Generalization of the Haag-Łopuszański-Sohnius theorem and the ring paradigm

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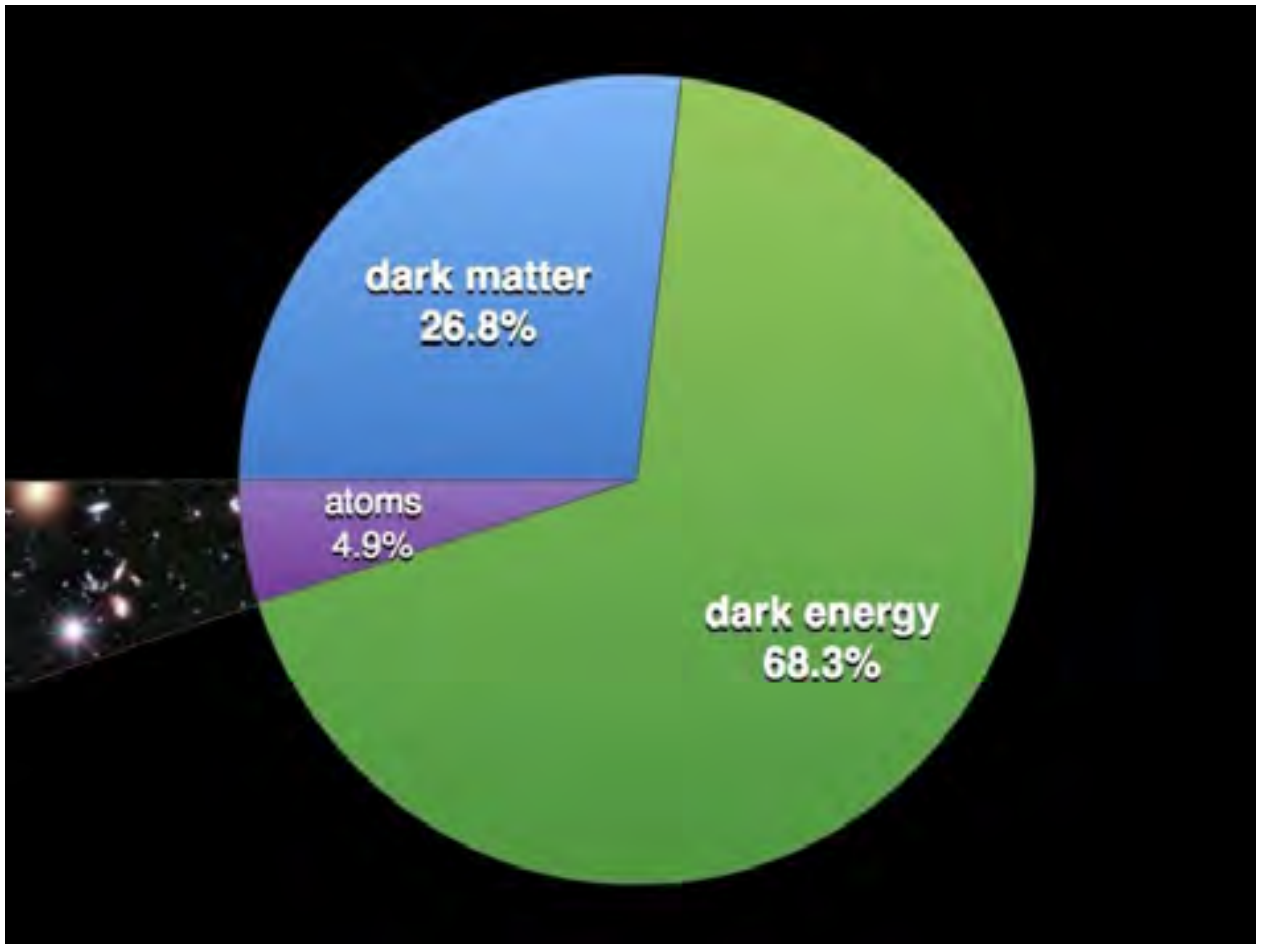
Articles

