cosmoedu

Doctoral Lecture by Mr. Enzo Bonacci about the possibility to go beyond Einstein's Theory of Relativity

Enzo Bonacci was born in Brescia (Italy) in 1972 and spent there his childhood.
At the end of the 70's his family moved to Latina, city where he still lives and works; his school marks were so excellent to deserve the City Medal conferred by the Mayor.
During his scientific high school he received a prize that used to study in Cambridge (UK), where he was extremely impressed with Newton's manuscripts on maths and physics.
After graduating in Chemical Engineering from "La Sapienza" University of Rome, he spent his university prize to travel the world and to achieve diplomas in numerous foreign languages.
He was chosen to do his national service at the office of the Under Secretary of Defence. In spite of his scientific education he has never neglected his artistic side, writing poems and novels selected by international literary contests and becoming a columnist for some newspapers.
Member of the *ODI* (Italian Order of Engineers) since 2001, he has become technical-scientific consultant for important boards.
After qualifying in *mathematics* and *physics*, he has been teaching at Scientific High School since 2001, holding several posts like *Responsible for Public Relations* and *Secretary of the School Council*.
In November 2003 he became responsible for the scientific project *Evolution of Rational Thinking and Epistemological Problems*. During 2004 he became responsible for the IFTS project *Transformation of Agroindustrial Products*. In January 2005 he was elected *Secretary of AEDE-Latina* (European Association of Teachers).
In 2007 he got the cover of BLU magazine about his effort to extend Relativity and he was elected Member of The Institute of Physics.
In 2008 he was selected among the 280 CBEL mathematicians and he was awarded with the Honorary Ph.D. in Theoretical Physics by the Cosmopolitan University.

 *Lectio Doctoralis* 

Is it possible to go beyond Relativity?

Mr. Enzo Bonacci (Italy), Honorary Doctor[*]

- Title of the Doctoral Lecture: **Is it possible to go beyond Relativity?**
- Author: **Dr. h.c. Enzo Bonacci (Italy)**
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- Program Director: **Dr. Emma Hollis**
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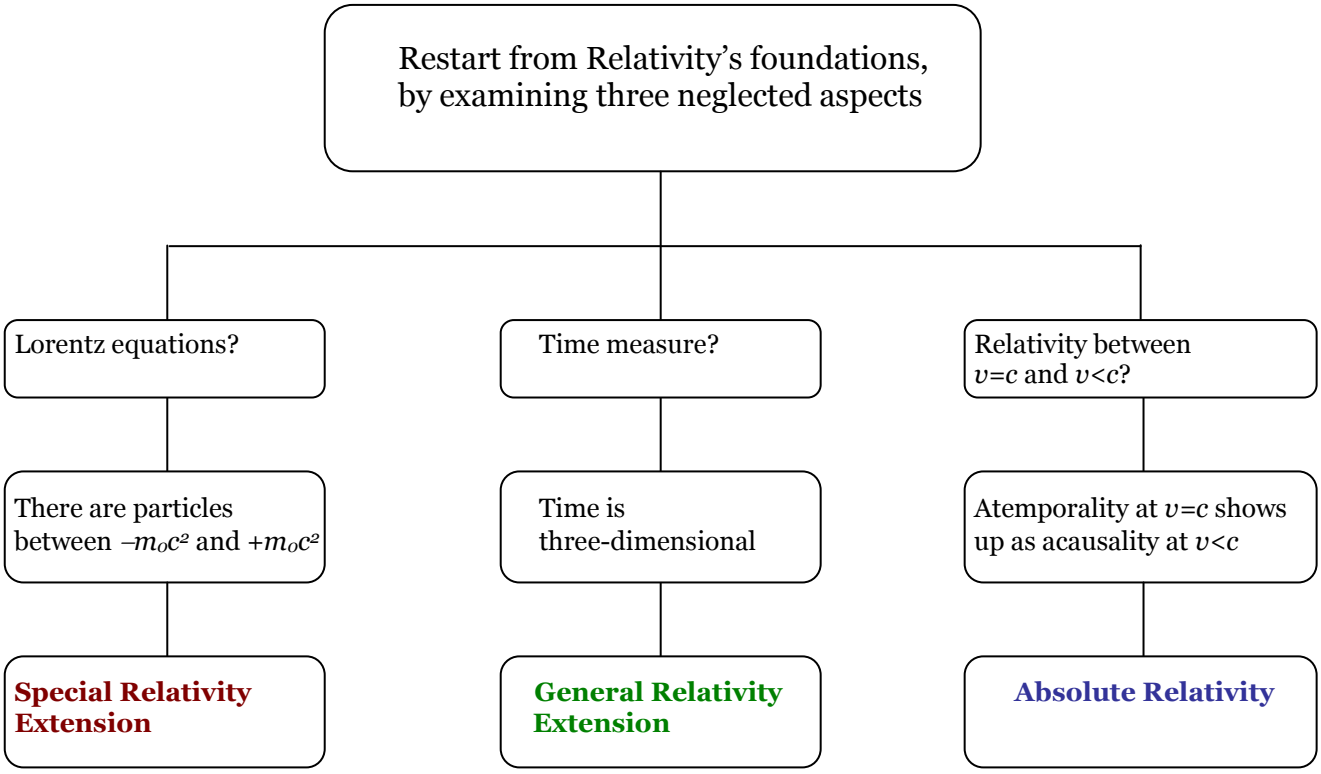
- Index:

(*) Ph.D. Honoris Causa in Theoretical Physics by Cosmopolitan University

DOCTORAL ACCEPTANCE SPEECH

I'm proud to be honored by a University whose motto is "Always one step ahead in research".
When I proposed it in the 90's, my hypothesis of three-dimensional time was considered a bit less than a scientific heresy, but today the Cosmopolitan University has given it the chance to be divulgated inside the academic world.
As far as I know about this argument, only the CERN of Genève with Danny Ross Lunsford, the Pittsburgh University with George Sparling and the Harvard University with Xiaodong Chen have recently shown the same courage, by validating their 3T theories to the rank of scientific proposals.
Although our six-dimensional continuum (3T+3S) hypothesis would objectively be one of the most elegant (because super-symmetric between space and time) and simple (since involving only two extra-dimensions) the mainstream in Physics is still oriented to what I consider Byzantine theories with too many not verifiable spatial extra-dimensions. The objection that such lucubrations are mathematically consistent let me think back to the Ptolemaic geocentric system, not wrong in itself because of motion relativity but so muddled that was replaced by the simpler Copernican heliocentrism without residual doubts.
If one day the scientific community should carry out a decisive experiment proving time's tridimensional nature (maybe at Large Hadron Collider as auspicated by Prof. Sparling) the Cosmopolitan University will be glad to say: *we were the first to bet on it!*
On the contrary, if some future tests should confirm time to be a monodimensional scalar, the Cosmopolitan University will be however proud for having let a dissident voice like mine free to speak in the best American tradition on freedom of thought.
But beyond the effective number of temporal dimensions, Einstein's theory of Relativity offers many other dark sides worthy of a proper investigation. For example the prohibited energetic interval between matter and antimatter (deepened in the paper *Special Relativity Extension*) and the physical mechanism of mass-energy conversion from the well-known formula $E=mc^2$ (analyzed in the paper *Absolute Relativity*).
This Doctoral Lecture (or better in Latin: *Lectio Doctoralis*) is just about the possible new frontiers of physics I'm proposing to explore...

Relativity revision



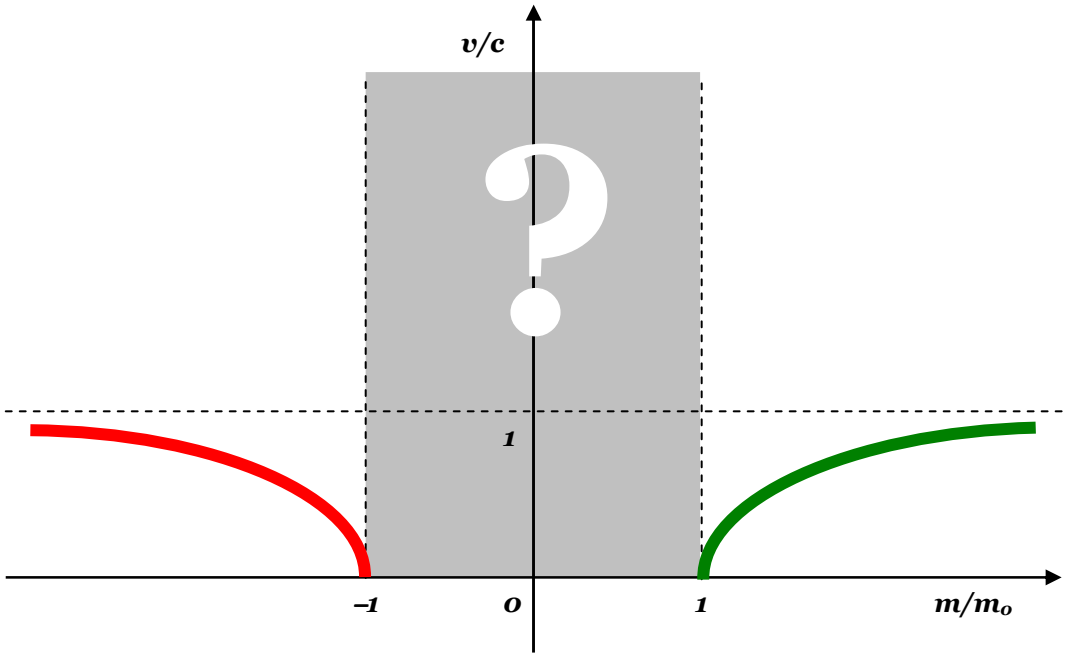
Special Relativity Extension

The paper *Special Relativity Extension* proposes a modification about Lorentz equations such that the energetic interval between $-m_oc^2$ and $+m_oc^2$ gets physical meaning, act to explain:

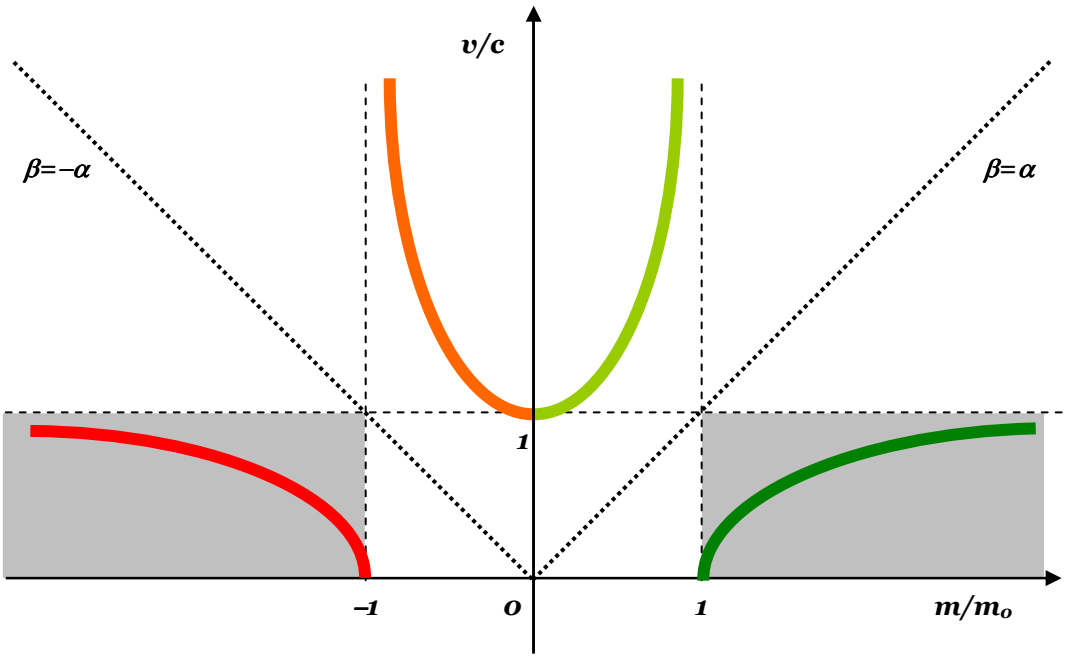
- the matter-antimatter's asymmetry;
- the time arrow;
- the nature of neutrino;
- the dark matter.

A Lorentz-invariant modification

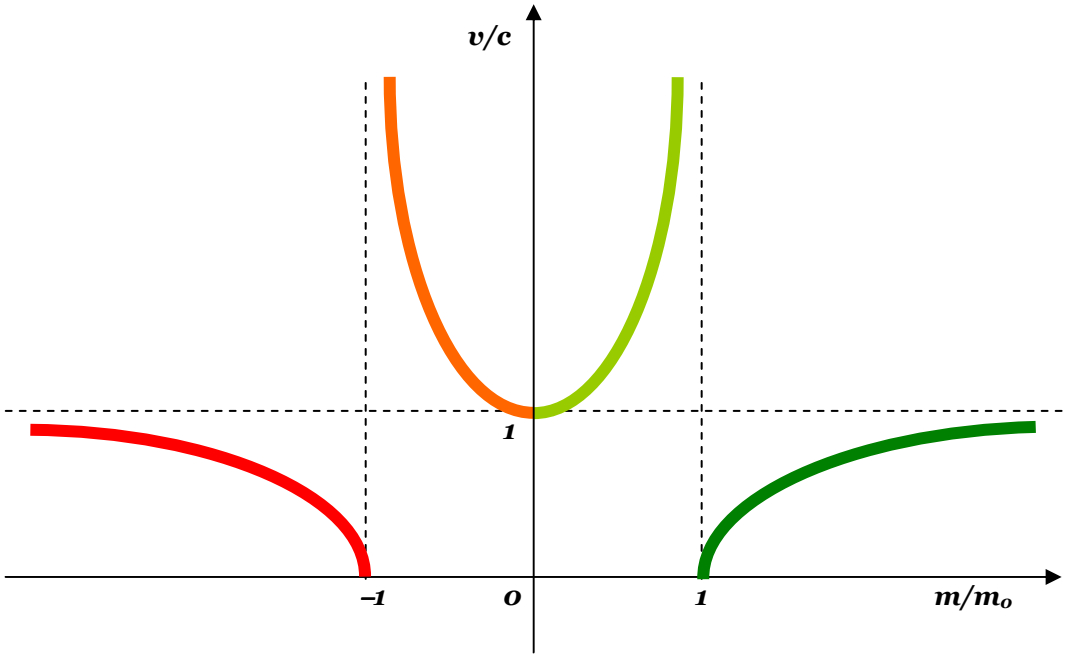
Relativistic relationship when $m>|m_o|$: $\beta^2=1-\alpha^{-2}$ (with $\beta=v/c$, $\alpha=m/m_o$).



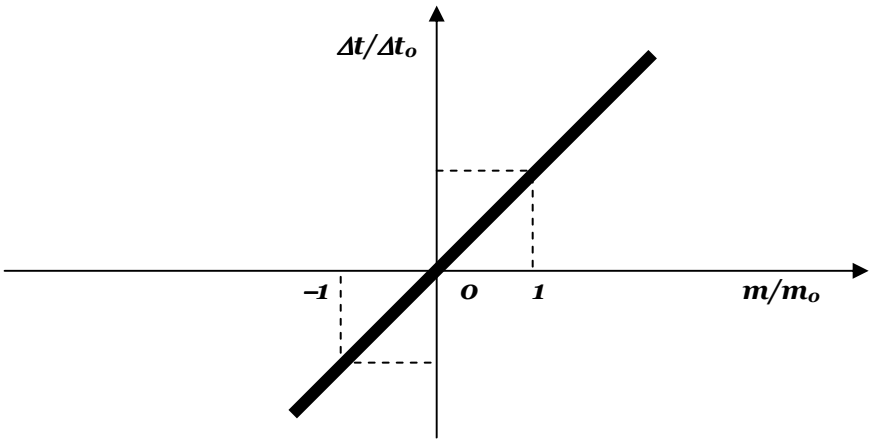
Proposed relationship when $m<|m_o|$: $\alpha^2=1-\beta^{-2}$ (symmetric with respect to the bisectors $\beta=\pm\alpha$).



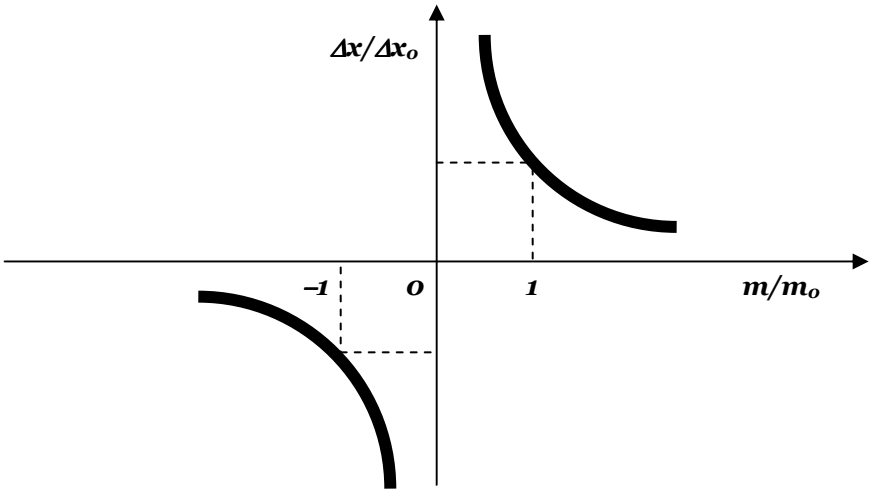
Velocity of particle in function of its mass $\beta=\beta(\alpha)$:



Time-stretching of particle in function of its mass $\Delta t=\alpha\Delta t_0$:



Length-contraction of particle in function of its mass $\Delta x=\Delta x_0/\alpha$:

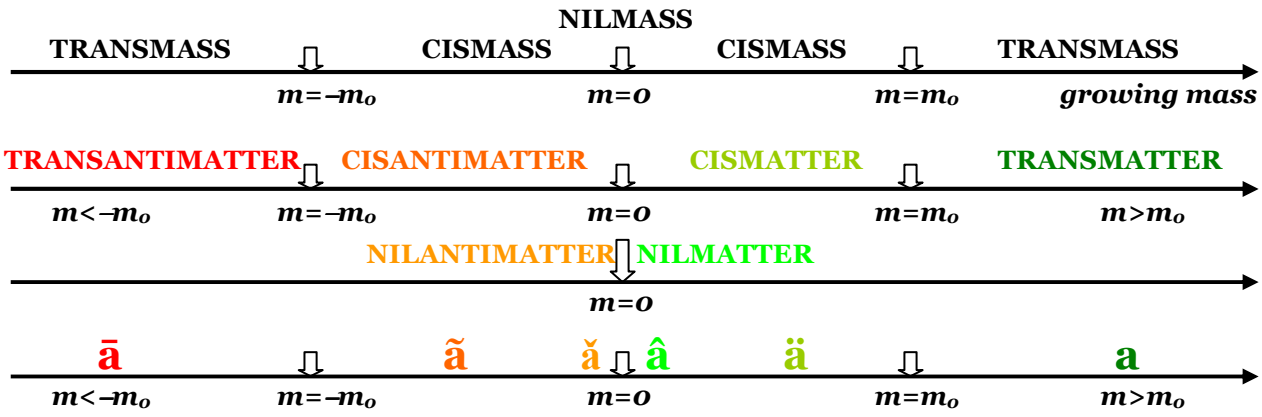


Classification of particles

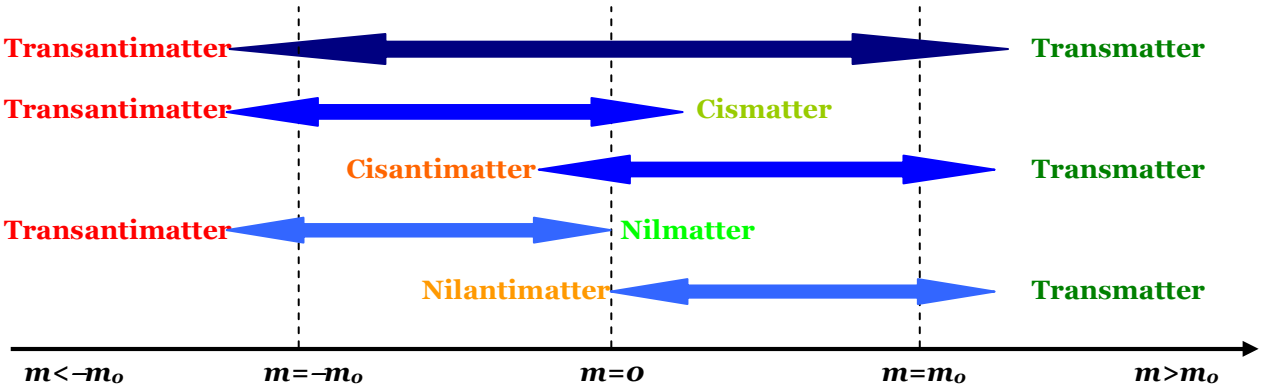
Description	*Particle*	*Symbol*	*Mass at rest*	*Moving mass*	*Length*	*Time*	*Velocity*	*Spin*
Radiant Energy	Photon	γ	$m_o=0$	$m=E/c^2\neq 0$	$\Delta x=0$	$\Delta t=\infty$	$v=c$	1
Transmass	Transmatter (Ordinary matter)	a	$m_o>0$	$m>m_o$	$0<\Delta x<\Delta x_o$	$\Delta t_o<\Delta t$	$v<c$	±½
	Transantimatter (Antimatter)	ā	$m_o<0$	$m<m_o$	$-\Delta x_o<\Delta x<0$	$\Delta t<-\Delta t_o$	$v<c$	±½
Cismass	Cismatter (Tachyons)	ä	$m_o>0$	$0<m<m_o$	$\Delta x_o<\Delta x$	$0<\Delta t<\Delta t_o$	$v>c$	±½
	Cisantimatter (Antitachyons)	ã	$m_o<0$	$m_o<m<0$	$\Delta x<-\Delta x_o$	$-\Delta t_o<\Delta t<0$	$v>c$	±½
	Nilmatter (Neutrinos etc...)	â	$m_o>0$	$m=0^+$	$\Delta x=\infty$	$\Delta t=0$	$v=c$	±½
	Nilantimatter (Antineutrinos etc...)	ă	$m_o<0$	$m=0^-$	$\Delta x=\infty$	$\Delta t=0$	$v=c$	±½

Energetic levels and transformations

Classification of particles based upon energy levels:

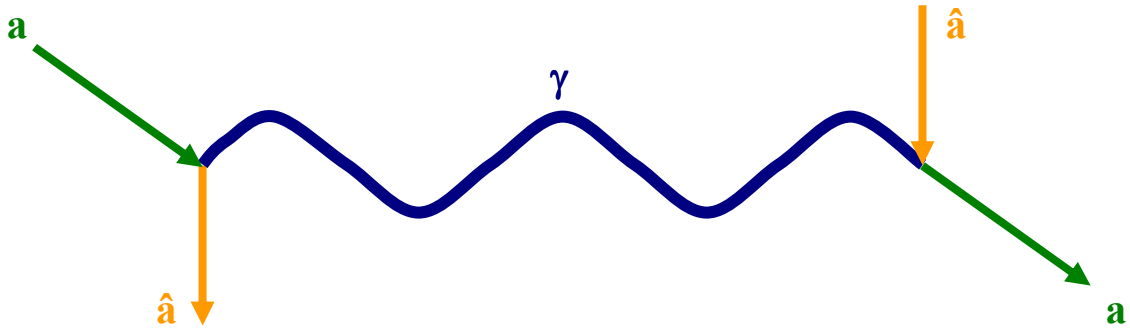


Transitions among energy levels where spin and charge are conserved:

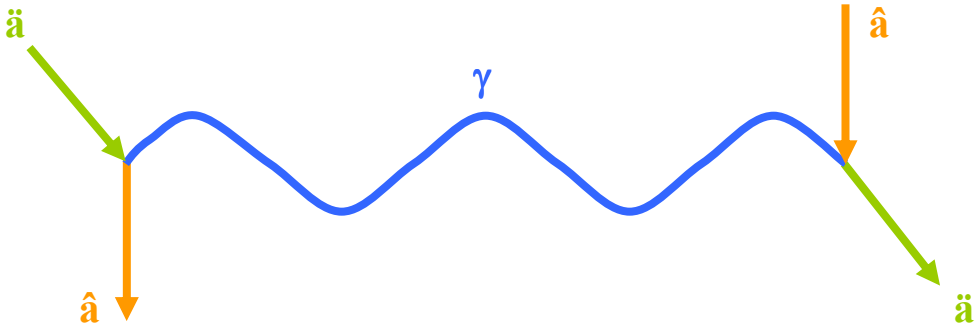


Teleportation through nilmass

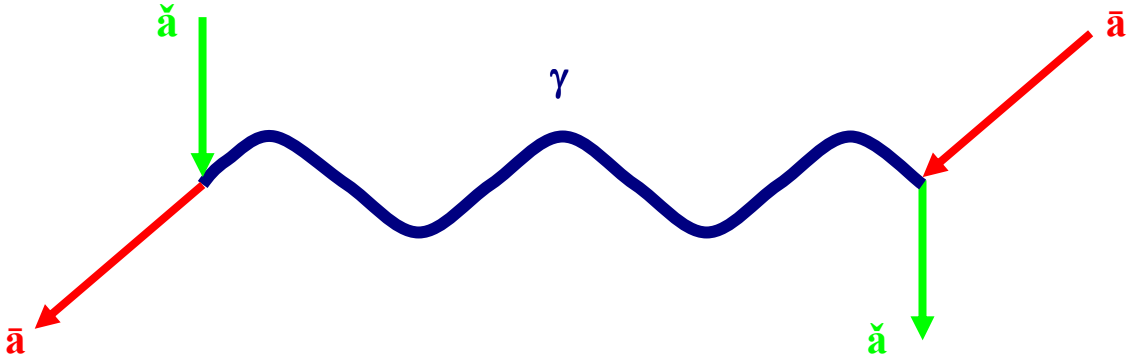
Teleportation of transmatter by nilantimatter: **a+â↔γ**.



