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Lecture by Dr. Enzo Bonacci about a possible extension of Einstein's General 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 October 2007 he got the cover of BLU magazine about his effort to extend Relativity and became member of the *IOP* (Institute of Physics, MInstP).
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.

Extending Einstein's General Relativity

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

1 SYNTHESIS

The proof of time's tridimensional nature completes the General Theory of Relativity, with the consequent esadimensional extension of Einstein field equations.
While Einstein's GR geometrically explains *gravity* as space-time curvature due to the "stress-energy-momentum" tetradimensional tensor, similarly in Bonacci's extension *all the observed interactions* are unitarily interpretable as space-time modifications linked to the esadimensional source tensor "stress-energy-momentum-electroweak charges-colour charges".
Thus we obtain the reduction of all forces to a unique geometrodynamics, the *esadimensional continuum* symmetrically distinguished between three spatial and three temporal coordinates.

2 INTRODUCTION

Keywords: tridimensional time, tangential, angular, radial, esadimensional continuum

Abstract: The purpose of the paper is the General Relativity's completion based on the tridimensional extension of time and consequent formulation of an *esadimensional* continuum able to unitarily explain the apparent multiplicity of observed interactions.
An ideal experiment carried out by a diode-photodiode reference in uniform circular motion gives three different temporal values according to the orientation of measurement so showing how time is at least *tridimensional*.
The bidimensional increase permits the *geometrodynamics* introduced by Einstein, so far valid for the gravitational interaction only, to describe all natural forces. In fact, beyond stress-energy-momentum, the source tensor at six dimensions $T_{\mu\nu}$ can include also electroweak and colour charges among its own components. Analogously the esadimensional variation principle can account for all the known conservation laws.
The reasons why forces seem manifold, instead of the same entity's manifestation, are at least three:

1) the habit to consider time as a monodimensional scalar;
2) the attitude to consider isotropic the interactions;
3) the highly complex structure of all observable bodies.

The efficacy of the esadimensional geometrodynamics is immediately evident by the simplest model, a structureless rotating sphere, whose anisotropic interactive frame is able to coherently explain some phenomena of contemporary physics:

1) the condensed *Cooper pairs* in superconductors;
2) the *weight reduction* in Podkletnov shield and Searl effect;
3) the black hole *jet* and *accretion disk*;
4) the *quasi-coplanar distribution* of stars in the galaxies and of planets in the solar system;
5) the *hadronic confinement* and the *asymptotic freedom* of quarks.

More complex models, involving several bodies with different shapes, velocities, trajectories and distances, can explain the whole variety of the interactions.
There are some practical applications deriving directly from the esadimensional theory:

1) rotating disks assimilable to structureless flat bodies generating *hypergravity* or *subgravity*;
2) rotating cylinders assimilable to structureless filiform bodies generating *hypergravity*.

Therefore *subgravity* and *hypergravity* are possible alternative sources of energy whose efficiency is however limited by building problems.

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

3 DEFINITIONS

3.1 Let *inertia* be the condition of *immobility or uniform rectilinear motion*.

3.2 Let *interaction* be any not inertial condition.

3.3 Denote *GR* the acronym for *General Relativity*.

3.4 Denote *URM* the acronym for *Uniform Rectilinear Motion*.

3.5 Denote *UCM* the acronym for *Uniform Circular Motion*.

3.6 Denote *DP* the *Diode–Photodiode* reference system.

3.7 Let $\boldsymbol{v}$ be the tangential velocity vector of reference DP, *i.e.* of the *diode*.

3.8 Let $\boldsymbol{r}$ be the *radius of curvature* vector of reference DP, *i.e.* of the *diode*.

3.9 Let $\boldsymbol{\omega}$ be the *angular velocity* vector of reference DP, *i.e.* of the *diode*: $\boldsymbol{v}=\boldsymbol{\omega}\mathbf{x}\boldsymbol{r}$.

3.10 Let d be the real trajectory of the diode, *i.e.* in any immobile reference system.

3.11 Let c be the speed of light in vacuo.

3.12 Denote $\beta=v/c$ the ratio between DP tangential velocity and speed of light.

3.13 Denote $\gamma=(1-\beta^2)$^$(-1/2)$ the Lorentz coefficient relative to the reference DP.

3.14 Let Δt_0 be the time-interval at rest, *i.e.* measured when DP is immobile.

3.15 Let $l_0=c\Delta t_0$ be the laser ray trajectory at rest, *i.e.* measured when DP is immobile.

3.16 Let Δt be the time-interval measured in motion, *i.e.* when DP moves at velocity v.

3.17 Let Δt_i be the inertial time-interval, *i.e.* measured when DP is in URM.

3.18 Let $\Delta\tau$ be the tangential time-interval, *i.e.* measured when DP is on a plane perpendicular to $\boldsymbol{v}$.

3.19 Let $l_\tau=c\Delta\tau$ be the laser ray trajectory emitted in *angular* direction, *i.e.* in the way of $\boldsymbol{\omega}$.

3.20 Let $d_i=v\Delta t$ be the *inertial* trajectory of the diode, *i.e.* rectified in tangential direction.

3.21 Let $\Delta\theta$ be the *angular* time-interval, *i.e.* measured when DP is on a plane perpendicular to $\boldsymbol{\omega}$.

3.22 Let $l_\theta=c\Delta\theta$ be the laser ray trajectory emitted in *radial* direction, *i.e.* in the way of $\boldsymbol{r}$.

3.23 Let $\Delta\rho$ be the *radial* time-interval, *i.e.* measured when DP is on a plane perpendicular to $\boldsymbol{r}$.

3.24 Let $l_\rho=c\Delta\rho$ be the laser ray trajectory emitted in *tangential* direction, *i.e.* in the way of $\boldsymbol{v}$.

3.25 Let m_0 be the mass at rest, *i.e.* measured when immobile.

3.26 Let m be the total mass, *i.e.* measured at velocity v.

3.27 Let xyz be a *space Cartesian* reference, *i.e.* three orthogonal axes in a Euclidean flat space.

3.28 Let $t_xt_yt_z$ be a *time Cartesian* reference, *i.e.* the three orthogonal planes t_x,t_y,t_z among the axes x,y,z.

3.29 Let $xyzt_xt_yt_z$ be a *space-time Cartesian reference*, *i.e.* three orthogonal axes x,y,z and relative planes t_x,t_y,t_z.

3.30 Let $P(x,y,z,t_x,t_y,t_z)$ be the *position* in an esadimensional Cartesian reference.

3.31 Let $X_1X_2X_3X_4X_5X_6$ be a Gaussian reference in an esadimensional curved space.

3.32 Let $E(X_1,X_2,X_3,X_4,X_5,X_6)$ be the space-time event in the esadimensional continuum.

3.33 Let ds be the *line element*: $\delta\int ds=0$.

3.34 Denote $g_{\mu\nu}$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *metric tensor*.

3.35 Denote $g_{\mu\nu}$, with $\mu, \nu=1,2,3,4,5,6$, the metric *esadimensional* tensor.

3.36 Denote $ds^2=g_{\mu\nu}dx_\mu dx_\nu$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *quadratic invariant*.

3.37 Denote $ds^2=g_{\mu\nu}dx_\mu dx_\nu$, with $\mu, \nu=1,2,3,4,5,6$, the *esadimensional* quadratic invariant.

3.38 Denote $R_{\mu\nu}$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *Ricci Curvature Tensor*.

3.39 Denote $R_{\mu\nu}$, with $\mu, \nu=1,2,3,4,5,6$, the *esadimensional* Ricci Curvature Tensor.

3.40 Denote $R^4=R_a{}^a=R_{11}+R_{22}+R_{33}+R_{44}$, the relativistic *scalar curvature*, trace of tetradimensional tensor $R_{\mu\nu}$.

3.41 Denote $R^6=R_a{}^a=R_{11}+R_{22}+R_{33}+R_{44}+R_{55}+R_{66}$, the scalar curvature trace of *esadimensional* tensor $R_{\mu\nu}$.

3.42 Denote $\nabla^\mu(R_{\mu\nu}-½Rg_{\mu\nu})=0$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *contracted Bianchi identities.*

3.43 Denote $\nabla^\mu(R_{\mu\nu}-½Rg_{\mu\nu})=0$, with $\mu, \nu=1,2,3,4,5,6$, the *esadimensional* contracted Bianchi identities.

3.44 Denote $G_{\mu\nu}=R_{\mu\nu}-½g_{\mu\nu}R$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *Einstein Tensor*.

3.45 Denote $G_{\mu\nu}=R_{\mu\nu}-½g_{\mu\nu}R$, with $\mu, \nu=1,2,3,4,5,6$, the *esadimensional* Einstein Tensor.

3.46 Denote $T_{\mu\nu}$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *source tensor*.

3.47 Denote $T_{\mu\nu}$, with $\mu, \nu=1,2,3,4,5,6$, the *esadimensional* source tensor.

3.48 Denote $\nabla^\mu T_{\mu\nu}=0$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *conservation equations.*

3.49 Denote $\nabla^\mu T_{\mu\nu}=0$, with $\mu, \nu=1,2,3,4,5,6$, the *esadimensional* conservation equations.

3.50 Denote $G_{\mu\nu}=kT_{\mu\nu}$, with $\mu, \nu=1,2,3,4$, the relativistic tetradimensional *Einstein field equations*.

3.51 Denote $G_{\mu\nu}=kT_{\mu\nu}$, with $\mu, \nu=1,2,3,4,5,6$, the *esadimensional* extension of the Einstein field equations.

3.52 Denote L^4 the relativistic tetradimensional *Lagrangian of matter*.

3.53 Denote L^6 the *esadimensional* Lagrangian of matter.

3.54 Denote J^4 the relativistic tetradimensional *scalar function*: $J^4=L^4-R^4/2k$.

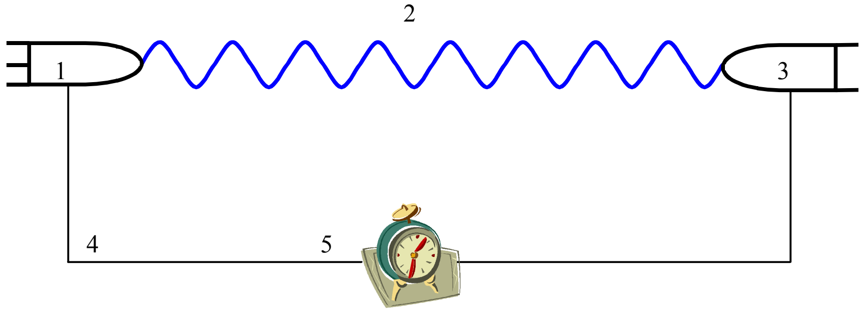
3.55 Denote J^6 the *esadimensional* extension of the scalar function: $J^6=L^6-R^6/2k$.

3.56 Denote $\delta\int J^4 \sqrt{g}\, d^4X=0$ the relativistic tetradimensional *variation principle*.

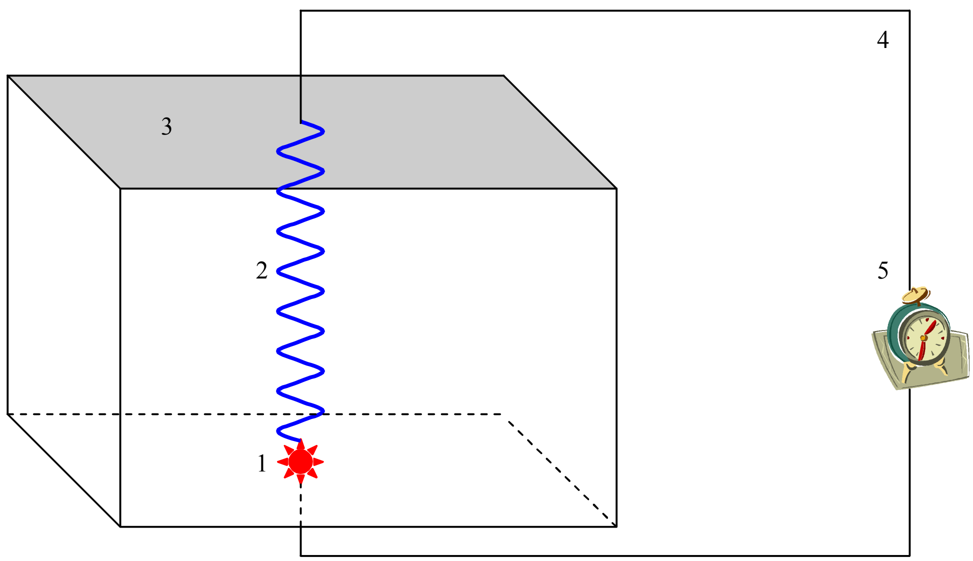
3.57 Denote $\delta\int J^6 \sqrt{g}\, d^6X=0$ the *esadimensional* extension of the variation principle.

4 HYPOTHESES

4.1 *Time is measured on an orientation, i.e. between two parallel planes DP.*



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



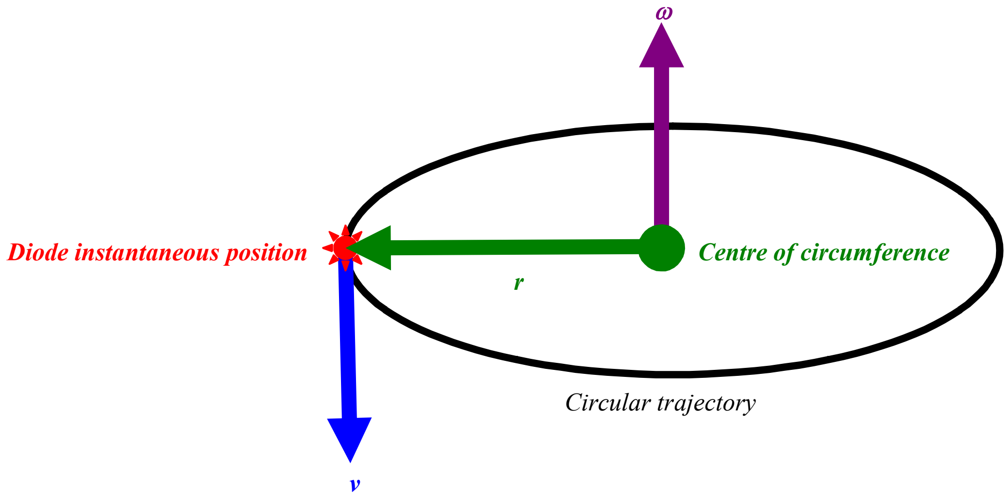
1) Diode
2) Laser ray
3) Photodiode
4) Feedback
5) Chronometer

4.2 ***The trajectory described by a material point is continuous.***

The *trajectory* is the set of infinite successive positions assumed by a material point in its motion.

