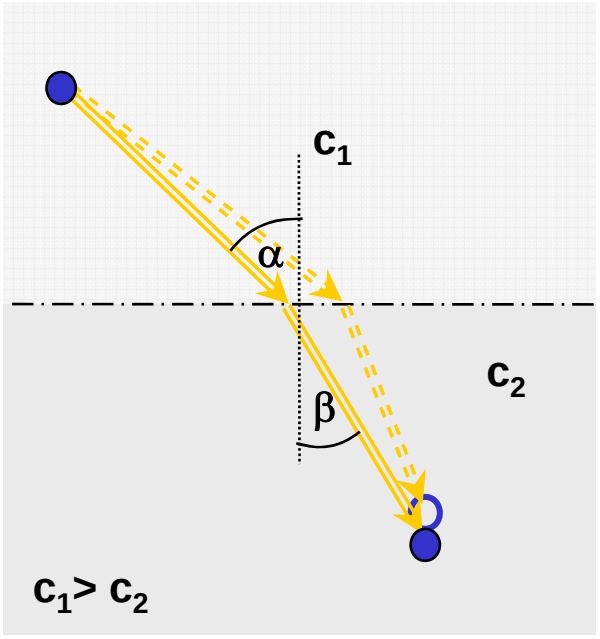
Contents

Fermat: The Principle of minimum time

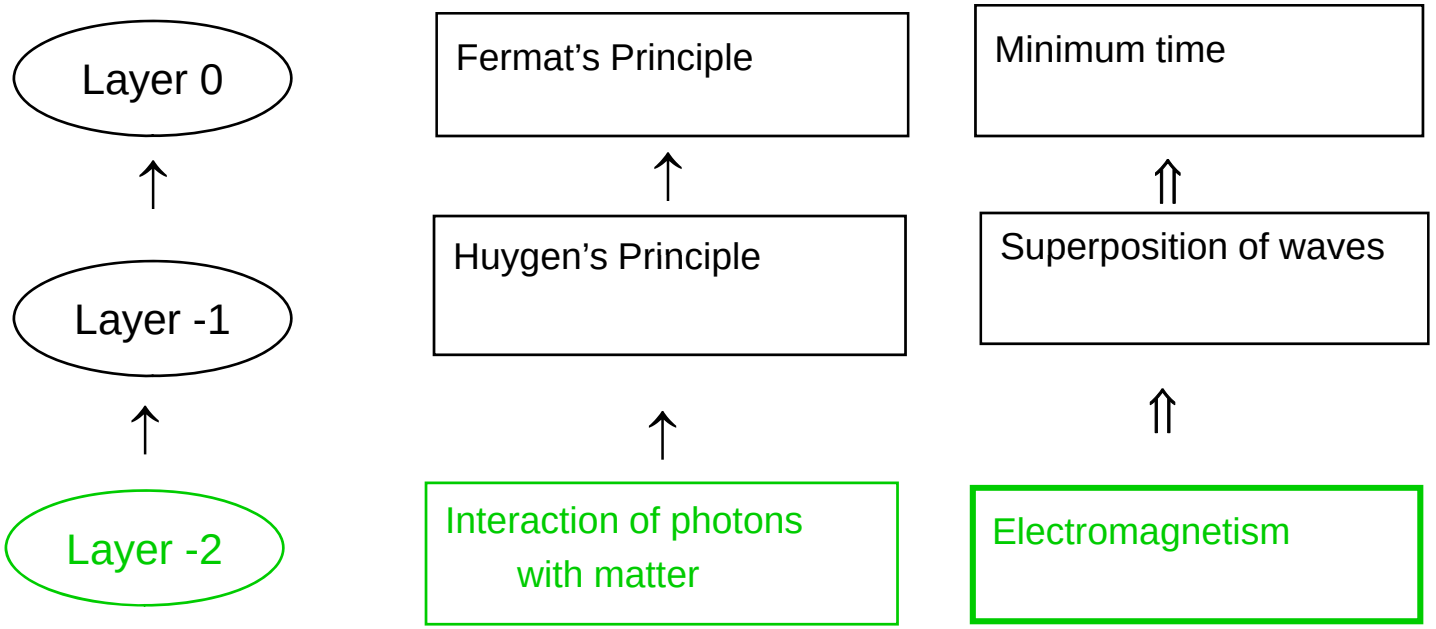


$\alpha = \beta$

$$\frac{\sin\alpha}{\sin\beta} = \frac{c_1}{c_2}$$



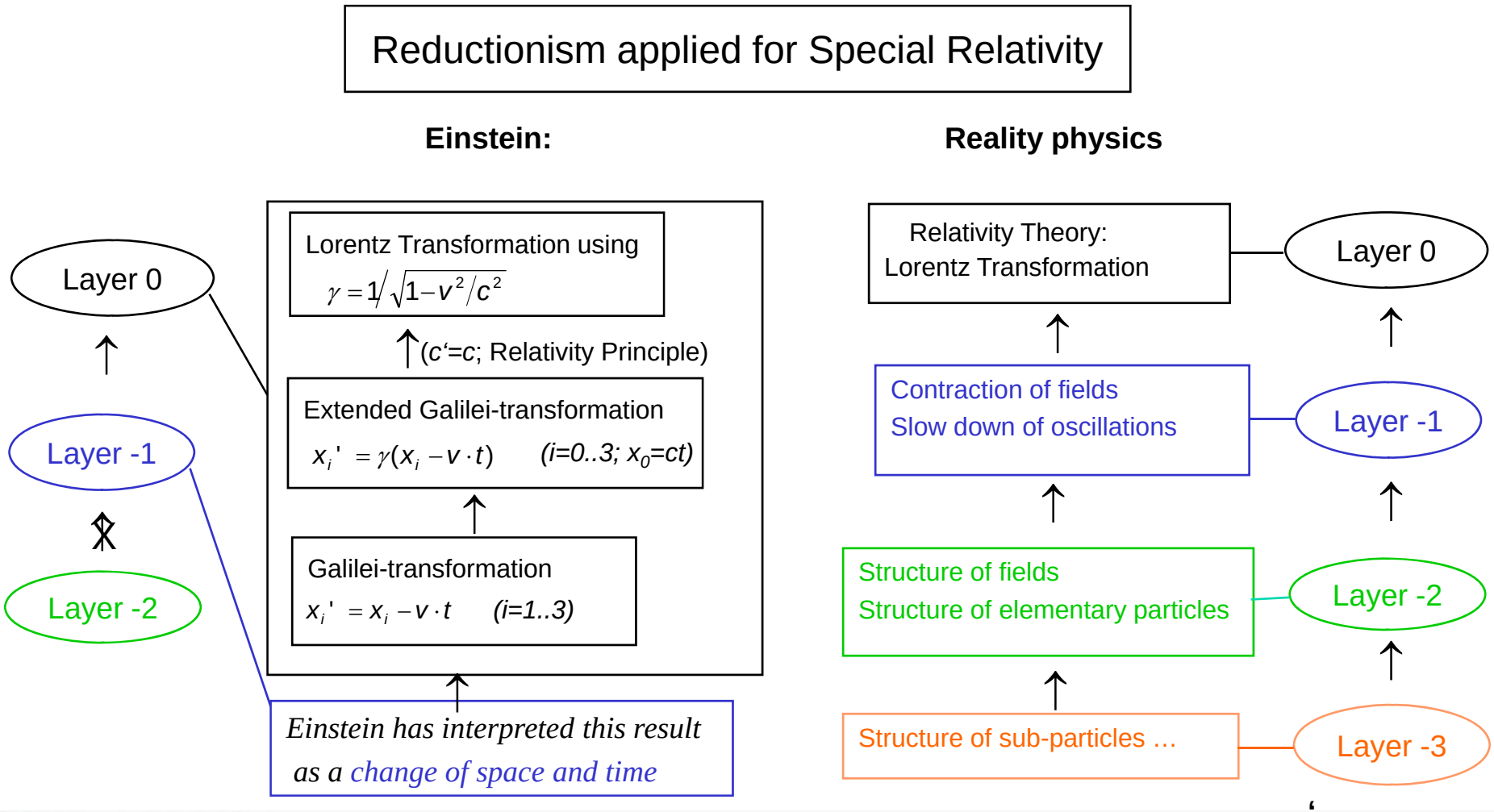
Reductionism for Fermat



We can understand the way down from Fermat to Electromagnetism as a way from a principle to Physical Reality

Contents

Reductionism applied for Special Relativity



The Elements of Special Relativity

- Contraction *Lorentz*
- Dilation *Structure of matter*
- Increase of Mass *Origin of mass*
- Energy-Mass Relation $E = m \cdot c^2$

Contraction:

Contraction of fields → of objects

was given by Hendrik Lorentz

- is a general property of all kinds of fields -

$$d \rightarrow d' = \frac{1}{\gamma} * d$$

$$\gamma = 1 / \sqrt{1 - \frac{v^2}{c^2}}$$

‘

Structure of an Elementary Particle: History of the internal motion

1908: J. Ziegler — *Motion at c within an 'atom'*

1924: L. de Broglie — *Internal oscillation causes 'matter waves'*
frequency: $\nu = E / h$

1928: P. Dirac — *Relativistic QM-function of the electron:*

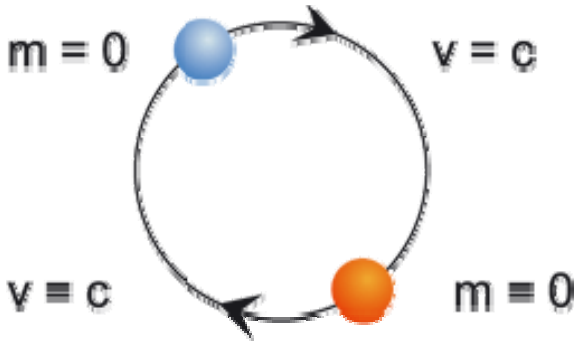
$$H\psi(x,t) = i\hbar \frac{\partial \phi(x,t)}{\partial t}$$

1930: E. Schrödinger — *Evaluation of the Dirac Function:*

$$x_k(t) = x_k(0) + c^2 p_k H^{-1} t + \underbrace{+\frac{1}{2} i\hbar c H^{-1}(\alpha_k(0) - c p_k H^{-1})(e^{-2iHt/\hbar} - 1)}_{\text{zitterbewegung}}$$

"Zitterbewegung" (Schrödinger) Completed ⇒

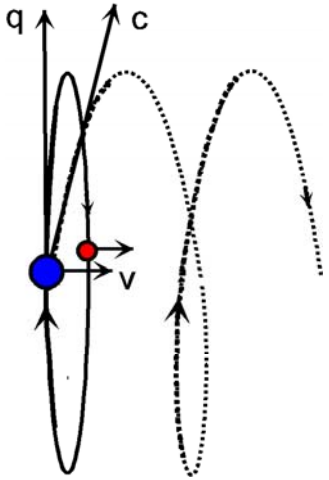
Structure of an Elementary Particle:



$\nu = E / h$	*(de Broglie 1924)*
$v = c$	*(Dirac / Schrödinger 1928/30)*
orbit	*(Spin, mag. moment)*
$N = 2$	*(Momentum law)*
$m = 0$	*(Relativity)*

No conflict with the electron experiments

Dilation:



$q^2 = c^2 - v^2$ **Pythagoras**

$T = 2\pi R/c$

$T' = 2\pi R/q$

$$\gamma = \frac{T'}{T} = \frac{c}{q} = 1/\sqrt{1-\frac{v^2}{c^2}}$$

i.e. the Lorentz-Factor

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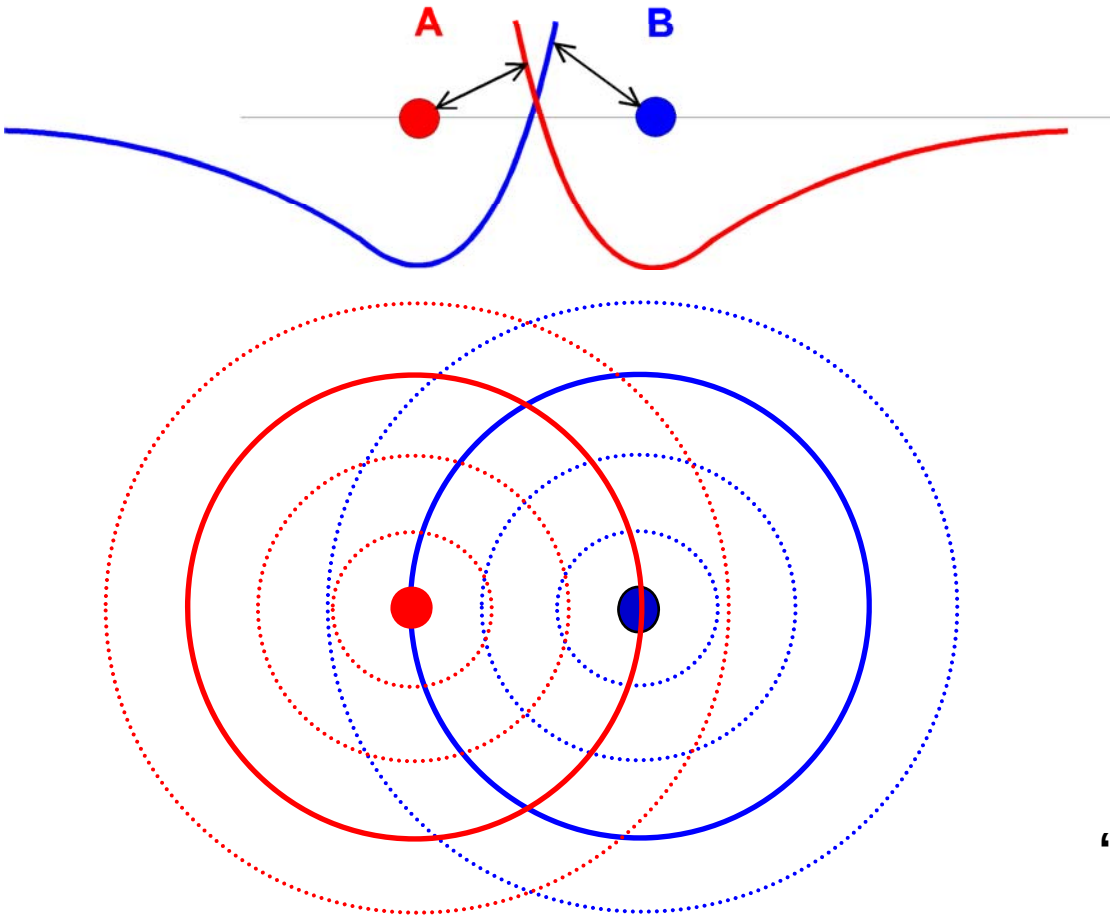
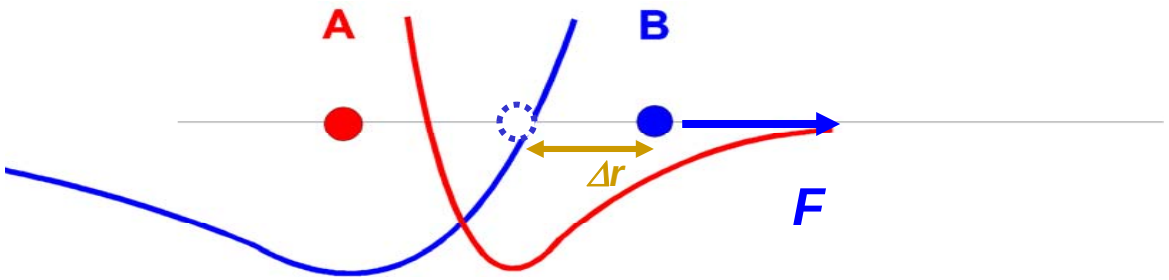
Contents