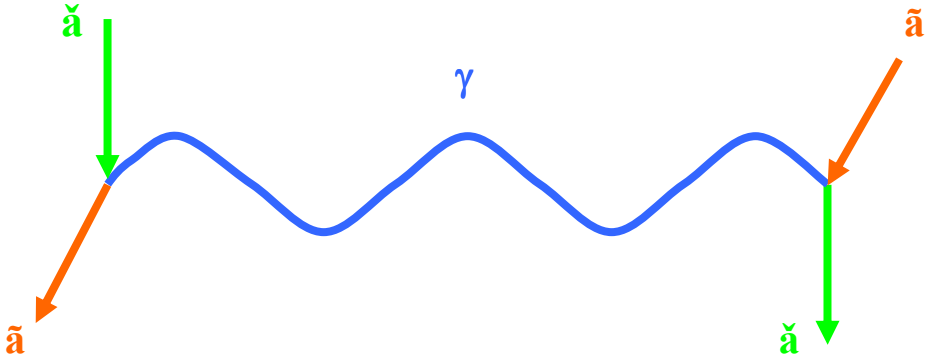
Teleportation of cismatter by nilantimatter: **ä+â↔γ**.



Teleportation of transantimatter by nilmatter: **ā+ă↔γ**.

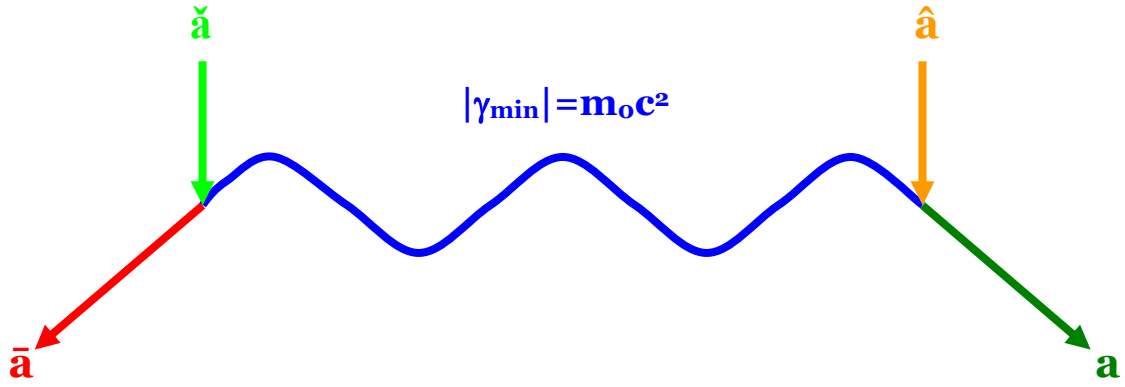


Teleportation of cisantimatter by nilmatter: **ã+ă↔γ**.

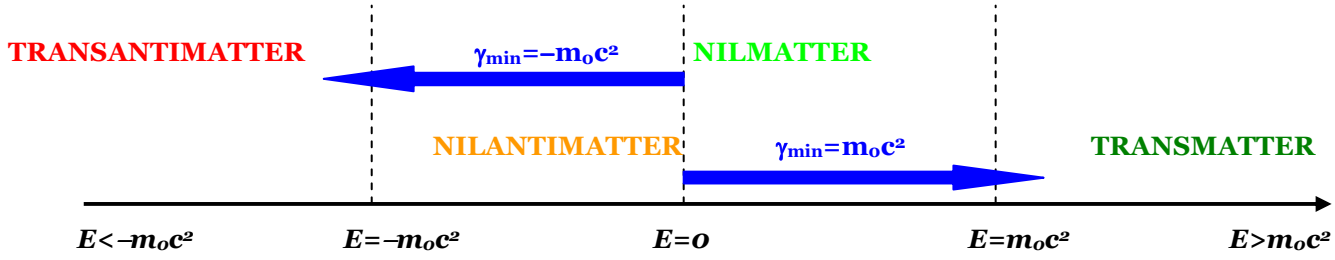


Transitions transmass-nilmass

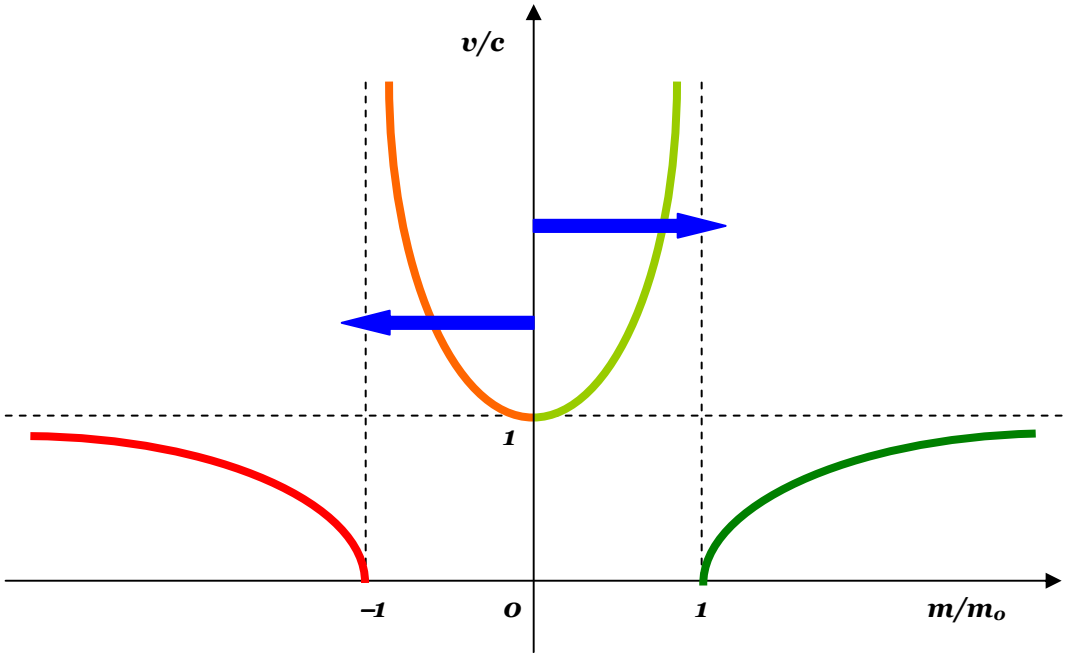
Transformation of antiparticle-nilparticle pair into particle-nilantiparticle's:



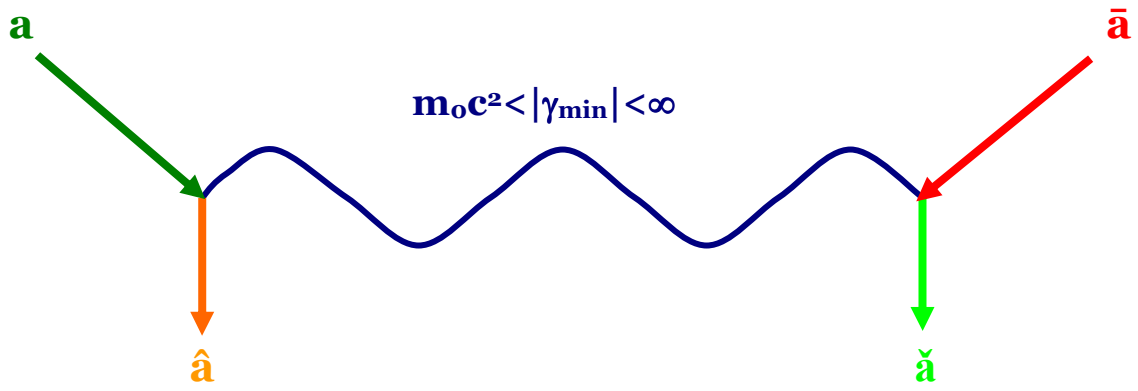
γ_{min} necessary to come out of nilmass: $\pm m_oc^2$.



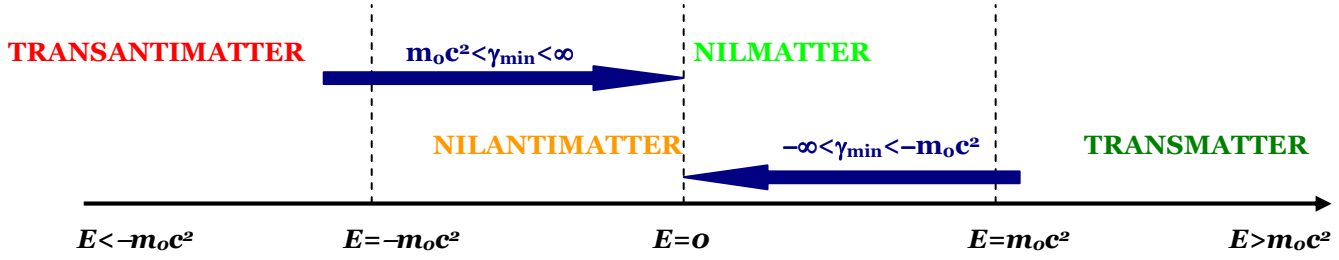
Minimum energy sufficient for any transition nilmass→transmass: $E_{min}=m_oc^2$.



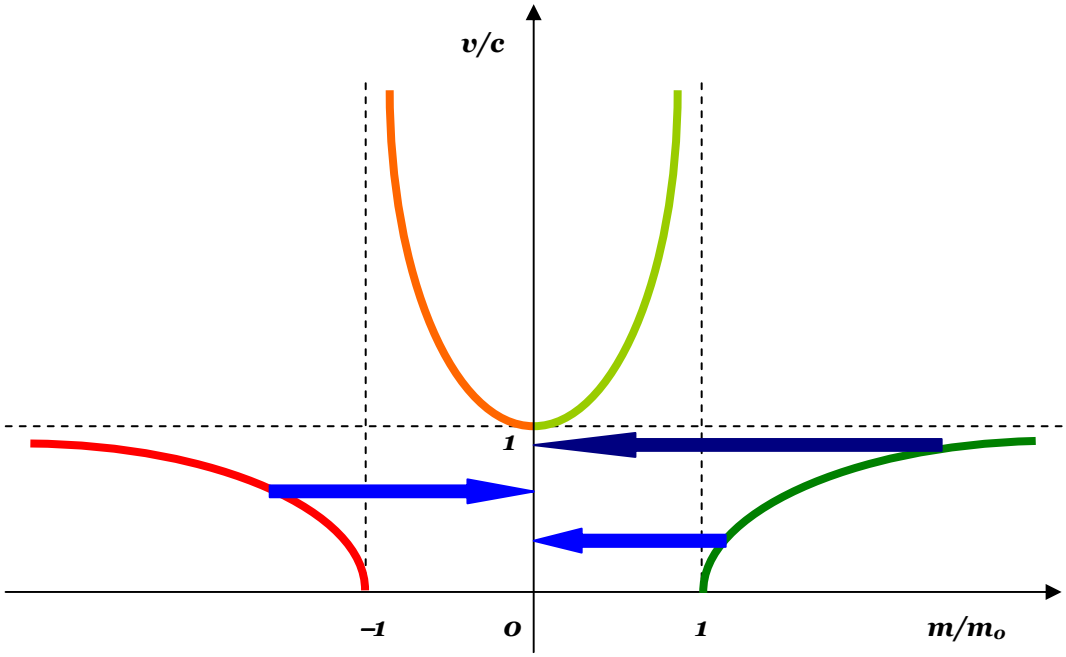
Transformation of particle-nilantiparticle pair into antiparticle-nilparticle's:



The γ_{min} necessary to become nilmass depends on particle's energy, between $\pm m_0c^2$ and $\pm\infty$:

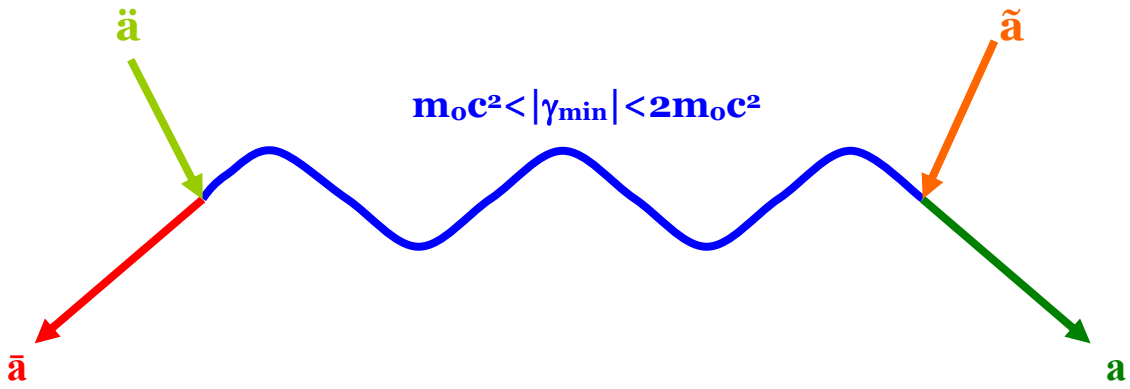


There is not a minimum energy sufficient for any transition transmass→nilmass:

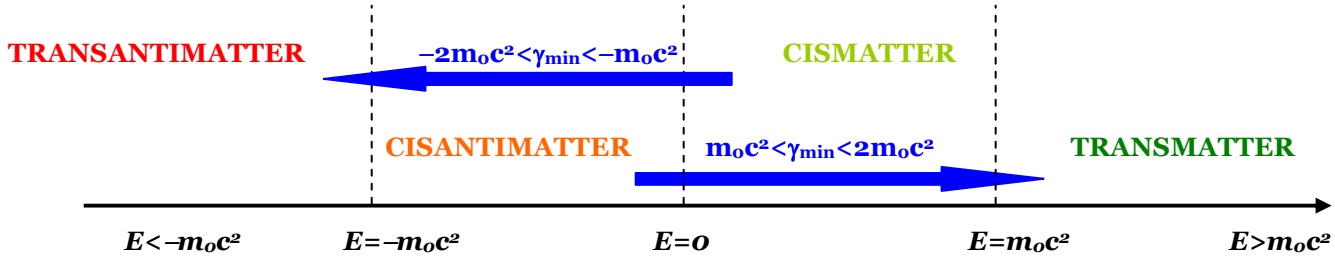


Transitions transmass-cismass

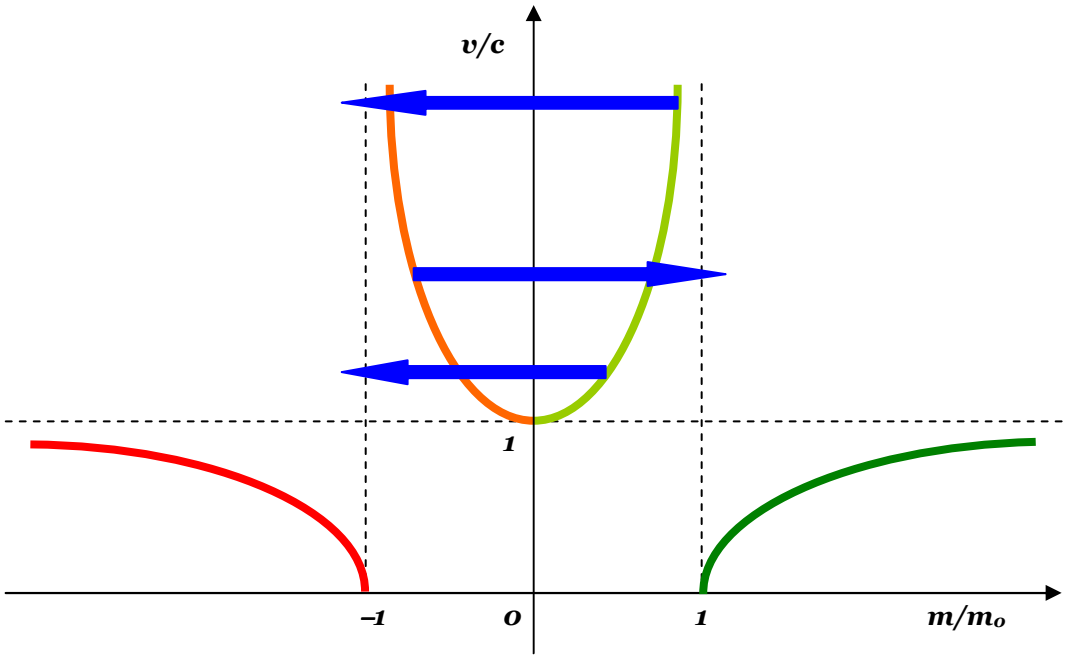
Transformation of antiparticle-cisparticle pair into particle-cisantiparticle's:



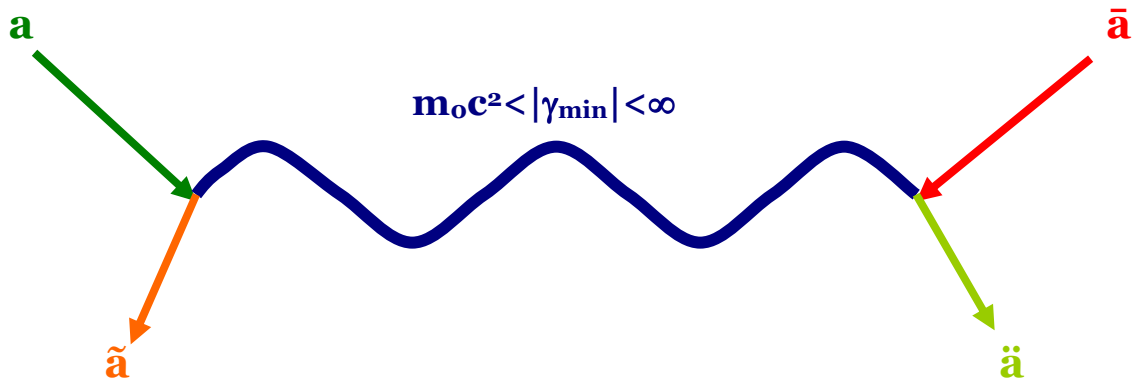
The γ_{min} to leave cismass depends on cisparticle's energy, between $\pm m_0c^2$ and $\pm 2m_0c^2$:



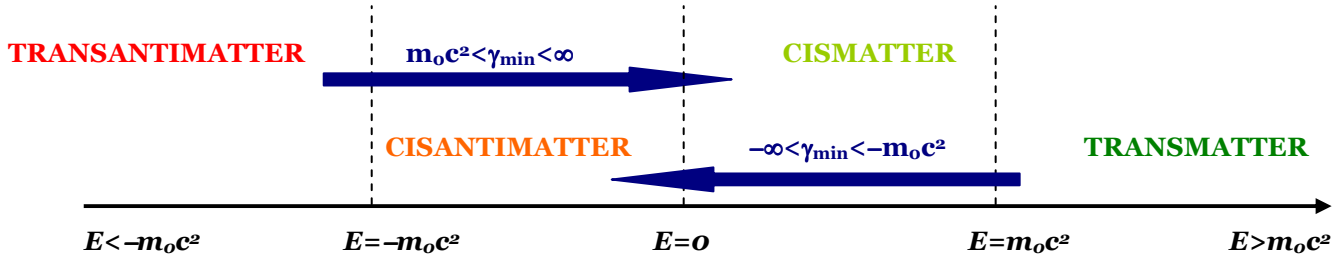
Minimum energy sufficient for any transition cismass→transmass: $E_{min}=2m_0c^2$.