4.3 ***The uniform circular motion individuates the three vectors v, ω, r: v=ωxr.***

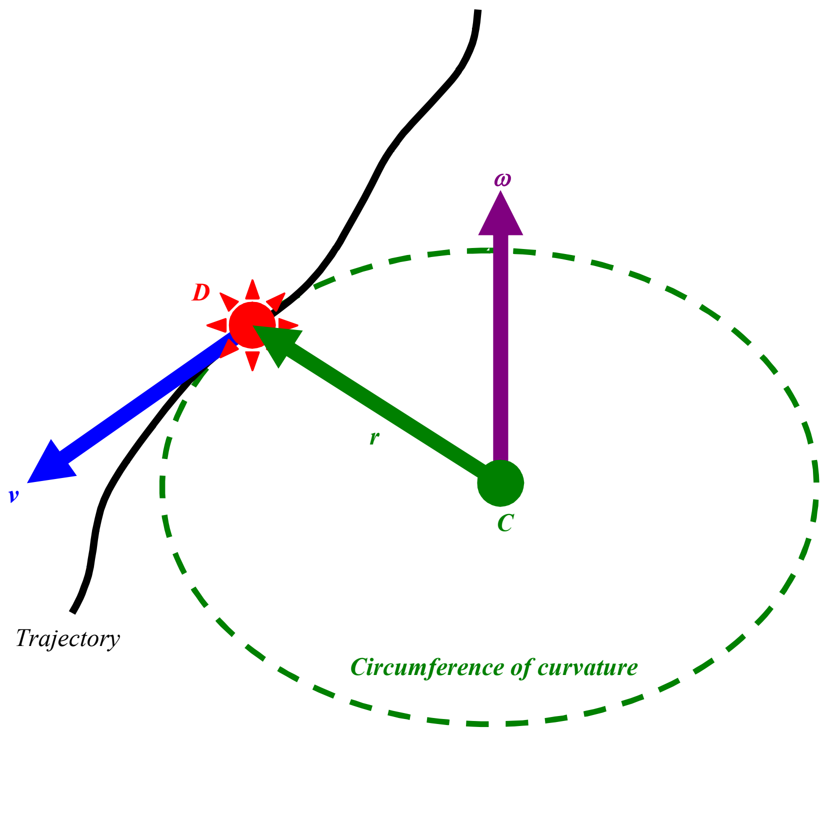
Denote *v=tangential velocity*; *ω= angular velocity*; *r=radius of circumference.*



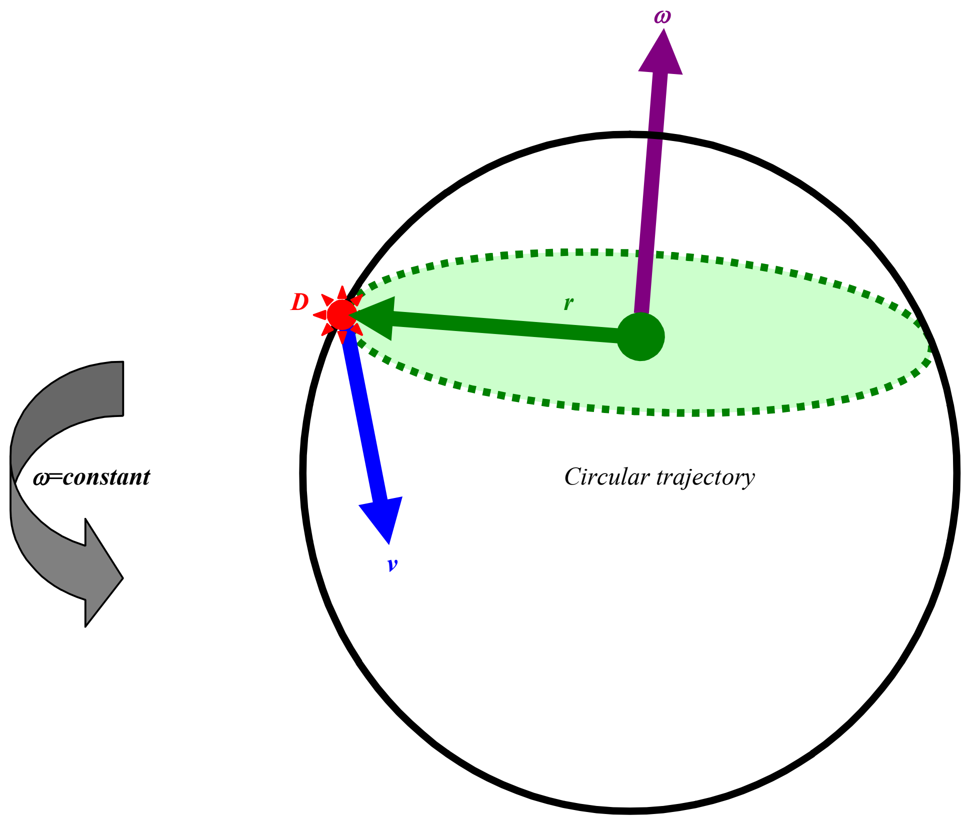
4.4 ***In any trajectory each point individuates the three instantaneous vectors v, ω, r: v=ωxr.***

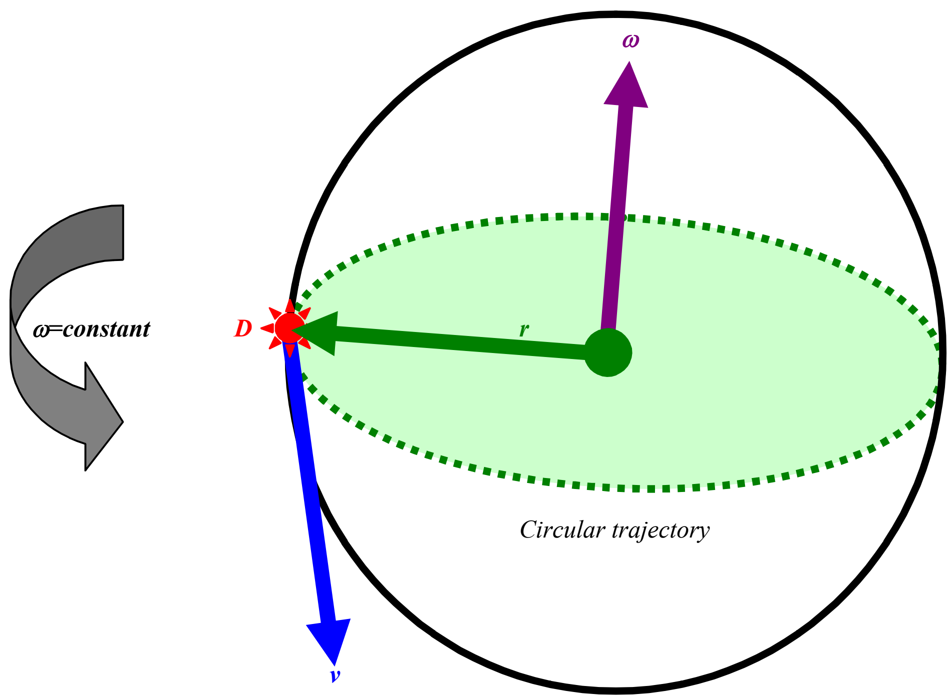
Each point of a trajectory is assimilable to an *instantaneous UCM*.

The rectilinear trajectory is a limit case of degenerated *UCM*: *r*⟶∞, *ω=0*.



4.5 ***A structureless sphere in UCM consists of infinite parallel circular trajectories.***
The DP reference system can be placed along different parallels:





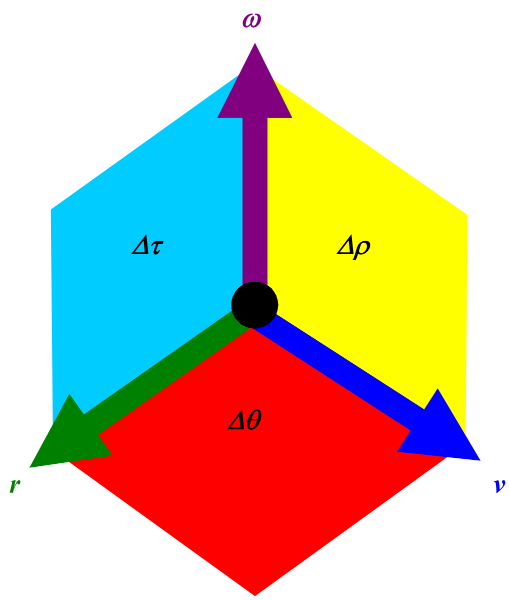
4.6 ***In UCM time is measured on three mutually orthogonal orientations: $\Delta\tau\perp v$, $\Delta\theta\perp\omega$, $\Delta\rho\perp r$.***

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 v.

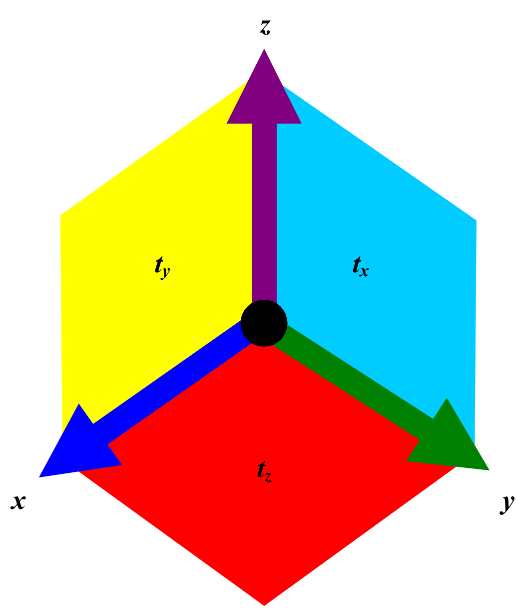
$\Delta\theta$=*angular time,* measured on the orientation perpendicular to ω.

$\Delta\rho$=*radial time,* measured on the orientation perpendicular to r.



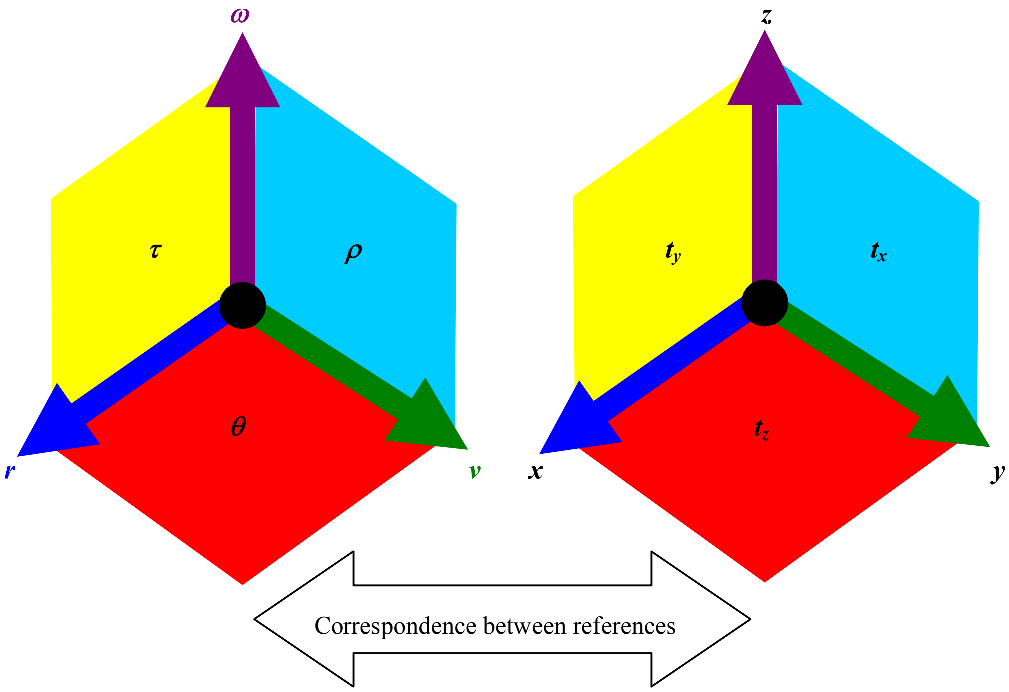
4.7 ***Fixed esadimensional Cartesian reference in a flat Euclidean space-time.***

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.



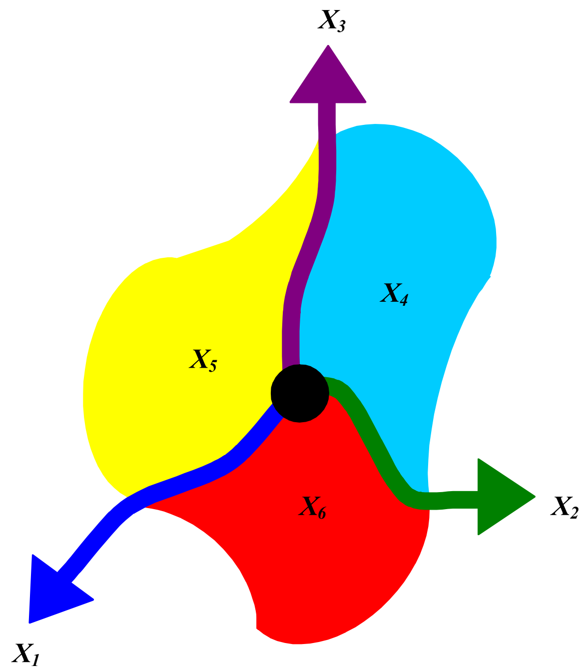
4.8 ***The three times τ, θ, ρ are in biunivocal correspondence with the three times t_x, t_y, t_z.***

The measures in the instantaneous reference $v\omega r\tau\theta\rho$ are univocally projected on the fixed reference $xyzt_xt_yt_z$.