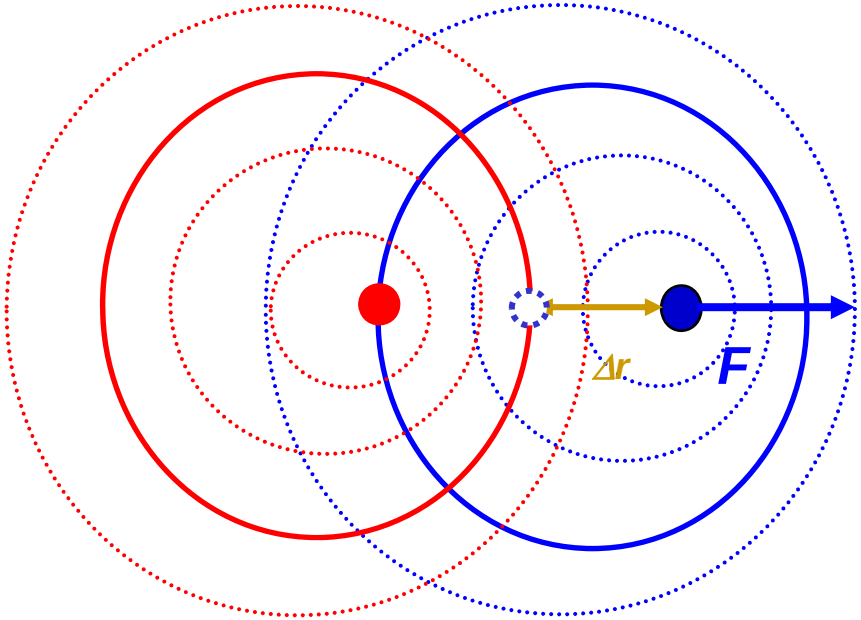
The Origin of Mass: Bind of the Basic Particles



$$F = K \cdot q^2 \cdot \frac{r - r_0}{r^3}$$

Bind of the Basic Particles





$$F = K \cdot q^2 \cdot \frac{\Delta r}{r^3}$$

The Mass Equation

$$F = K \cdot q^2 \cdot \frac{r - r_0}{r^3} \quad \rightarrow \quad F = a \cdot C \cdot \frac{1}{r \cdot c^2} \quad \Rightarrow \quad m = \frac{F}{a} = C \cdot \frac{1}{r \cdot c^2}$$

$$E = m \cdot c^2 \qquad E = h \cdot \nu = h \cdot c / 2\pi R = \hbar \cdot c / R$$

$$\Rightarrow \quad \boxed{m = \frac{\hbar}{R \cdot c}}$$ universal for all elem. particles!

The classical magnetic moment: $\mu = \frac{1}{2} \cdot c \cdot e_0 \cdot R$

Radius R computed from the magnetic moment μ and then inserted above $\Rightarrow$ the correct mass m

Or both equations combined: $\mu = \frac{1}{2} \cdot \frac{e_0}{m}$ = Bohr magneton in case of the electron
universally valid for all elem. particles

Mass and Increase of Mass

$$F = K \cdot q^2 \cdot \frac{r - r_0}{r^3} \quad \rightarrow \quad F = a \cdot C \cdot \frac{1}{r \cdot c^2} \quad \Rightarrow \quad m = \frac{F}{a} = C \cdot \frac{1}{r \cdot c^2}$$

$$E = m \cdot c^2 \qquad E = h \cdot \nu = h \cdot c / 2\pi R = \hbar \cdot c / R \qquad R = r/2$$

$$\Rightarrow \qquad \boxed{m = \frac{\hbar}{R \cdot c}}$$

Relativistic increase of mass: From $R \rightarrow R' = R/\gamma \quad \Rightarrow \quad m \rightarrow m' = m \cdot \gamma$

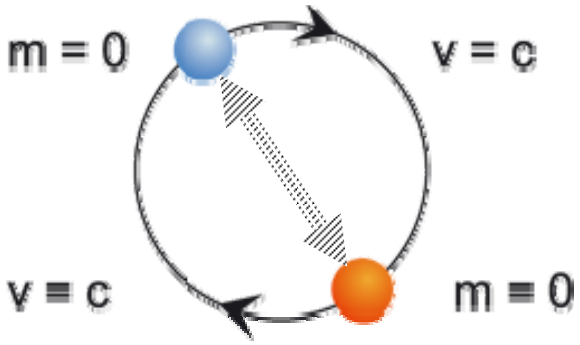
Putting the object to motion: $\Rightarrow \quad dE = dm \cdot c^2 \qquad \boxed{E = m \cdot c^2}$

Spin: $m = \frac{\hbar}{R \cdot c} \quad \Rightarrow m \cdot R \cdot c = \hbar$

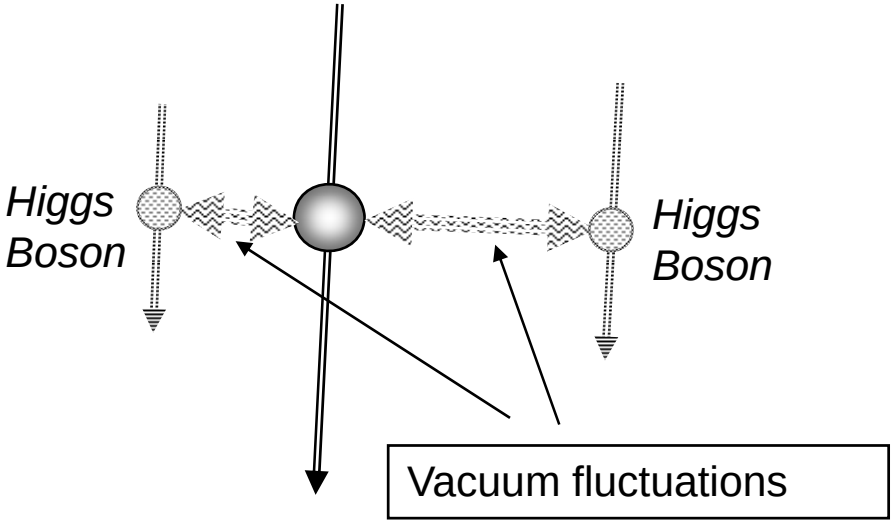
Classical angular momentum

The Origin of Mass

Existing Models



Basic Particle Model



Higgs Model

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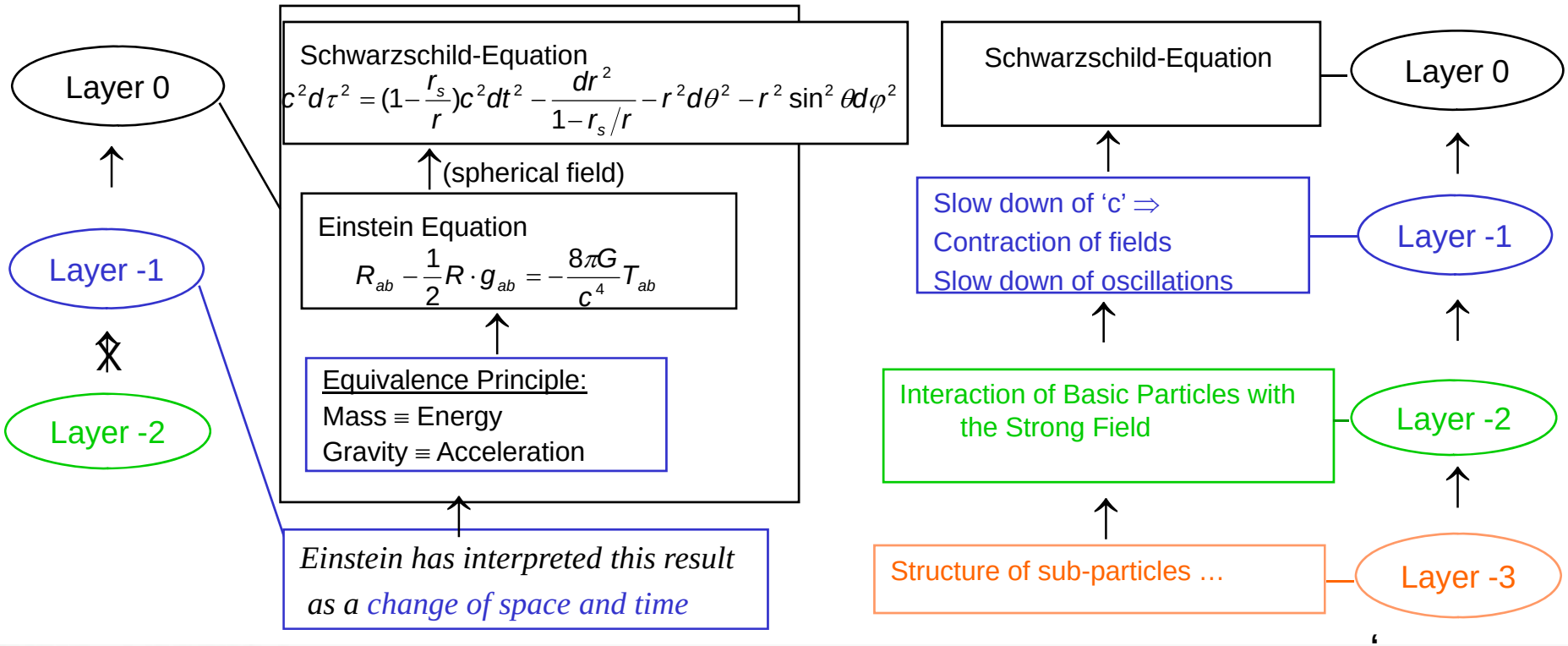
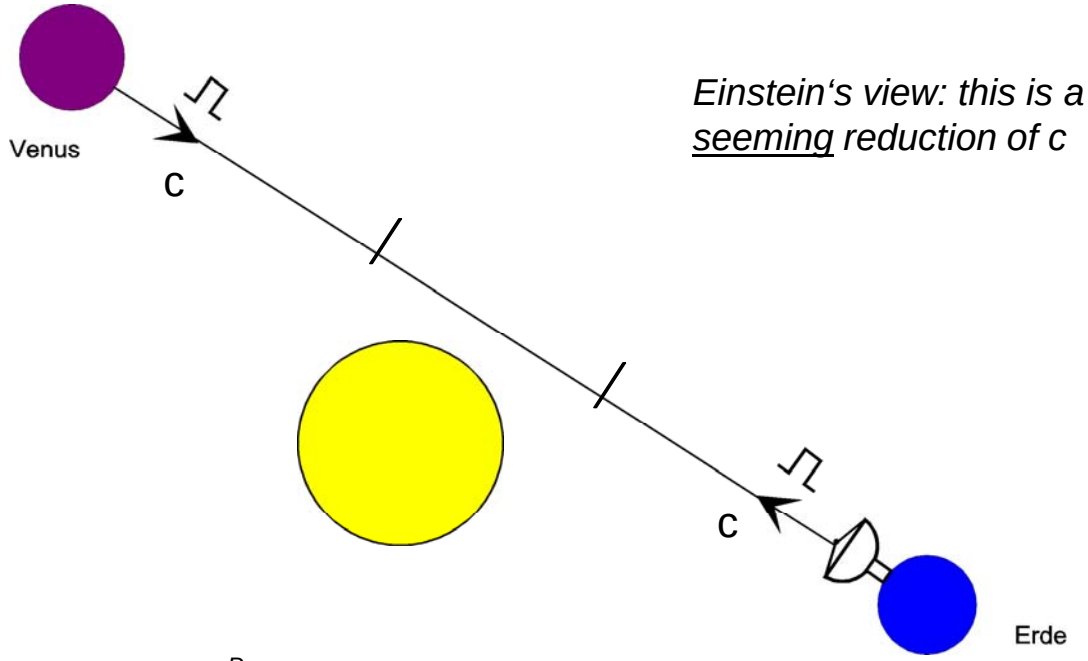
Reductionism for General Relativity