Presentation is based on the serie of 4 articles:

1. Essay "The old problem of the cosmological constant solved? "[JN, Oem Trivedi] (arXiv: 2505.22553, sent for publication)
2. Article "Graviton as a phonon and dark energy problem"[JN] (sent for publication)
3. Article "Accelerated expansion of the Universe as a quantum gravity phenomenon" [JN, Oem Trivedi] (in preparation)
4. Article "Ring paradigm and the old problem of the cosmological constant" [JN, Oem Trivedi] (in preparation)

Martial artist Bruce Lee (1940-1972): "Adapt what is useful, reject what is useless, and add what is specifically your own."

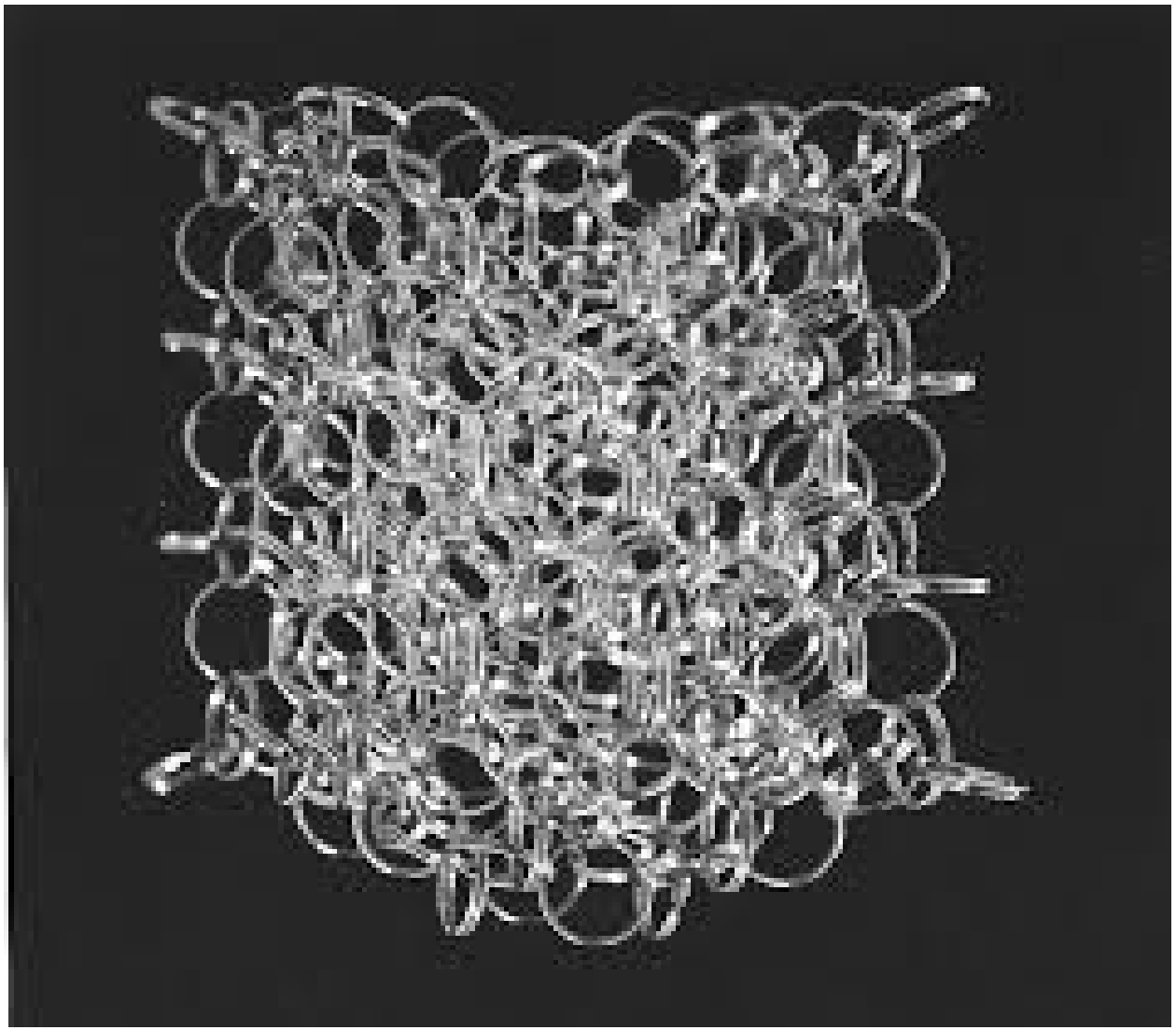
Big issues in cosmology



Approaches to quantum gravity

1. string theory
2. loop quantum gravity
3. causal set approach
4. causal dynamical triangulation
5. asymptotic safety
6. non-commutative geometry
7. ...