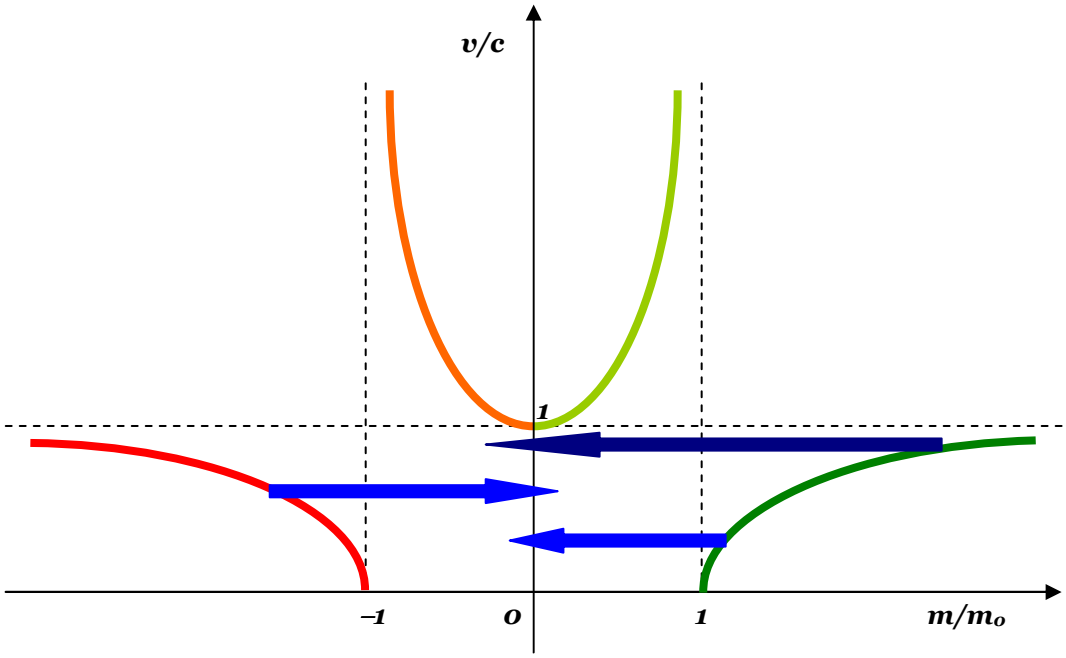
Transformation of particle-cisantiparticle pair into antiparticle-cisparticle's:



γ_{min} necessary to enter cismass depends on particle's energy, between $\pm m_0c^2$ and $\pm\infty$:



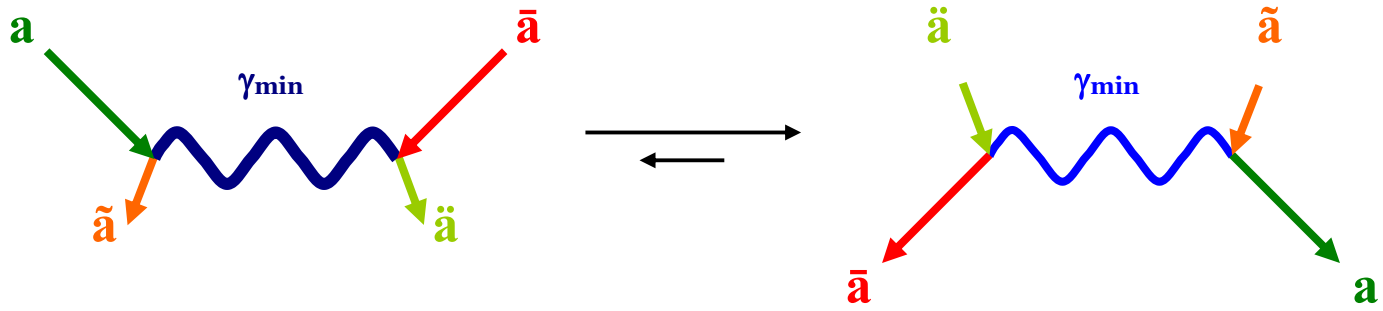
There is not a minimum energy sufficient for any transition transmass→cismass:



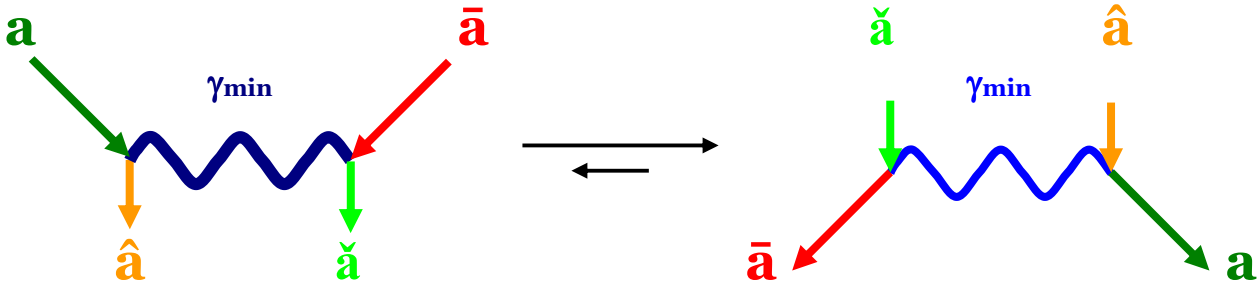
Violation of the CP symmetry

The CP symmetry is violated in favor of transmatter, nilantimatter and cisantimatter.

Transmatter and cisantimatter are *energetically favourite* with regard to antimatter and cismatter:



Transmatter and nilantimatter are *energetically favourite* in comparison with antimatter and nilmatter:



Time, dark matter, neutrino

ARROW OF TIME

- The transformations producing matter, antineutrinos and antitachyons, are energetically favourite (*i.e.*, *asymmetric*) compared to those producing antimatter, neutrinos and tachyons.
- Such asymmetry defines two temporal directions and we, ordinary observers, are following the one at *minimum energy*, as shown by the predominance of matter whose relative abundance, growing with respect to antimatter's, becomes an irreversible cosmic measurement of time.
- Although coinciding with the entropic arrow, the time flow has, therefore, a microscopic explanation not related to any thermodynamic consideration.

DARK MATTER

The *nilmass* has the same features of the so called *dark matter*, by showing currently inexplicable gravitational and electromagnetic effects.

NATURE OF NEUTRINO

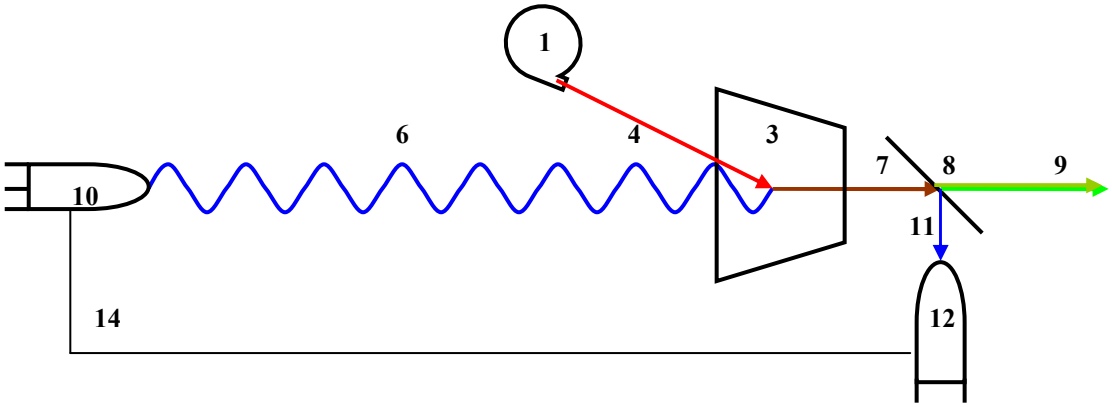
The nilmass at *null charge* shows the same features of *neutrino* (if $m=o^{+}$) and *antineutrino* (if $m=o^{-}$).

VIOLATION OF CONSERVATION

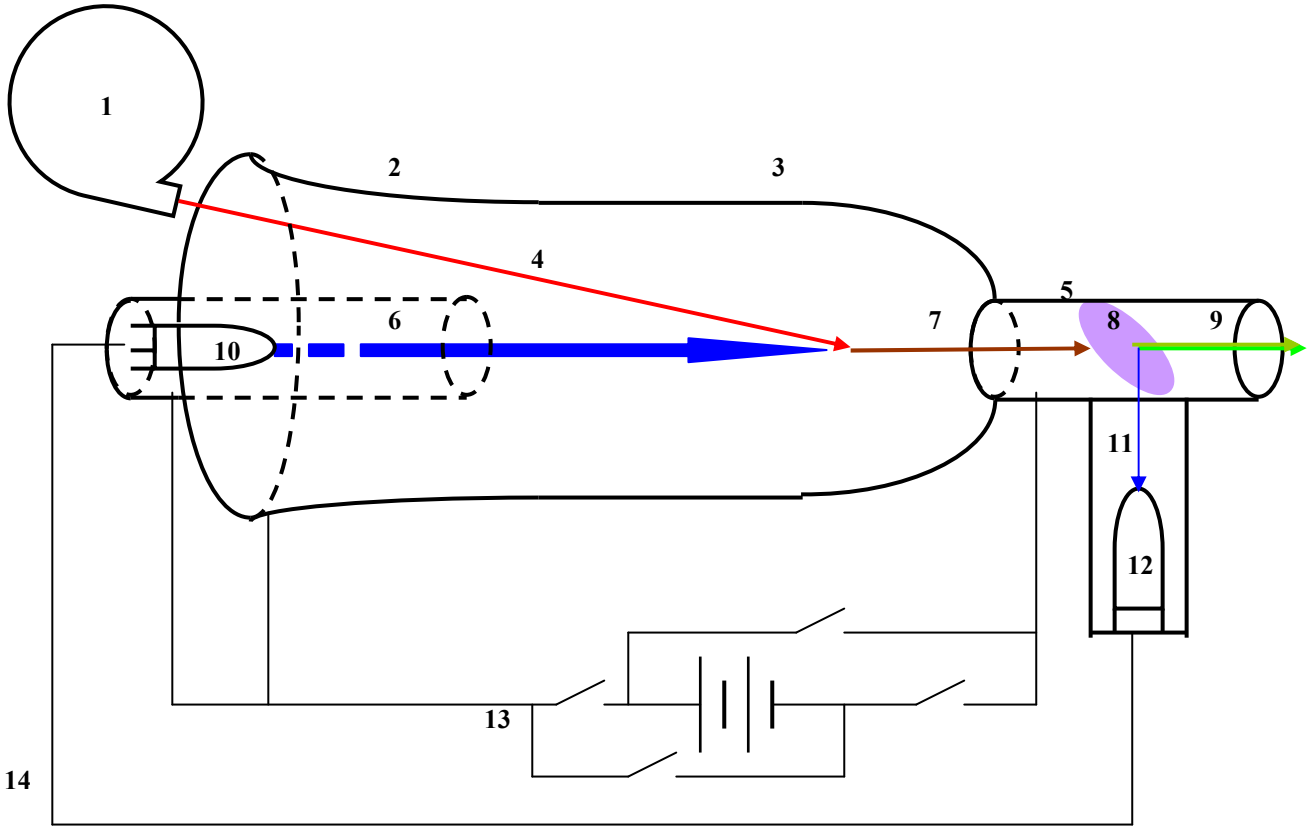
In transformations involving *cismass* there are apparent violations of charge and spin conservation and of the mass-energy balance, because the ordinary observer can not perceive neither *tachyons* nor *antitachyons*.

Generators

Generator of nilmatter or cismatter from antimatter: conceptual plan.



Project plan:



Caption:

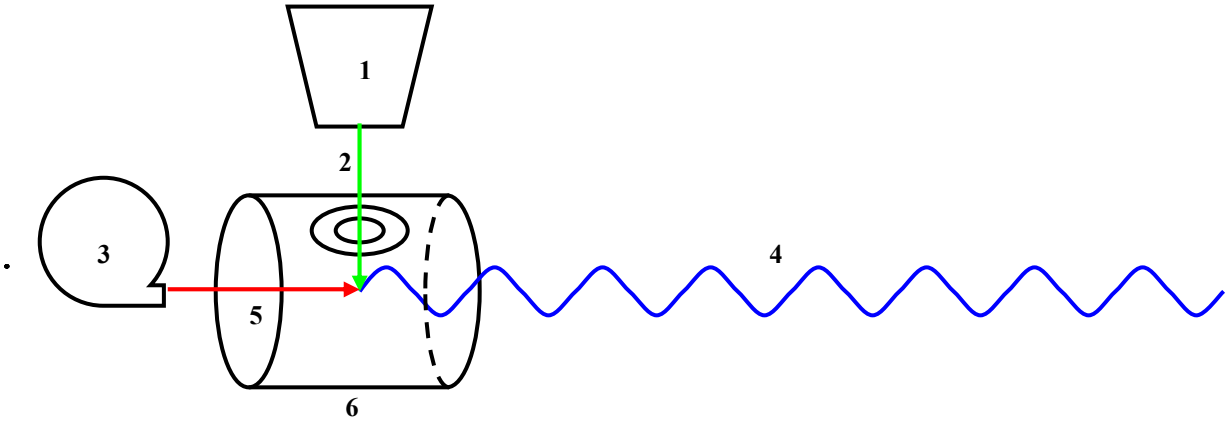
1) Antiparticles' generator.
2) Conveyor.
3) Conversion chamber.
4) Antiparticles beam.
5) Nozzle with ionic neutralizzator.
6) Laser ray at adjustable frequency coming in.
7) Beam of nilparticles (or cisparticles), ions and photons.
8) Mirror.
9) Beam of nilmatter or cismatter.
10) Laser diode.
11) Laser ray going out.
12) Photodiode.
13) Switch anode/catode.
14) Feedback photodiode↔laser diode.

Explanation:

Denote: *h=Plank's constant*, *n=antiparticles' number*, *<m>=average mass*, *ν=laser ray's frequency*.
Cismatter's generation requires a laser ray whose frequency is:
$\nu_{cismatter}=n_{antiparticles}*(<m_{cisparticle}>-<m_{antiparticle}>)*c^2/h$.
Nilmatter's generation requires: $\nu_{nilmatter}=n_{antiparticles}*(m_{nilparticle}-<m_{antiparticle}>)*c^2/h=n_{antiparticles}*|<m_{antiparticle}>|*c^2/h$.

Neutralizators

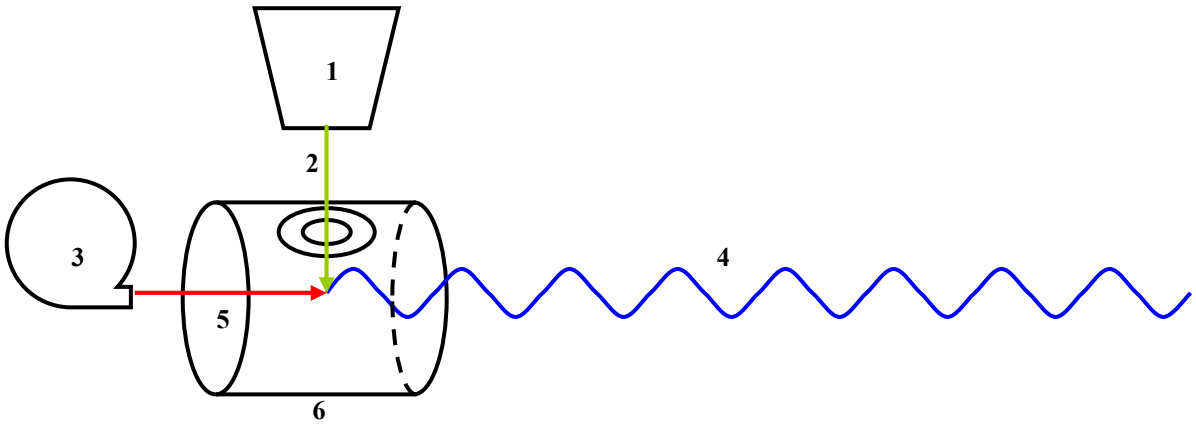
Neutralizator of nilmatter: project plan.



Caption:
1) Nilparticles' generator.
2) Nilparticles' beam coming in.
3) Antiparticles' generator.
4) Photons' beam going out.
5) Antiparticles' beam.
6) Conversion chamber: $\bar{a}+\check{a}\rightarrow\gamma$.

Explanation: an antiparticles' beam collides with a nilparticles' one according to conversion into photons: $\bar{a}+\check{a}\rightarrow\gamma$.

Neutralizator of cismatter: project plan.



Caption:
1) Cisparticles' generator.
2) Cisparticles' beam coming in.
3) Antiparticles' generator.
4) Photons' beam going out.
5) Antiparticles' beam.
6) Conversion chamber: $\bar{a}+\ddot{a}\rightarrow\gamma$.

Explanation: an antiparticles' beam collides with a cisparticles' one according to conversion into photons: $\bar{a}+\ddot{a}\rightarrow\gamma$.

General Relativity Extension

The paper *General Relativity Extension* proposes a six-dimensional geometrodynamics, based on the proof of time's three-dimensionality through an ideal diode-photodiode test, act to explain:

- the quasi-coplanar distribution of celestial objects;
- the quasar's jet and accretion disk;
- the hadronic confinement and the asymptotic freedom of quarks;
- the Cooper pairs, the Podkletnov shield and the Searl effect.

Towards the six-dimensionality (1963-2007)

R.P. Kerr (1963) describes the black hole by a *six* components metrics.

J.S. Dowker (1977) studies the single loop divergences at *six dimensions*.

R. Critchely (1978) shows the necessity to integrate by *two* dimensions the relativistic source tensor 4x4 in order to explain the trace anomaly for neutrinos and gravitons.

P.S. Wesson (1981) proposes a 6d model of universe called STMC (Space-Time-Mass-Charge) in which the two dimensions more than the Standard Model are the rest mass and the charge.

J. Strnad (1983) discusses the space-time relation with 3 spatial and 2n+1 temporal coordinates and suggests possible tests to falsify the hypothesis of tridimensional time.

G. Ziino (1985) confutes the J. Strnad's theses by proposing several argumentations to support the 3T conjecture.

M. Rosenbaum and M.P. Ryan (1988) propose a 6d space-time where the two extra-dimensions own a 2-sphere geometry deriving from the coupling of Yang-Mills and Higgs fields.

T. Fukui (1992) analyses the physical properties of the 6d universe STMC by Wesson getting a solution for the cosmic vacuum and predicting the unification between gravity and electromagnetism.

F. Bastianelli, S. Frolov and A.A. Tseytlin (1999) analyze super-symmetric conformal theories in 3d and *6d*.

K. Intriligator (2000) analyses the N=(2,0) fields theories in *six dimensions* at low energy.

P.S. Howe (2000) describes some features of the (2,0) tensor multiplet in *six dimensions*.

R. Manvelyan and A.C. Petkou (2001) analyze the trace anomalies in the (2,0) tensor multiplet in *6d*.

B. Eden, S. Ferrara and E. Sokatchev (2001) describe the (2,0) super-conformal OPEs in *six dimensions*.

D.R. Lunsford (2003) develops a Weyl geometry over SO(3,3) by interpreting the two extra-dimensions as *coordinatized matter*, indicating how the *6d* neutrinos would show up as 4d massive fermions and proposing the unification between gravity and electromagnetism.

X. Chen (2005) proposes a tridimensional time theory to unify the basic principles of Quantum Mechanics and Relativity, in which the two temporal extra-dimensions are interpreted as quantum hidden variables and the electron is expressed as time monopole.

I. Bars (2006) develops a 2T theory in *4+2 dimensions* to fix some inconsistencies in the Standard Model.

E. Bonacci (2006) proves time's *three-dimensionality* through an ideal experiment of diode-photodiode measurement, and he formulates a six-dimensional *geometrodynamics* based on a super-symmetric 6x6 source tensor act to describe all the known fields.

G. Sparling (2006) confirms the *3+3* dimensions space-time through spinorial calculations and he solicits a resolving test by the *Large Hadron Collider*.

E. Bonacci (2007) confirms the tridimensional time by the Principle of Reciprocity, acausal extension of Newton third law of motion uniting Relativity to Quantum Mechanics.

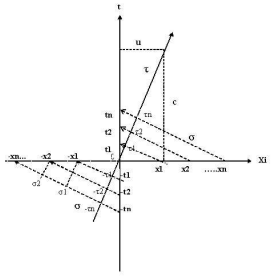
The four pioneers of the model SO(3,3)

	Why should time have three dimensions?	**Which representation?**	**Why does time seem scalar?**	**The nature of the two extra-dimensions ?**	**Affinity with the String Theory?**	**Why are there acausal phenomena?**
XIADONG CHEN (USA)	The temporal extra-dimensions explain the not-local motion; they must be 2 for an actual physical observation	Motion equations with multiple proper time; the trajectory given by 3 world lines corresponds to the wave function	The time extra-dimensions are hidden, with radius minor than Planck length	Although temporal the two extra-dimensions show up space-like in 4d (negative sign)	Lagrangian similar to the bosonic strings; compact and periodical extra-dimensions	Due to the "invisible" motion lines along the two temporal extra-dimensions
DANNY ROSS LUNSFORD (USA)	Six dimensions are the minimum number leading to a variational principle devoid of arbitrary factors	6d Weyl geometry with a symmetrically connected space	Not specified	The two extra-dimensions are coordinatized matter	Not related	Not specified
GEORGE A.J. SPARLING (USA)	The rotational symmetry of the not local spinorial transform Ξ with two 6d twistor spaces forces the space-time to be 6d	Three six-dimensional spaces (the ordinary space-time and two twistors) united by Cartan triality. The triality symmetry of the type developed by Elie Cartan, associated with the real Lie group O(4, 4), requires a 6d space-time of signature (3,3)	The space 3d and time 3d; from which $s^2=x^2+y^2+z^2-t^2-u^2-v^2$, (with u and v time extra-variables) are around the ordinary 4d space-time	The 2 extra-dimensions have negative sign (are timelike) because the geometry of twistor spaces is ultrahyperbolic	The trouser-pants diagram becomes an amplitude relating 3 strings, one in each of 3 *different* spaces (1 extended space-time + 2 twistor spaces)	Not specified
ENZO BONACCI (ITALY)	Direct measurement diode-photodiode in UCM. Principle of Reciprocity applied to Special Relativity	Riemannian classic, with a 6d Gaussian reference frame: three spatial axis and three temporal surfaces	Bodies' structural complexity privileges the tangential time above all (with rare exceptions)	Same nature, same rank and same sign of Relativistic proper time	6d Gaussian reference with three temporal surfaces; matter as electromagnetic helix	By Absolute Relativity there is the indistinguishability among atemporal systems at $v=c$ and acausal at $v<c$

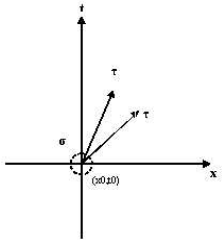
The quantum approach by Chen

Basic quantum principles of single particle (non-localization, non-determinism, spin and related statistics) are derivable from pure geometry of two extra time dimensions and the consequent 6-dimensional KK theory could unify electromagnetism and gravity. Chen uses the two dimensional world sheet starting the calculation from the same lagrangian of bosonic string, but instead of considering the extra dimension σ as string, he interprets it as world line of extra dimensional time. He proves that only one extra time dimension σ leads to complex space-time values, while two extra time dimensions σ and ϕ give the correct possibility of physical observable in measurement (under the hypothesis they are both compact small loop satisfying 2π-period condition and whose radius has scale of Planck length). A puntiform particle moves along three separate world lines, each one associated with one proper time; and the whole trajectory of particle becomes a wave in space. The projections of extra two world lines in 4-dimensional spacetime are space like because of their signs, but in the whole 6-dimensional spacetime, all three world lines are light like. Electron can be expressed as time monopole. Chen introduces the 5th component of momentum-energy tensor for general electromagnetic field, which can also help us to get spin magnetic moment but cannot include strong and weak forces because these interactions are related to nucleons which have finite spatial size.