The Shapiro-Experiment:

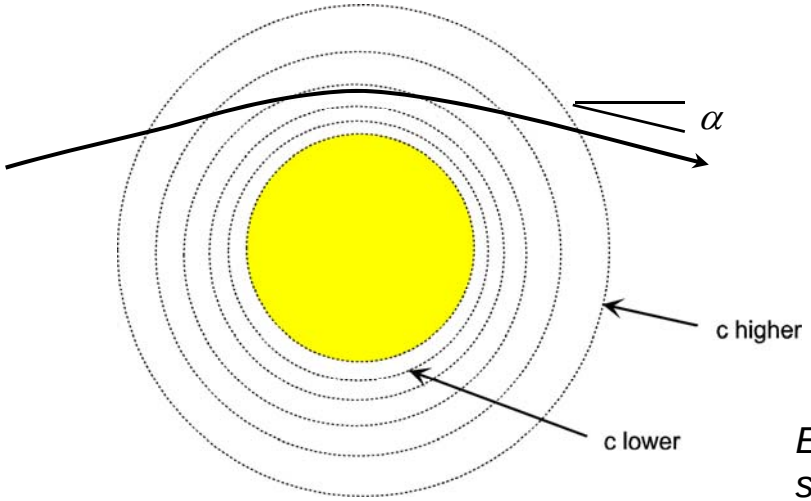


Einstein's view: this is a <u>seeming</u> reduction of c

$$c(r) = c_0 \cdot \left(1 - 2\frac{G \cdot M}{r \cdot c_0^{\,2}}\right)^P$$

P=1/2 or 1 depending on direction

The gravitational field of the sun:



$$c(r) = c_0 \cdot \left(1 - 2\frac{G \cdot M}{r \cdot c_0^{\,2}}\right)^P$$

P=1/2 or 1 depending on direction

Einstein's view: the path ís straight but the space is curved

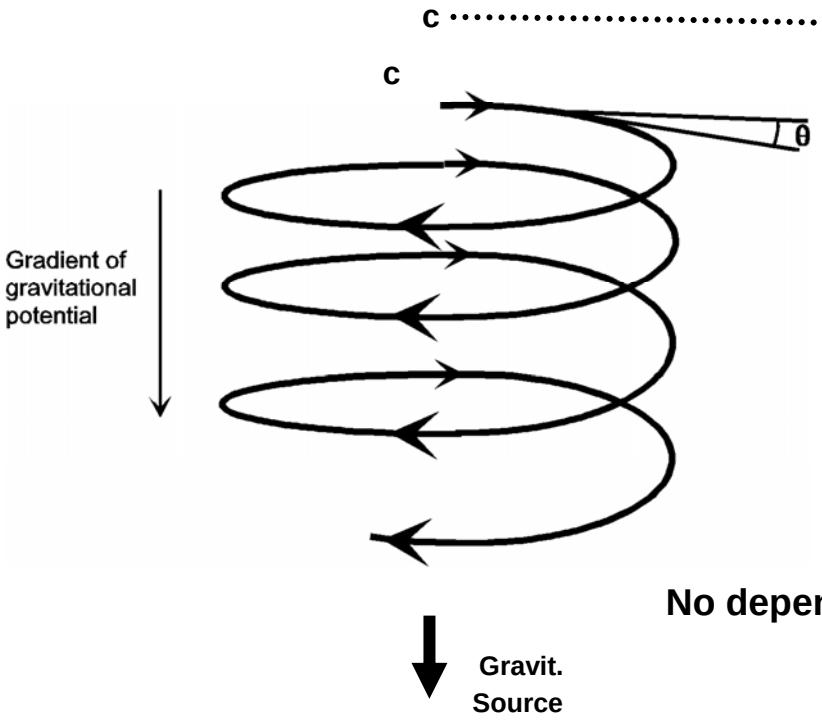
The application of classical refraction yields for the vertex: $a = G \cdot \frac{M}{r^2}$

Integrating deflection α from $-\infty$ to $+\infty$ yields: **1.75** arcsec
…. with Newton: 0.88 arcsec

Now: Acceleration at rest!!

This was the great breakthrough for Einstein in 1919 (Solar eclipse)!!

Elementary Particle in a Gravitational Field (with Vertical Axis):

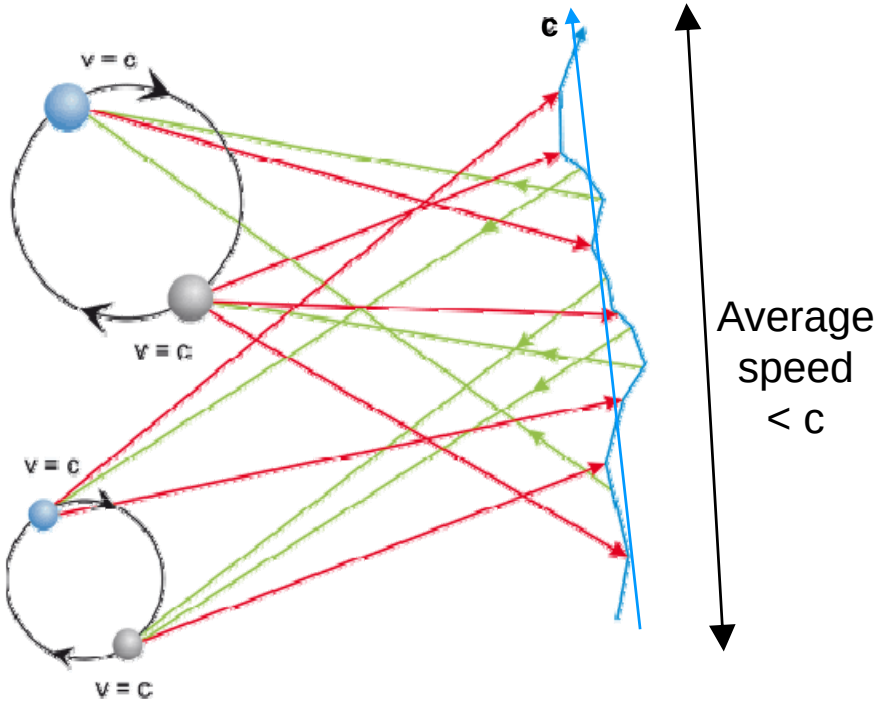


$$a = G \cdot \frac{M}{r^2}$$

No dependency of the mass!

Why is ‘c’ reduced?

--> by the perturbed path of a light-like particle



Force is the Strong Force

This solves Quantum Gravity!

Reduction of c independent of Radius $\Rightarrow$ independent of mass ‘

Results of General Relativity (Gravity)

Reduced speed of light c

$$c(r) = c_0 \cdot \left(1 - \frac{r_s}{r}\right)^P$$

P= 1 for vertical motion
P=1/2 for horizontal motion

$$r_s = 2\frac{GM}{r \cdot c^2}$$

$$r_s = 2\frac{G^* N}{r \cdot c^2}$$

Consequences for measurement of time and scale

$$T' = (1 - \frac{r_s}{r})^{-\frac{1}{2}} \cdot T$$

$$d' = (1 - \frac{r_s}{r})^{P-\frac{1}{2}} \cdot d$$

+ *Lorentz-Transformation:* $x_i' = \gamma(x_i - v \cdot t)$ *(i=0..3; x_0=ct)*

Schwarzschild Solution:

$$(1 - \frac{r_s}{r})\dot{x}_0^{\,2} - (1 - \frac{r_s}{r})^{-1}\dot{r}^2 - r^2\dot{\varphi}^2 = c^2$$

Summary

What are the benefits of this model of gravity?

The model explains:

- The "Dark Matter" phenomenon
- The "only attracting" effect

The model maintains:

- The classical understanding of space and time

The model avoids:

- Conflicts between gravity and quantum theory
  QUANTUM GRAVITY BECOMES OBSOLETE
- The necessity of the Equivalence Principle
- The force #4 assigned to gravity (non-existent; step towards a unified theory)

Contents

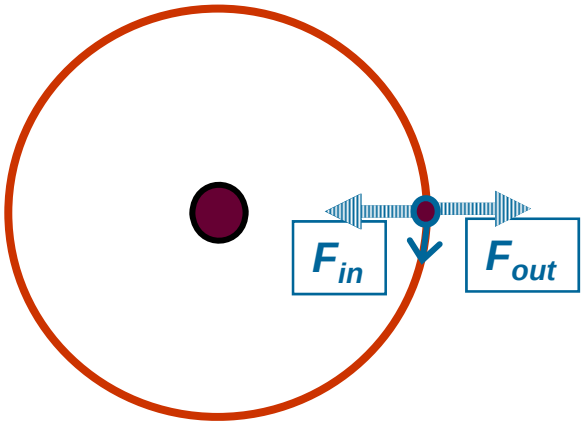
A specific German grammar-school
called “Humanistic Gymnasium”
was standard for intelligent young people
until the middle of 20th century

It was mainly related to the ancient Greek philosophy

- Plato
- Aristotle
- ...

and the ability for abstract thinking meant a high value

The structural world of Plato:



Newton:
$F_{out} = F_{in}$

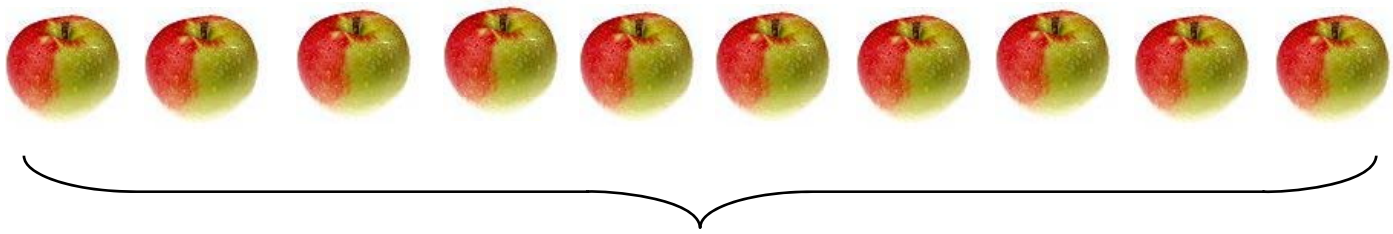
Plato:
Circuit is structural rule

W. Heisenberg:
“Quantum mechanics can only be correct
if it conforms to the structure ideas of Plato”

A. Einstein?

‘

The point of abstraction:



10!

- Object-related: There are apples
- Abstraction-related: There is an application of the number of 10

Einstein has learned at school:

A person is higher-minded if abstraction-related

Einstein was impressed by the “Beauty of the GR-Formalism”

$$R_{ab} - \frac{1}{2} R \cdot g_{ab} = -\frac{8\pi G}{c^4} T_{ab}$$

$$T_{\mu\nu} = \frac{1}{4\pi}\left[F_{\mu\lambda} F^{\lambda}{}_{\nu} + \frac{1}{4} g_{\mu\nu} F_{\alpha\beta} F^{\alpha\beta} \right]$$

Which way
to develop physics?

Original Paradigm:

Following Newton, Lorentz, deBroglie …

to investigate

Processes in Detail

Present Paradigm:

Following Plato, Heisenberg, Bohr …

to argue with

Symmetries and Principles

The End

Deflection quantitatively

Deflection (cross speed) depends on original rate, entropy, distance

original rate $\propto N$ (number of sources)

entropy $\propto r$

distance $\propto 1/r^2$

Single deflections add on in a statistical manner:

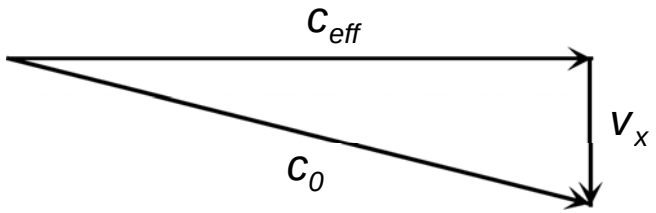
Cross speed $v_x = \sqrt{4g} \cdot \sqrt{N/r}$

Now the reduction of '*c*':

$$c_{eff} = \sqrt{c_0^{\,2} - v_x^{\,2}}$$

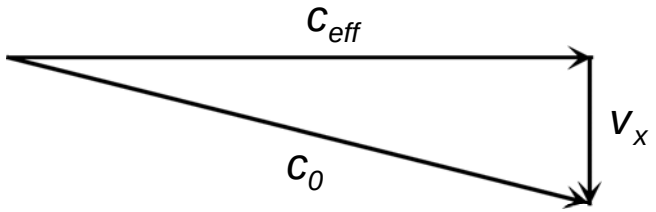
$$c_{eff} = c_0 \sqrt{1 - \frac{v_x^{\,2}}{c_0^{\,2}}}$$

$$c_{eff} = c_0 \sqrt{1 - 4g \frac{N}{r \cdot c_0^{\,2}}}$$



Deflection quantitatively (2)

$$c_{eff} = c_0 \sqrt{1 - 4g \frac{N}{r \cdot c_0^{\,2}}}$$



$$c_{eff} = c_0 \cdot \left[1 - 2g \frac{N}{r \cdot c_0^{\,2}} - \frac{1}{2} \cdot \left(g \frac{N}{r \cdot c_0^{\,2}}\right)^2 - \ldots\right]$$

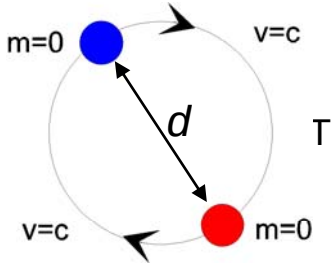
$$c_{eff} \approx c_0 \cdot \left(1 - 2 \frac{g \cdot N}{r \cdot c_0^{\,2}}\right)$$

$$\Re = 2 \cdot \frac{g \cdot N}{r}$$

$$\boxed{c_{eff} \approx c_0 \cdot \left(1 - \frac{\Re}{r}\right)}$$

Conforms to Einstein / Schwarzschild (except for N)

Changes of space and time?