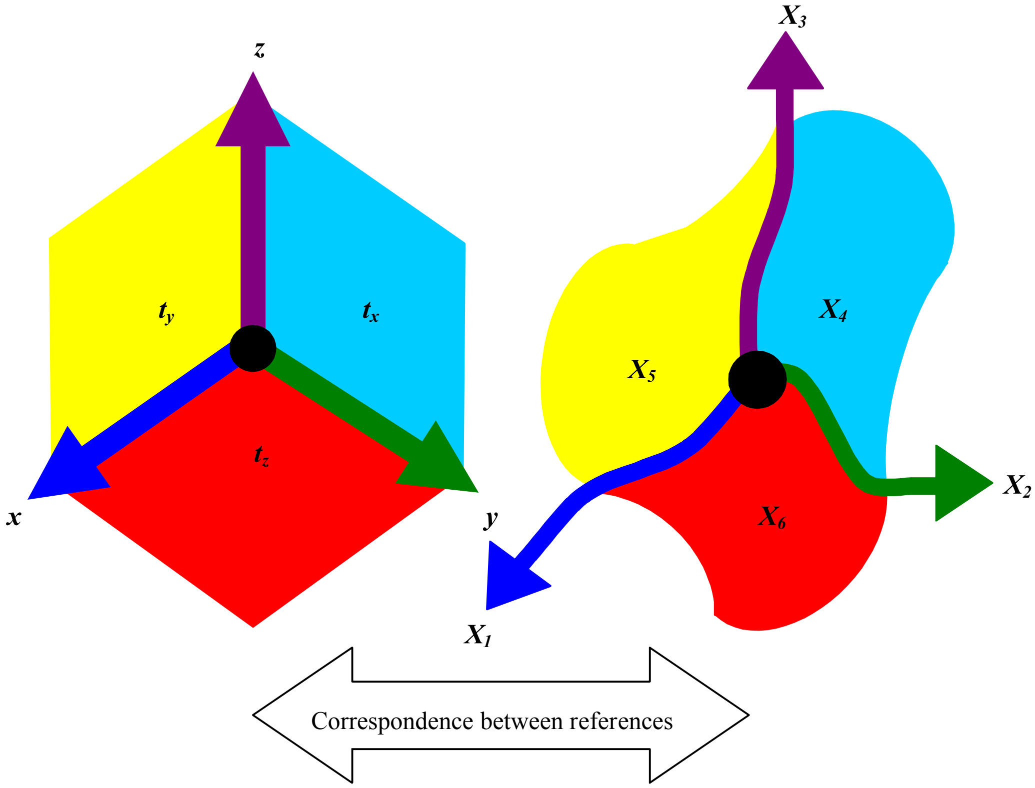
4.9 ***Gaussian esadimensional reference in a curved space-time.***

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.



4.10 ***The position** $P(x,y,z,t_x,t_y,t_z)$ **is in biunivocal correspondence with the event** $E(X_1,X_2,X_3,X_4,X_5,X_6)$.*

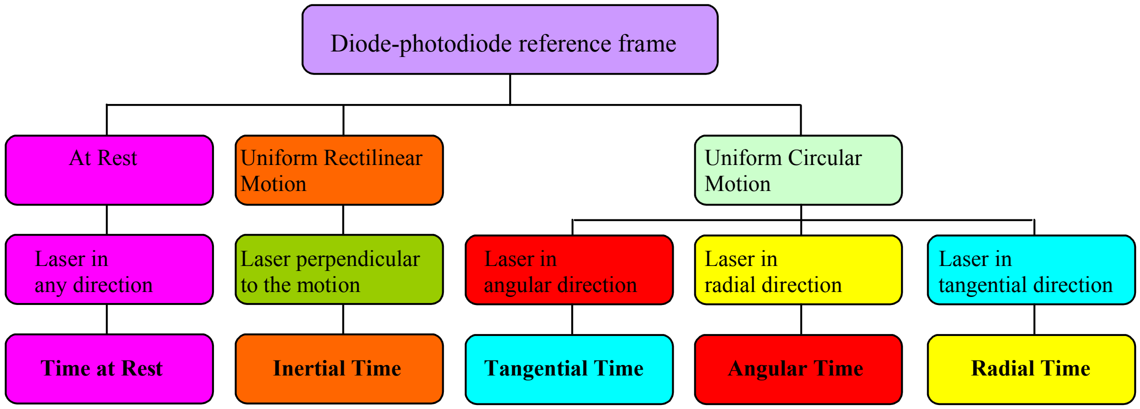
By keeping the relativistic assumption about the quasi-Euclidean nature of space-time continuum at local level, there is the biunivocal correspondence between the measures in any Cartesian reference $xyzt_xt_yt_z$. and the same taken in a Gaussian reference $X_1X_2X_3X_4X_5X_6$ in curved space-times locally almost flat.



4.11 ***Flux lines are proportional to the intensity of temporal measures.***

Time measure	*Flux lines*	*Graphical representation*
$\Delta t=\Delta t_i$	MEDIUM	
$0<\Delta t<\Delta t_i$	THIN	
$\Delta t>\Delta t_i$	THICK	

4.12 ***Flow chart of measured times.***



4.13 ***Tetradimensional relativistic source tensor.***

It is symmetrical only with respect to the matrix main diagonal.

Energy density	T_{00}	T_{21}	T_{22}	T_{23}	**Energy flux**
Momentum density	T_{30}	T_{31}	T_{32}	T_{33}	**Momentum flux**
	T_{40}	T_{41}	T_{42}	T_{43}	
	T_{50}	T_{51}	T_{52}	T_{53}	

4.14 ***Esadimensional extension of the relativistic source tensor.***

It is supersymmetrical, consisting of 4 quadrants each with 9 components.

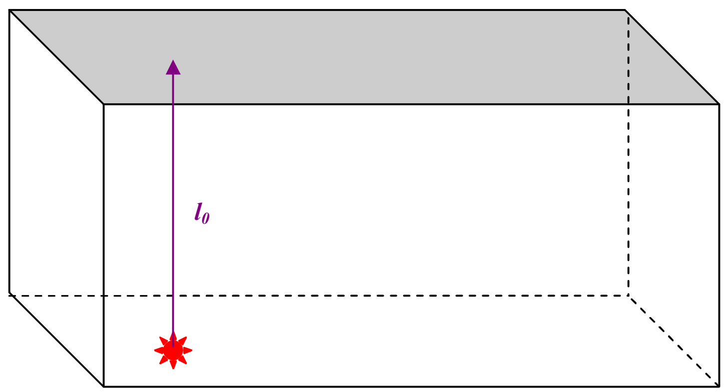
It can contain all sources: energy-momentum, electroweak and colour charges.

Energy density	T_{00}	T_{01}	T_{02}	T_{03}	T_{04}	T_{05}	**Energy flux**
	T_{10}	T_{11}	T_{12}	T_{13}	T_{14}	T_{15}	
	T_{20}	T_{21}	T_{22}	T_{23}	T_{24}	T_{25}	
Momentum density	T_{30}	T_{31}	T_{32}	T_{33}	T_{34}	T_{35}	**Momentum flux**
	T_{40}	T_{41}	T_{42}	T_{43}	T_{44}	T_{45}	
	T_{50}	T_{51}	T_{52}	T_{53}	T_{54}	T_{55}	

5 PROPOSITIONS

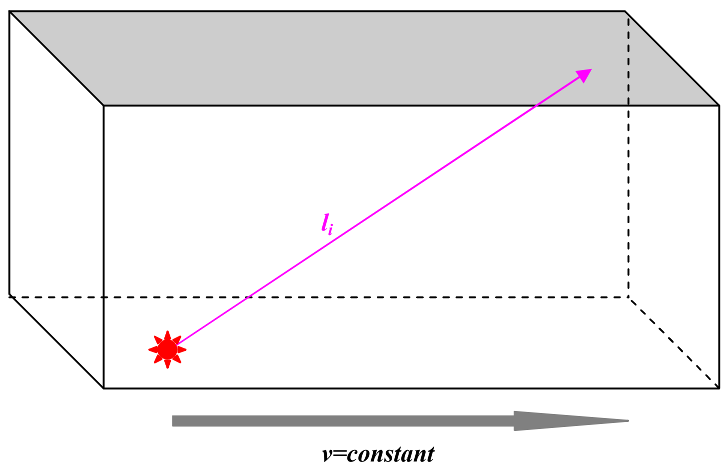
5.1 *Time at rest Δt_0 is measured when the two parallel planes DP are immobile.*

Proof. Denote l_0 the laser ray trajectory in an immobile DP reference: $\Delta t_0 = l_0/c$.

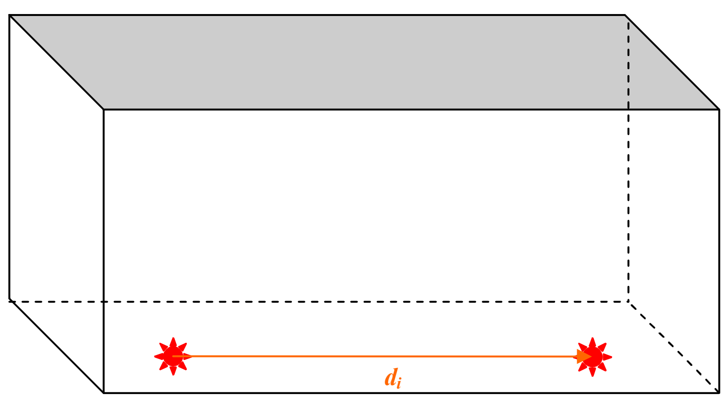


5.2 *The time measured in a reference in uniform rectilinear motion is: $\Delta t_i = \gamma \Delta t_0$.*

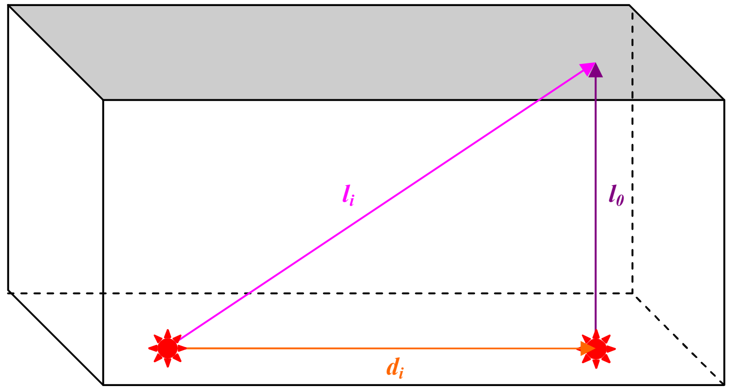
Proof. Denote l_i the laser ray trajectory perpendicular to the DP reference in URM: $\Delta t_i = l_i/c$.



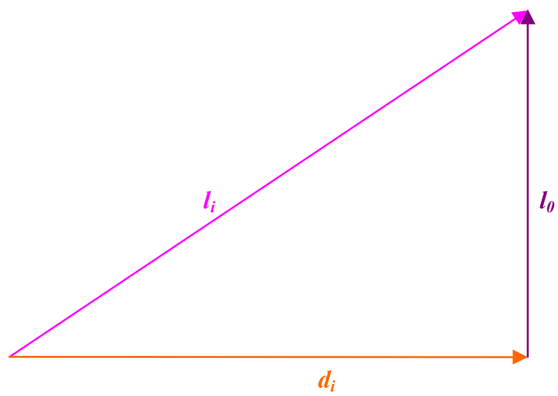
Trajectory of the diode in URM:



Composition of the trajectories in the URM:



Relationship between the time in URM Δt_i and the one at rest Δt_0:



$l_i = c\Delta t_i$ inertial laser ray trajectory, *i.e.* relative to a DP reference in URM at velocity v.
$l_0 = c\Delta t_0$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$d_i = v\Delta t_i$ inertial trajectory of the diode, *i.e.* in URM at velocity v.

By Hypothesis 4.10, the locally quasi-Euclidean space-time permits the Pythagorean theorem:

$l_i^2 = l_0^2 + d_i^2$

$(c\Delta t_i)^2 = (c\Delta t_0)^2 + (v\Delta t_i)^2$

$\Delta t_i^2\ (c^2 - v^2) = c^2 \Delta t_0^2$

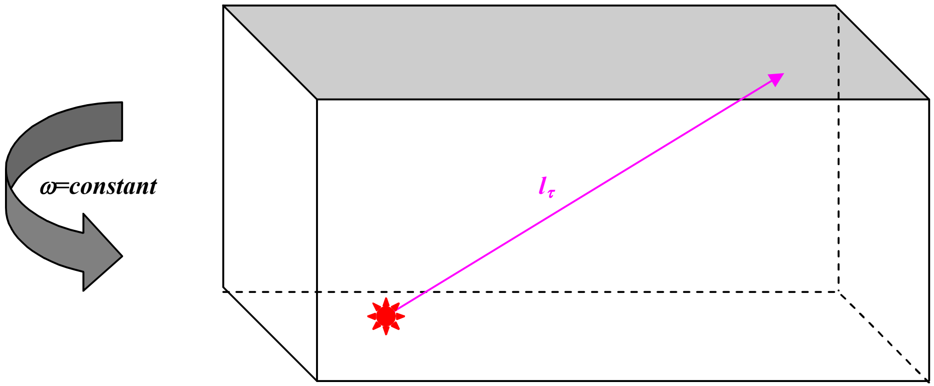
$\Delta t_i^2 (1 - \beta^2) = \Delta t_0^2$

$\Delta t_i^2 = \Delta t_0^2/(1-\beta^2)$

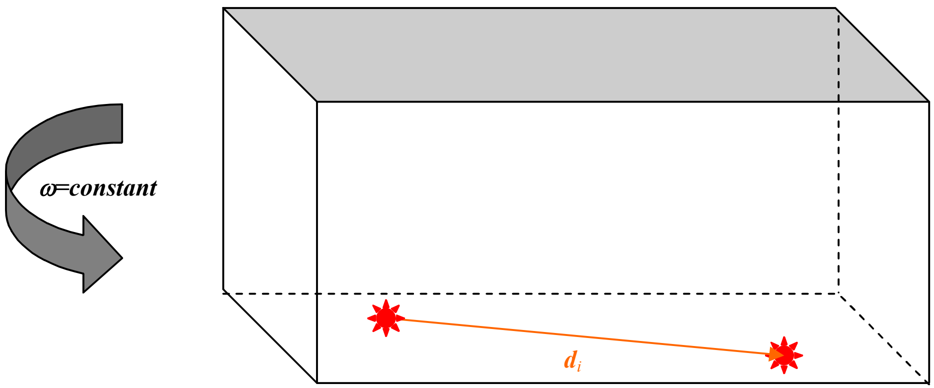
$\Delta t_i = \gamma \Delta t_0$

5.3 ***In UCM the tangential time coincides with the inertial one: $\Delta\tau=\Delta t_i$.***

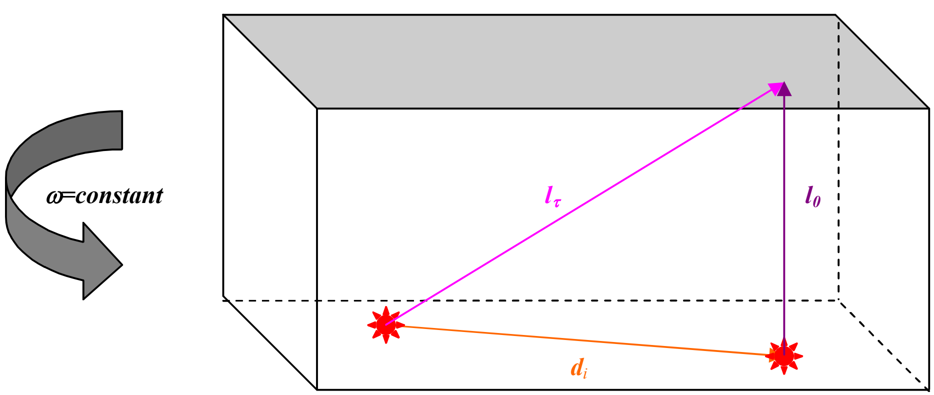
Proof. Denote l_τ the laser ray trajectory emitted in *angular* direction, *i.e.* in the way of vector $\boldsymbol{\omega}$: $\Delta\tau=l_\tau/c$.