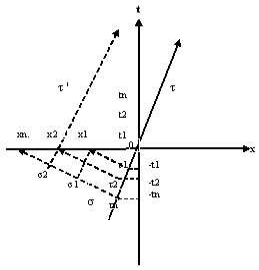
World line τ and world line σ on $t–x_i$ plane in Minkowski space. Particle can move along both world lines, slope of τ is u/c. At $t=0$, the single particle will be shown at all positions: $–x_1$,$–x_2$, … $–x_n$ with different values of τ and σ $(-\tau_1, \sigma_1)..(-\tau_n, \sigma_n)$. Also the single particle will be shown at $x=0$ at different time: t_1, t_2, ..t_n with different τ and σ values; where $x_n=h/mu$ and $t_n=h/mc^2$ which are de Broglie wavelength and period:



World lines σ is a infinitesimal loop to fixed point (x_0, t_0). τ perpendicular to loop σ, so τ can point to any direction, the slope of τ is from $-\infty$ to ∞ which means the momentum is from $-\infty$ to ∞:



Current universal time is $t=–t_2$, particle reaches x_2 at $t=0$, it is in future since $t=0>–t_2$. When event *2* happens at x_2, the particle interacts with other particles, so particle's world lines is changed, its next movement will be based on new world line τ':



The field equations by Lunsford

Lunsford thinks that Weyl's theory in 4d failed because lacking of a proper variational integrand; he finds that first in 6d we obtain a variational principle with no arbitrary factors:
$\int \mathbf{R} d^6\omega = \int \mathbf{R} W d\Omega = 0$, where $\mathbf{W} = \mathbf{F}^{mn}\mathbf{F}_{mn}$.
He develops a Weyl geometry over SO(3,3) as base, under which gravity and electromagnetism are essentially unified via an irreducible 6-calibration invariant Lagrange density and corresponding variational principle.
The extra dimensions are given a physical meaning as "coordinatized matter".
Matter appears by interpreting source-free homogeneous fields over a 6-dimensional space of signature (3,3) as interacting inhomogeneous fields in spacetime.
The inhomogeneous energy-momentum relations for the interacting fields in spacetime are automatically generated by the simple homogeneous relations in 6d.
The Einstein-Maxwell equations are shown to represent a low-order approximation, and the cosmological constant must vanish in order that this limit exists.

The conformal covariant derivative of a tensor of weight N is $\mathcal{D}_\alpha$:

$$\mathcal{D}_\alpha T_{(N)} = (\nabla_\alpha + N A_\alpha) T_{(N)}$$

It's a formalism necessary to a joint field theory for the A and g.

Lunsford's combined electromagnetic and gravitational equations are:

$$\begin{cases} R_{\underline{mn}} = \left(\frac{2R}{W}\right) T_{mn} - \left(\frac{1}{2W}\right)(\mathcal{D}_m\mathcal{D}_n + \mathcal{D}_n\mathcal{D}_m)W \\ \frac{1}{\sqrt{}}\partial_n(\sqrt{R}F^{mn}) = \frac{5}{4}\mathcal{D}^m W \end{cases}$$

Since T has conformal weight -1, the equations are calibration invariant.
The underbars on the indices of the Ricci tensor indicate the symmetric part
When do these equations take on the form of Einstein's equations?
Before we must introduce the conformal wave equation for W (= weight):

$$\mathcal{D}_m\mathcal{D}^m W = 0 \quad \text{(conservation of "geometrical charge" invariantly written)}$$

then we may write:

$$R_{\underline{mn}} - \frac{1}{2} g_{mn}(R - \Lambda) = \left(\frac{2R}{W}\right)\left(T_{mn} - \frac{1}{4} g_{mn}\frac{W}{R}(R-\Lambda) - \left(\frac{1}{4R}\right)(\mathcal{D}_m\mathcal{D}_n + \mathcal{D}_n\mathcal{D}_m)W\right)$$

the last two terms on the right must cancel:

$$(\mathcal{D}_m\mathcal{D}_n + \mathcal{D}_n\mathcal{D}_m + g_{mn}(R-\Lambda))W = 0$$

Contracting with the metric and by the conformal wave equation for W:

$$(R-\Lambda)W = 0$$

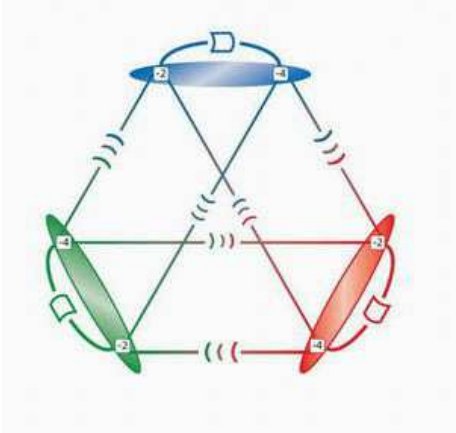
Thus we obtain general relativity only in the limit:

$$\Lambda = 0,\ R \to 0,\ W \to 0,\ \frac{R}{W} \to -4\pi G$$

If R and W differ from zero by a factor of first order, their product is second order and may be ignored; so the Einstein–Maxwell equations are to be regarded as first-order approximation to the full calibration-invariant system.

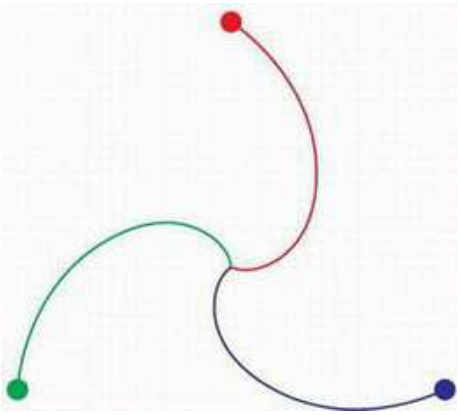
The spinorial interpretation by Sparling

Sparling's work has three six-dimensional spaces which at one level are on an equal footing and which are bound together by a new integral transformation, which he calls the Ξ-transform.
Two of these spaces can be understood at the space-time level as twistors. Then the third space can be given a space-time interpretation, but only if we have two extra dimensions: so it is the requirement of symmetry between the spinor spaces and the space-time that dictates that the extra dimensions be there.
In Sparling's theory, the two twistor spaces are each six-dimensional, forcing space-time to also have six dimensions, in accordance with Cartan's unifying triality. Because the twistor spaces' geometry is ultra-hyperbolic, the extra dimensions are time-like (minus sign).
The four dimensional space is hyperbolic as usual, but in the surrounding space there are equal numbers (3 each) of space and time dimensions, so the formula for s^2 reads something like $s^2=x^2+y^2+z^2-t^2-u^2-v^2$, where u and v represent the new time variables.
The structure is a Xi-transform, which moves between the three spaces in the directions given by the bendings of the upper case Greek letter Xi. The distorted squares represent the wave operator. The product of a wave operator and a Xi transform, taken in any order, is zero:



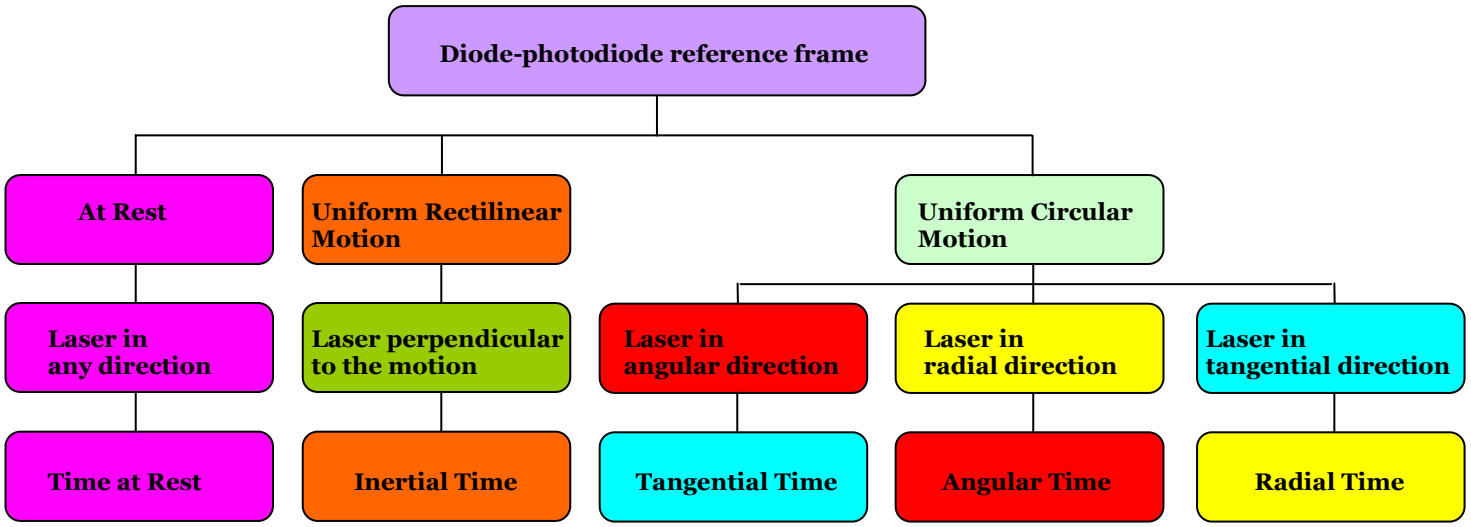
The analytical structure underlying the spinorial theory. Image credit: Erin Sparling.

Sparling's spinorial theory is based on Einstein's general relativity and Elie Cartan's triality concept, which can link space-time with two twistor spaces. Twistor spaces are mathematical spaces used to understand geometrical objects in space-time landscapes:



Cartan's triality symbol links two twistor space and space-time. Image credit: Erin Sparling

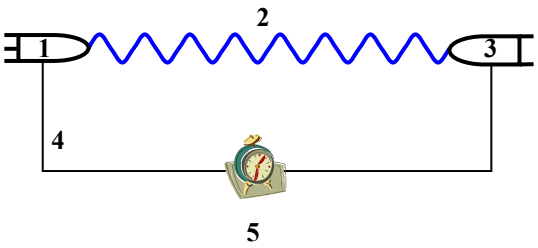
Proving time's three-dimensionality



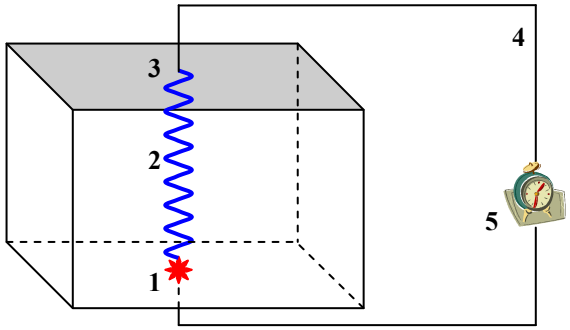
Diode-photodiode measurement in UCM

Diode-photodiode measurement system.

Time is measured on an orientation,
i.e. between two parallel planes diode-photodiode:



Let the diode be puntiform while the
photodiode is distributed on the opposite wall:

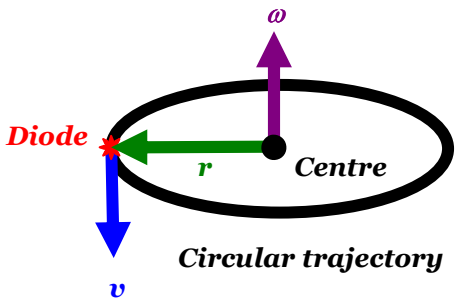


Caption:
1) Diode
2) Laser ray
3) Photodiode
4) Feedback
5) Chronometer

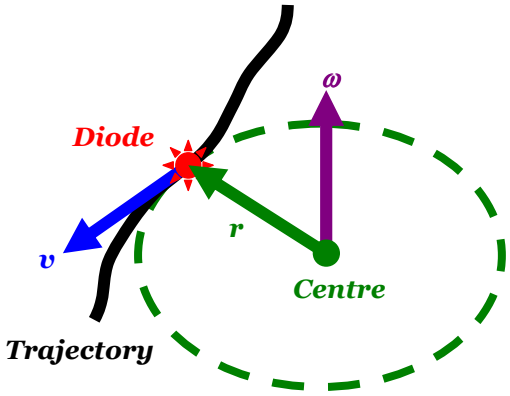
Why the Uniform Circular Motion?

- Each point of a continuous trajectory is assimilable to an instantaneous UCM.
- In fact, each point individuates the three instantaneous vectors:
  $\boldsymbol{v}$=tangential velocity;
  $\boldsymbol{r}$=radius of curvature;
  $\boldsymbol{\omega}$=angular velocity.
- The rectilinear trajectory is a limit case of degenerated UCM: $r \to \infty$, $\omega = 0$.

<u>In the Uniform Circular Motion: $\boldsymbol{v=\omega x r}$</u>



<u>Along any continuous trajectory:</u>

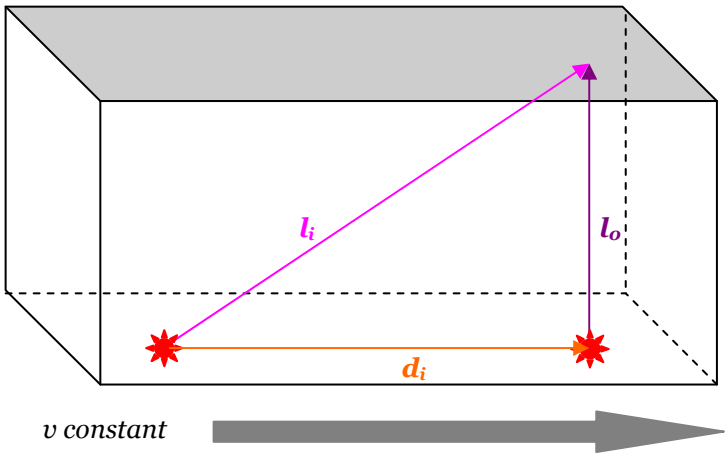


Instantaneous circumference of curvature

Inertial Time

- γ is the relativistic coefficient.
- The laser ray is emitted in any direction perpendicular to the motion.

Composition of the trajectories in the URM:



The locally quasi-Euclidean space-time permits the Pythagorean theorem:

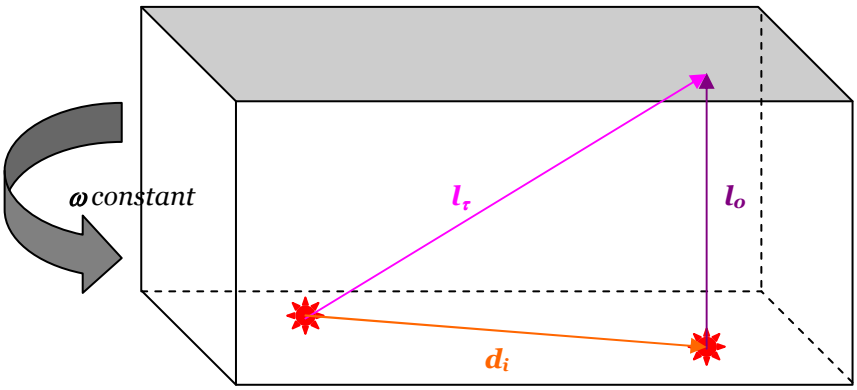
$l_i^2=l_o^2+d_i^2$
$(c\Delta t_i)^2=(c\Delta t_o)^2+(v\Delta t_i)^2$
$\Delta t_i^2\ (c^2-v^2)=c^2\Delta t_o^2$
$\Delta t_i^2\ (1-\beta^2)=\Delta t_o^2$
$\Delta t_i^2=\Delta t_o^2/(1-\beta^2)$
$\boldsymbol{\Delta t_i=\gamma\Delta t_o}$

$\boldsymbol{l_i=c\Delta t_i}$ inertial laser ray trajectory, *i.e.* relative to a DP reference in URM at velocity v.
$\boldsymbol{l_o=c\Delta t_o}$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$\boldsymbol{d_i=v\Delta t_i}$ inertial trajectory of the diode, *i.e.* in URM at velocity v.

Tangential Time

- In UCM the tangential time coincides with the inertial one: $\boldsymbol{\Delta\tau=\Delta t_i}$.
- The laser ray is emitted in direction of the vector angular velocity $\boldsymbol{\omega}$.

Composition of the trajectories in direction tangential to the rotation:



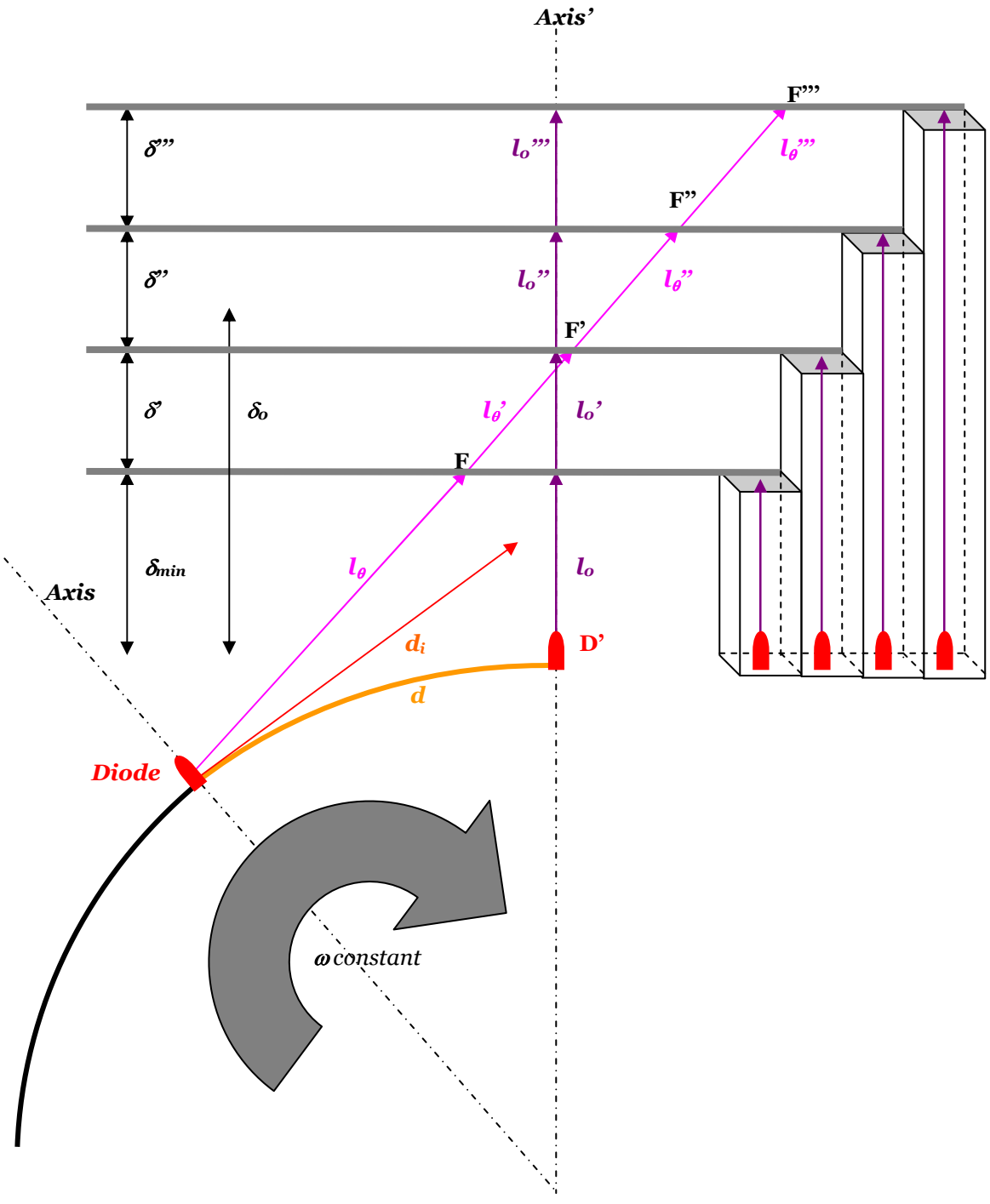
The locally quasi-Euclidean space-time permits the Pythagorean theorem:

$l_\tau^2=l_o^2+d_i^2$
$(c\Delta\tau)^2=(c\Delta t_o)^2+(v\Delta\tau)^2$
$\Delta\tau^2\ (c^2-v^2)=c^2\Delta t_o^2$
$\Delta\tau^2\ (1-\beta^2)=\Delta t_o^2$
$\Delta\tau^2=\Delta t_o^2/(1-\beta^2)$
$\Delta\tau=\gamma\Delta t_o$
$\boldsymbol{\Delta\tau=\Delta t_i}$

$\boldsymbol{l_\tau=c\Delta\tau}$ tangential laser ray trajectory, *i.e.* relative to a DP reference in UCM at velocity $\boldsymbol{v=\omega x r}$.
$\boldsymbol{l_o=c\Delta t_o}$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$\boldsymbol{d_i=v\Delta\tau}$ inertial trajectory of the diode in UCM, *i.e.* rectified in tangential direction.

Angular Time

Composition of the trajectories in direction tangential to rotation, at different DP distances δ:

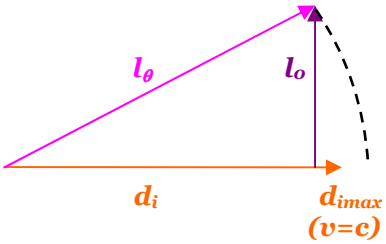


The laser ray is emitted in *radial* direction.

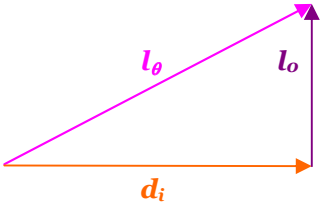
Denote δ_0 the diode-photodiode distance when: $\Delta\theta=\Delta t_i$.