T = Period time

$$c = \pi \frac{d}{T}$$

In the gravitational field the quantities change to:

$$c^* = \pi \frac{d^*}{T^*}$$

$$\boxed{c^* = (1 - \frac{\Re}{r})^P \cdot c}$$

$$\boxed{T^* = (1 - \frac{\Re}{r})^{-\frac{1}{2}P} \cdot T}$$ (from experiments)

$$\Rightarrow \quad \boxed{d^* = (1 - \frac{\Re}{r})^{\frac{1}{2}P} \cdot d}$$

‘

The way to Schwarzschild

Special relativity: $c^2 \cdot \left(\frac{d\tau}{dt}\right)^2 + \left(\frac{d\vec{x}}{dt}\right)^2 = c^2$ (from Lorentz transformation)

$\Rightarrow$ $c^2 + \left(\frac{d\vec{x}}{d\tau}\right)^2 = c^2 \cdot \left(\frac{dt}{d\tau}\right)^2$ (if mult. by $(dt/d\tau)^2$)

$\dot{x}_0{}^2 - \dot{x}_{1,2,3}{}^2 = c^2$ (with $x_0 = ct$, $\dot{x} = dx/d\tau$ and reordered)

$\boxed{\dot{x}_0{}^2 - (\dot{r}^2 + r^2 \cdot \dot{\varphi}^2) = c^2}$ (transformed to polar co-ordinates)

Gravity ON: $\dot{x}_0{}^{2^*} - (\dot{r}^{2^*} + r^{2^*} \cdot \dot{\varphi}^{2^*}) = c^2$

with $\tau^* = (1 - \frac{\Re}{r})^{1/2} \cdot \tau \qquad r^* = (1 - \frac{\Re}{r})^{-\frac{1}{2}} \cdot r$

$\Rightarrow$ $\boxed{(1 - \frac{\Re}{r})\dot{x}_0{}^2 - (1 - \frac{\Re}{r})^{-1}\dot{r}^2 - r^2\dot{\varphi}^2 = c^2}$ (Schröder 9.16)

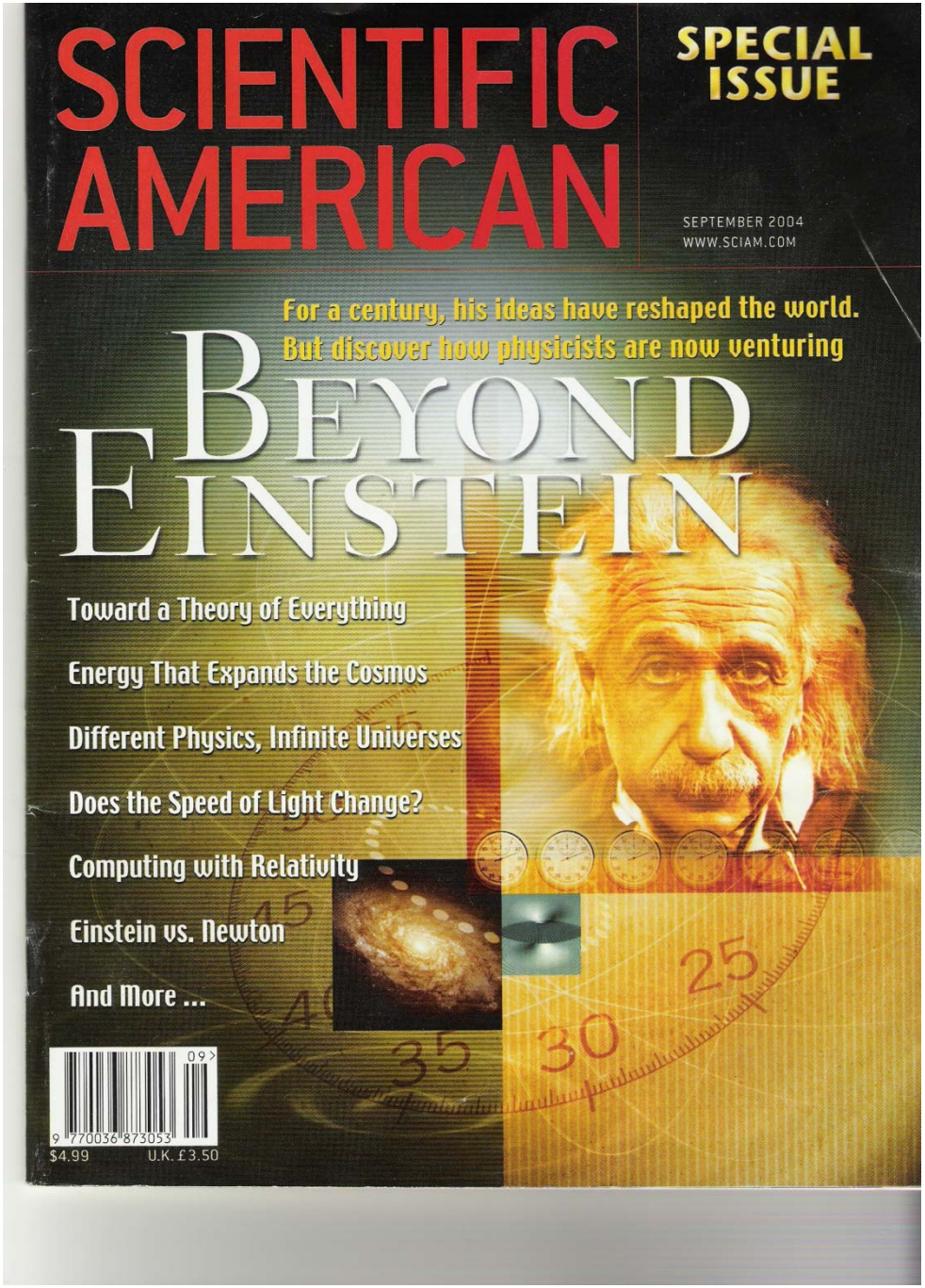
What is the explaining potential of this model?

The model explains:

- Special Relativity
  and the particle structure causing SR

- The "Mass" of a particle
  with spin, magn. Moment
  and the particle structure causing SR

- General Relativity / Gravity with
  and the particle structure causing GR
  Quantum Gravity
  Dark Matter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General Relativity

(Gravity)

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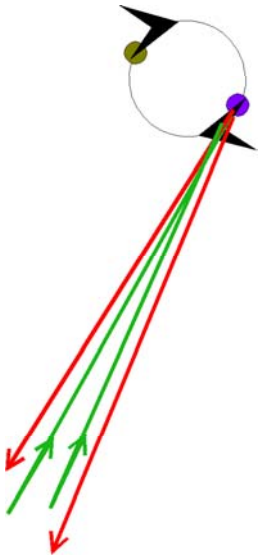
What is Gravity?

Gravity is the change of the speed of light ‘c’ in the vicinity of an object

But: What is the physical reason for the change of the speed of light ‘c’ in the vicinity of an object?

Relativity: Gravity

Perturbed path ⇒ Reduced ‘c’



Reduction is dependent on the
- Rate of interaction with exchange particles
- Entropy of the exchange particle distribution

Example of low entropy - low rate:

Example of low entropy - high rate rate:

Example of high entropy:

‘

Relativity / Gravity

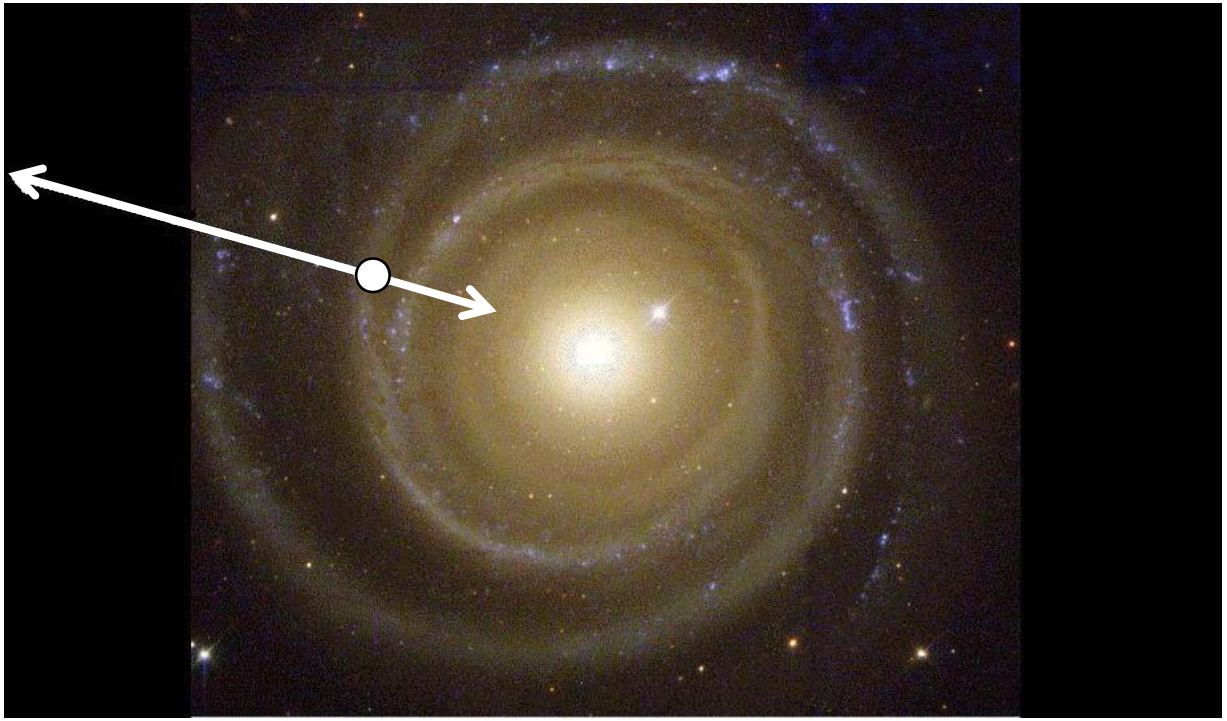
Problems of Present Theory of Gravitation:

- **Missing Matter in a rotating Galaxy (= Dark matter)**
- **Dark Energy**
- **Quantum Gravity**

Relativity / Gravity

The Dark Matter Problem:

Missing Matter in a rotating Galaxy



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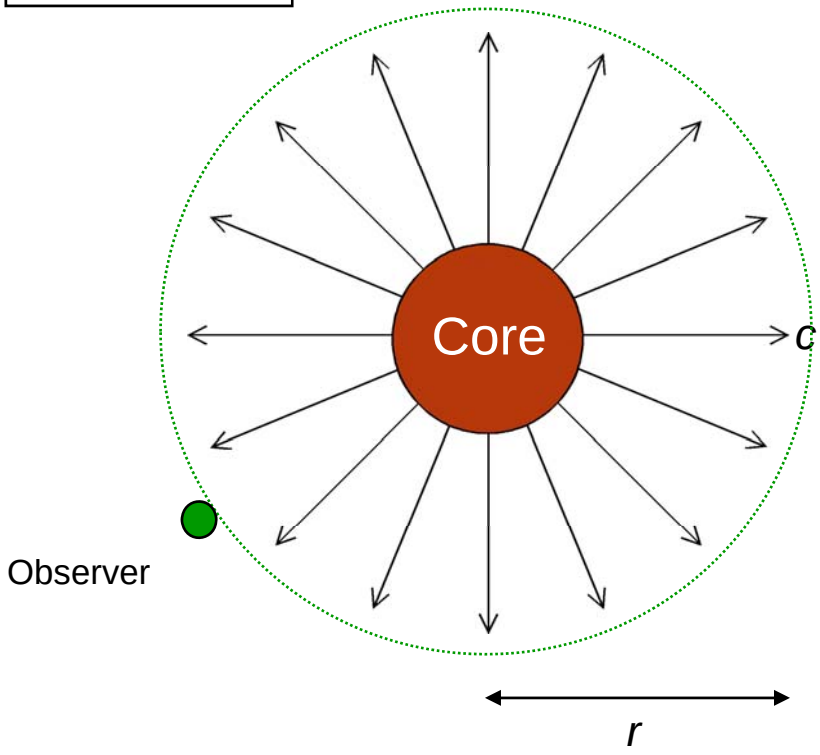
Relativity / Gravity

Gravitational Field of Light Particles at the Sun

Light Particles (Photons)



Gravitational field of the 'Core'

$$\Gamma \propto \frac{N}{r^2}$$

The density of the light particles:

$$\rho \propto \frac{1}{r^2}$$

The number of light particles up to *r*:

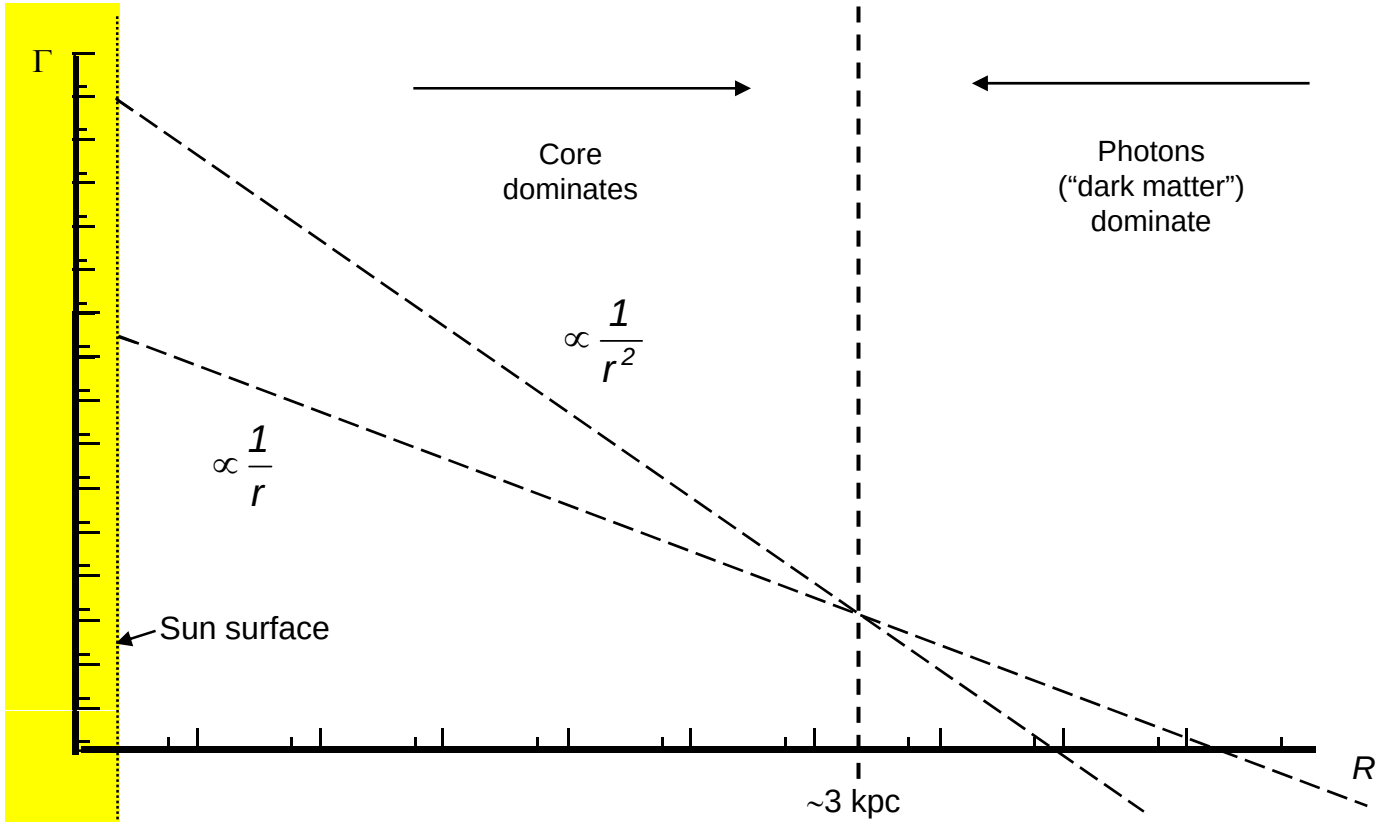
$$N = \int \rho \cdot 4\pi r^2 dr \propto \int \frac{1}{r^2} \cdot 4\pi r^2 dr \propto r$$

Gravitational field of photons at *r*:

$$\Gamma \propto \frac{1}{r^2} \cdot n \propto \frac{N}{r^2} \cdot r = \frac{N}{r}$$

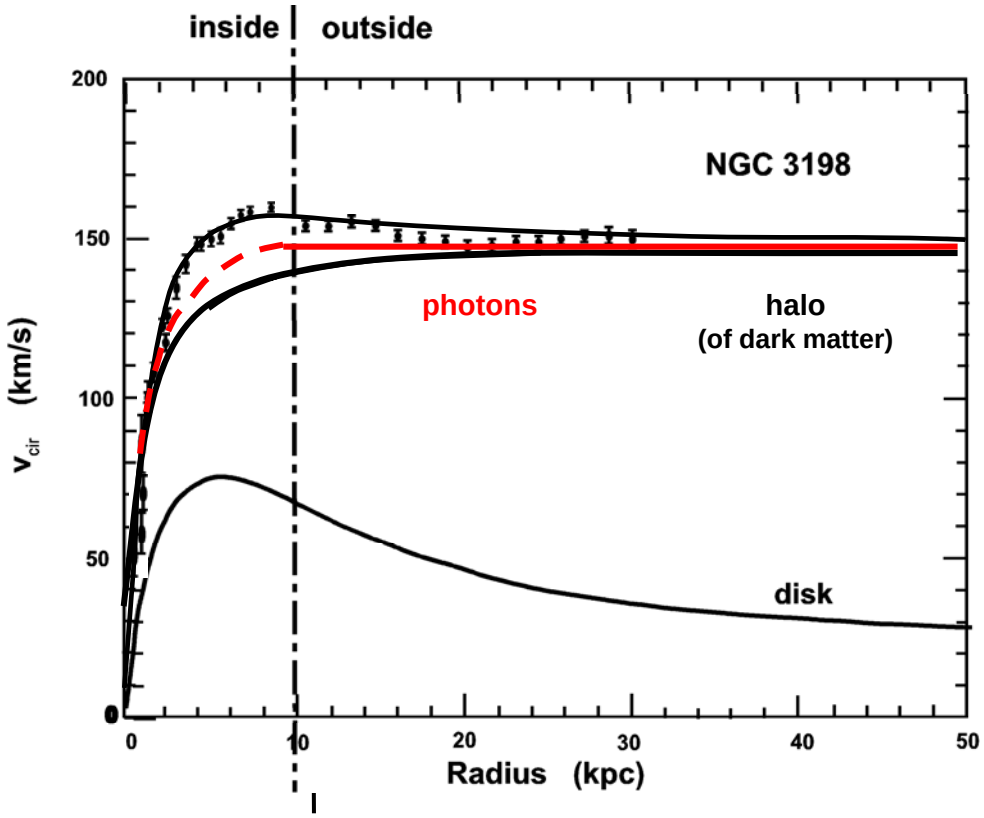
Relativity / Gravity

Gravitational Field of Light Particles at the Sun per Distance



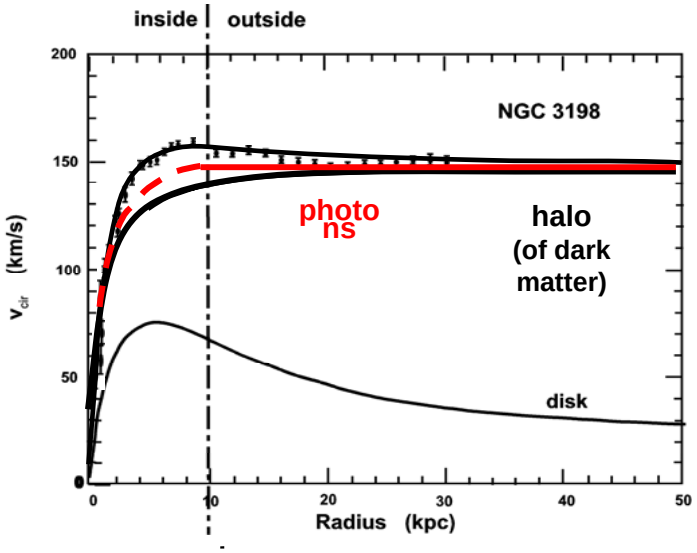
Relativity / Gravity

Rotation of the Galaxy NGC 3198



Relativity / Gravity

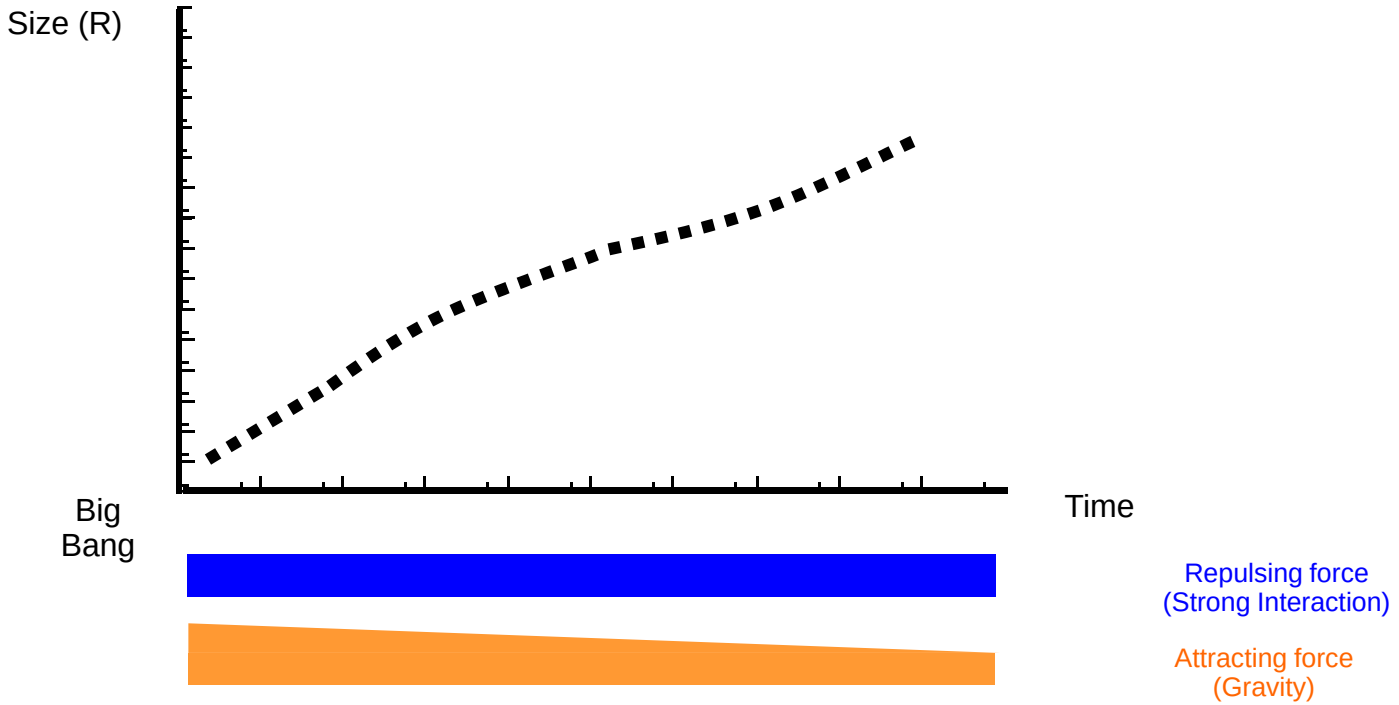
Rotation of the Galaxy NGC 3198



Relativity / Gravity

Need for Dark Energy?

Development of the Universe:



Both fields are scaled by R^2

Relativity / Gravity

What is Gravity?

- **Gravity is the change of the speed of light in the vicinity of an object**

- **Gravity has nothing to do with mass**

‘

Relativity

Gravity: Summary

What are the benefits of this model of gravity?

The model explains:

- The "Dark Matter" phenomenon
- The "Dark Energy" phenomenon
- The "only attracting" effect

The model maintains:

- The classical understanding of space and time

The model avoids:

- Conflicts between gravity and quantum theory
  QUANTUM GRAVITY BECOMES OBSOLETE
- The necessity of the Equivalence Principle
- The force #4 assigned to gravity (non-existent; step towards a unified theory)

Relativity

Gravity: Summary

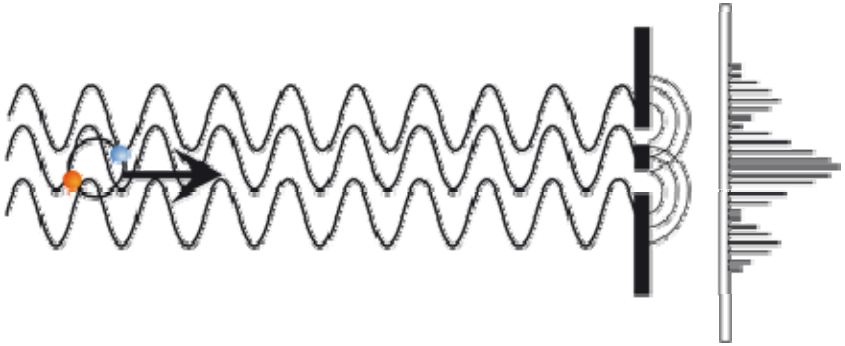
Predictions of the Model:

- No Higgs Bosons
- No “Dark Matter”
- No Gravitational Waves ?