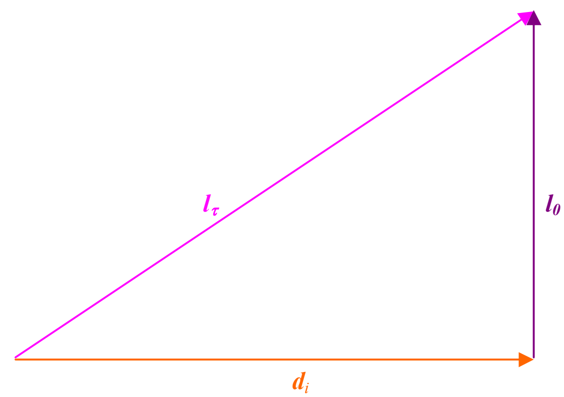
Denote d_i the inertial trajectory of the diode in UCM, *i.e.* rectified in tangential direction:



Composition of the trajectories in direction tangential to the rotation:



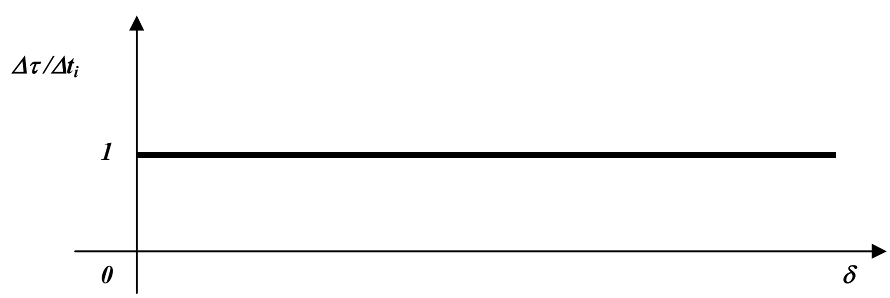
Relationship between the tangential time in UCM $\Delta\tau$ and the one at rest Δt_0:



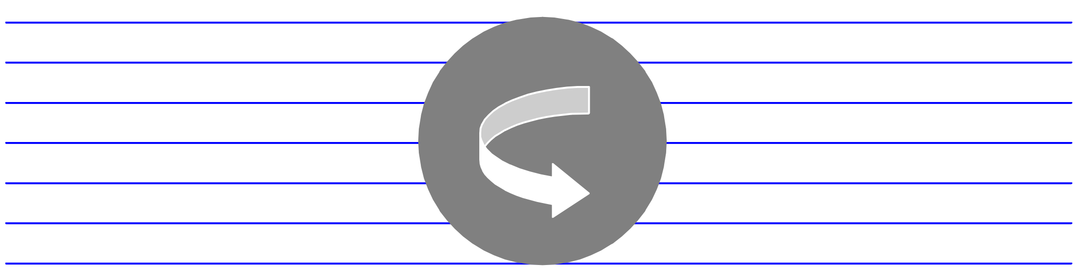
$l_\tau = c\Delta\tau$, tangential laser ray trajectory, *i.e.* relative to a DP reference in UCM at velocity $\boldsymbol{v}=\boldsymbol{\omega}\mathbf{x}\boldsymbol{r}$.
$l_0 = c\Delta t_0$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$d_i = v\Delta\tau$ inertial trajectory of the diode in UCM, *i.e.* rectified in tangential direction.

By Hypothesis 4.10, the locally quasi-Euclidean space-time permits the Pythagorean theorem:
$l_\tau^2 = l_0^2 + d_i^2$
$(c\Delta\tau)^2 = (c\Delta t_0)^2 + (v\Delta\tau)^2$
$\Delta\tau^2\,(c^2 - v^2) = c^2\Delta t_0^2$
$\Delta\tau^2(1-\beta^2) = \Delta t_0^2$
$\Delta\tau^2 = \Delta t_0^2/(1-\beta^2)$
$\Delta\tau = \gamma\Delta t_0$
$\Delta\tau = \Delta t_i$

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:

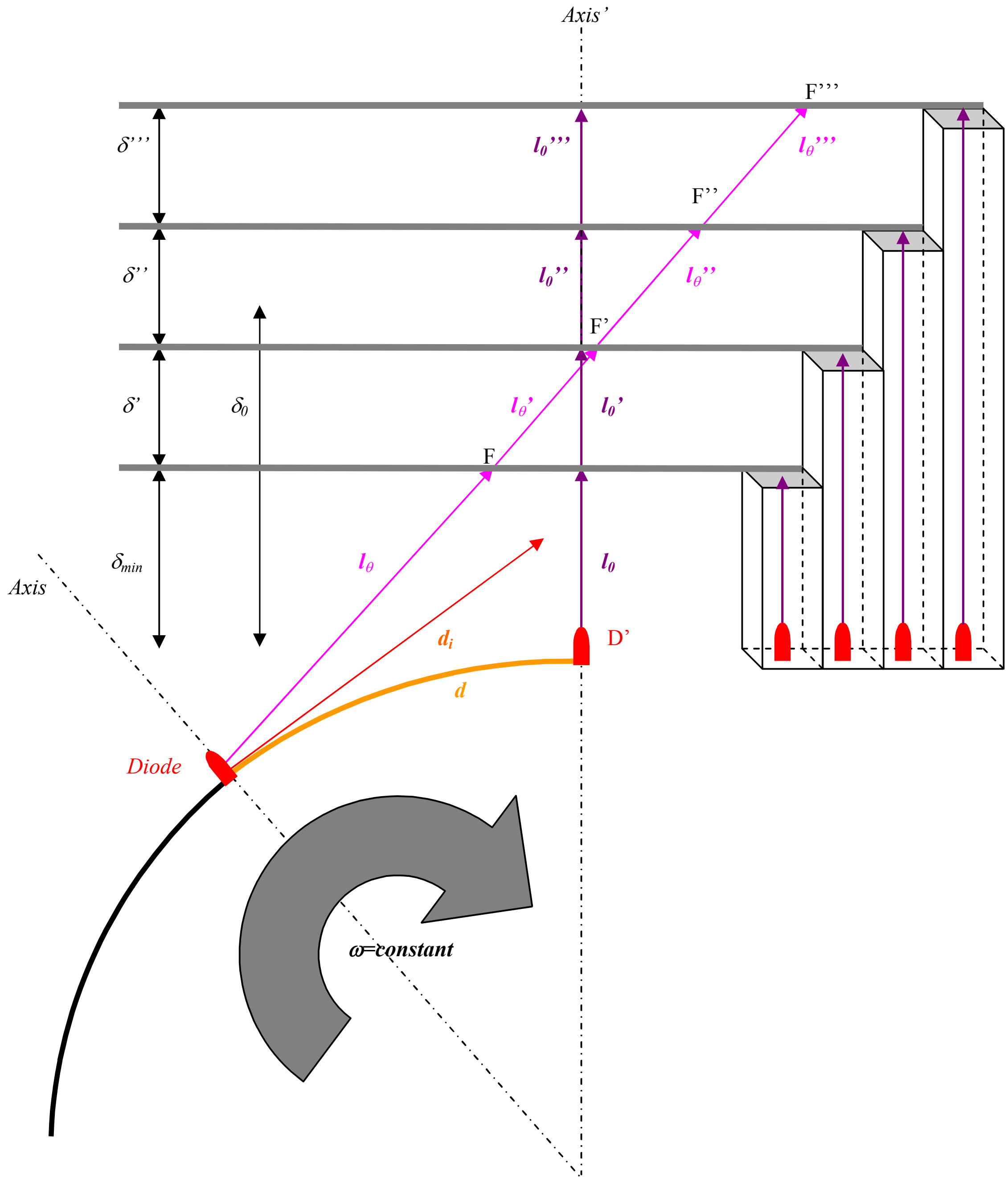


By Hypothesis 4.11, around a structureless sphere in UCM the tangential time flux lines $\Delta\tau$ are medium:



5.4 ***In UCM the angular time is: $\Delta\theta<\Delta t_i$ beside and $\Delta\theta>\Delta t_i$ increasing with the distance.***

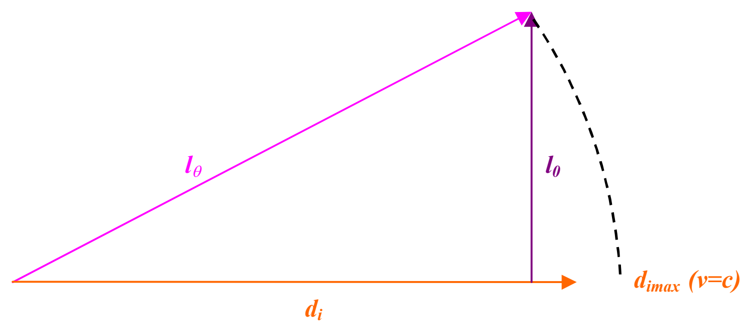
Proof. Composition of the trajectories in direction tangential to rotation, at different DP distances δ:



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

Denote l_θ the laser ray trajectory emitted in *radial* direction, *i.e.* in the way of vector $\boldsymbol{r}$: $\Delta\theta=l_\theta/c$.

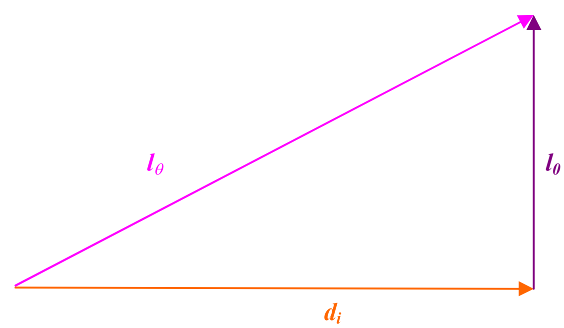
Relationship between the angular time in UCM $\Delta\theta$ and the one at rest Δt_0, when $\delta<\delta_0$:



$l_\theta=c\Delta\theta$ angular laser ray trajectory, *i.e.* relative to a DP reference in UCM at velocity $\boldsymbol{v=\omega x r}$.
$l_0=c\Delta t_0$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$d_i=v\Delta\theta$ inertial trajectory of the diode in UCM, *i.e.* rectified in tangential direction.

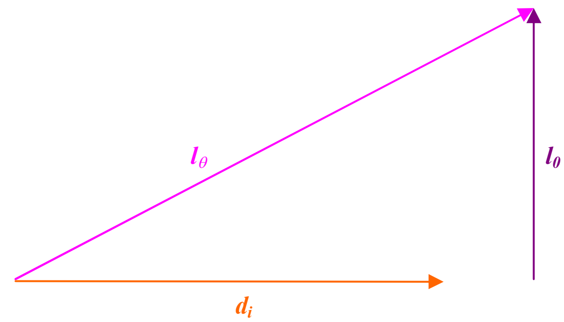
By Hypothesis 4.10, the locally quasi-Euclidean space-time permits the Pythagorean theorem:
$l_\theta^2<l_0^2+d_i^2$
$(c\Delta\theta)^2<(c\Delta t_0)^2+(v\Delta\theta)^2$
$\Delta\theta^2\ (c^2-v^2)<c^2\Delta t_0^2$
$\Delta\theta^2(1-\beta^2)<\Delta t_0^2$
$\Delta\theta^2<\Delta t_0^2/(1-\beta^2)$
$\Delta\theta<\gamma\Delta t_0$
$\Delta\theta<\Delta t_i$

Relationship between the angular time $\Delta\theta$ in UCM and the one at rest Δt_0, when $\delta=\delta_0$:



By Hypothesis 4.10, the locally quasi-Euclidean space-time permits the Pythagorean theorem:
$l_\theta^2=l_0^2+d_i^2$
$(c\Delta\theta)^2=(c\Delta t_0)^2+(v\Delta\theta)^2$
$\Delta\theta^2\ (c^2-v^2)=c^2\Delta t_0^2$
$\Delta\theta^2(1-\beta^2)=\Delta t_0^2$
$\Delta\theta^2=\Delta t_0^2/(1-\beta^2)$
$\Delta\theta=\gamma\Delta t_0$
$\Delta\theta=\Delta t_i$

Relationship between the angular time in UCM $\Delta\theta$ and the one at rest Δt_0, when $\delta > \delta_0$:



By Hypothesis 4.10, the locally quasi-Euclidean space-time permits the Pythagorean theorem:

$l_\theta^2 > l_0^2 + d_i^2$

$(c\Delta\theta)^2 > (c\Delta t_0)^2 + (v\Delta\theta)^2$

$\Delta\theta^2\ (c^2 - v^2) > c^2\Delta t_0^2$

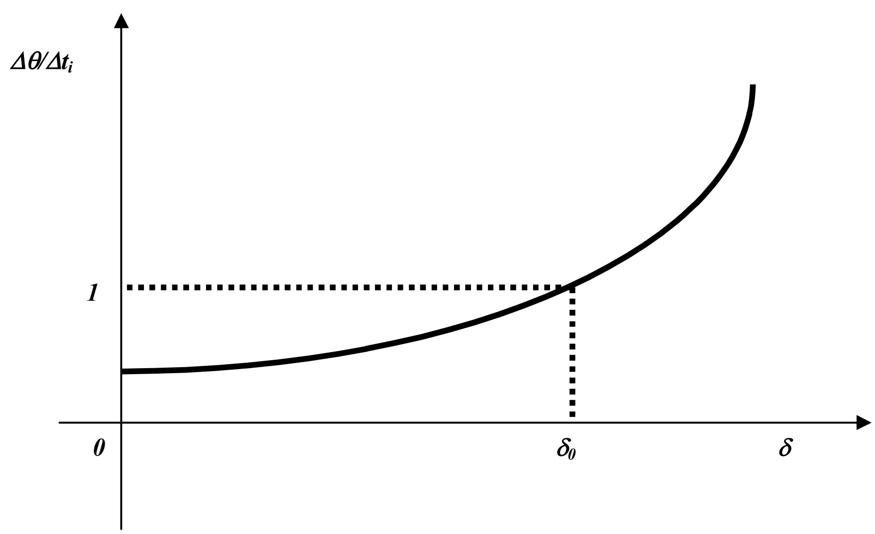
$\Delta\theta^2 (1-\beta^2) > \Delta t_0^2$

$\Delta\theta^2 > \Delta t_0^2/(1-\beta^2)$

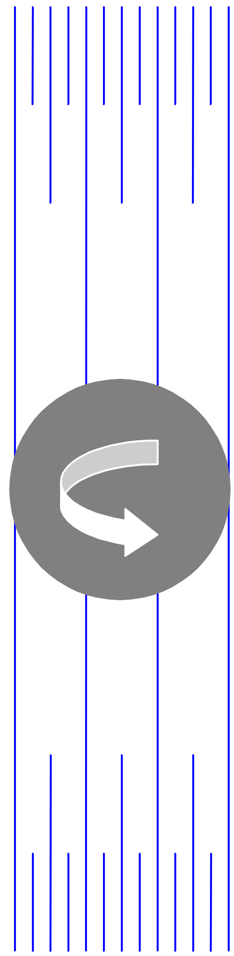
$\Delta\theta > \gamma\Delta t_0$

$\Delta\theta > \Delta t_i$

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:

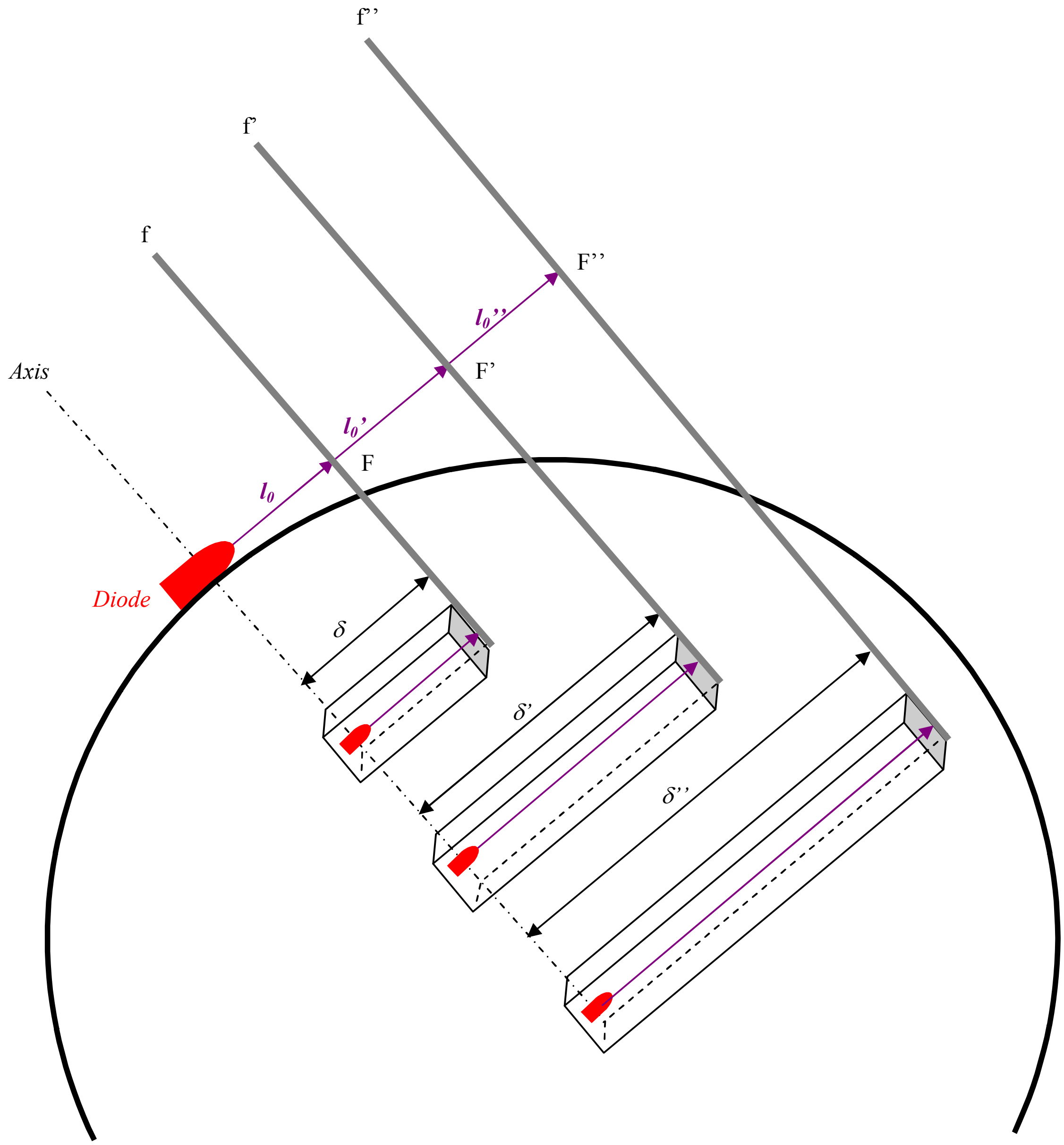


By Hypothesis 4.11, for a structureless sphere in UCM the angular time $\Delta\theta$ flux lines are thin beside and thick far away:

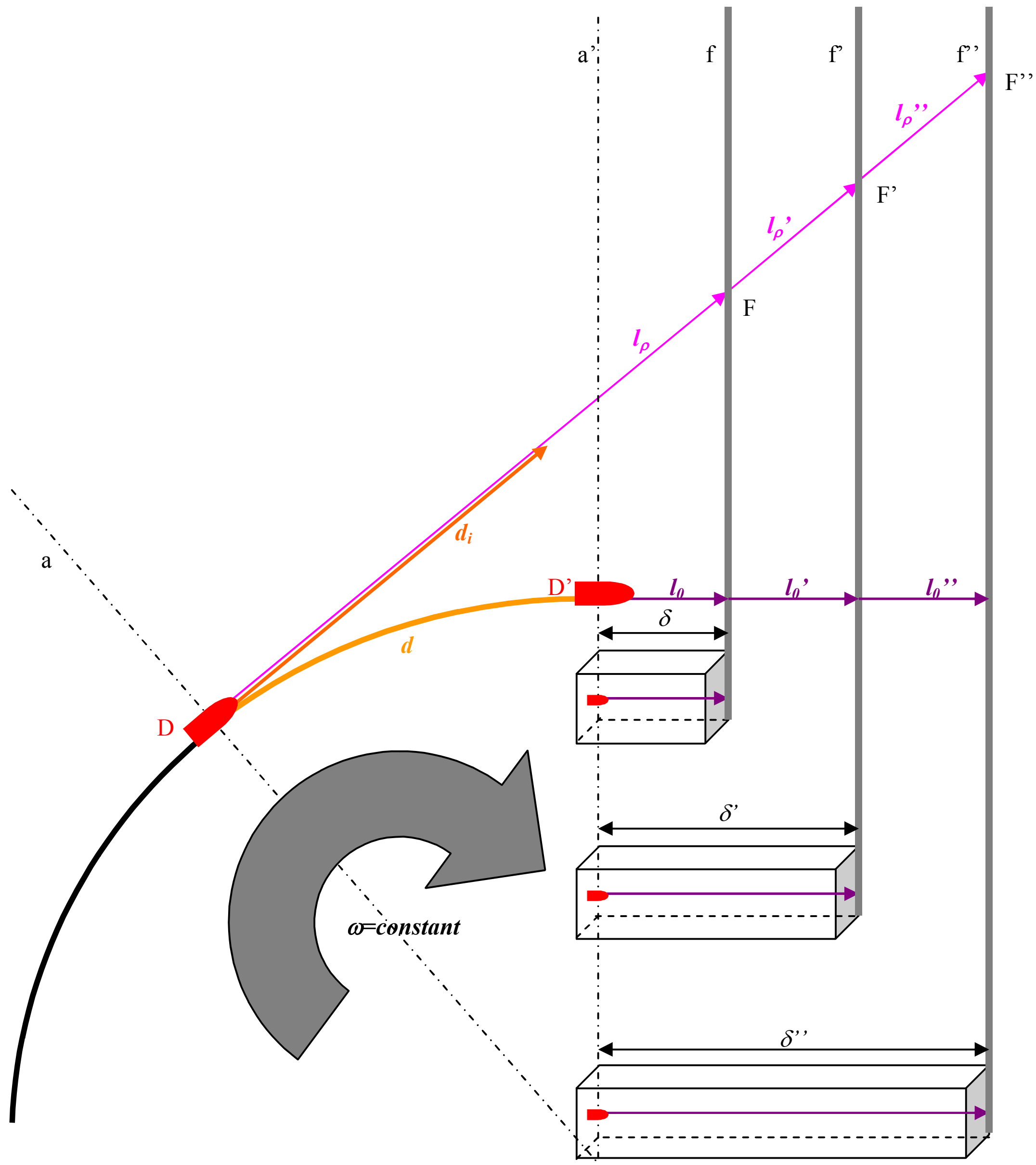


5.5 ***In UCM the radial time is: $\Delta\rho > \Delta t_i$, asymptotically decreasing towards Δt_i with the distance.***

Proof. Laser ray trajectory in an immobile reference, at different distances diode-photodiode δ:

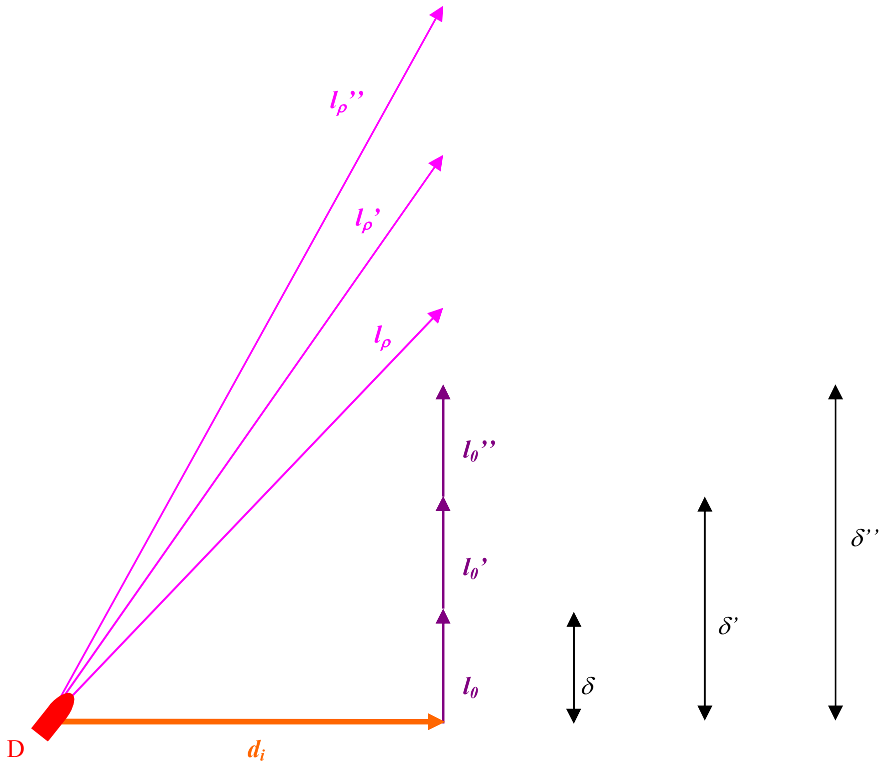


Laser ray trajectory in a DP reference in UCM, at different diode-photodiode distances δ:

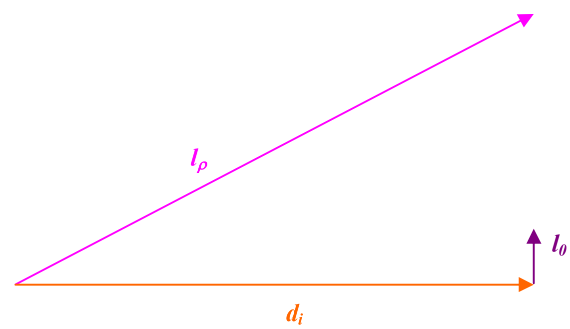


Denote l_ρ the laser ray trajectory emitted in *tangential* direction, *i.e.* in the way of vector $\boldsymbol{v}$: $\Delta\rho = l_\rho / c$.