Relationship between the angular time in UCM $\Delta\theta$ and the one at rest Δt_o:

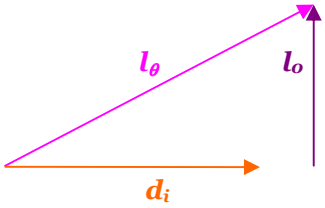
When $\delta<\delta_o$:



When $\delta=\delta_o$:



When $\delta>\delta_o$:



$\boldsymbol{l_\theta=c\Delta\theta}$ angular laser ray trajectory, *i.e.* relative to a DP reference in UCM at velocity $\boldsymbol{v=\omega x r}$.
$\boldsymbol{l_o=c\Delta t_o}$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$\boldsymbol{d_i=v\Delta\theta}$ inertial trajectory of the diode in UCM, *i.e.* rectified in tangential direction.

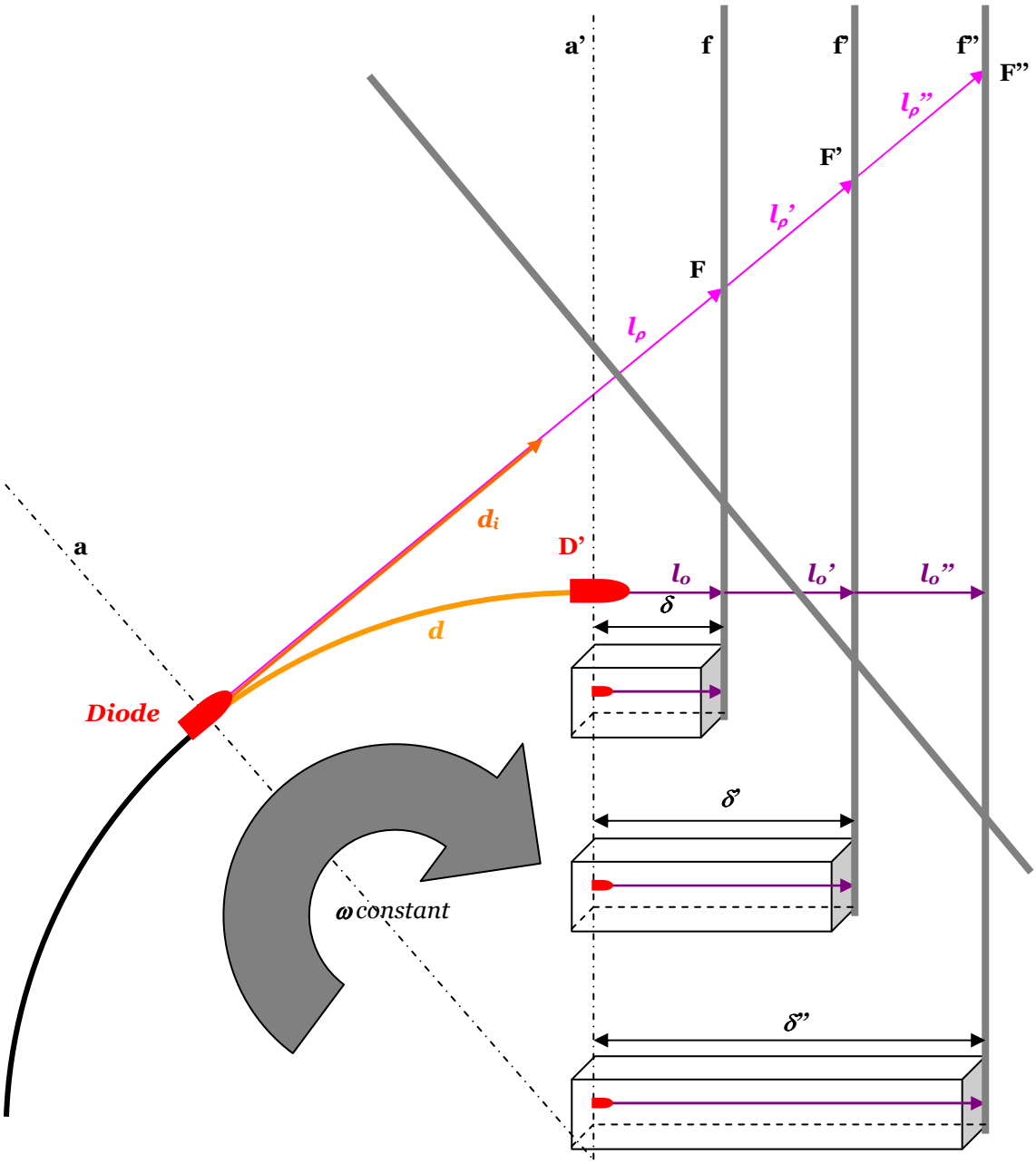
The locally quasi-Euclidean space-time permits the Pythagorean theorem:

$l_\theta^2<l_o^2+d_i^2$	$l_\theta^2=l_o^2+d_i^2$	$l_\theta^2=l_o^2+d_i^2$
$(c\Delta\theta)^2<(c\Delta t_o)^2+(v\Delta\theta)^2$	$(c\Delta\theta)^2=(c\Delta t_o)^2+(v\Delta\theta)^2$	$(c\Delta\theta)^2>(c\Delta t_o)^2+(v\Delta\theta)^2$
$\Delta\theta^2\ (c^2-v^2)<c^2\Delta t_o^2$	$\Delta\theta^2\ (c^2-v^2)=c^2\Delta t_o^2$	$\Delta\theta^2\ (c^2-v^2)>c^2\Delta t_o^2$
$\Delta\theta^2\ (1-\beta^2)<\Delta t_o^2$	$\Delta\theta^2\ (1-\beta^2)=\Delta t_o^2$	$\Delta\theta^2\ (1-\beta^2)>\Delta t_o^2$
$\Delta\theta^2<\Delta t_o^2/(1-\beta^2)$	$\Delta\theta^2=\Delta t_o^2/(1-\beta^2)$	$\Delta\theta^2>\Delta t_o^2/(1-\beta^2)$
$\Delta\theta<\gamma\Delta t_o$	$\Delta\theta=\gamma\Delta t_o$	$\Delta\theta>\gamma\Delta t_o$
$\boldsymbol{\Delta\theta<\Delta t_i}$	$\boldsymbol{\Delta\theta=\Delta t_i}$	$\boldsymbol{\Delta\theta>\Delta t_i}$

In UCM the angular time is: $\boldsymbol{\Delta\theta<\Delta t_i}$ beside; $\boldsymbol{\Delta\theta>\Delta t_i}$ far away, growing with the distance.

Radial Time

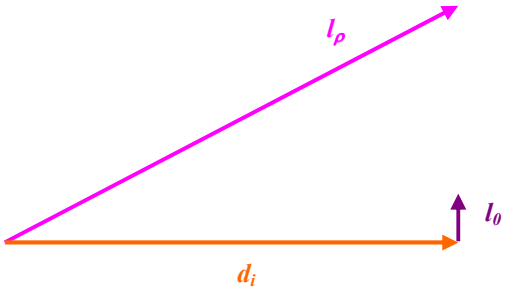
Composition of the trajectories in direction radial to the rotation, at different diode-photodiode distances δ:



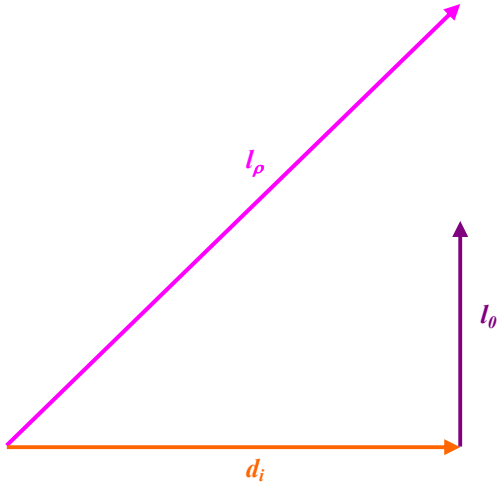
The laser ray is emitted in *tangential* direction.

Relationship between the radial time in UCM $\Delta\rho$ and the one at rest Δt_o.

***Beside* (short δ):**



***Far away* (long δ):**



$\boldsymbol{l_\rho=c\Delta\rho}$ radial laser ray trajectory, *i.e.* relative to a DP reference in UCM at velocity $\boldsymbol{v=\omega x r}$.
$\boldsymbol{l_o=c\Delta t_o}$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$\boldsymbol{d_i=v\Delta\rho}$ inertial trajectory of the diode in UCM, *i.e.* rectified in tangential direction.

The locally quasi-Euclidean space-time permits the Pythagorean theorem:

$l_\rho^2>>l_o^2+d_i^2$
$(c\Delta\rho)^2>>(c\Delta t_o)^2+(v\Delta\rho)^2$
$\Delta\rho^2\,(c^2-v^2)>>c^2\Delta t_o^2$
$\Delta\rho^2\,(1-\beta^2)>>\Delta t_o^2$
$\Delta\rho^2>>\Delta t_o^2/(1-\beta^2)$
$\Delta\rho>>\gamma\Delta t_o$
$\boldsymbol{\Delta\rho>>\Delta t_i}$

$l_\rho^2>l_o^2+d_i^2$
$(c\Delta\rho)^2>(c\Delta t_o)^2+(v\Delta\rho)^2$
$\Delta\rho^2\,(c^2-v^2)>c^2\Delta t_o^2$
$\Delta\rho^2\,(1-\beta^2)>\Delta t_o^2$
$\Delta\rho^2>\Delta t_o^2/(1-\beta^2)$
$\Delta\rho>\gamma\Delta t_o$
$\boldsymbol{\Delta\rho>\Delta t_i}$

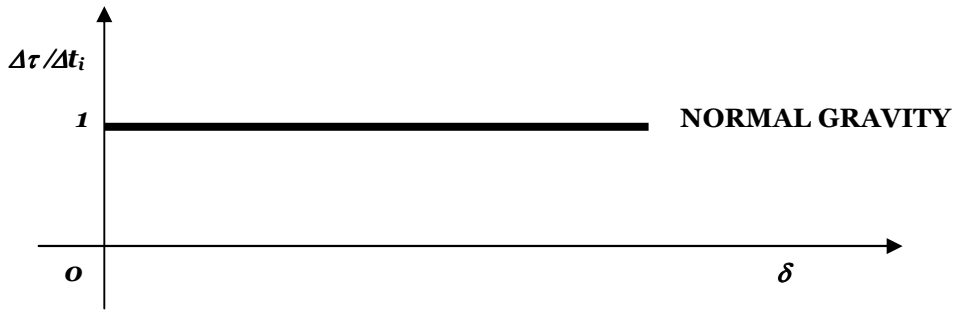
In UCM the radial time is: $\Delta\rho>\Delta t_i$, asymptotically decreasing towards Δt_i with the distance.

Time-gravity link

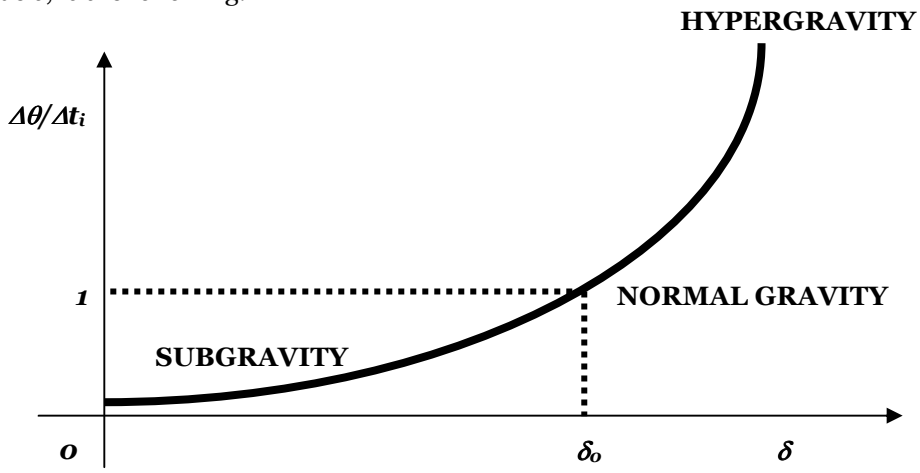
In Lorentz equations there is proportionality between time and mass: $m/m_o=\Delta t/\Delta t_o$.
Therefore, in quasi-Euclidean conditions the temporal flux lines supply a qualitative indication about the interaction's intensity:

- $\Delta t=\Delta t_i$ is the *normal* interaction (relativistic)*;*
- $\Delta t>\Delta t_i$ is the *hyperinteraction;*
- $\Delta t<\Delta t_i$ is the *subinteraction.*

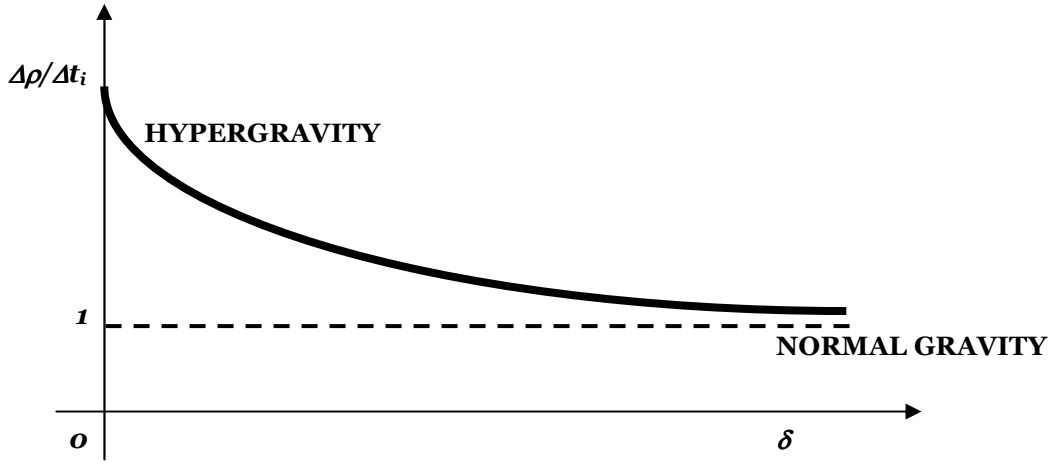
The qualitative course of **tangential time** (normalized regarding the inertial one) $\Delta\tau/\Delta t_i$, in function of the distance diode-photodiode δ, is the following:



The qualitative course of the **angular time** (normalized regarding the inertial one) $\Delta\theta/\Delta t_i$, in function of the distance diode-photodiode δ, is the following:

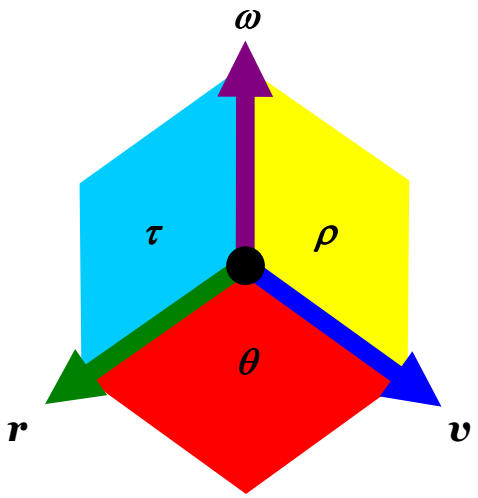


The **radial time** qualitative course (normalized regarding the inertial one) $\Delta\rho/\Delta t_i$, in function of the distance diode-photodiode δ, is the following:



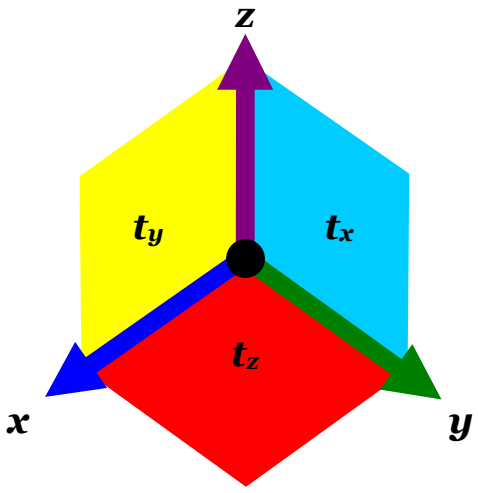
Six-dimensional reference frames

INSTANTANEOUS VECTORIAL REFERENCE:



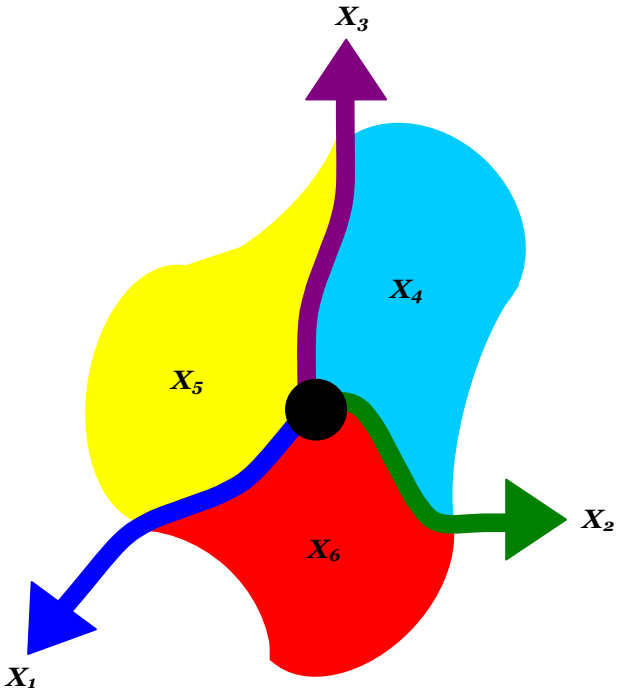
The three instantaneous vectors v,ω,r and their relative planes τ,θ,ρ altogether constitute an instantaneous Cartesian reference system $v\omega r\tau\theta\rho$ on whose orientations the following times are measured:
$\Delta\tau$=*tangential time,* measured on the orientation perpendicular to $\boldsymbol{v}$.
$\Delta\theta$=*angular time,* measured on the orientation perpendicular to $\boldsymbol{\omega}$.
$\Delta\rho$=*radial time,* measured on the orientation perpendicular to $\boldsymbol{r}$.

CARTESIAN SIX-DIMENSIONAL REFERENCE IN A FLAT EUCLIDEAN SPACE-TIME:



The three spatial axes x, y, z and the three temporal orientations t_x, t_y, t_z are mutually orthogonal and immobile. Each position $P(x,y,z,t_x,t_y,t_z)$ is unique, *i.e.* representable without ambiguity.
The three times τ, θ, ρ are in biunivocal correspondence with the three times t_x, t_y, t_z, because the measures in the instantaneous reference $v\omega r\tau\theta\rho$ are univocally projected on the fixed reference $xyzt_xt_yt_z$.

GAUSSIAN SIX-DIMENSIONAL REFERENCE IN A CURVED SPACE-TIME:



The three spatial lines X_1, X_2, X_3 are not necessarily neither rectilinear nor mutually orthogonal and the three temporal surfaces X_4, X_5, X_6 are not necessarily neither plane nor reciprocally orthogonal. The only condition is that each event $E(X_1,X_2,X_3,X_4,X_5,X_6)$ is unique, *i.e.* representable without ambiguity.
The position $P(x,y,z,t_x,t_y,t_z)$ is in biunivocal correspondence with the event $E(X_1,X_2,X_3,X_4,X_5,X_6)$. In fact, by keeping the relativistic assumption about the quasi-Euclidean nature of space-time continuum at local level, there is the biunivocal correspondence between the measures in any Cartesian reference $xyzt_xt_yt_z$. and the same taken in a Gaussian reference $X_1X_2X_3X_4X_5X_6$ in curved space-times locally almost flat.

Time is ***three-dimensional*** because time's measurement gives three different values according to the orientation where it is executed.

Space-time is ***six-dimensional*** because an event requires six coordinates to be defined.