‘

Particle Structure

The Double-Slit Experiment



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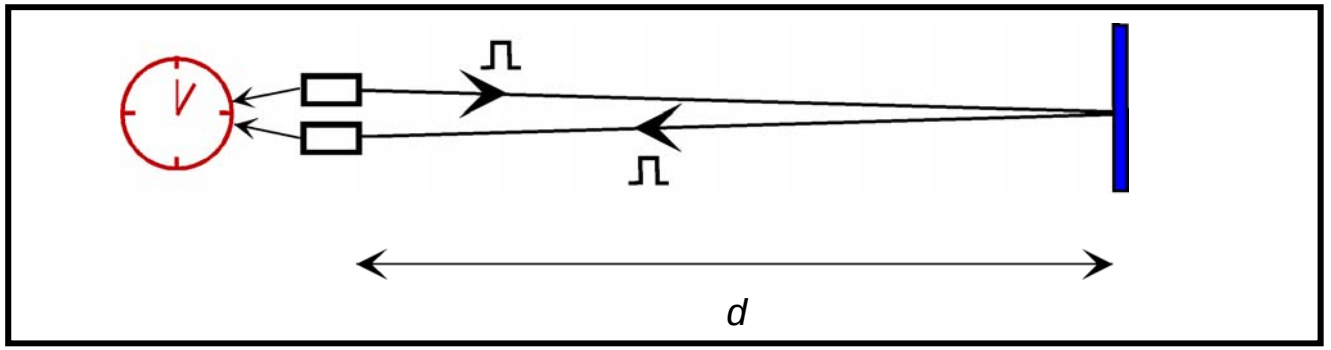
Relativity: Special Relativity

Measuring ‚c‘:



⇒ *v*

At rest: **Measurement of *d* and *T*:** ***d* = fixed ; *T* = 2d/c**

measured $c_m = 2d/T = c$

Lab in motion with *v*:

Measurement of *d* and *T*: ***d* = fixed**

$$T = d/(c-v) + d/(c+v) = 2cd/(c^2 - v^2) = 2d/c * \gamma^2$$

measured $c_m = 2d'/T'$

with $d' = d/\gamma$

$$T' = T*\gamma$$

$$\gamma = \frac{T'}{T} = \frac{c}{q} = 1/\sqrt{1-\frac{v^2}{c^2}}$$

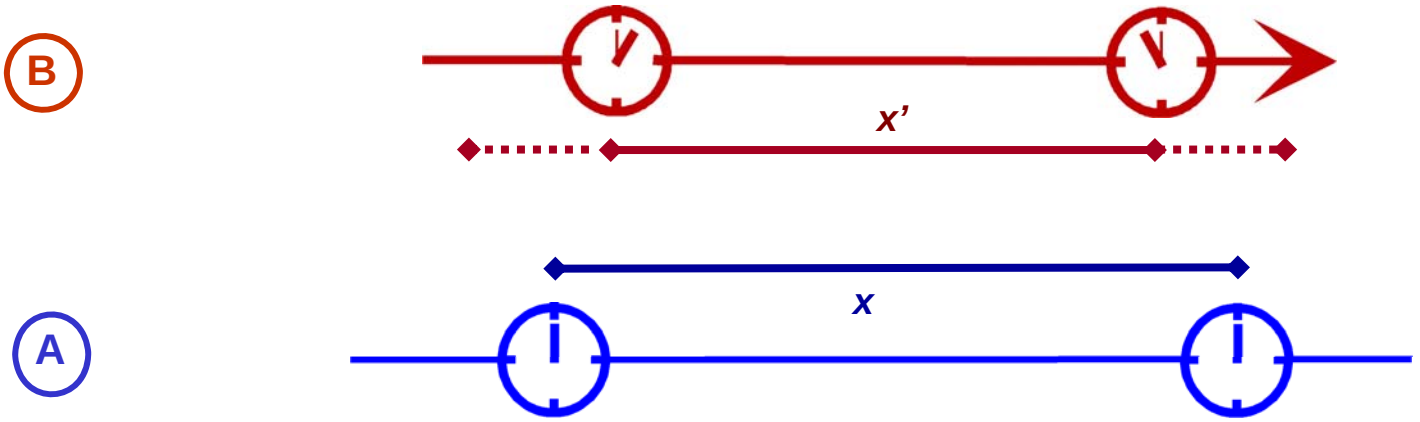
i.e. the Lorentz-Factor

measured $c_m = 2d'/T' = 2d/T/\gamma^2 = c*\gamma^2 / \gamma^2 = c$

‘

Relativity: Special Relativity

Contraction (Seeming contraction)



$$x' = x \cdot \frac{1}{\gamma}$$

$$t' = \gamma \cdot \left(t - \frac{x \cdot v}{c^2} \right)$$

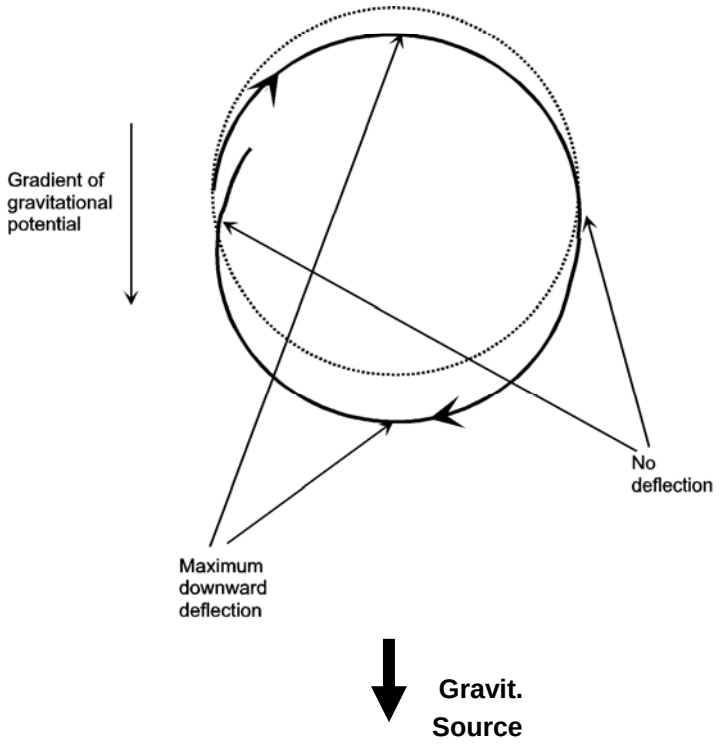
The clocks in B are de-synchronised

$\Rightarrow$ **For the observer B the rod in A *looks* shorter:**

$$x = x' \cdot \frac{1}{\gamma}$$

Relativity / Gravity

Elementary Particle in a Gravitational Field (with Horizontal Axis):



Integration over a circuit yields the factor: 1/2

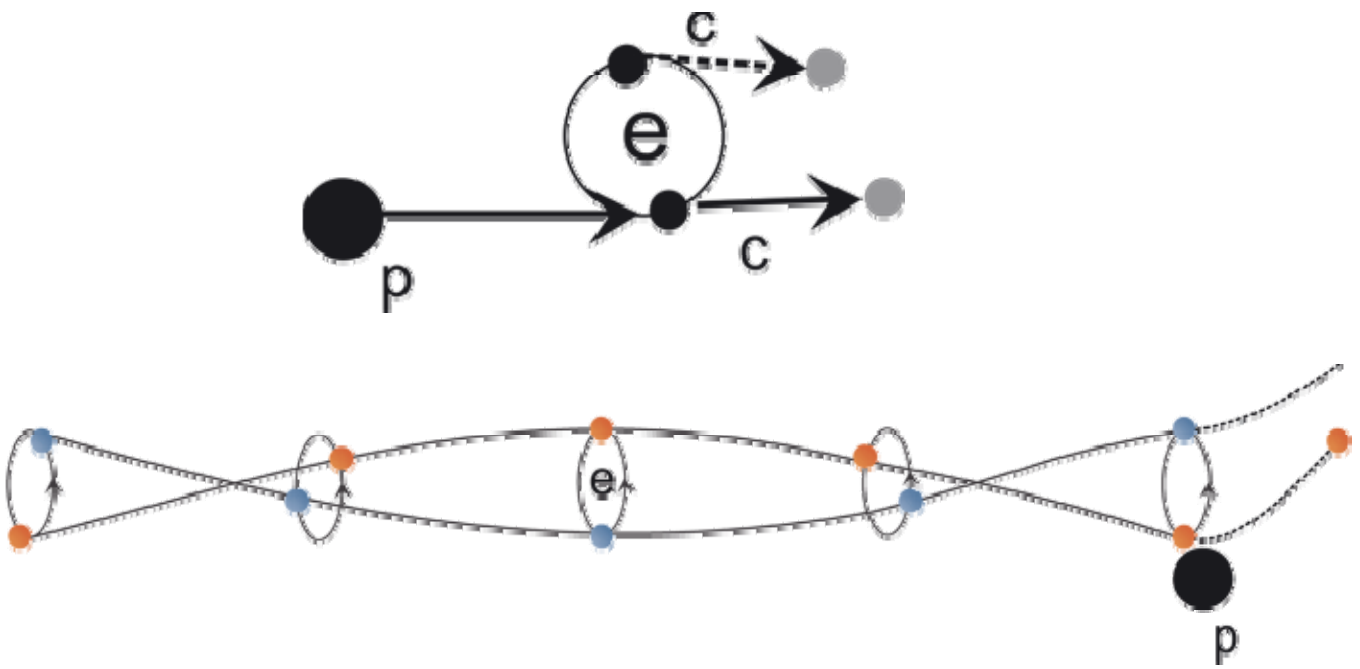
Resulting acceleration is:

$$a = 1/2 \cdot 2 \cdot G \cdot \frac{M}{r^2} = 1 \cdot G \cdot \frac{M}{r^2}$$

No dependency of the mass!

Particle Structure: The Electron

Electron Experiments



Relativity: Special Relativity

2 historical interpretations of Special Relativity:

- Lorentz and others: Physical interpretation
- Einstein: Geometrical interpretation

The possible geometrisation of physical processes was invented ~1800

Einstein reinvented geometrization 1905 …

Einstein was successful because he could use his General Relativity to explain/predict phenomena in gravity

Relativity: Special Relativity

Special Relativity

is explained here physically

based on a general particle structure, the

Basic Particle Model

The Basic Particle Model
Pair Structure

Elementary particles

leptons – quarks

are built by pairs of sub-particles

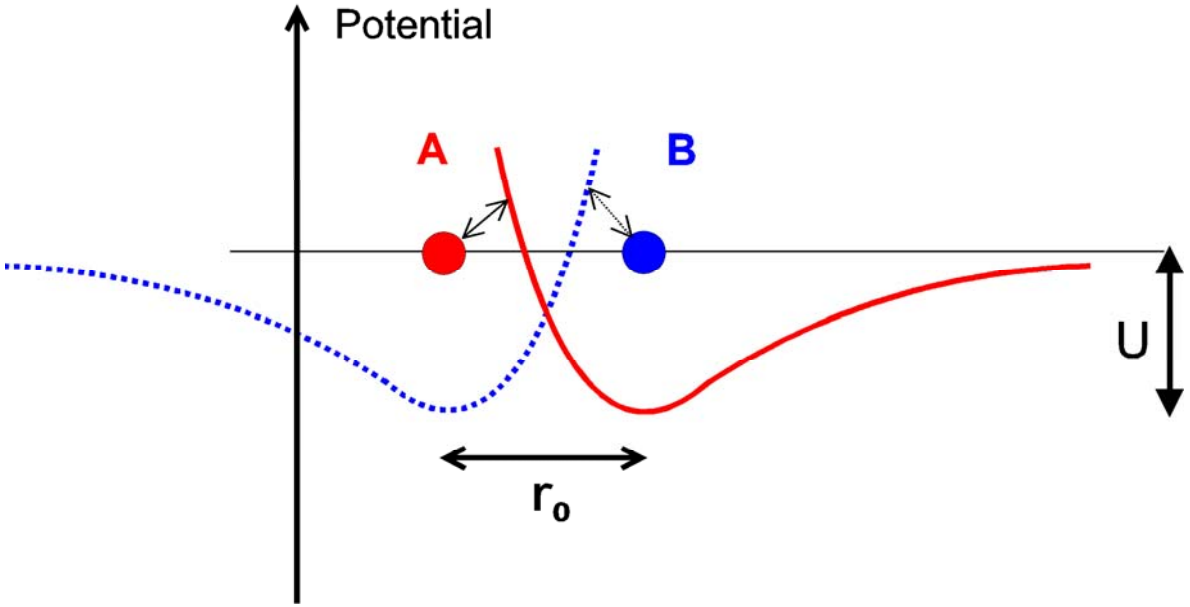
they are NOT point-like

How do we know that?

- Elem. Particles have a spin
- Elem. Particles have a magnetic moment
- Special Relativity is immediately explained

Relativity: Origin of Mass

Bind of the Basic Particles



$$F = K \cdot q^2 \cdot \frac{r - r_0}{r^3}$$

Relativity: Special Relativity

What are the benefits of this interpretation of relativity?

The model explains:

- The seeming constancy of c in an easily understandable way
- The contraction phenomenon in a physical way
- The dilation phenomenon in a physical way

The model maintains:

- The classical understanding of space and time

The model gives way to an understanding of other areas of physics:

- The structure of elementary particles: The Basic Particle Model
- The origin of the mass: No Higgs needed
- An easy and helpful understanding of gravity

The Re-Physicalization of Physics

by
Albrecht Giese, Hamburg, Germany

Puebla 2008

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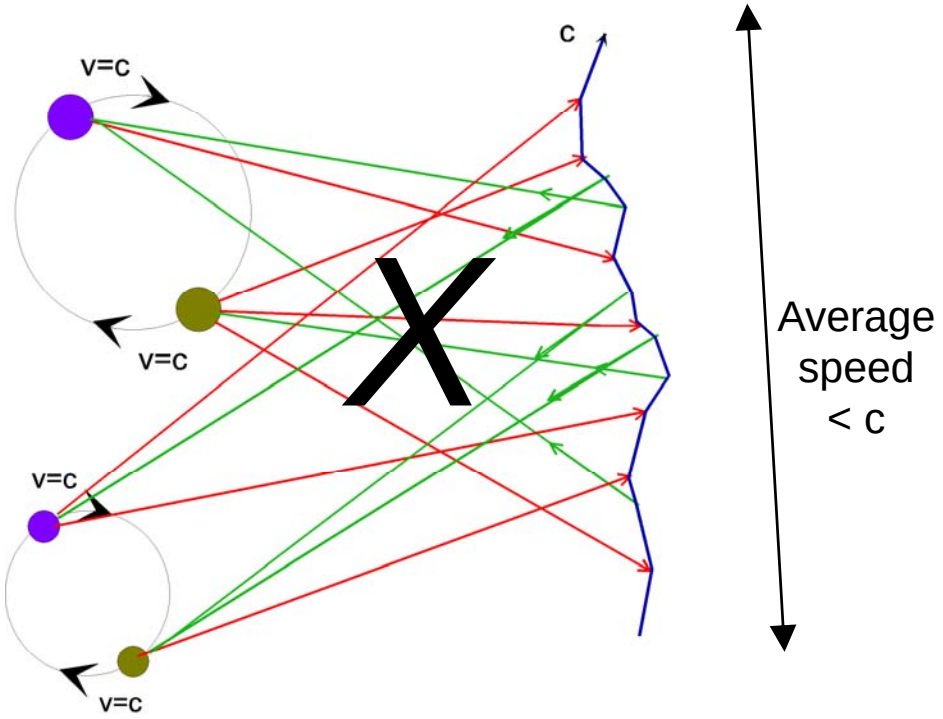
Why is ‘c’ reduced?