Ring paradigm

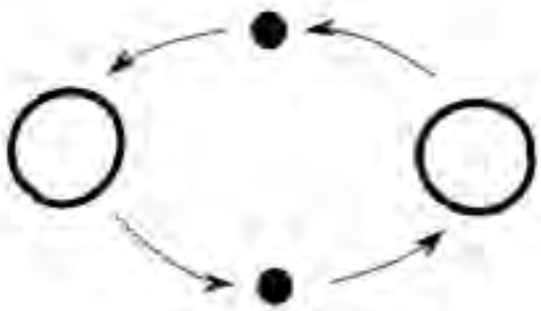


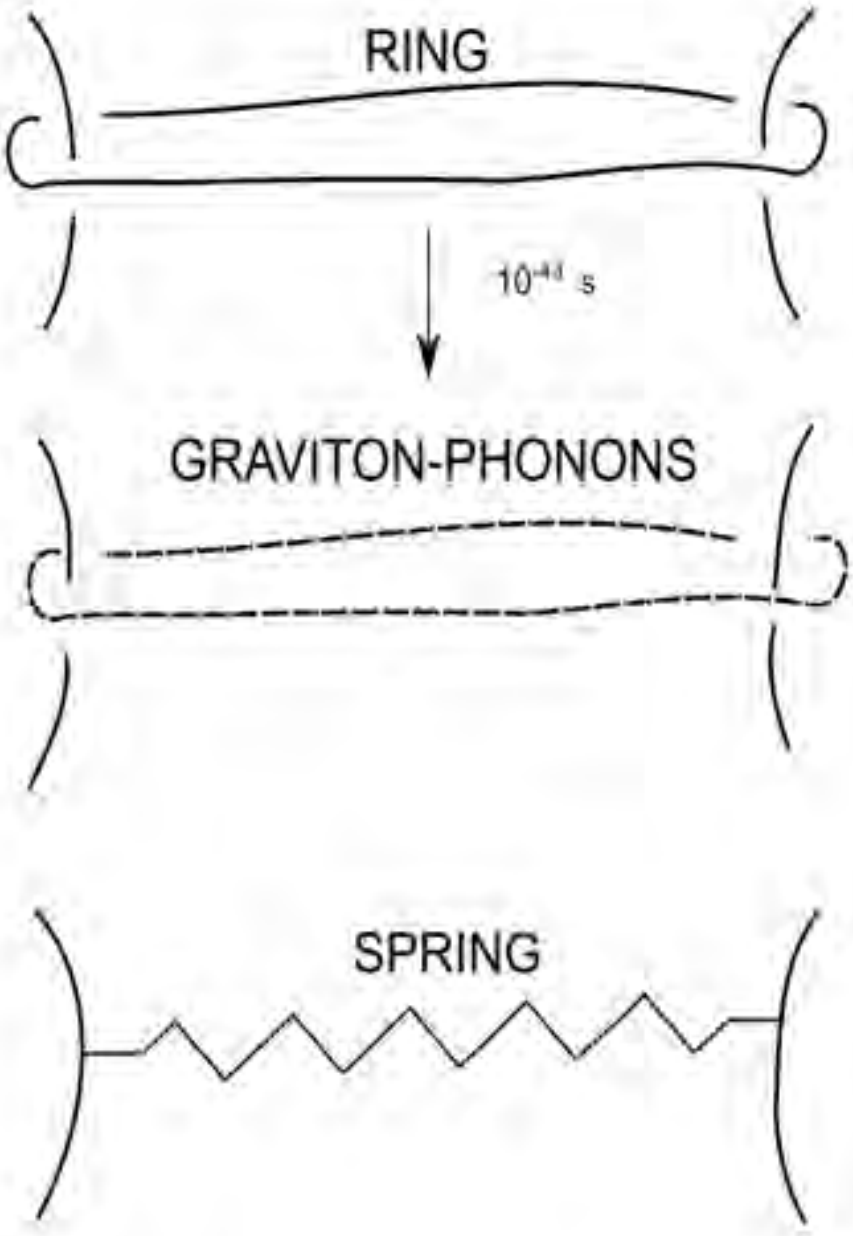
Basic concept

We will do two tricks simultaneously:

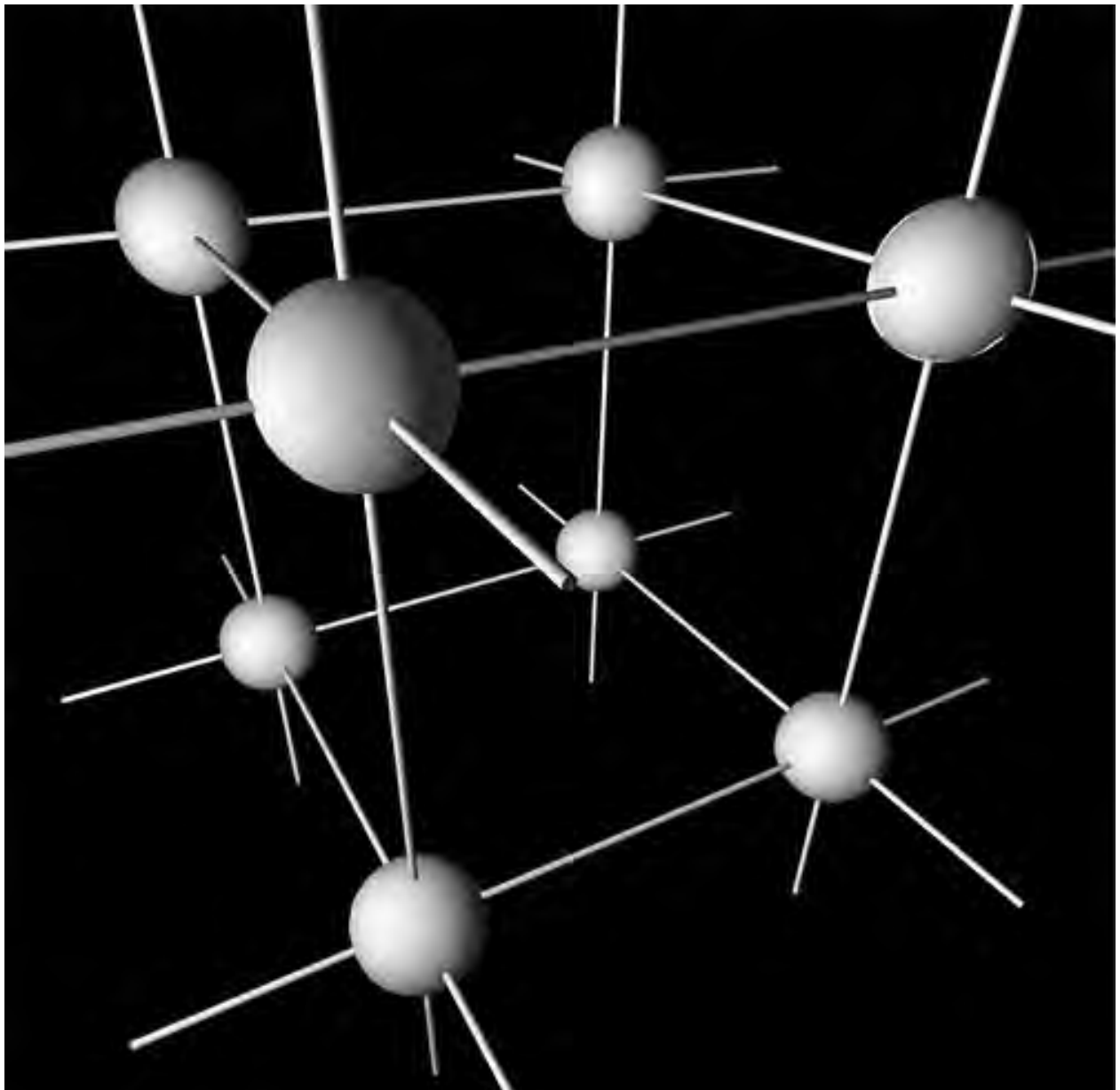
1. New phenomenological object (which is not a particle or field)
2. Breaking the assumption that the velocity of light is the highest velocity, how the information is transmitted in the universe