Six-dimensional source tensor

<table>
<tr><td colspan="8">It is supersymmetrical, consisting of 4 quadrants each with 9 components</td></tr>
<tr><td rowspan="3">Energy density</td><td>T_{00}</td><td>T_{01}</td><td>T_{02}</td><td>T_{03}</td><td>T_{04}</td><td>T_{05}</td><td rowspan="3">Energy flux</td></tr>
<tr><td>T_{10}</td><td>T_{11}</td><td>T_{12}</td><td>T_{13}</td><td>T_{14}</td><td>T_{15}</td></tr>
<tr><td>T_{20}</td><td>T_{21}</td><td>T_{22}</td><td>T_{23}</td><td>T_{24}</td><td>T_{25}</td></tr>
<tr><td rowspan="3">Momentum density</td><td>T_{30}</td><td>T_{31}</td><td>T_{32}</td><td>T_{33}</td><td>T_{34}</td><td>T_{35}</td><td rowspan="3">Momentum flux</td></tr>
<tr><td>T_{40}</td><td>T_{41}</td><td>T_{42}</td><td>T_{43}</td><td>T_{44}</td><td>T_{45}</td></tr>
<tr><td>T_{50}</td><td>T_{51}</td><td>T_{52}</td><td>T_{53}</td><td>T_{54}</td><td>T_{55}</td></tr>
<tr><td colspan="8">It can contain all sources: energy-momentum, electroweak and colour charges.</td></tr>
</table>

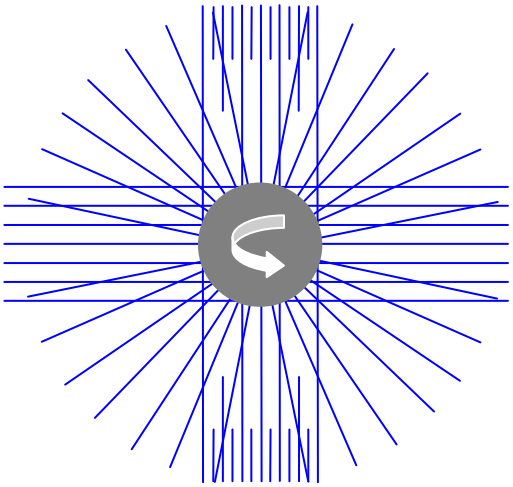
Six-dimensional continuum

General Relativity compared with its six-dimensional extension:

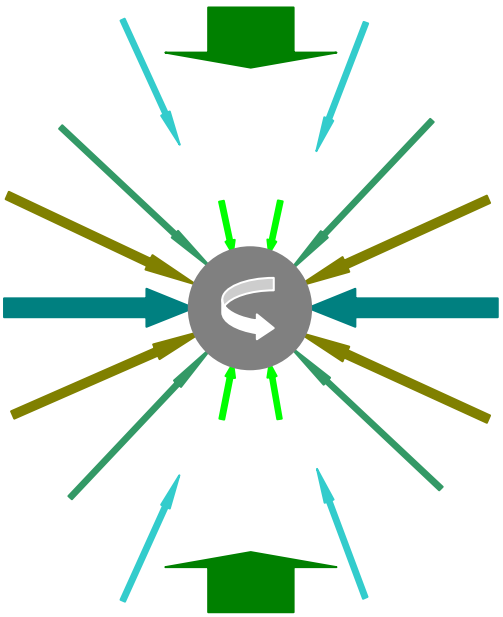
Characteristics of the theory	**GR by A. Einstein**	**GR Extension by E. Bonacci**
Trajectory of a material point	Continuous	Continuous
Space-time continuum	Four-dimensional	Six-dimensional
Space Cartesian coordinates	x, y, z	x, y, z
Time Cartesian coordinates	t	t_x, t_y, t_z
Relation between space and time coordinates	Asymmetry: 3+1	Symmetry: 3+3
Cartesian reference	xyzt	$xyzt_xt_yt_z$
Space-time position	P(x,y,z,t)	P(x,y,z,t_x,t_y,t_z)
Gaussian reference	$X_1X_2X_3X_4$	$X_1X_2X_3X_4X_5X_6$
Space-time event	E(X_1,X_2,X_3,X_4)	E(X_1,X_2,X_3,X_4,X_5,X_6)
Space-time geometry	Hyperbolic	Ultrahyperbolic
Line element: ds	$\delta\int ds=0$	$\delta\int ds=0$
Metric tensor: $g_{\mu\nu}$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Invariant quadratic form: $ds^2=g_{\mu\nu}dx_\mu dx_\nu$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Ricci curvature tensor: $R_{\mu\nu}$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Scalar curvature, trace of tensor $R_{\mu\nu}$: $R_a{}^a$	Four-dimensional: R^4	Six-dimensional: R^6
Source tensor $T_{\mu\nu}$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Stress-energy-momentum	Components of $T_{\mu\nu}$	Components of $T_{\mu\nu}$
Electromagnetical, weak and colour charges	Not included in $T_{\mu\nu}$	Components of $T_{\mu\nu}$
Conservation equations: $\nabla^\mu T_{\mu\nu}=0$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Contracted Bianchi identities: $\nabla^\mu(R_{\mu\nu}-\frac{1}{2}Rg_{\mu\nu})=0$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Einstein tensor: $G_{\mu\nu}=R_{\mu\nu}-\frac{1}{2}Rg_{\mu\nu}$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Field equations: $G_{\mu\nu}=kT_{\mu\nu}$	Four-dimensional: $\mu,\nu=1,2,3,4$	Six-dimensional: $\mu,\nu=1,2,3,4,5,6$
Field equations' total number: $\mu\times\nu$	4x4=16	6x6=36
Field equations' reduced number	10, for $G_{\mu\nu}$ and $T_{\mu\nu}$ are symmetric	21, if $G_{\mu\nu}$ and $T_{\mu\nu}$ are symmetric
Lagrangian of matter: L	Four-dimensional: L^4	Six-dimensional: L^6
Scalar function: $J=L-R/2k$	Four-dimensional: $J^4=L^4-R^4/2k$	Six-dimensional: $J^6=L^6-R^6/2k$
Variation principle: $\delta\int J^n\sqrt{g}\,d^nX=0$	Four-dimensional: $\delta\int J^4\sqrt{g}\,d^4X=0$	Six-dimensional: $\delta\int J^6\sqrt{g}\,d^6X=0$
Conservation laws	Stress-energy-momentum	Stress-energy-momentum-charges
Described interactions	Gravitational	Gravitational-electroweak-strong

Structureless rotating sphere

Anisotropic temporal flux lines around a structureless sphere in UCM:

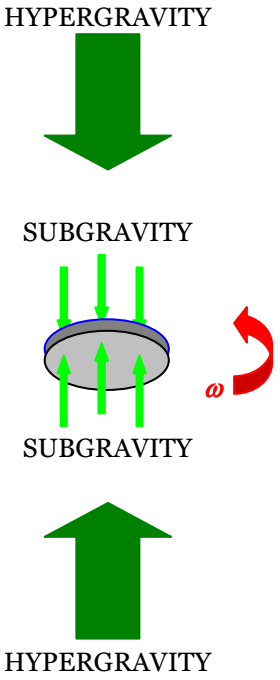


Anisotropic interactions around a structureless sphere in UCM:

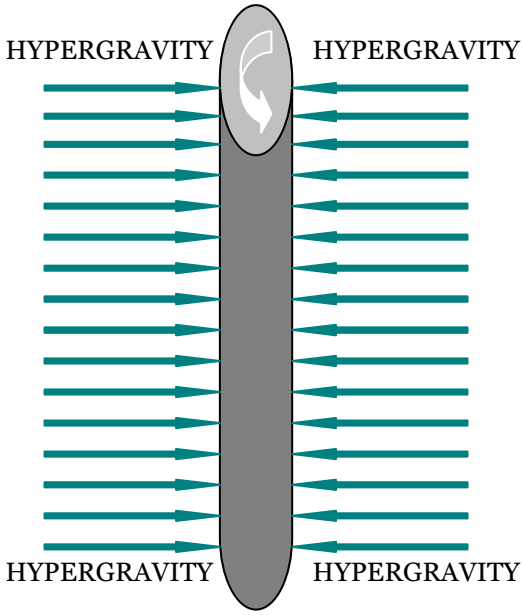


Other structureless rotating shapes

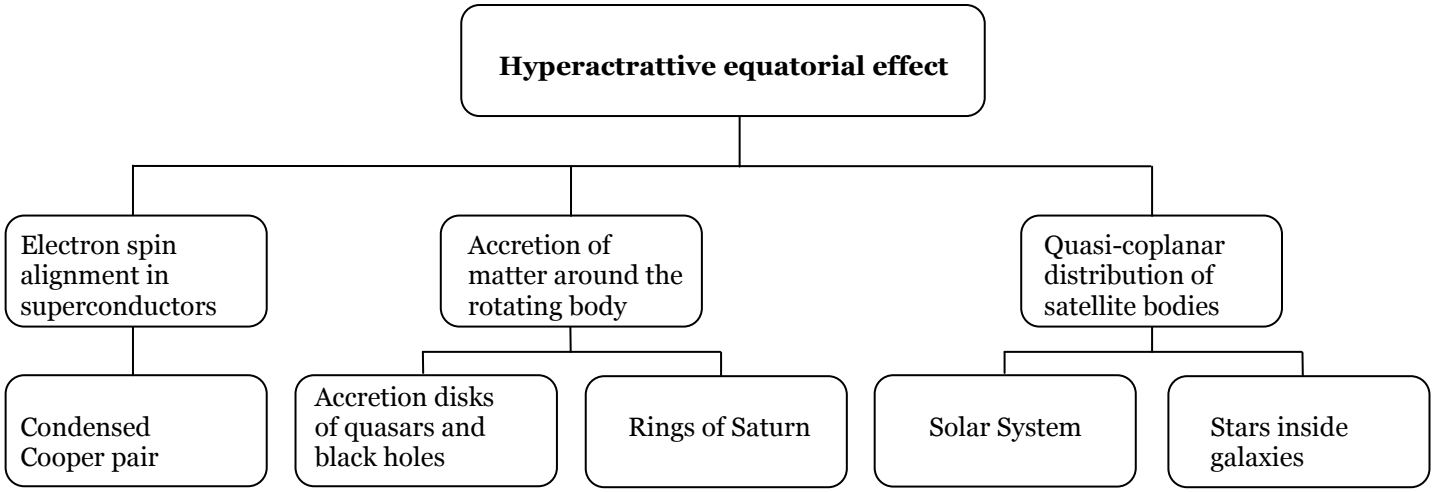
Axial subgravity and hypergravity generated respectively beside and far away by a structureless **flat disk** in UCM:



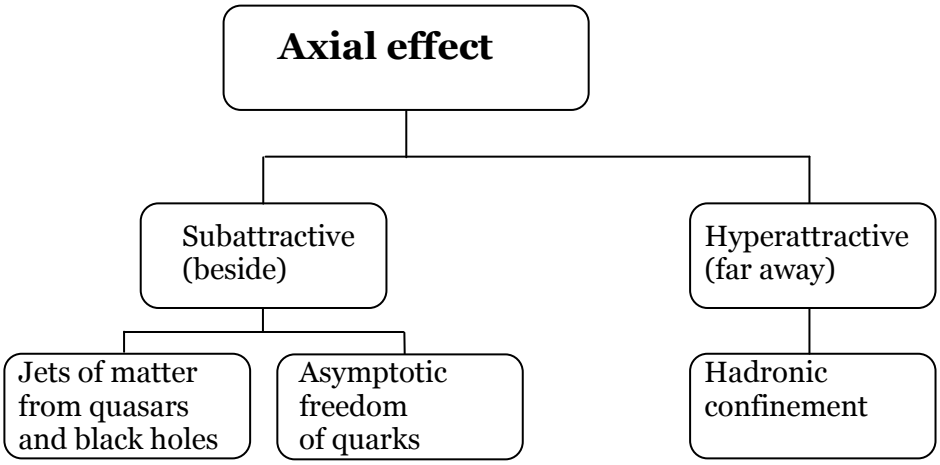
Lateral hypergravity generated by a structureless **cylinder** in UCM:



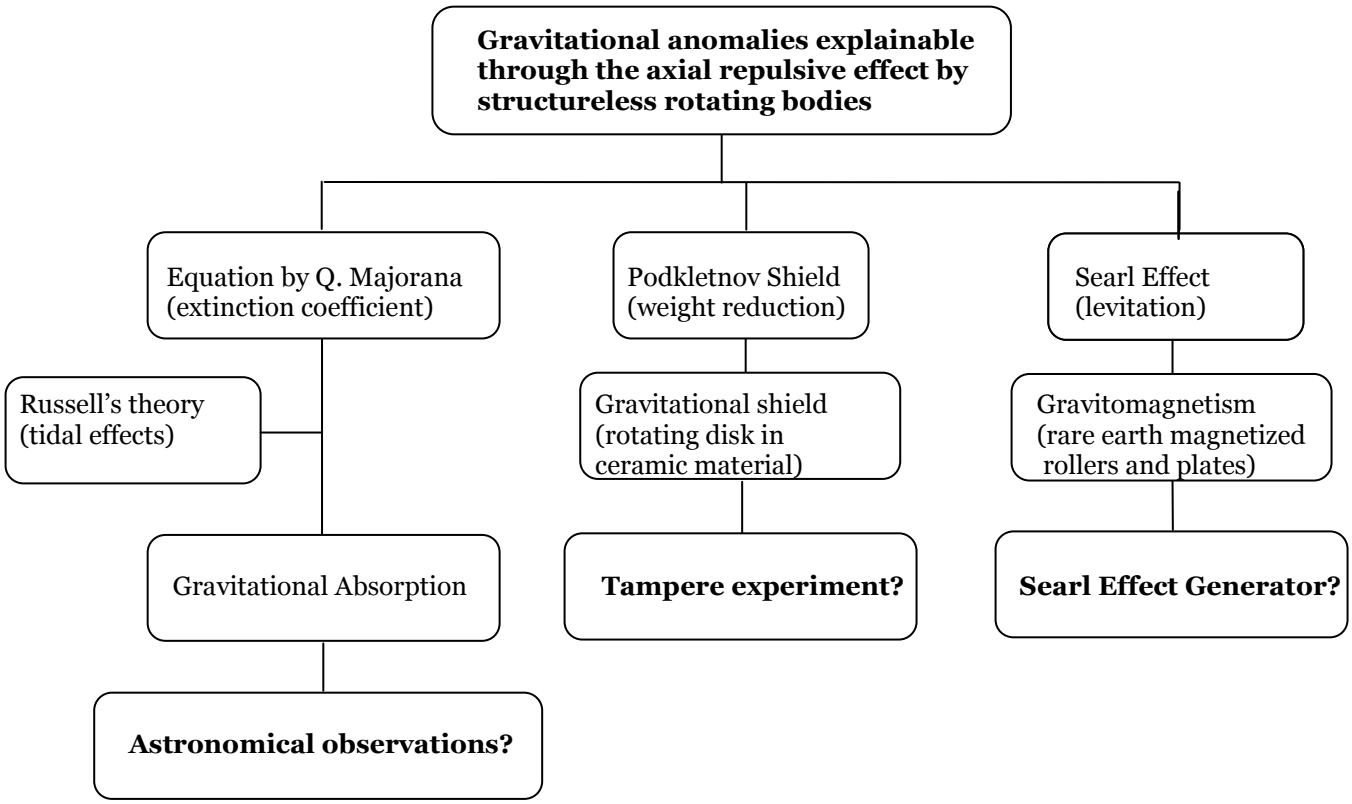
Consequences of the equatorial effect



Phenomena ascribable to the axial effect



Anomalies imputable to the axial effect



Alternative energy sources?

Modifying gravity
Rotating disks assimilable to structureless flat bodies generating *hypergravity* or *subgravity*;
rotating cylinders assimilable to structureless filiform bodies generating *hypergravity*.
Therefore *subgravity* and *hypergravity* are possible alternative energy sources.

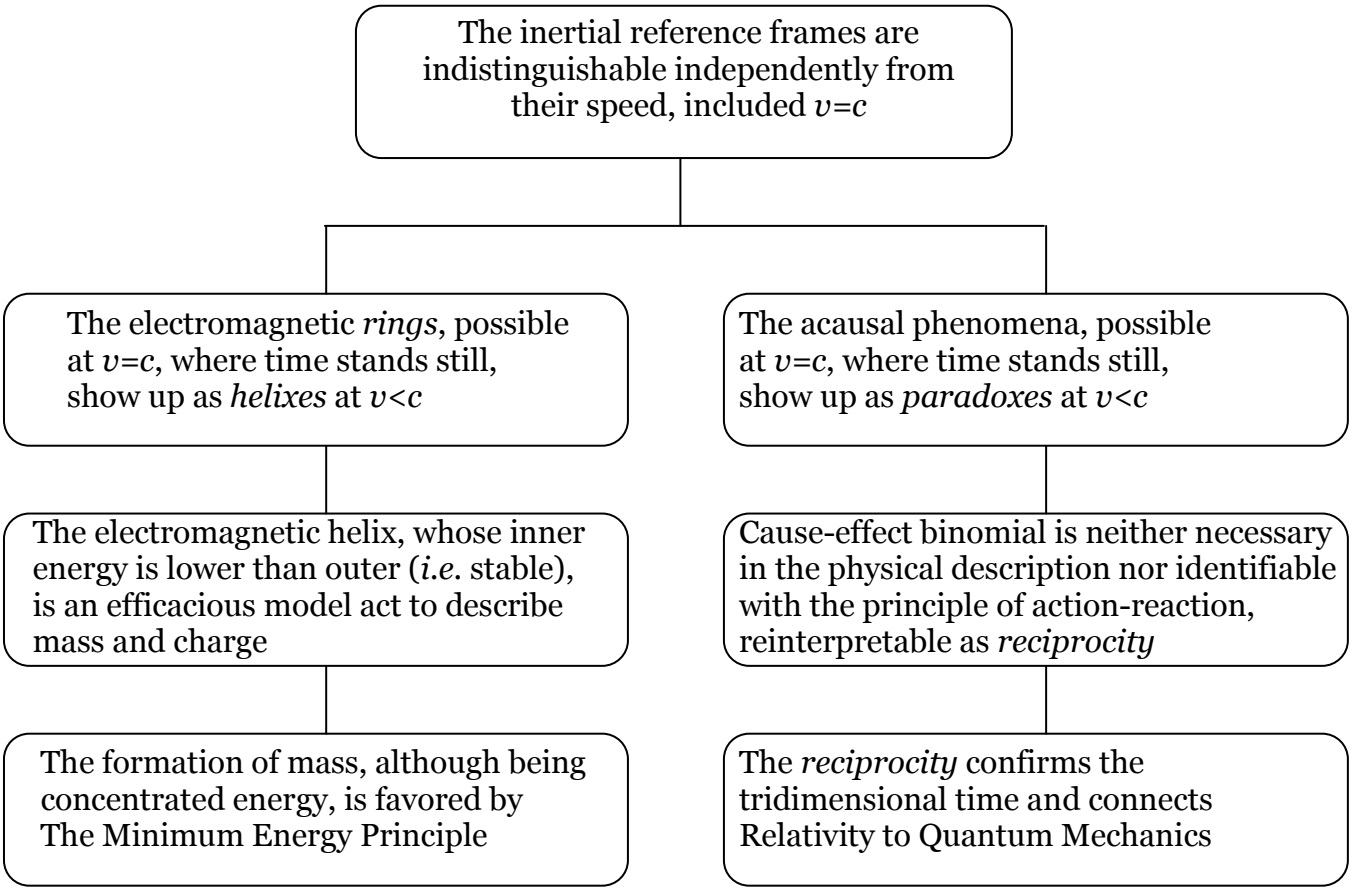
Building problems
Only few materials have a partial microscopic order sufficient to be assimilable to a structureless body, *e.g.*, the rare earth magnets used in the *Searl effect* or the superconductors used in the *Podkletnov shield*.

Absolute Relativity

The paper *Absolute Relativity* proposes the indistinguishability between the inertial reference frames at $v=c$, characterized by atemporality, and those at $v<c$ where the corresponding phenomena show acausality; there follows:

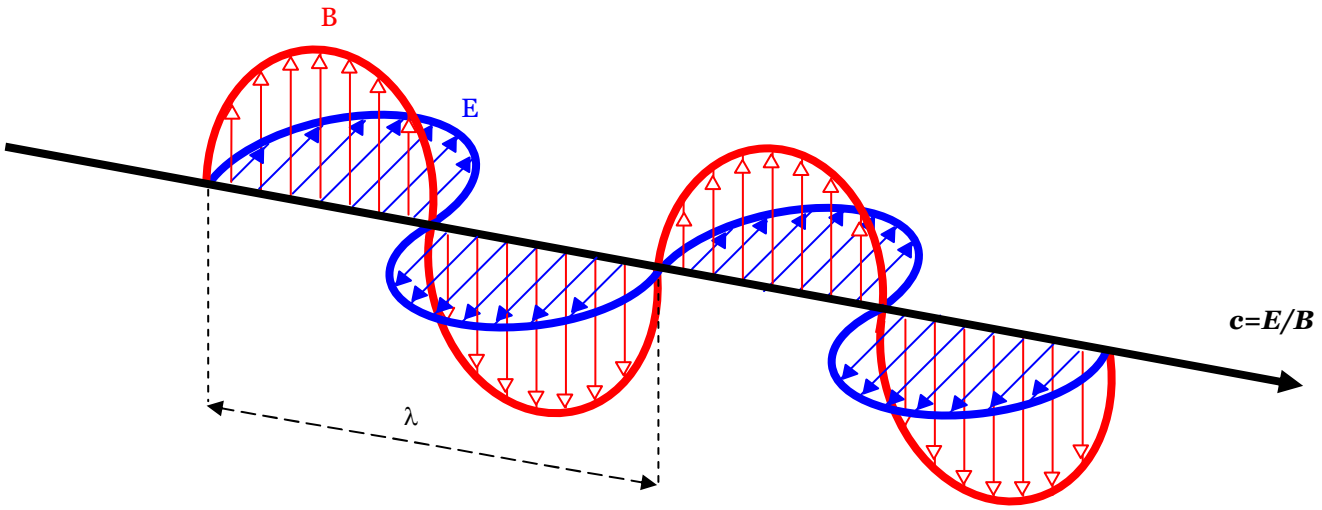
- the **principle of reciprocity**, acausal extension of action-reaction supporting the tridimensional time;
- the **mass as electromagnetic helix**, a model explaining all the intrinsic quantities of particles, the unreachability of speed c and the inadmissibility of rest condition for the mass, the wave-particle duality, the absence of magnetic monopoles and the matter-antimatter asymmetry.

From a trivial postulate...