Composition of the trajectories in direction radial to the rotation:



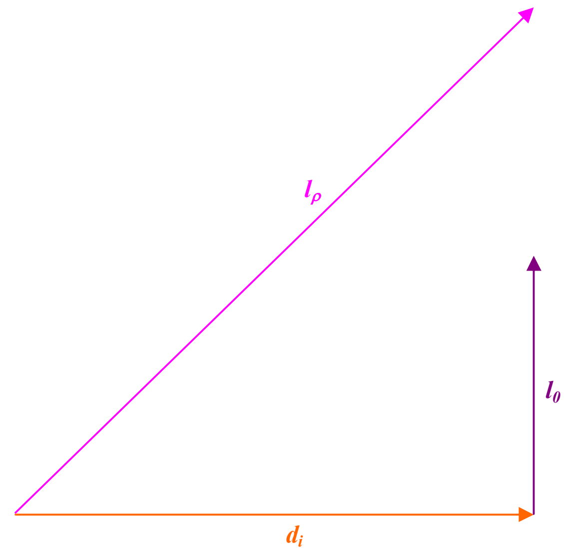
Relationship between the radial time in UCM $\Delta\rho$ and the one at rest Δt_0 beside (short δ):



$l_\rho = c\Delta\rho$ radial laser ray trajectory, *i.e.* relative to a DP reference in UCM at velocity $\boldsymbol{v=\omega x r}$.
$l_0 = c\Delta t_0$ laser ray trajectory at rest, *i.e.* relative to an immobile DP reference.
$d_i = v\Delta\rho$ inertial trajectory of the diode in UCM, *i.e.* rectified in tangential direction.

By Hypothesis 4.10, the locally quasi-Euclidean space-time permits the Pythagorean theorem:
$l_\rho^2 >> l_0^2 + d_i^2$
$(c\Delta\rho)^2 >> (c\Delta t_0)^2 + (v\Delta\rho)^2$
$\Delta\rho^2\ (c^2 - v^2) >> c^2 \Delta t_0^2$
$\Delta\rho^2 (1-\beta^2) >> \Delta t_0^2$
$\Delta\rho^2 >> \Delta t_0^2/(1-\beta^2)$
$\Delta\rho >> \gamma\Delta t_0$
$\Delta\rho >> \Delta t_i$

Relationship between the radial time in UCM $\Delta\rho$ and the one at rest Δt_0 far away (long δ):



By Hypothesis 4.10, the locally quasi-Euclidean space-time permits the Pythagorean theorem:

$l_\rho^2 > l_0^2 + d_i^2$

$(c\Delta\rho)^2 > (c\Delta t_0)^2 + (v\Delta\rho)^2$

$\Delta\rho^2\ (c^2 - v^2) > c^2 \Delta t_0^2$

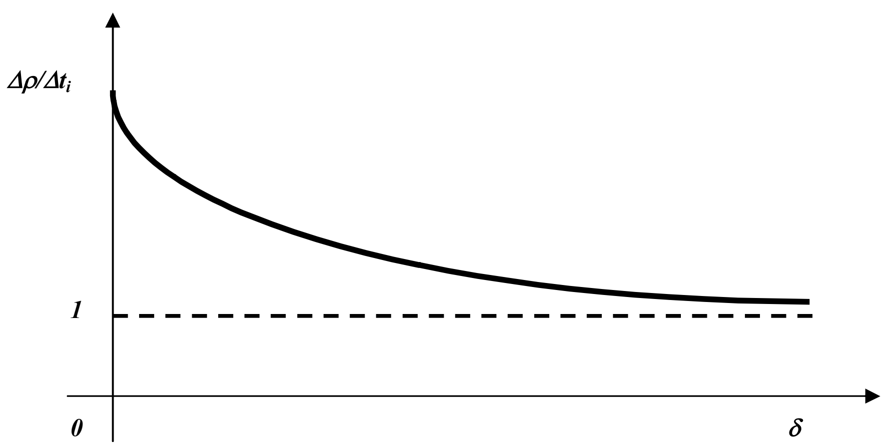
$\Delta\rho^2 (1-\beta^2) > \Delta t_0^2$

$\Delta\rho^2 > \Delta t_0^2/(1-\beta^2)$

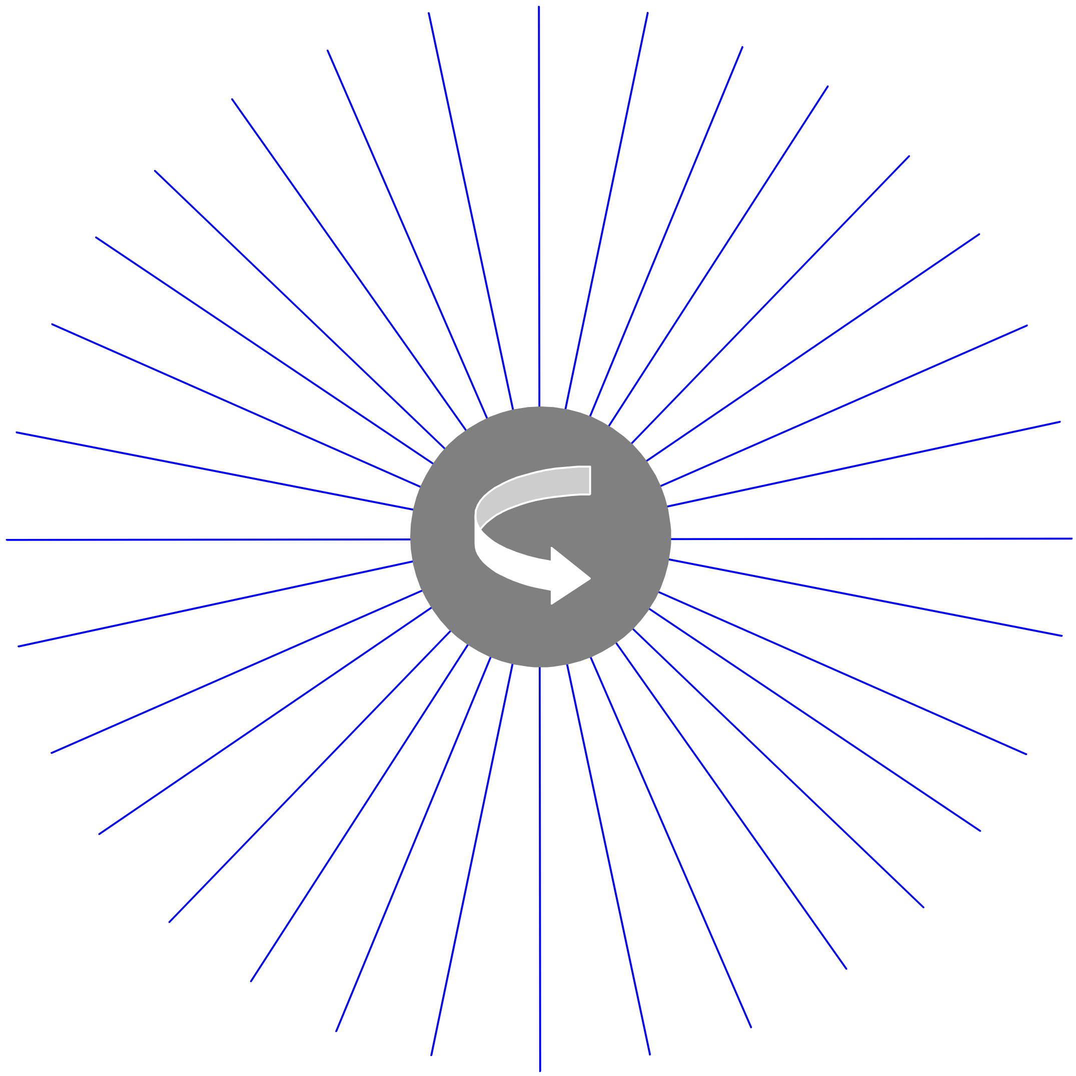
$\Delta\rho > \gamma\Delta t_0$

$\Delta\rho > \Delta t_i$

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:

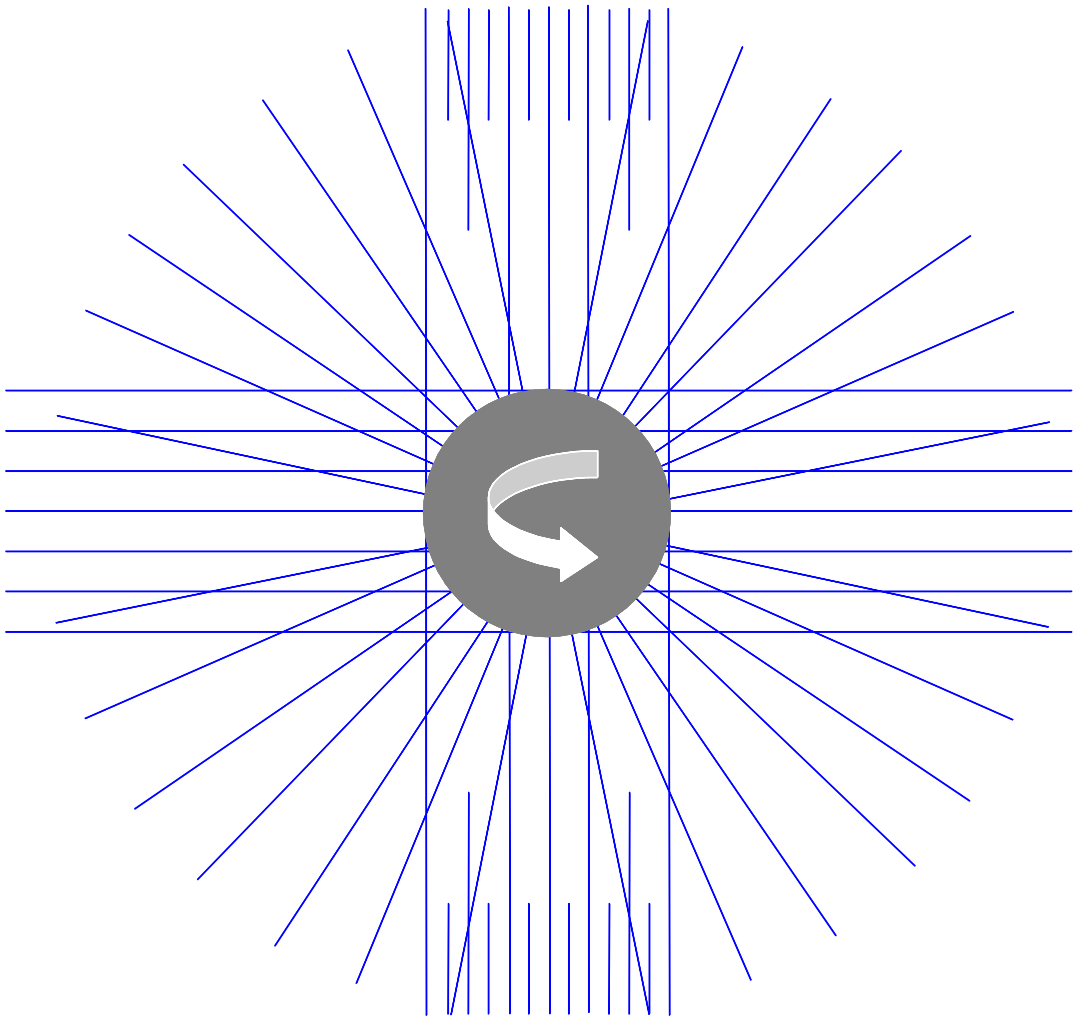


By Hypothesis 4.11, for a structureless sphere in UCM the radial time $\Delta\rho$ flux lines are thick:



5.6 ***In UCM the time measure is different along the three orientations: $\Delta\tau$, $\Delta\rho$, $\Delta\theta$.***
Proof. By Props. 5.3÷5.5 in UCM time assumes three different values by the orientation where it is measured.

5.7 ***Around a structureless sphere in UCM the temporal flux lines are anisotropic.***
Proof. By Props. 5.3÷5.6 we get the following graphical representation of global temporal flux lines:



5.8 ***Time is at least tridimensional.***
Proof. By Prop. 5.6 and according to Hypothesis 4.8 there is a biunivocal correspondence between the measures in an instantaneous Cartesian reference $v\varpi r\tau\theta\rho$ and the same taken in a fixed Cartesian reference $xyzt_xt_yt_z$, so that time's measurement is generally different on three mutually orthogonal orientations: t_x, t_y, t_z.

5.9 ***Space-time is at least esadimensional.***
Proof. By Prop. 5.8 and according to Hypothesis 4.10, each point of a trajectory is individuated by at least six coordinates, three spatial and three temporal, thus the *position* in an esadimensional Cartesian reference is $P(x,y,z,t_x,t_y,t_z)$ while the corresponding *event* in an esadimensional Gaussian reference is $E(X_1,X_2,X_3,X_4,X_5,X_6)$.

6 THESES

6.1 ***The metric tensor $g_{\mu\nu}$ is at least esadimensional: $\mu,\nu=1,2,3,4,5,6$.***
Proof. By Prop. 5.9.

6.2 ***The quadratic form $ds^2=g_{\mu\nu}dx_\mu dx_\nu$ is at least esadimensional: $\mu,\nu=1,2,3,4,5,6$.***
Proof. By Thesis 6.1.

6.3 ***The Ricci curvature tensor $R_{\mu\nu}$ is at least esadimensional: $\mu,\nu=1,2,3,4,5,6$.***
Proof. By Thesis 6.1.

6.4 ***The scalar curvature R, trace of $R_{\mu\nu}$, is at least esadimensional: $R^6=R_a{}^a=R_{11}+R_{22}+R_{33}+R_{44}+R_{55}+R_{66}$.***
Proof. By Thesis 6.3.

6.5 ***The contracted Bianchi identities $\nabla^\mu(R_{\mu\nu}-\frac{1}{2}Rg_{\mu\nu})=0$ are at least esadimensional: $\mu,\nu=1,2,3,4,5,6$.***
Proof. By Theses 6.3 and 6.4.

6.6 ***The Einstein Tensor $G_{\mu\nu}=R_{\mu\nu}-\frac{1}{2}g_{\mu\nu}R$ is at least esadimensional: $\mu,\nu=1,2,3,4,5,6$.***
Proof. By Theses 6.3÷6.5.

6.7 ***The source tensor $T_{\mu\nu}$ is at least esadimensional: $\mu,\nu=1,2,3,4,5,6$.***
Proof. By Theses 6.1÷6.6.

6.8 ***The conservation equations $\nabla^\mu T_{\mu\nu}=0$ are at least esadimensional: $\mu,\nu=1,2,3,4,5,6$.***
Proof. By Theses 6.7.

6.9 ***The Lagrangian of matter is at least esadimensional: L^6.***
Proof. By Theses 6.1÷6.8.

6.10 ***Einstein field equations $G_{\mu\nu}=kT_{\mu\nu}$ must be at least esadimensionally extended: $\mu,\nu=1,2,\dots,6$.***
Proof. By Theses 6.6, 6.7 and 6.7.