--> by the perturbed path of a light-like particle

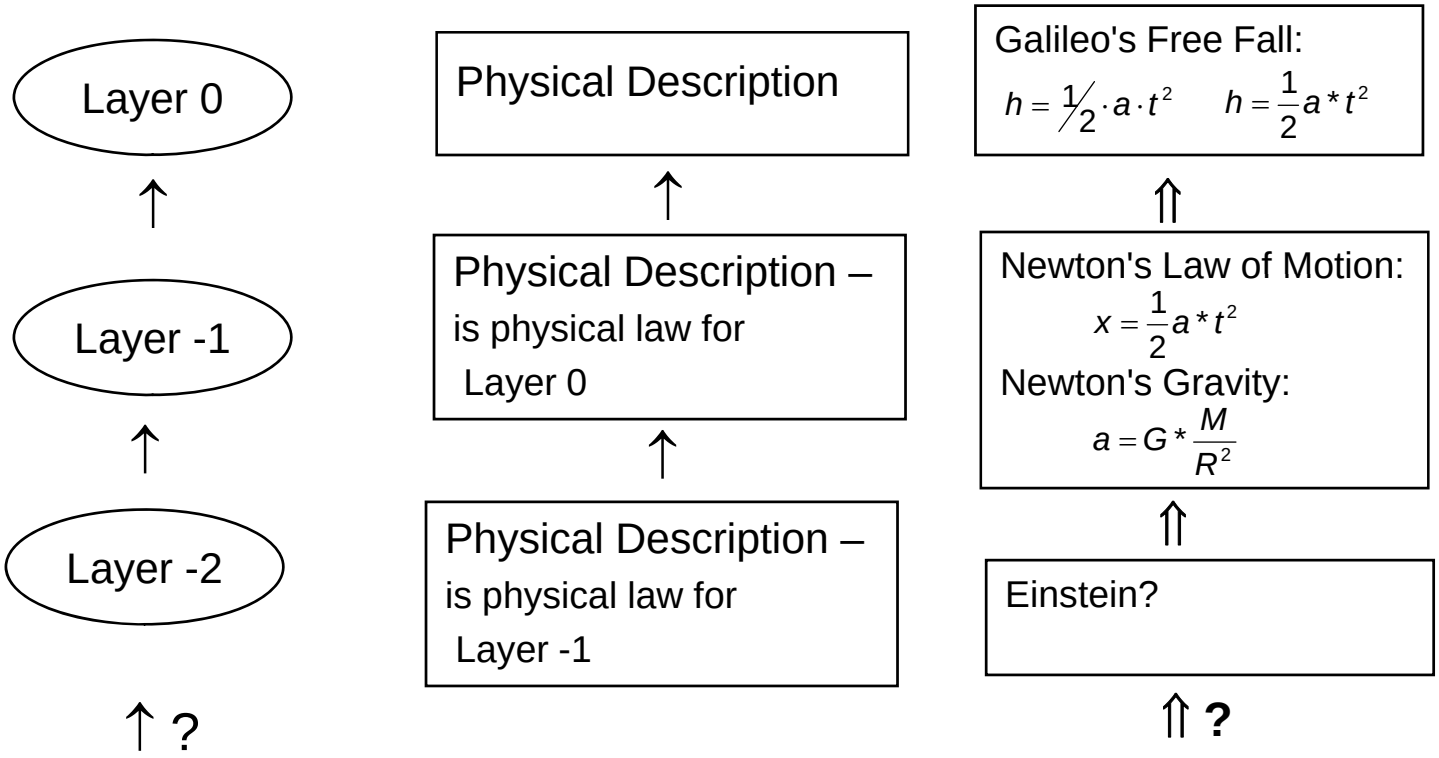


Reduction of c independent of Radius ⟹ independent of mass ‘

Contents

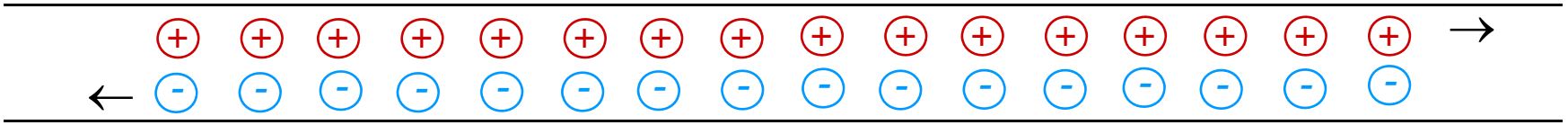
- Problems of Present Physics
- Changing to Reality Physics
  - General: Reductionism
  - Example: Fermat's Principle
  - Case: Special Relativity
  - Case: General Relativity
  - Case: Origin of Mass
- Historical Background of the present paradigm

Reductionism



Magnetism

Conductor Slightly – symmetrically – contracted

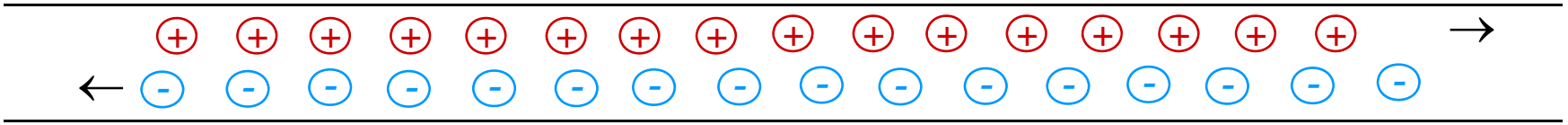


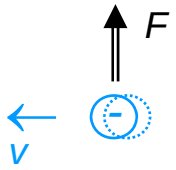
Test particle (electron) at rest

no force

Magnetism

Conductor Slightly – **asymmetrically** – contracted – as seen from the test particle

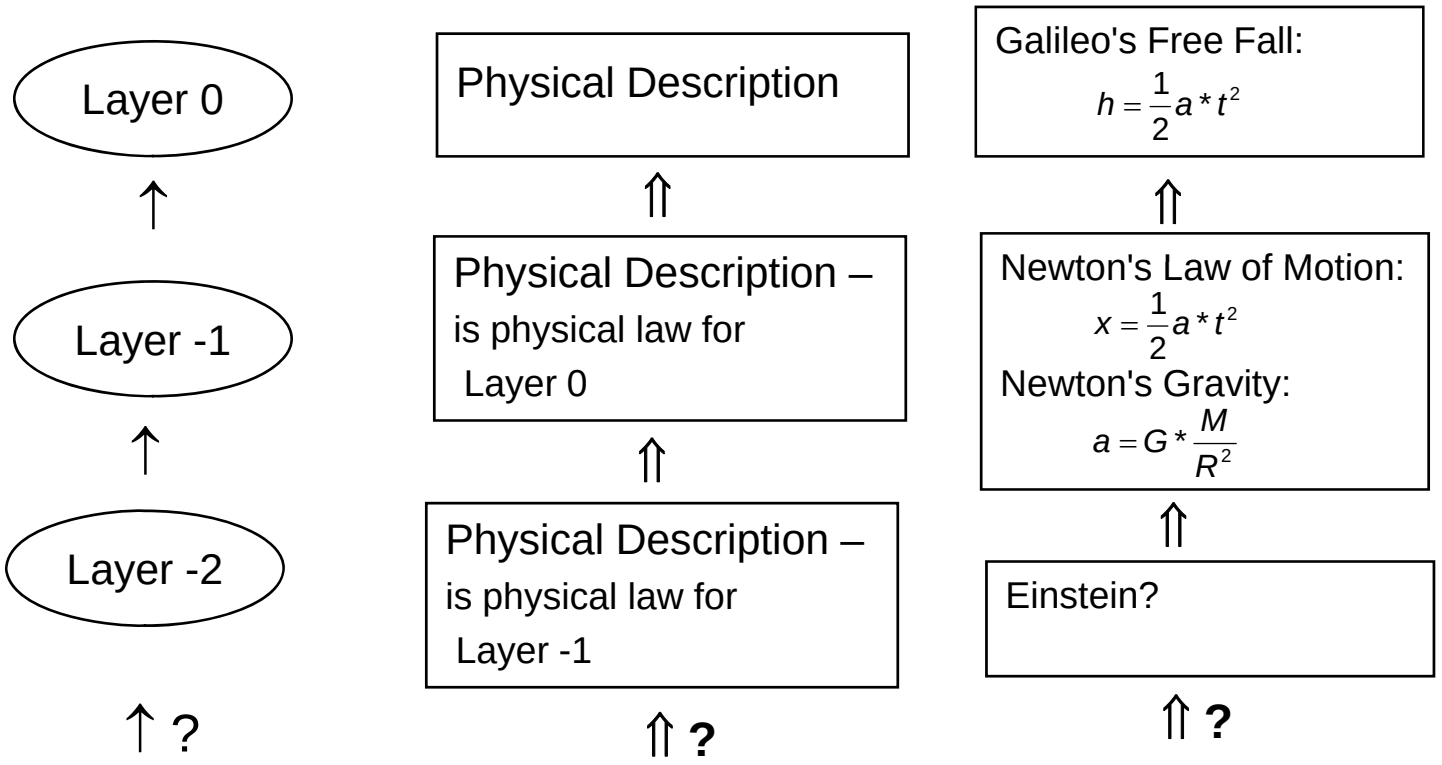


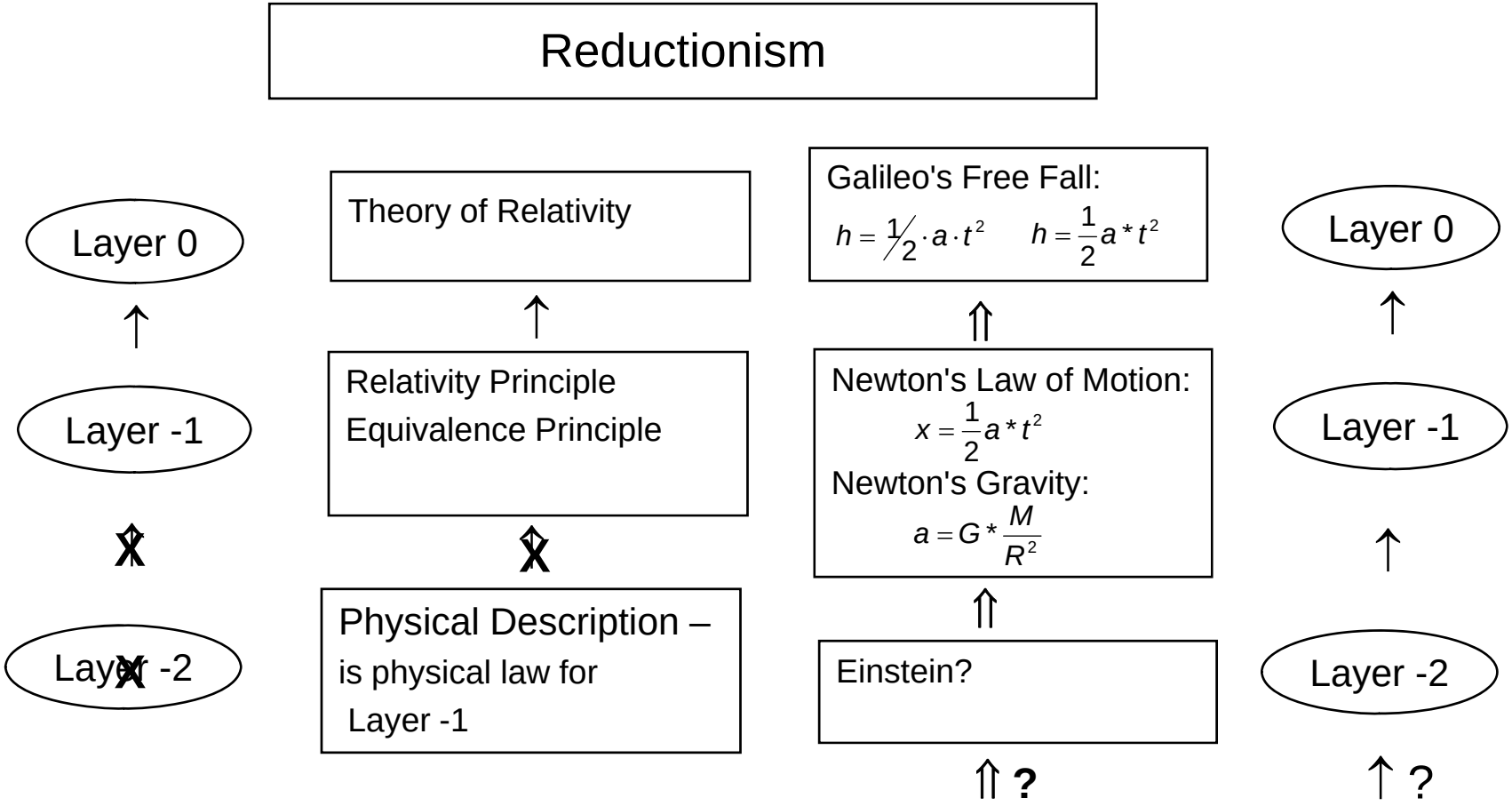


Test particle (electron) moving -

a force towards conductor occurs

Reductionism




Reductionism
Layer 0
Layer -1
Layer -2
Theory of Relativity
Relativity Principle
Equivalence Principle
Physical Description –
is physical law for
Layer -1
Galileo's Free Fall:
$h = \frac{1}{2} \cdot a \cdot t^2$ $h = \frac{1}{2} a * t^2$
Newton's Law of Motion:
$x = \frac{1}{2} a * t^2$
Newton's Gravity:
$a = G * \frac{M}{R^2}$
Einstein?
?
Layer 0
Layer -1
Layer -2
?