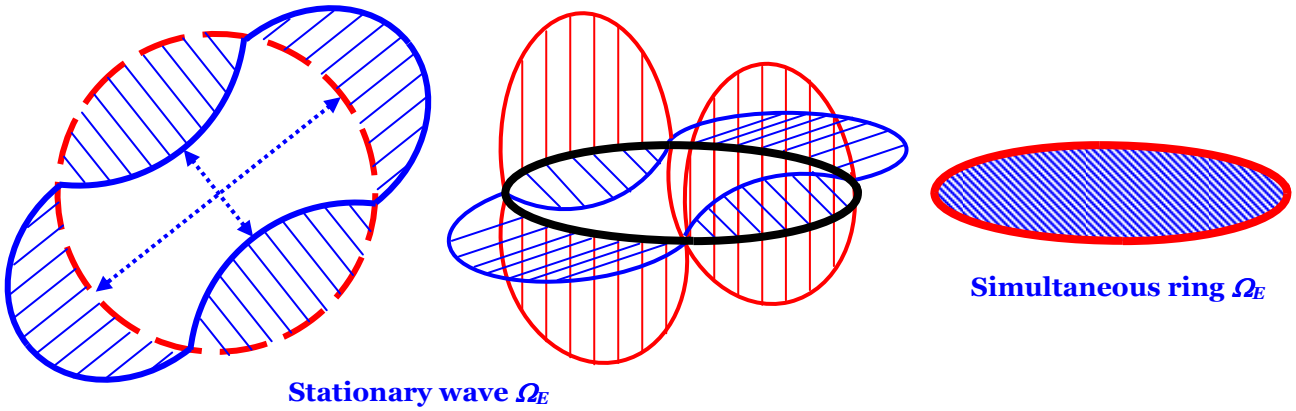


The electromagnetic simultaneous ring

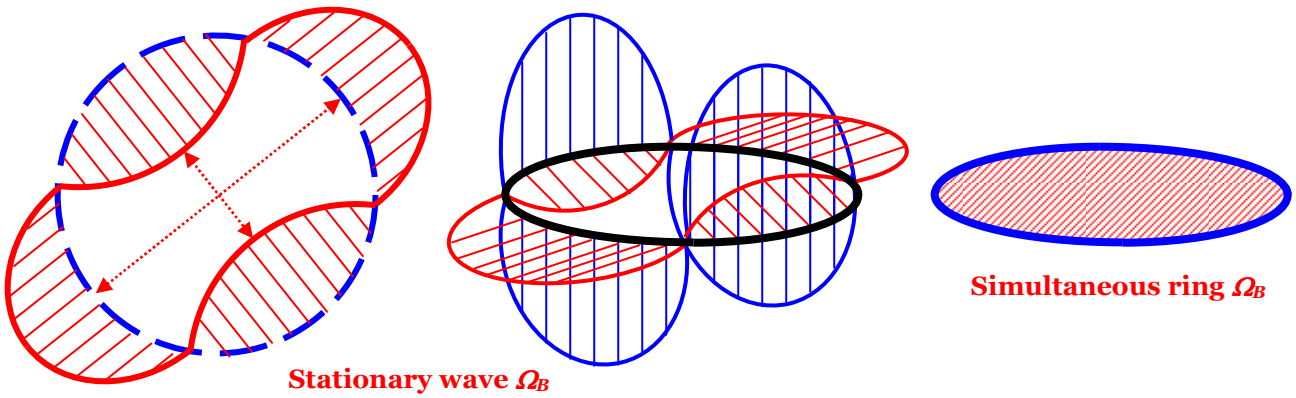
Classic model of electromagnetic wave with $E \perp B$ e $c=E/B$:



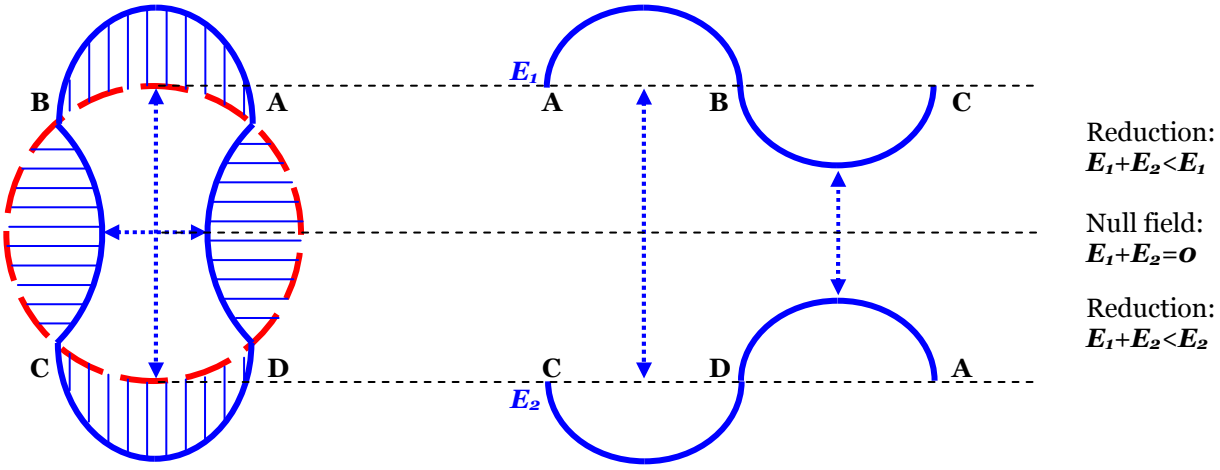
The EM wave can close to simultaneous ring Ω_E by electric self-interaction because at $v=c$ time stands still:



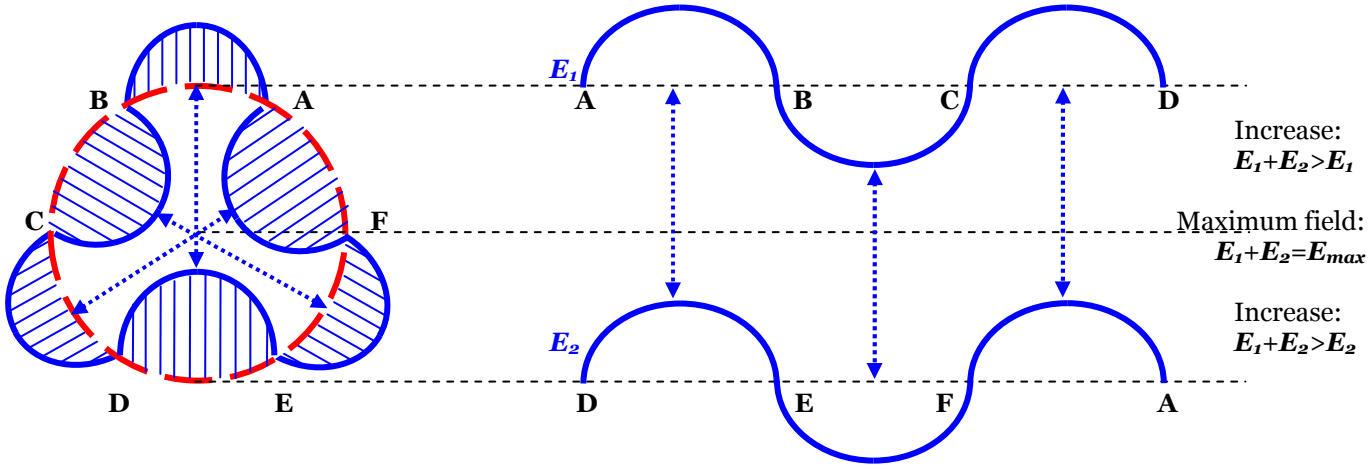
The EM wave can close to simultaneous ring Ω_B by magnetic self-interaction because at $v=c$ time stands still:



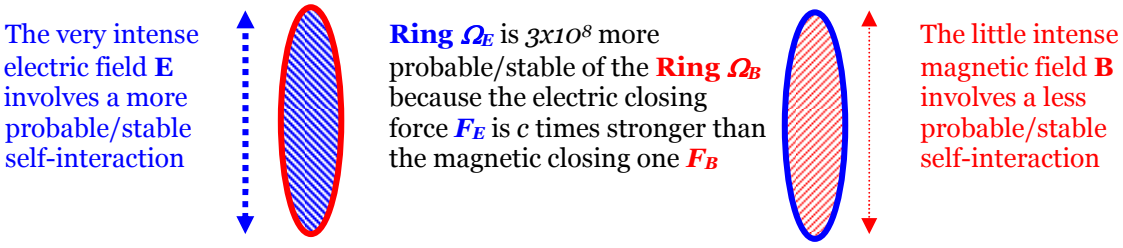
With an even number of wavelengths λ, the ring Ω_E is stable:



With an odd number of wavelengths λ, the ring Ω_E is unstable:



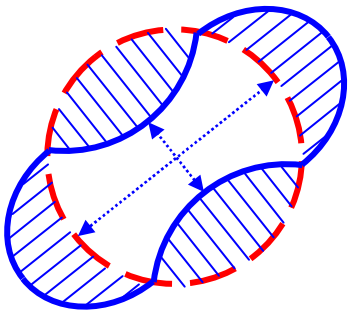
The electric ring Ω_E prevails on the magnetic one Ω_B by the factor $c=3x10^8$:



Mass is an electromagnetic helix

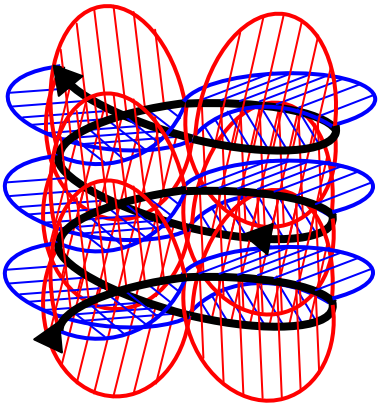
Generation of electrically charged moving mass:

At $v=c$, because time stands still:

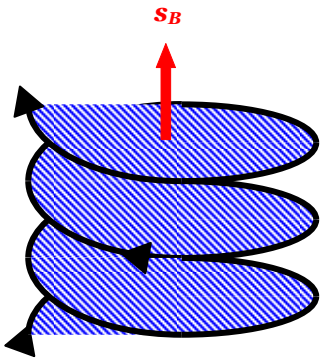


Quasi-instantaneous ring Ω_E (the discrepancy with the ring is infinitesimal, the closing is almost perfect).

At $v<c$, for the principle of Absolute Relativity:



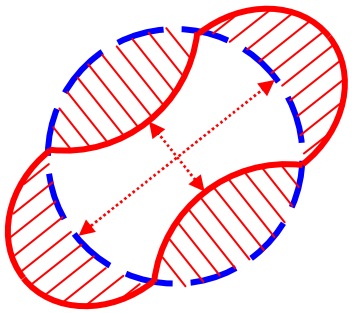
Helical trajectory



Moving mass, with electric charge q_E and magnetic spin s_B in the advancing direction.

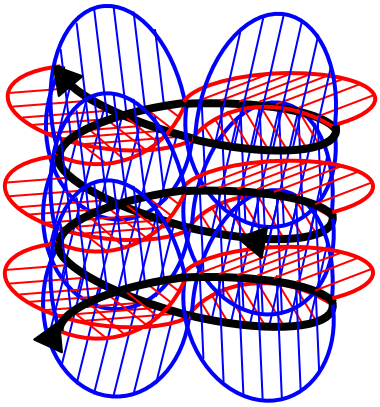
Generation of magnetically charged moving mass:

At $v=c$, because time stands still:

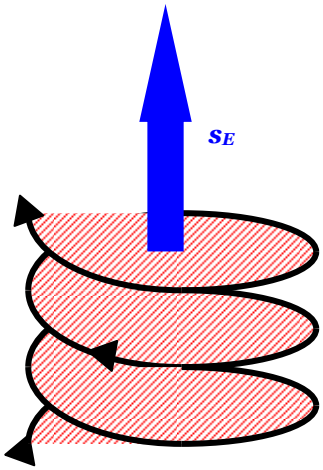


Quasi-instantaneous ring Ω_B (the discrepancy with the ring is infinitesimal, the closing is almost perfect).

At $v<c$, for the principle of Absolute Relativity:



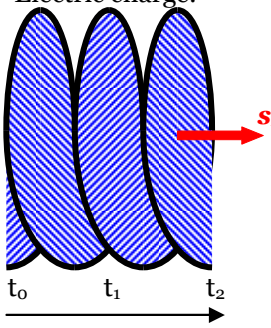
Helical trajectory



Moving mass, with electric charge q_B and magnetic spin s_E in the advancing direction.

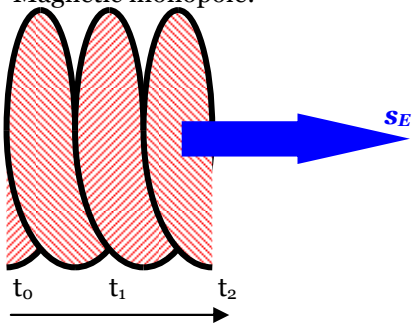
The magnetic monopole is $3x10^8$ times less probable/stable than the electric charge:

Electric charge:

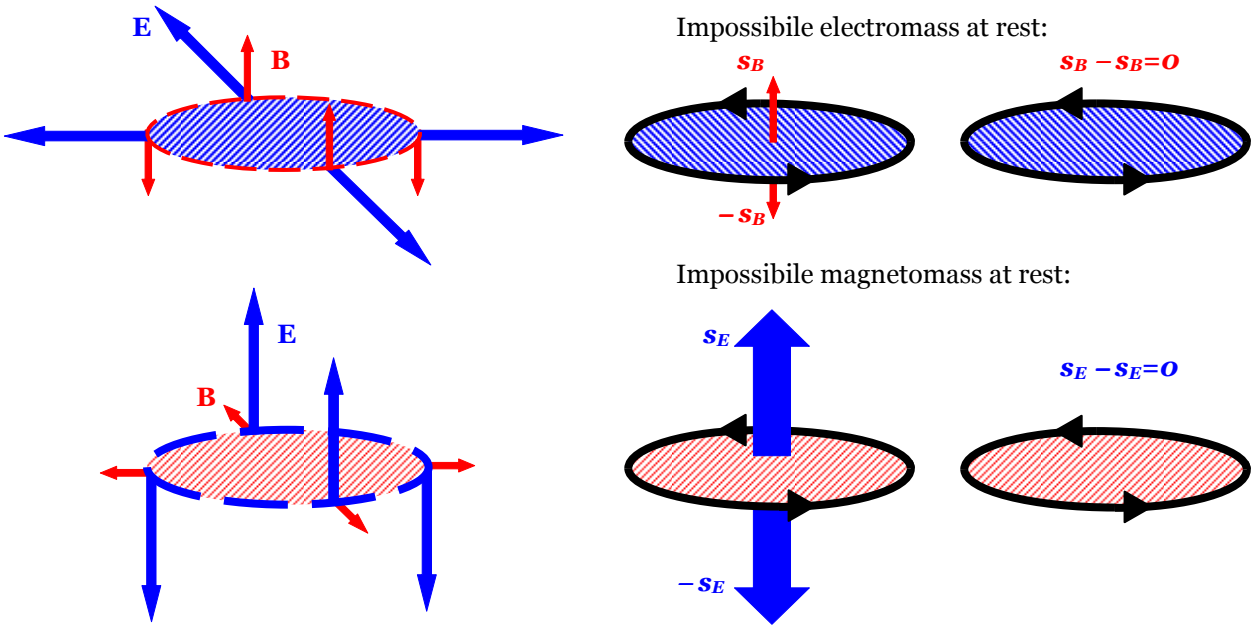


Real electroparticle q_E is $3x10^8$ times more probable/stable than the hypothetical magnetoparticle q_B because the closing electrical force F_E is c times stronger than the magnetic one F_B

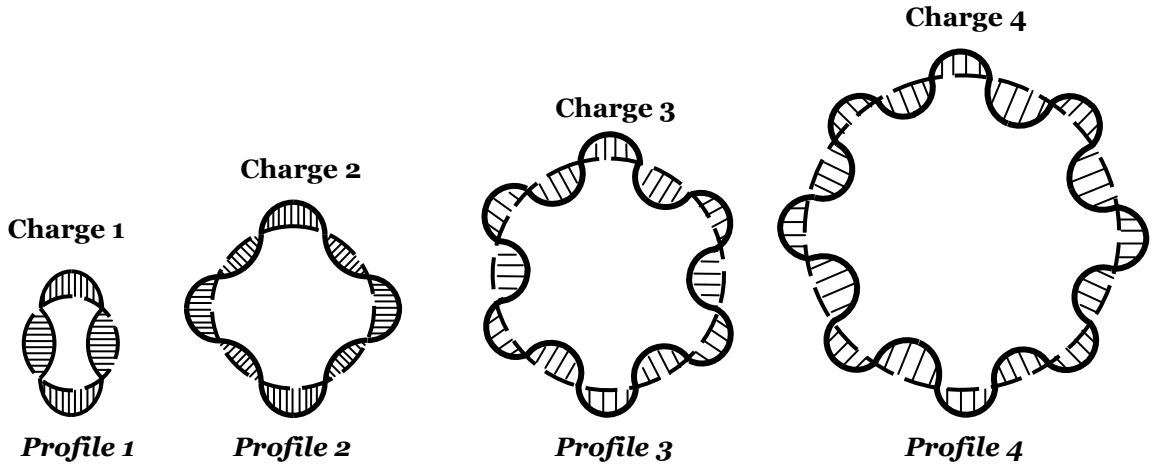
Magnetic monopole:



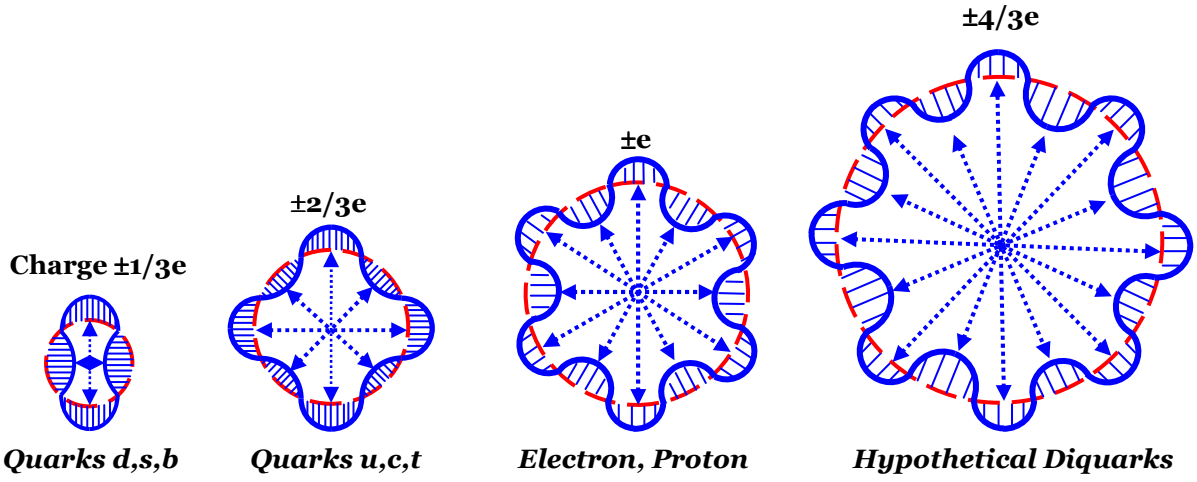
The rest mass would violate the spin conservation:



The electric charge q_E and the hypothetical magnetic monopole q_B are quantized:



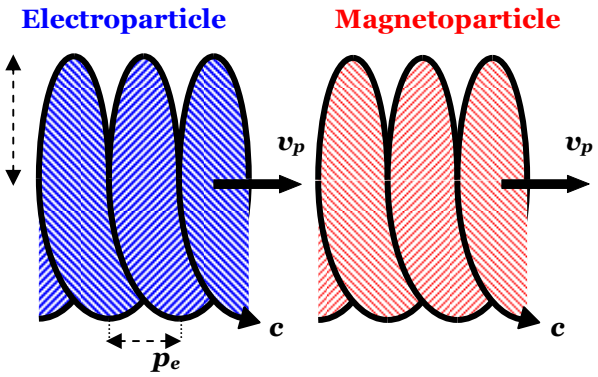
Correspondence shape-charge according to the currently available information:



Features of the helical model

The particle as electromagnetic helix:

r_p= radius of the particle, *i.e.* of the helix
p_e= pitch of the helix associated with the particle
c= tangential speed of the spiral
v_p= advancing velocity of the particle

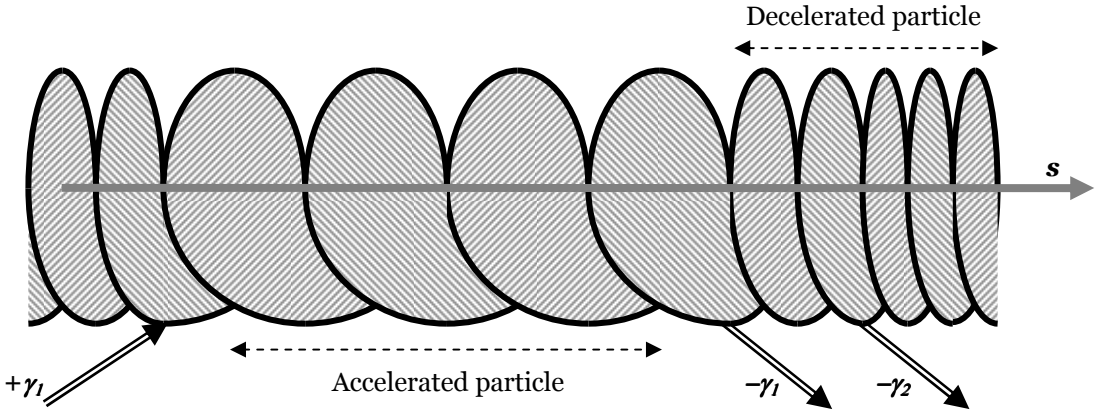


Velocity of the particle:
$\boldsymbol{v_p=c/[1+(2\pi r_p/p_e)^2]^{(1/2)}}$, thus $v_p<c$

Radius of the particle:
$\boldsymbol{r_p=(p_e/2\pi)*[(c/v_p)^2-1]^{(1/2)}}$

Pitch of the helix:
$\boldsymbol{p_e^2=(2\pi r_p/E_o)^2*\gamma^2+(8\pi^2 r_p^2/E_o)*\gamma}$, with γ the energetic increase and E_o the energy at rest.
There is a *quasi-linear* link between the energetic increase γ and the particle's pitch increase p_e.

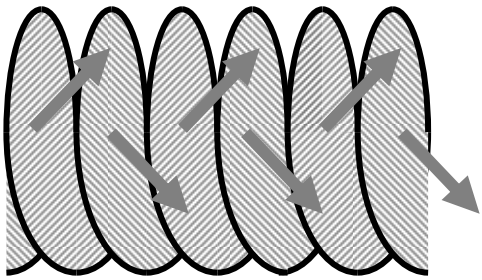
Particle-photon energetic exchanges:



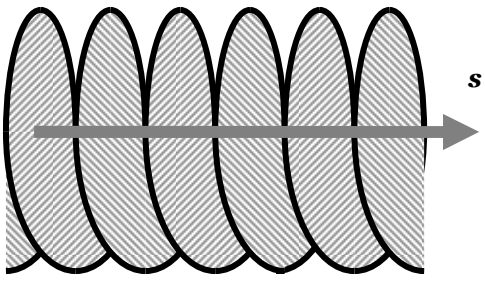
Consistent with the particles' wave function, the helical model geometrically explains the helicity (s^+ and s^-), the momentum state ($\Psi=e^{iP\cdot x/\hbar}$) and the *ZBW*:

Zitterbewegung:

Zig-zag oriented spin:

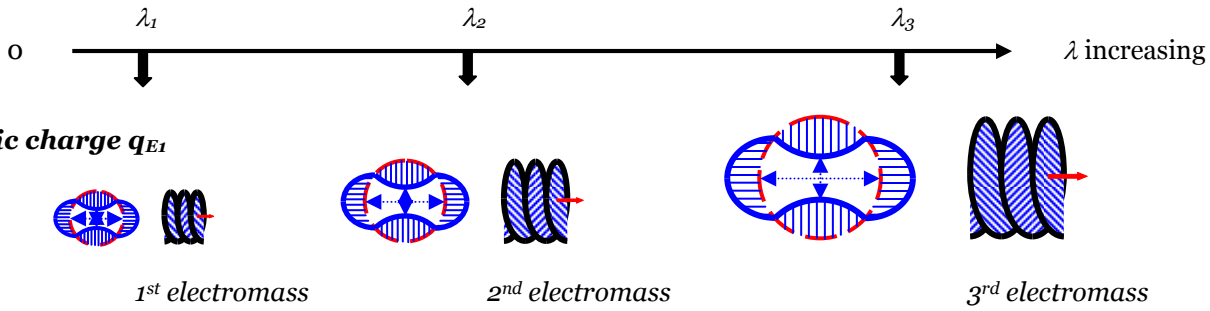


Resulting spin:



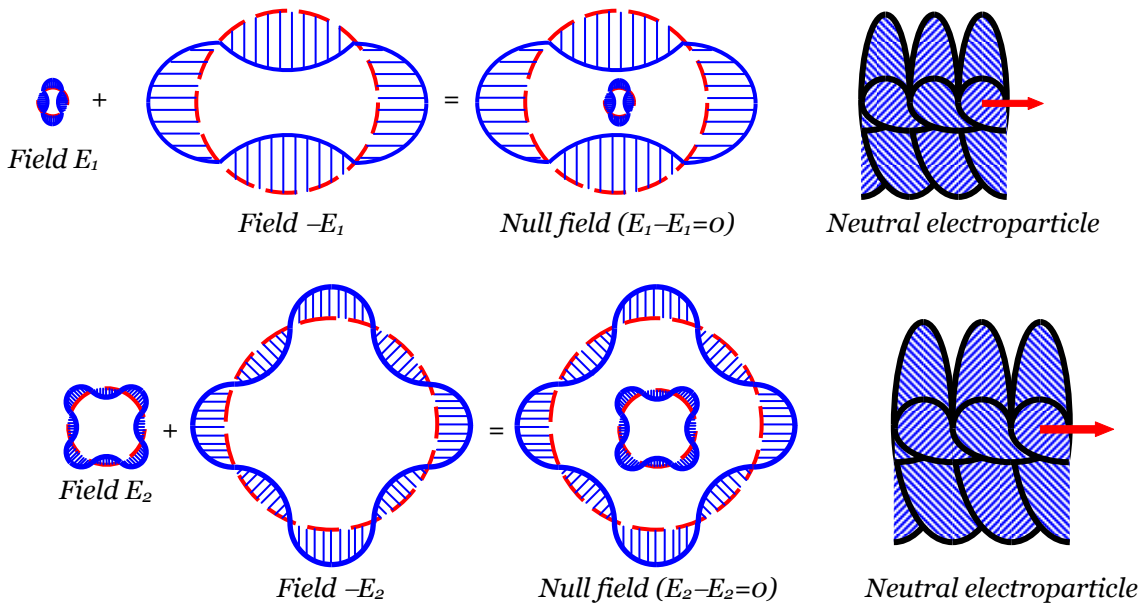
The same charge can be associated to different masses.