6.11 ***Relativistic scalar function $J^4=L^4-R^4/2k$ must be at least esadimensionally extended: $J^6=L^6-R^6/2k$.***
Proof. By Theses 6.4 and 6.9.

6.12 ***Relativistic variation principle $\delta\int J^4\sqrt{g}\,d^4X=0$ must be at least esadimensionally extended: $\delta\int J^6\sqrt{g}\,d^6X=0$.***
Proof. By Theses 6.8 and 6.11.

7 CONJECTURES

7.1 ***Esadimensional equations $G_{\mu\nu}=kT_{\mu\nu}$ are 36, reducible to 21 in case of symmetry.***
Proof. Einstein tetradimensional field equations are 4x4=16, reduced to 10 because $G_{\mu\nu}$ and $T_{\mu\nu}$ are symmetric. The esadimensional field equations are 6x6=36, reducible to 21 if $G_{\mu\nu}$ and $T_{\mu\nu}$ are symmetric.

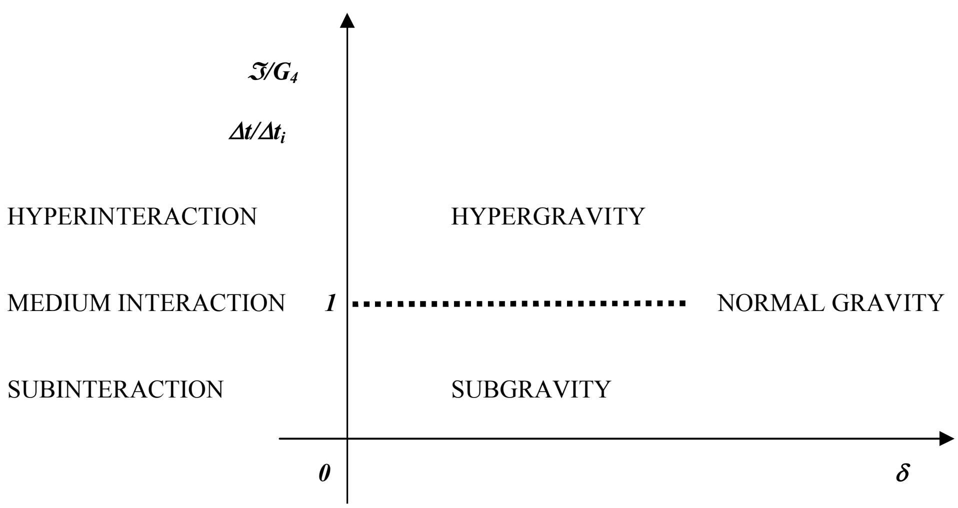
7.2 ***Esadimensional equations $G_{\mu\nu}=kT_{\mu\nu}$ describe all fields of forces.***
Proof. The tetradimensional Einstein field equations describe gravity. Their esadimensional extension can describe all interactions: gravitational, electroweak and strong.

7.3 ***The components of esadimensional tensor $T_{\mu\nu}$ are all the fundamental quantities.***
Proof. The components of the tetradimensional source tensor in GR are stress-energy-momentum. The two further components of the esadimensional source tensor can be both electromagnetic and colour charges.

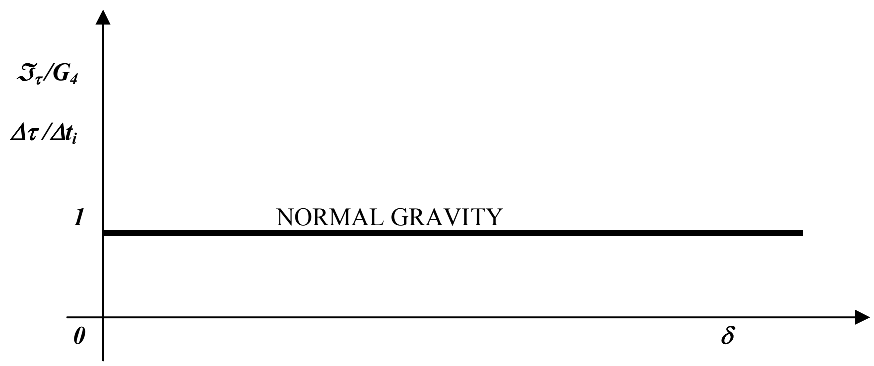
7.4 ***The esadimensional variation principle $\delta\int^6\sqrt{g}d^6X=0$ describes all the conservation laws.***
Proof. The tetradimensional variation principle explains the stress-energy-momentum conservation law. The esadimensional variation principle can also explain the conservation of both electromagnetic and colour charges.

7.5 ***Temporal flux lines are proportional to the interaction intensity:***
A) $\Delta t=\Delta t_i$ is the condition of normal interaction along the direction of Δt measurement;
B) $\Delta t>\Delta t_i$ is the condition of hyperinteraction along the direction of Δt measurement;
C) $\Delta t<\Delta t_i$ is the condition of subinteraction along the direction of Δt measurement.
Proof. In Lorentz transformations there is proportionality between time and mass: $m/m_0=\Delta t/\Delta t_0=\gamma$. Hence, according to Hypothesis 4.11, time's flux lines in quasi-Euclidean conditions provide a qualitative indication of interaction intensity.

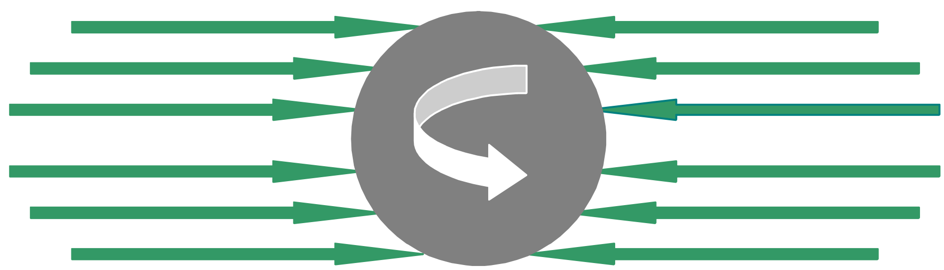
7.6 ***The relativistic tetradimensional gravity G_4 can be the paradigm of all the interactions $\Im$:***
A) $\Delta t=\Delta t_i$ is the condition of normal gravity along the direction of Δt measurement: $\Im/G_4=1$
B) $\Delta t>\Delta t_i$ is the condition of hypergravity along the direction of Δt measurement: $\Im/G_4>1$
C) $\Delta t<\Delta t_i$ is the condition of subgravity along the direction of Δt measurement: $\Im/G_4<1$
Proof. By Conjecture 7.2, since forces are unified it is possible to denominate them collectively *gravity*, so far used to indicate only a subset of the interactive manifestation and whose relativistic value G_4 is assumed as term of comparison for interaction intensity. By Conjectures 7.4 and 7.5 the interaction intensity (normalized regarding tetradimensional gravity) $\Im/G_4$ is proportional to the qualitative course of temporal measure (normalized regarding the inertial one) $\Delta t/\Delta t_i$. The diagram in function of the diode-photodiode distance δ is the following:



7.7 ***In UCM the tangential interaction coincides with normal tetradimensional gravity: $\mathfrak{I}_\tau = G_4$.***
Proof. By Prop. 5.3 and according to Conjecture 7.6 the tangential interaction (normalized regarding tetradimensional gravity) $\mathfrak{I}_\tau / G_4$ is proportional to the qualitative course of tangential temporal measure (normalized regarding the inertial one) $\Delta\tau/\Delta t_i$. The diagram in function of the diode-photodiode distance δ, is the following:

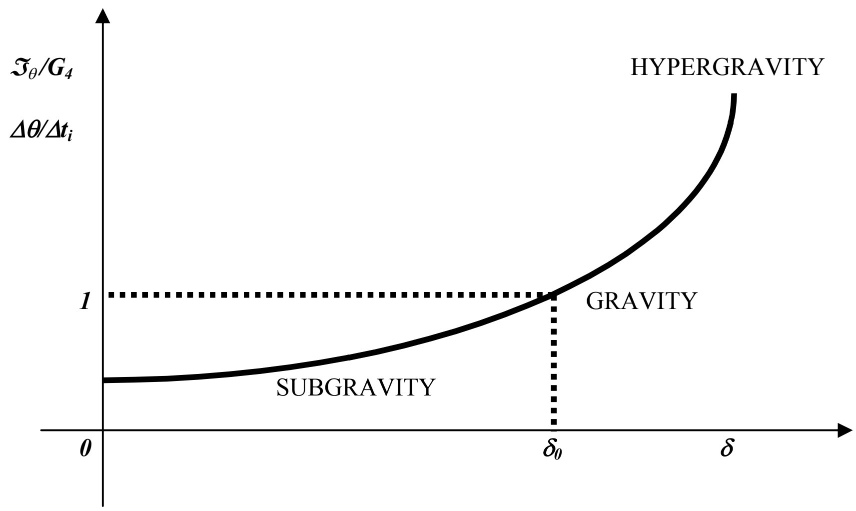


Tangential interaction: normal gravity $\mathfrak{I}_\tau = G_4$, constant with the distance:



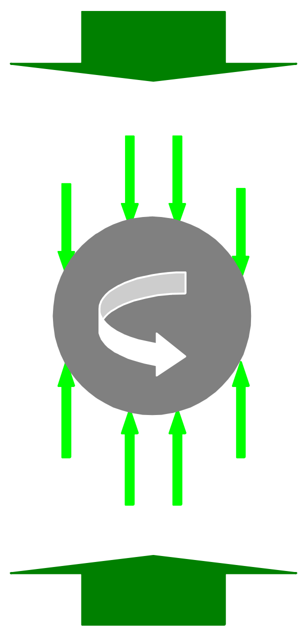
7.8 ***In UCM angular interaction is: $\Im_\theta$<G_4 beside and $\Im_\theta$>G_4 far, increasing with the distance.***

Proof. By Prop. 5.4 and according to Conjecture 7.6 the angular interaction (normalized regarding tetradimensional gravity) $\Im_\theta/G_4$ is proportional to the qualitative course of angular temporal measure (normalized regarding the inertial one) $\Delta\theta/\Delta t_i$. The diagram in function of the diode-photodiode distance δ, is the following:



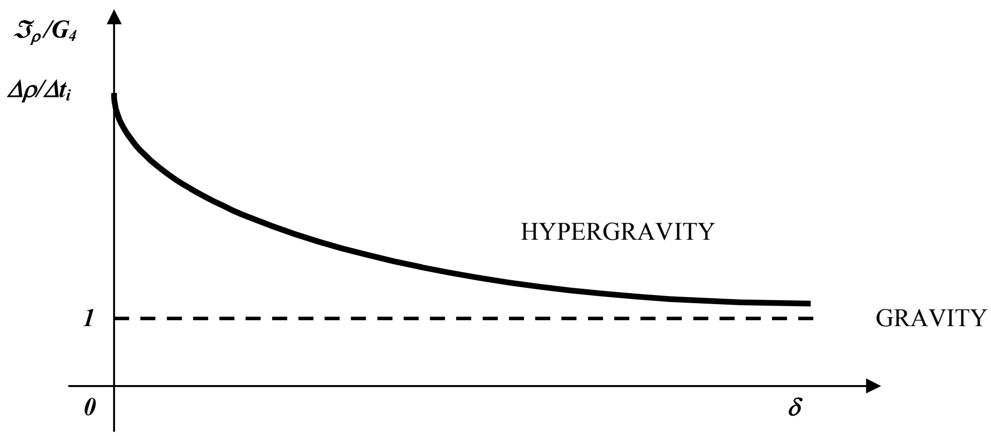
Diode-photodiode distance	*Interaction*	*Temporal flux lines*
Short: $\delta<\delta_0$	Subgravity: $\Im_\theta<G_4$	$0<\Delta t<\Delta t_i$: thin
Medium: $\delta=\delta_0$	Normal gravity: $\Im_\theta=G_4$	$\Delta t=\Delta t_i$: medium
Long: $\delta>\delta_0$	Hypergravity: $\Im_\theta>G_4$	$\Delta t>\Delta t_i$: thick

Angular interaction: subgravity $\Im_\theta<G_4$ beside and hypergravity $\Im_\theta>G_4$ far away, increasing with the distance:



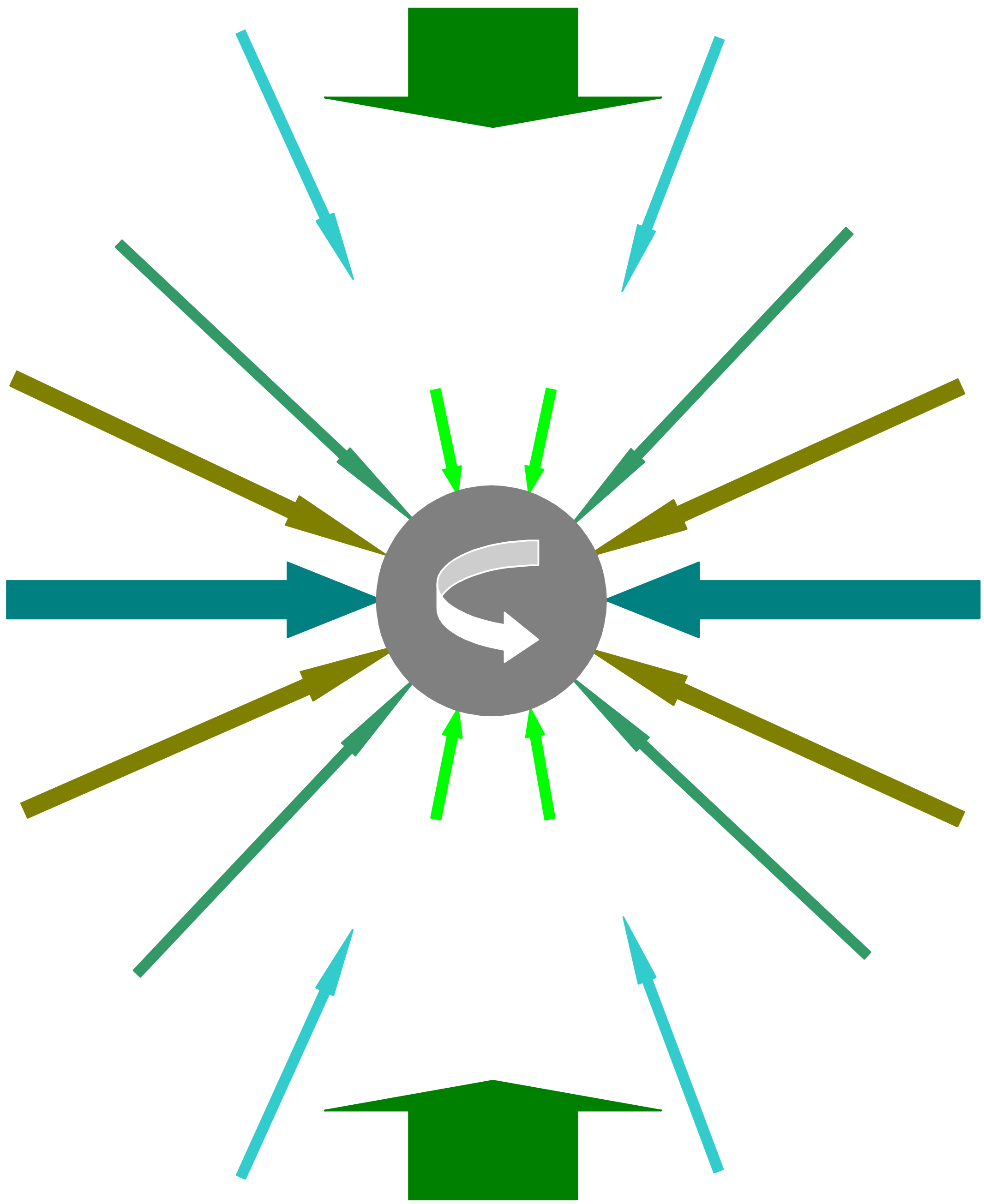
7.9 ***In UCM the radial interaction is: $\Im_\rho > G_4$, asymptotically decreasing to G_4 with the distance.***