Reductionism applied for Special Relativity

Einstein:

Layer 0

Lorentz Transformation using
$\gamma = 1/\sqrt{1 - v^2/c^2}$

($c'=c$; Relativity Principle)

Extended Galilei-transformation
$x_i' = \gamma(x_i - v \cdot t)$ $(i=0..3;\ x_0=ct)$

Galilei-transformation
$x_i' = x_i - v \cdot t$ $(i=1..3)$

Layer -1

Layer -2

Layer -3

Einstein has interpreted this result as a change of space and time

Reality physics

Relativity Theory:
Lorentz Transformation

Layer 0

Contraction of fields
Slow down of oscillations

Layer -1

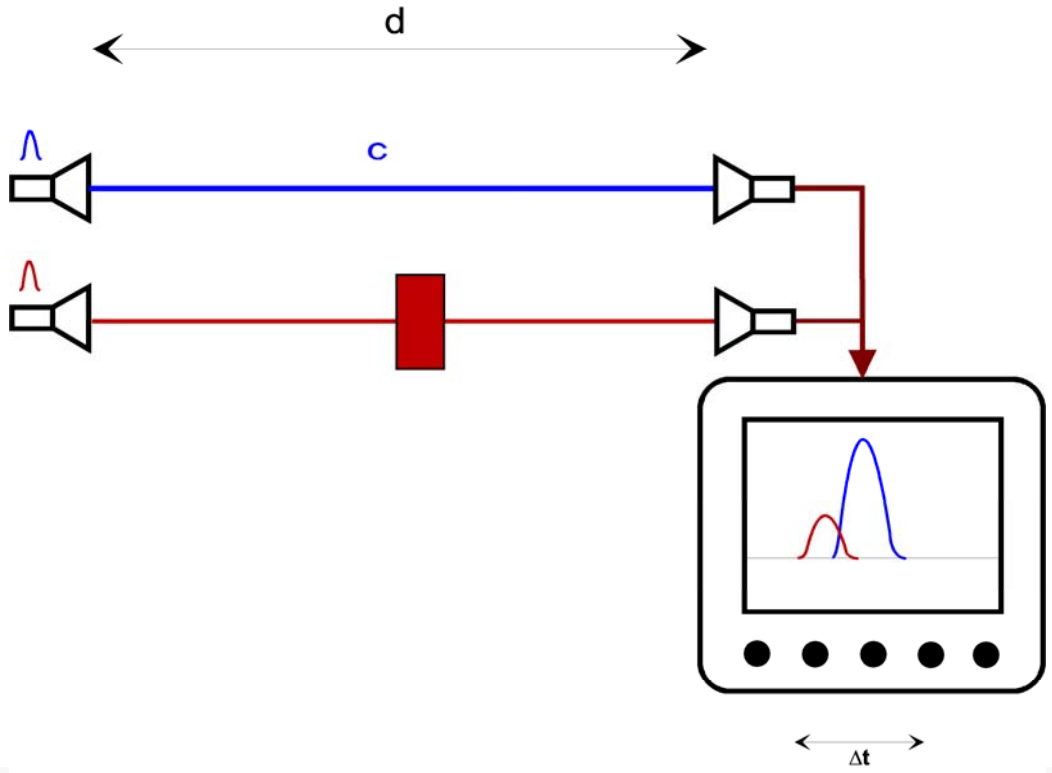
Structure of fields
Structure of elementary particles

Layer -2

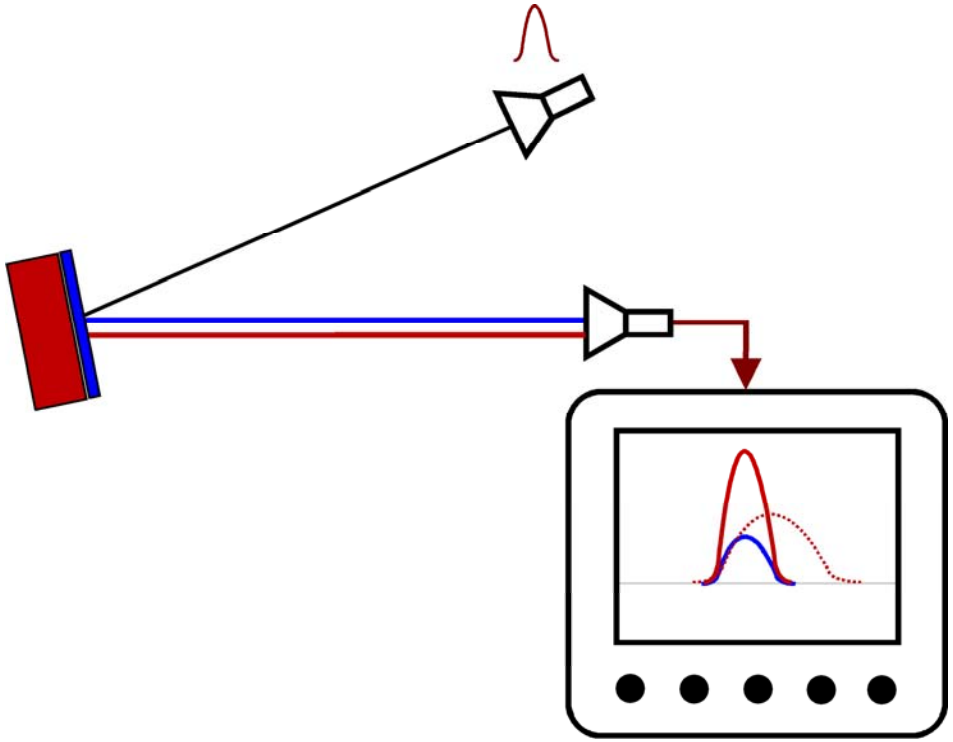
Structure of sub-sub-particles …

Layer -3

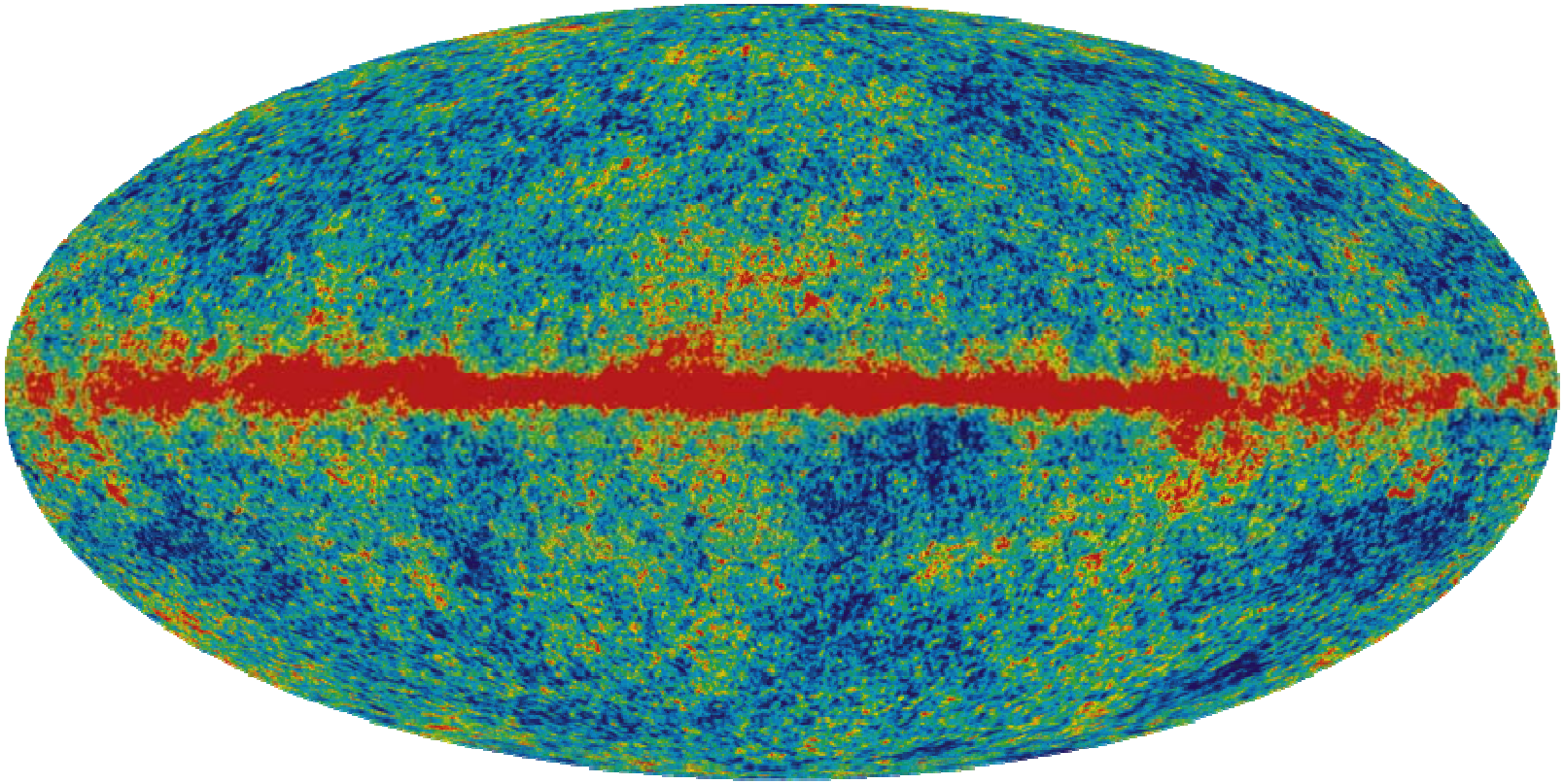
Superluminal speed: Nimtz-Experiment



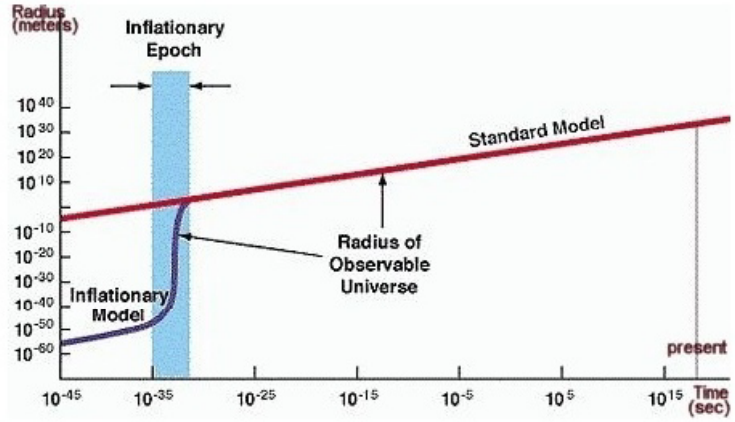
Superluminal speed:
Nimtz-Experiment II



Microwave Background (WMAP)



Cosmological Inflation



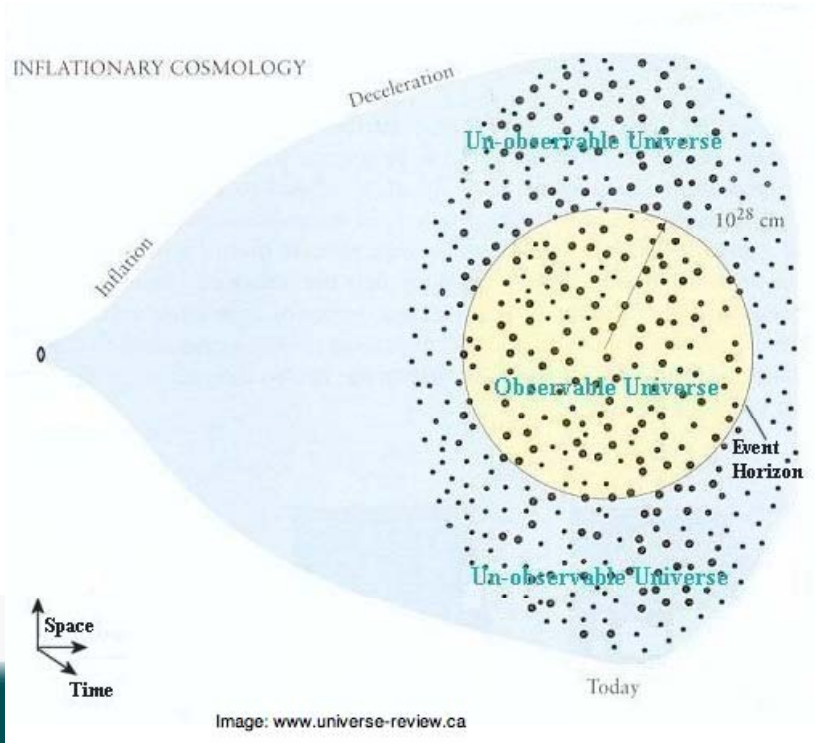


Image: www.universe-review.ca