The total charge depends on the radial field, which depends on the shape of the stationary wave generating the simultaneous ring:



Opposite fields originated from concentrical standing waves with same shape cancel each other out.

The total charge depends on the radial field, which depends on the stationary wave's profile only:

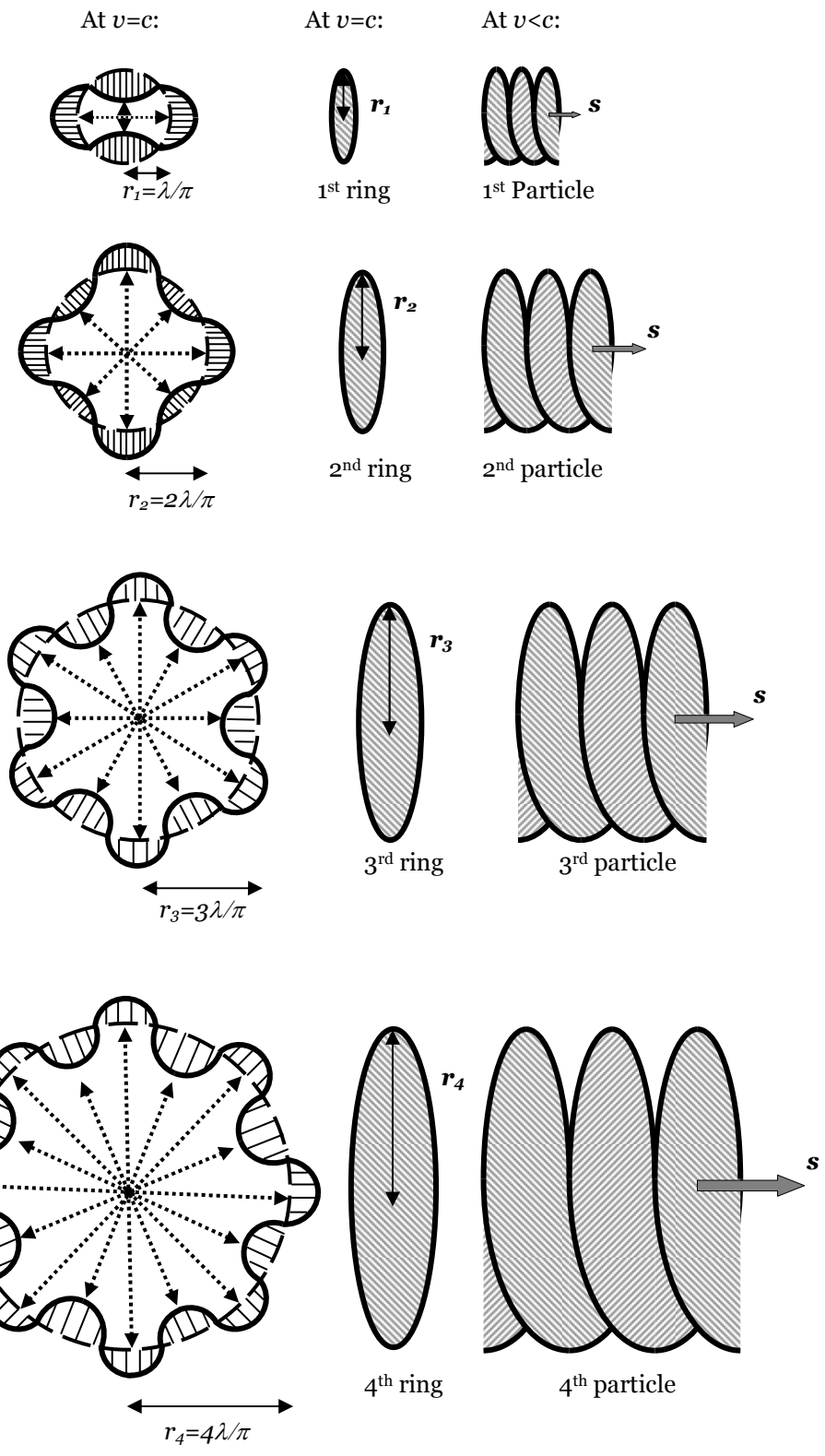


Were they stable, the same considerations would be valid for *magnetic monopoles* as well.

Quantization and conservation

Quantization of the particle's radius on equal wavelength

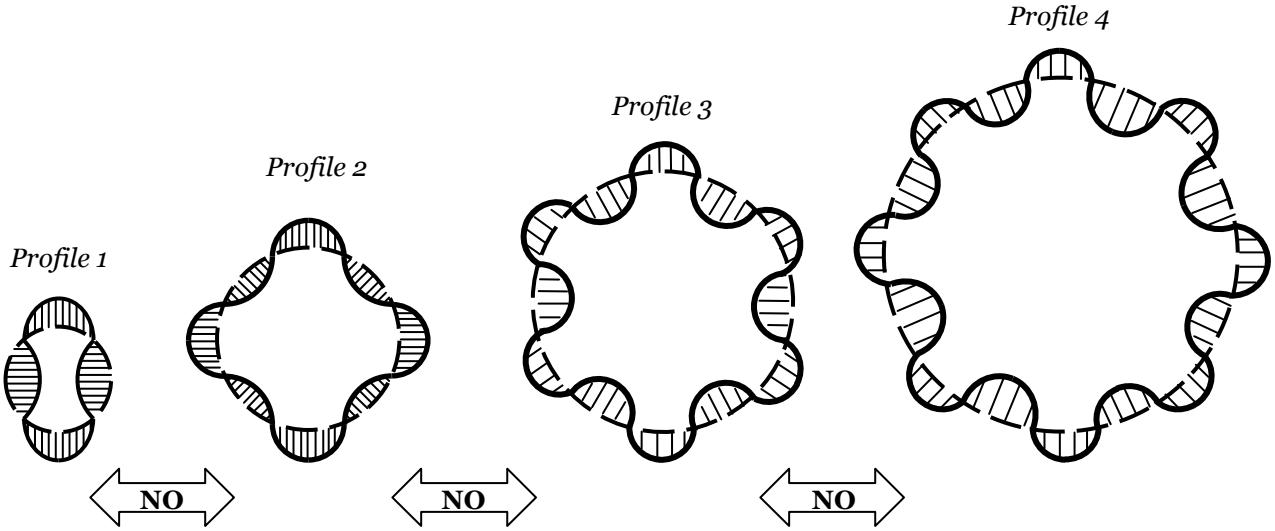
The stable standing waves have an even number of wavelengths: $2\pi r_n=2n\lambda$.
The stationary waves' quantized radius corresponds to the particles': $r_p=r_n=n\lambda/\pi$, being $n\in\boldsymbol{Z}^+$.



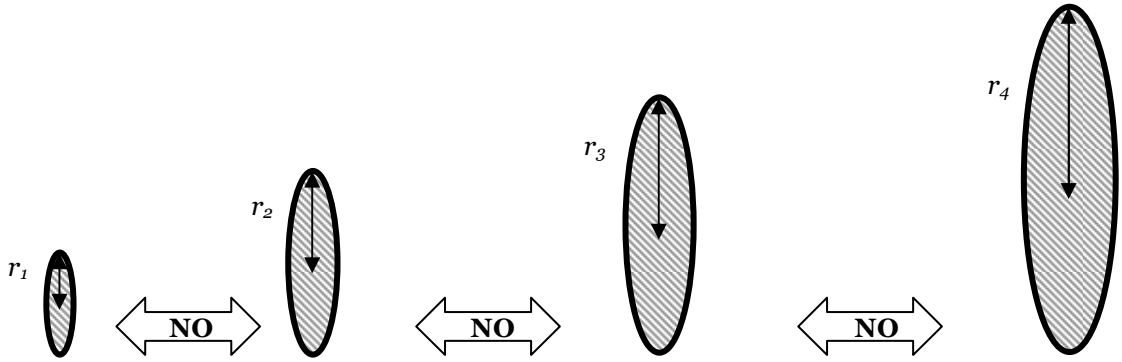
Conservation of charge and mass stability.

The invariance of both the dimension of the particle, from a quantized radius to the successive, and of its radial shape, from a profile to the successive, it is due to the stationarity of the wave generating the ring Ω_E or Ω_B.

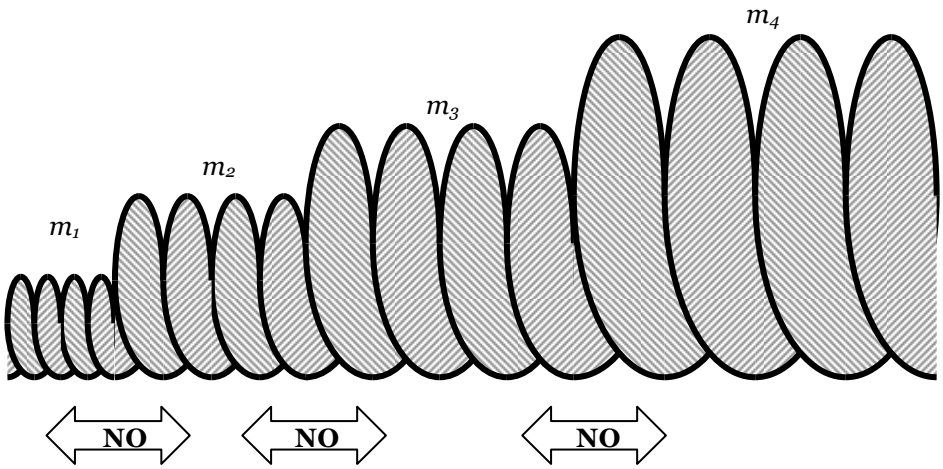
Invariant shape, *i.e.* charge conservation:



Invariant radius, *i.e.* mass stability:



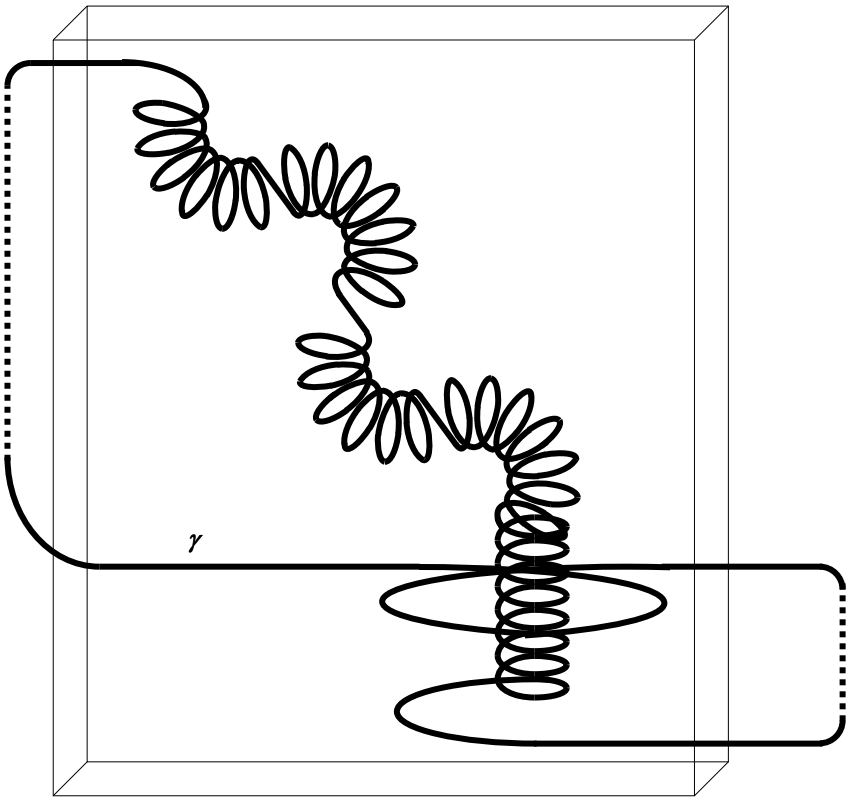
Invariant particle's size:



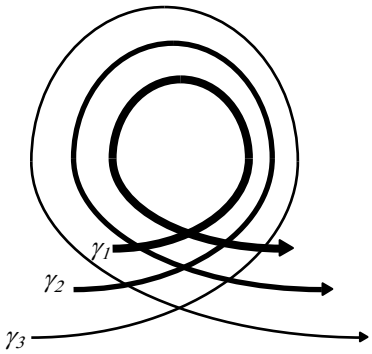
The Lord's pencil?

The electromagnetic field could be the only material reality.
If matter is *radiant energy*, *i.e. EM* linear field, and *mass*, *i.e. EM* helical field based on *AR*, everything but vacuum is however electromagnetic field. There are two alternatives:

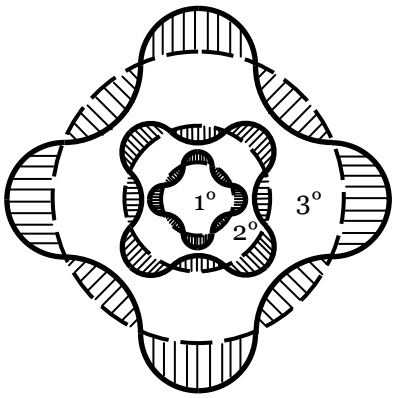
1) A unique self-interacting electromagnetic field.
A unique photon moves in the universe, interacting only with itself but in moments that for observers at $v<c$ are different and therefore originated by apparently different entities. The *Lord's pencil* would be a unique *EM* field γ drawing the entire existing, with a continuous and *closed* stroke which seems *open* in the limited cosmic portion observed. Let us notice how the mass can not *stop* in such model:



2) More electromagnetic fields interacting by induction.
The interaction among different photons is a still controversial topic. If it is possible, the *EM* fields can attract or repulse and they can create complex structures, by *induction*, similarly to the *domino effect*:



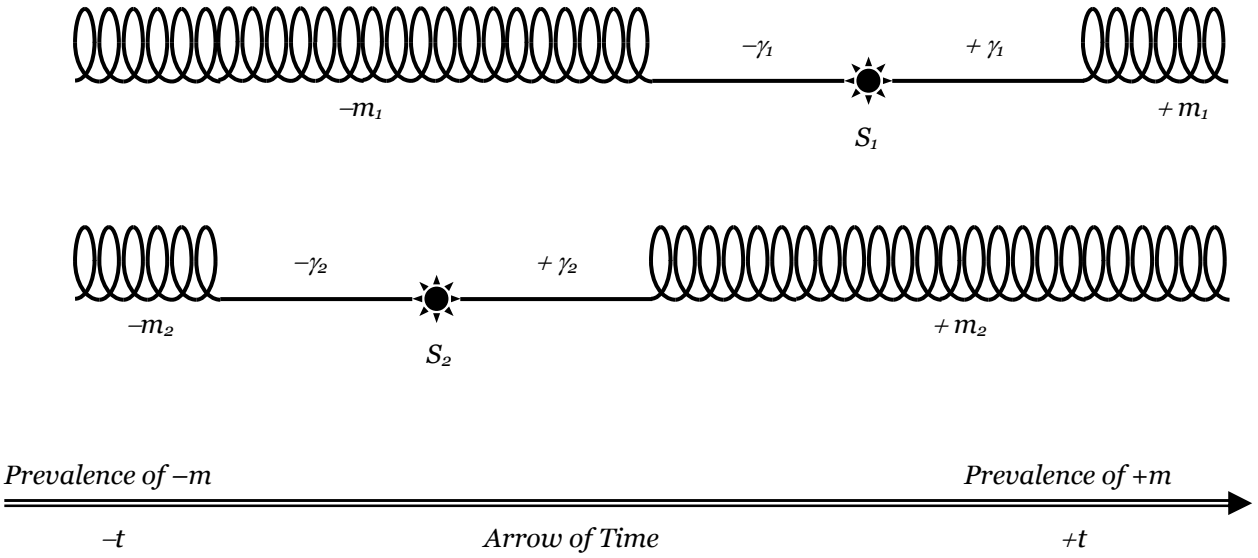
Inductive effect among different EM fields



Complex structures formed by induction

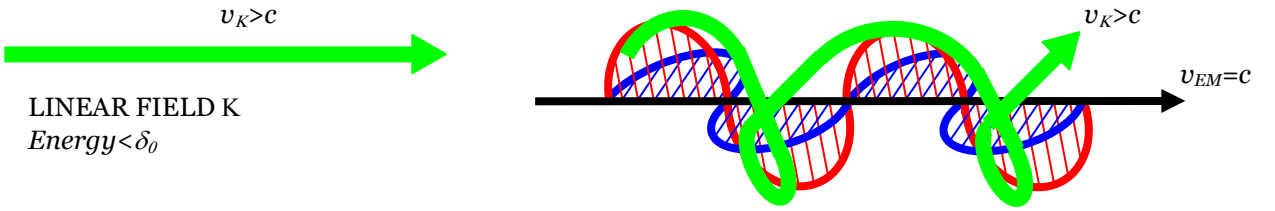
Violation of the matter-antimatter symmetry along time's arrow.

Assuming valid also the negative solutions of Maxwell's equations, for each electromagnetic field $+\gamma$ developing along time's arrow, there must exist an equal and temporally opposite $-\gamma$, emitted from the same source S and assuming invariant regarding time the tendency to pass from radiant energy to the helical structure, there is the formation of ordinary matter $+m$ at expense of *antimatter* $-m$ with pasting time. Such violation of the CP symmetry is perfectly reversible, so that going backwards in time to a remote past the percentage of antimatter should prevail on the ordinary matter's:



The electromagnetic field could be generated from another primordial field by covering.

In such case it would just be an intermediate in the potentially limitless chain of successive coverings and the immediately previous field, denominated K, should travel at $v_K>c$ (because in the helical motion the helix velocity of advance, in this case c, is always minor than the tangential speed v_K):



EM FIELD=FIELD K WRAPPED IN A HELIX
$\delta_0<Energy<\delta_1$ (δ_0=minimum electromagnetic threshold)

The Principle of Reciprocity

If cause and effect are not inescapable in the physical description then *action and reaction* can be considered *equivalent* and Newton's third law of motion should be reformulated as ***reciprocity***.

The reciprocity principle in physical description expresses the invariance following the substitution between subject (cause) and direct object (effect) within a well-formulated proposition.

Overcoming the scheme cause/effect for the benefit of a perfect logic symmetry and temporal reversibility, it seems the missing link to unite Relativity and Quantum Mechanics with respect to the *acausal* and *precausal* paradoxes.

Consequences of Reciprocity

Space-time is six-dimensional (3,3).

In a Euclidean space-time (flat) the Fitzgerald contraction must be interpretable both in the conventional direction:
$\boldsymbol{0<v<c \Rightarrow \Delta x<\Delta x_o}$ (the speed of the body generates the length's contraction in the movement direction), and in the reversal:
$\boldsymbol{\Delta x<\Delta x_o \Rightarrow 0<v<c}$ (the length's contraction in a certain direction generates the speed of the body).

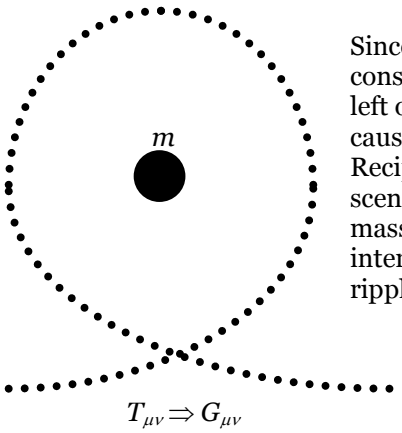
Similarly, based on reciprocity and time's three-dimensionality, in a Euclidean space-time (flat) the time dilation can be read both in the conventional direction:
$\boldsymbol{0<v<c \Rightarrow \Delta t>\Delta t_o}$ (the speed of the body generates the time dilation in the movement direction),
and in the reversal:
$\boldsymbol{\Delta t<\Delta t_o \Rightarrow 0<v<c}$ (the time dilation in a certain direction generates the speed of the body).

If time were not three-dimensional, the second interpretation would not be possible; in fact, without a direction identifying Δt, a temporal dilation could not be associated with a specific vector velocity $\boldsymbol{v}$.

Matter is a space-time's ripple.

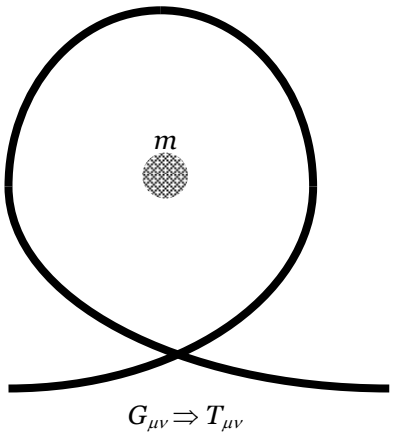
Since action and reaction are *equivalent*, Einstein's field equations $G_{\mu\nu}=kT_{\mu\nu}$ can be interpreted both in the conventional direction:
$\boldsymbol{T_{\mu\nu} \Rightarrow G_{\mu\nu}}$ (the presence of matter generates a space-time curvature),
and in the reversal:
$\boldsymbol{G_{\mu\nu} \Rightarrow T_{\mu\nu}}$ (the space-time curvature generates a presence of matter).

Thus there is not anymore a cause (the source tensor $T_{\mu\nu}$) and an effect (the Einstein tensor $G_{\mu\nu}$), but the two entities are interchangeable in physical description:



$T_{\mu\nu} \Rightarrow G_{\mu\nu}$

Since 1916, in *GR* has been considered the scenery on the left only, with energy tensor causing the geometrical one. Reciprocity permits the opposite scenery, on the right, with mass and energy geometrically interpretable as space-time ripples.



$G_{\mu\nu} \Rightarrow T_{\mu\nu}$

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