Proof. By Prop. 5.5 and according to Conjecture 7.6 the radial interaction (normalized regarding tetradimensional gravity) $\Im_\rho/G_4$ is proportional to the qualitative course of radial temporal measure (normalized regarding the inertial one) $\Delta\rho/\Delta t_i$. The diagram in function of the diode-photodiode distance δ, is the following:

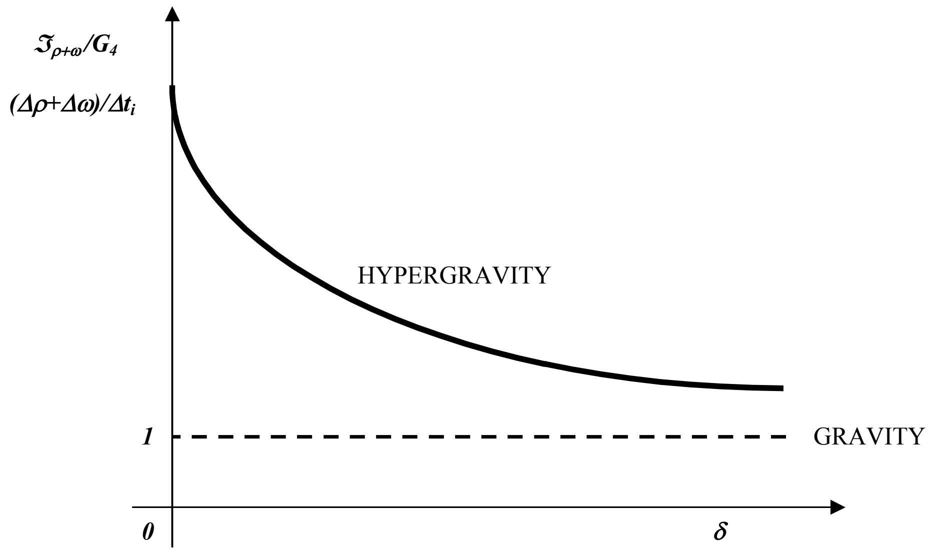


Radial interaction: hypergravity $\Im_\rho > G_4$ decreasing with the distance:

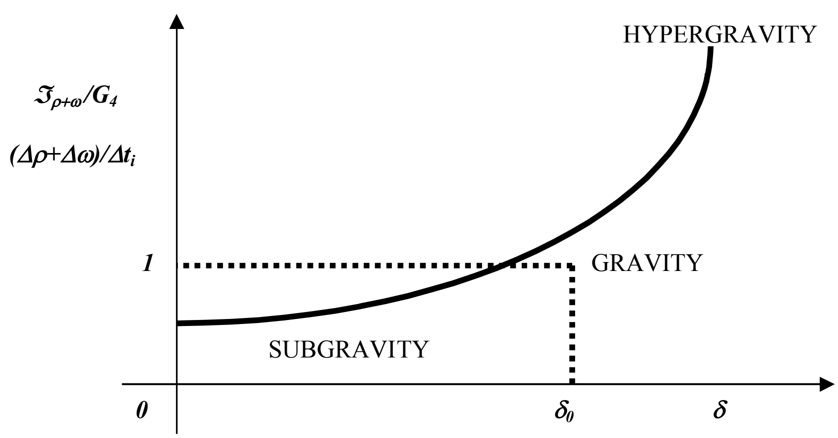
7.10 ***Around a structureless sphere in UCM the interactions are anisotropic.***
Proof. By Prop. 5.7 and by Conjecture 7.6, we get the following global interactive frame:



7.11 ***Around a rotating body the equatorial hyperattractive interaction explains the following phenomena:***
A) the condensed Cooper pairs in superconductors due to alignment of electron spins;
B) the black hole accretion disk along its own equatorial plane;
C) the quasi-coplanar distribution of stars in galaxies and of planets in the solar system;
Proof. By Conjectures 7.7 and 7.9 the qualitative course of the summation between radial and tangential interactions (normalized regarding tetradimensional gravity) $\Im_{\rho+\tau}/G_4$, proportional to the corresponding temporal measurement (normalized regarding the inertial one) $(\Delta\rho+\Delta\tau)/\Delta t_i$, in function of the distance diode-photodiode δ, is the following:



7.12 ***Along a rotating body's axis the interaction, subattractive beside and hyperattractive far away, explains:***
A) the weight reduction along the rotation axis of a superconductor disk in Podkletnov effect;
B) the weight reduction along the rotation axis of magnetic roller rings in Searl effect;
C) the black hole jet along its own rotation axis;
D) the hadronic confinement and the asymptotic freedom of quarks.
Proof. By Conjectures 7.8 and 7.9 the qualitative course of the summation between radial and tangential interactions (normalized regarding tetradimensional gravity) $\Im_{\rho+\omega}/G_4$ is proportional to the corresponding temporal measurement (normalized regarding the inertial one) $(\Delta\rho+\Delta\omega)/\Delta t_i$. The diagram in function of the distance diode-photodiode δ, is the following:



8 APPLICATIONS

There are some practical applications deriving directly from the esadimensional theory, in particular from the model of structureless body in UCM:

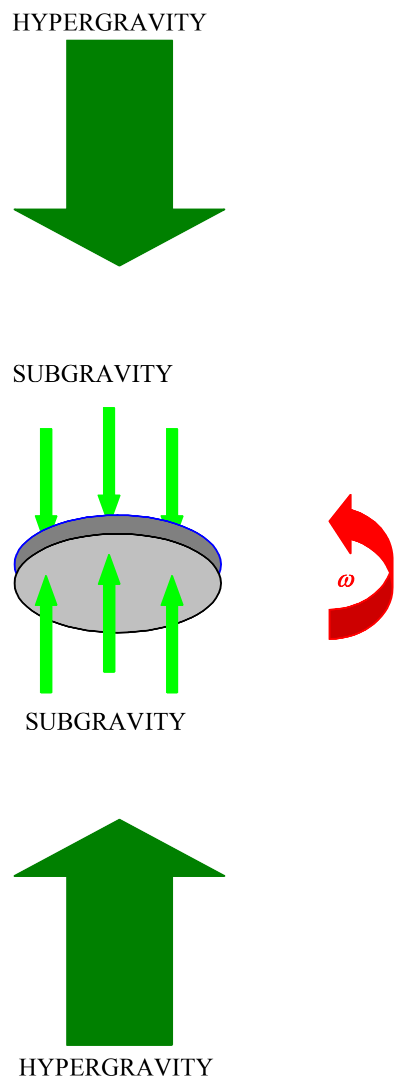
A) rotating disks assimilable to structureless flat bodies generating *hypergravity* or *subgravity*;

B) rotating cylinders assimilable to structureless filiform bodies generating *hypergravity*.

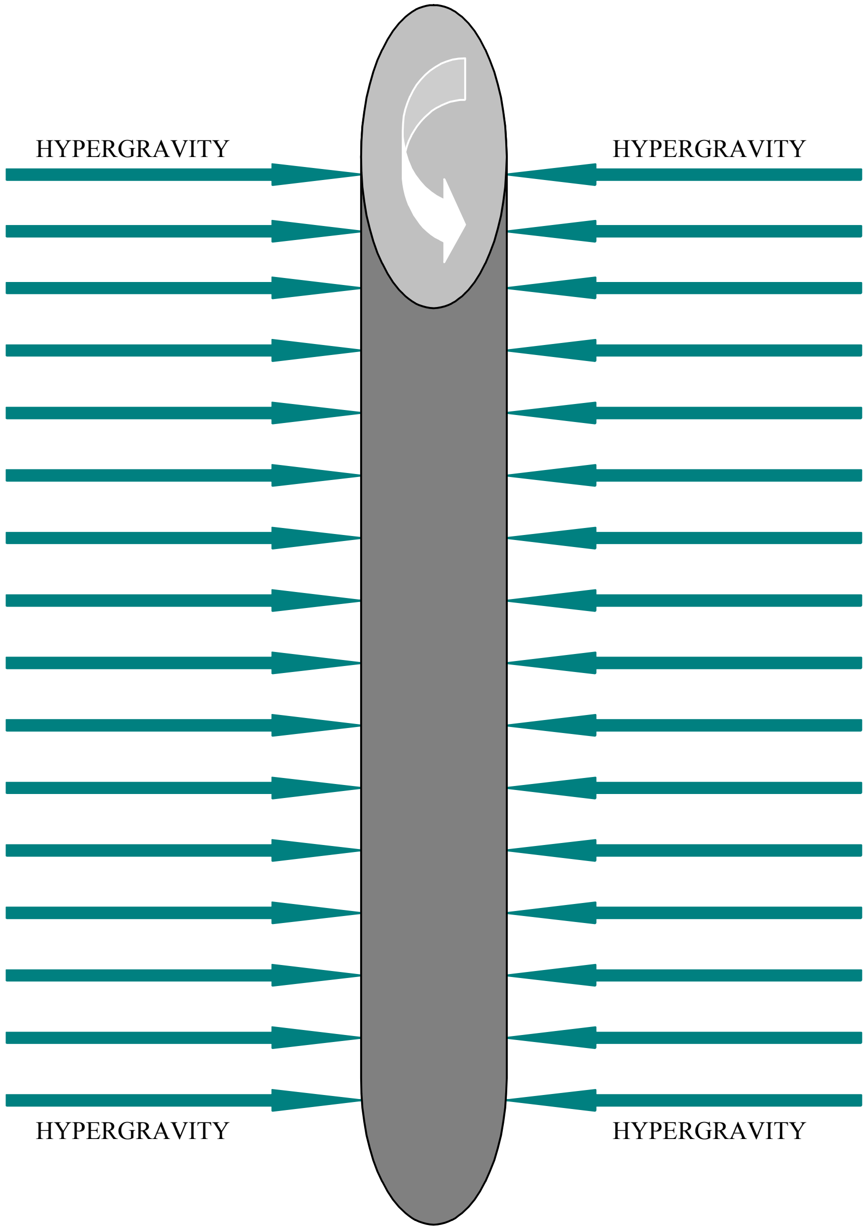
Therefore *subgravity* and *hypergravity* are possible alternative energy sources whose efficiency is however limited by building problems, because only few materials have a partial microscopic order sufficient to be assimilable to a structureless body, *e.g.*, the rare earth magnets used in the *Searl effect* or the superconductors used in the *Podkletnov shield*.

8.1 *Production of subgravity and hypergravity by rotating structureless disks.*

The flat shape privileges the subattraction until a certain distance and the hyperattraction after it, increasing with the distance, along the rotation axis.



8.2 *Production of hypergravity by rotating structureless filiform cylinders.*
The filiform shape privileges the hyperattractive equatorial effect.



9 CONCLUSIONS

In the following table there is the General Relativity compared with its esadimensional extension:

Characteristics of the theory	**GR by A. Einstein**	**GR Extension by E. Bonacci**
Trajectory of a material point	Continuous	Continuous
Space-time continuum	Tetradimensional	Esadimensional
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: $g_{\mu\nu}$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
Invariant quadratic form: $ds^2=g_{\mu\nu}dx_\mu dx_\nu$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
Ricci curvature tensor: $R_{\mu\nu}$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
Scalar curvature, trace of tensor $R_{\mu\nu}$: $R_a^{\ a}$	Tetradimensional: R^4	Esadimensional: R^6
Source tensor $T_{\mu\nu}$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
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: $\nabla^\mu T_{\mu\nu}=0$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
Contracted Bianchi identities: $\nabla^\mu(R_{\mu\nu}-½Rg_{\mu\nu})=0$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
Einstein tensor: $G_{\mu\nu}=R_{\mu\nu}-½Rg_{\mu\nu}$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
Field equations: $G_{\mu\nu}=kT_{\mu\nu}$	Tetradimensional: $\mu,\nu=1,2,3,4$	Esadimensional: $\mu,\nu=1,2,3,4,5,6$
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	Tetradimensional: L^4	Esadimensional: L^6
Scalar function: J=L–R/2k	Tetradimensional: $J^4=L^4-R^4/2k$	Esadimensional: $J^6=L^6-R^6/2k$
Variation principle: $\delta\int J^n \sqrt{g}\, d^nX=0$	Tetradimensional: $\delta\int J^4 \sqrt{g}\, d^4X=0$	Esadimensional: $\delta\int J^6 \sqrt{g}\, d^6X=0$
Conservation laws	Stress-energy-momentum	Stress-energy-momentum-charges
Described interactions	Gravitational	Gravitational-electroweak-strong

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