We substitute the picture of the gravitons carrying the initial impulse by the creation of a gravitational ring, which tightens the objects in Planck time.

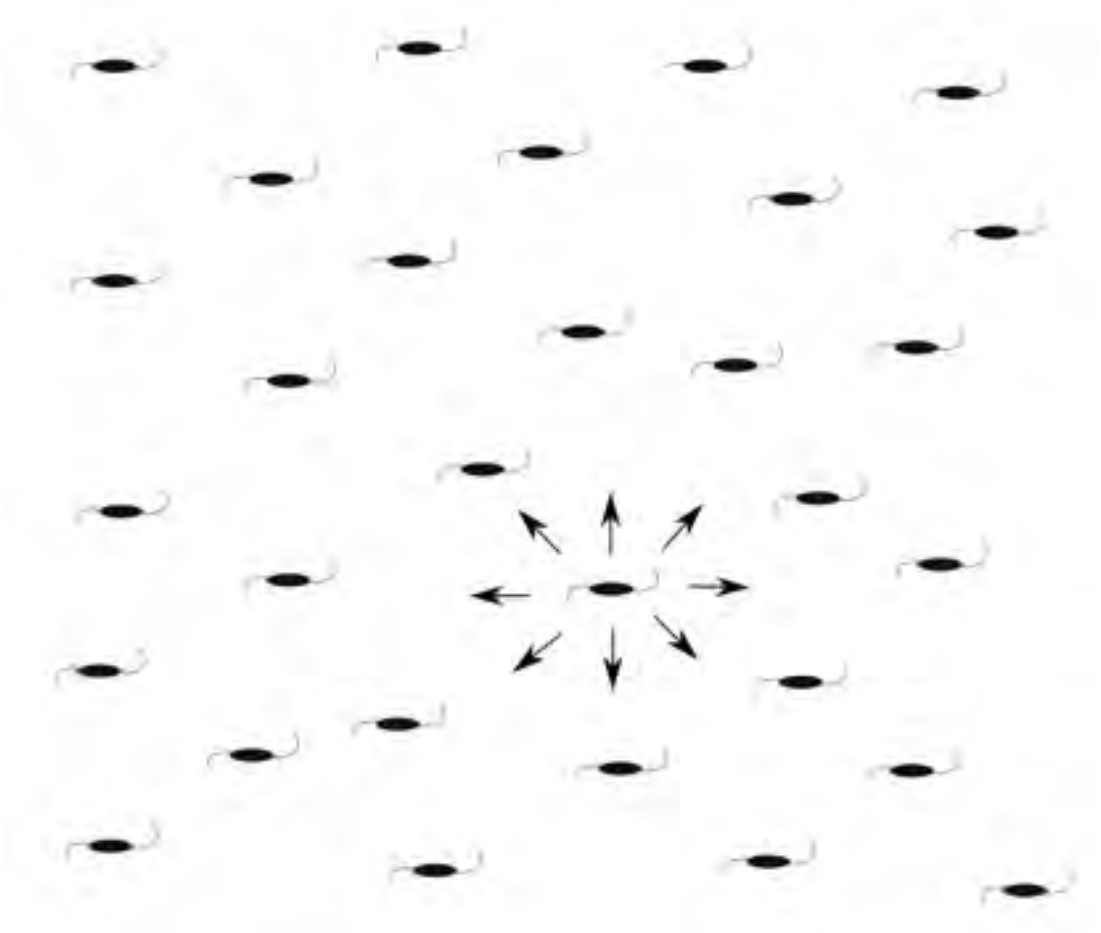



RING
10^{-44} s
GRAVITON-PHONONS
SPRING

The Universe is homogeneous and isotropic

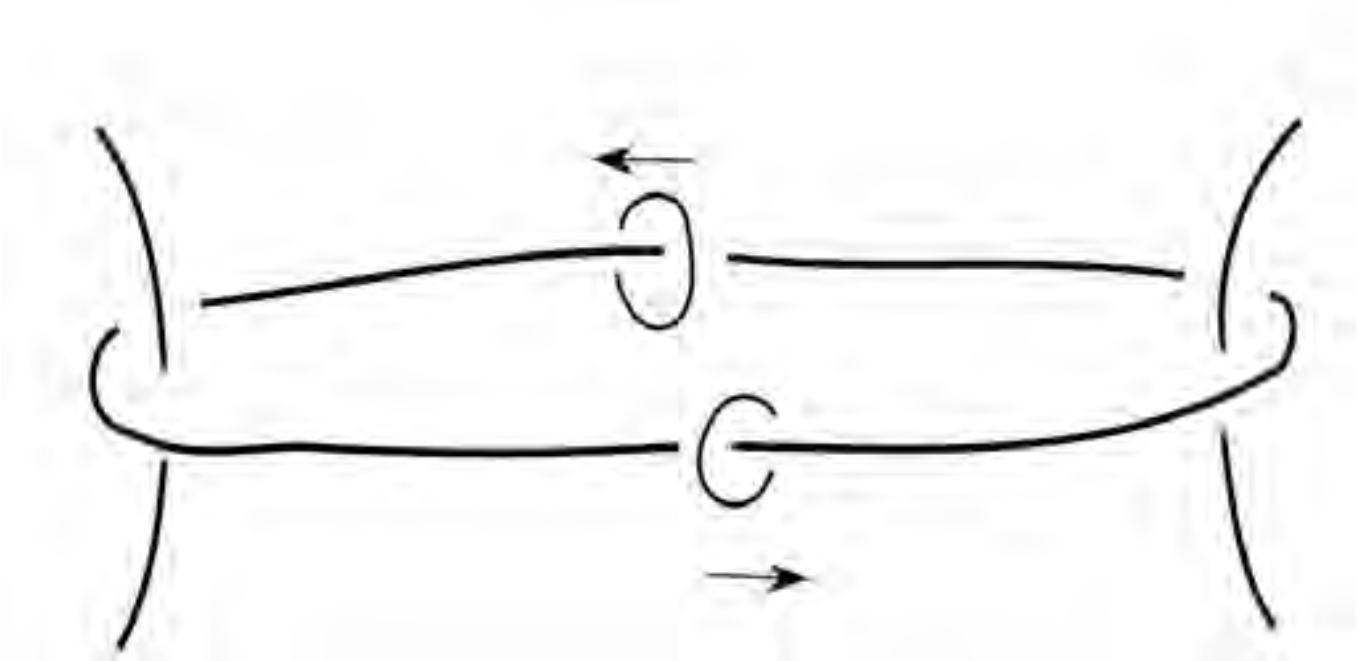


Symmetries



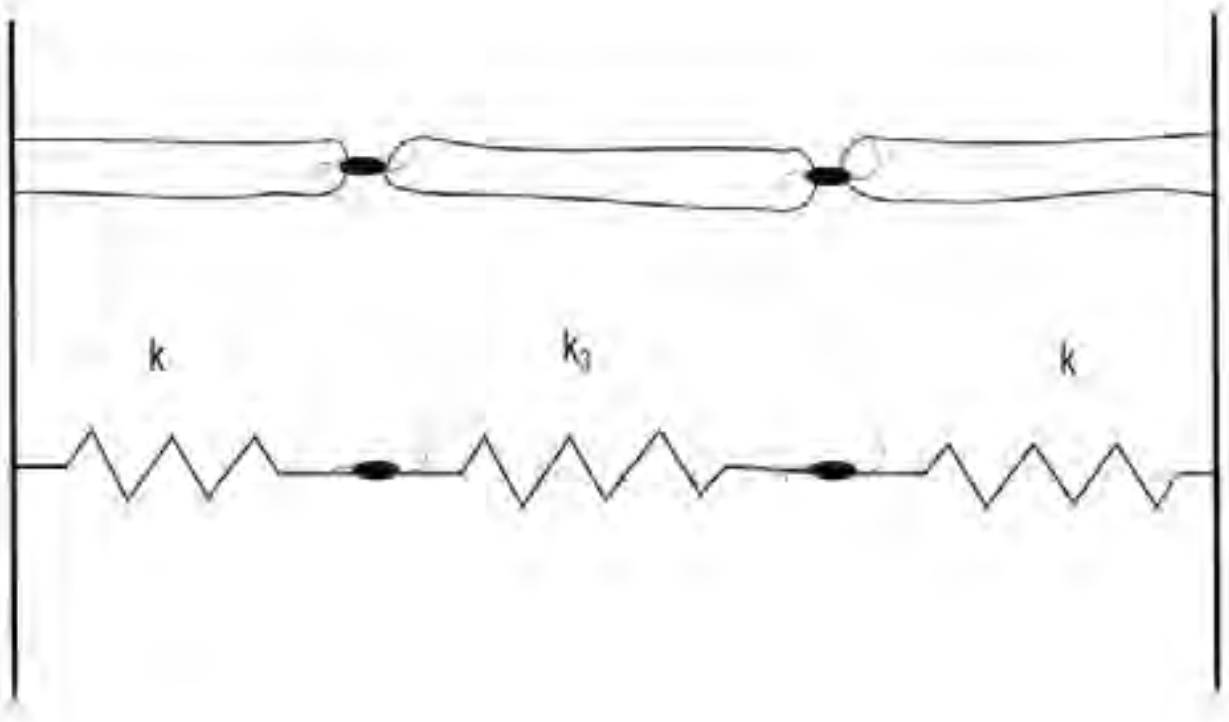
Unchanged particle sector

The elementary particles of the standard model could move only around gravitational rings.



Graviton as a phonon

The creation of rings in Planck time effectively gives rise to springs between the galaxies. We quantize their longitudinal vibrations and obtain the graviton-phonons, which mediate the Newtonian force.



Graviton-phonon

$$graviton \leftrightarrow phonon \leftrightarrow photon$$

$$\vec{F}_{Q_1 Q_2} = \frac{1}{4\pi\epsilon_0}\frac{Q_1 Q_2}{R^2}, \qquad F_{m_1 m_2} = G\frac{m_1 m_2}{R^2}$$

Graviton-phonons are the correct "mediators" of the **Newtonian force**!

Two immediate outcomes

1. Gravitational waves are traveling by velocity c_{gw}, which is very close to the velocity of light c with an amazing precision, $|c - c_{gw}| < 10^{-15}$. But c_{gw} should be exactly c according to ring paradigm (it was supposed in general relativity that $c_{gw} = c$, but there had been no reason for that!).
2. The similarity of the formulas for the Coulomb and Newton laws is not accidental, but it is necessary for building **the parallelism between photons and graviton-phonons**.

Modification of gravity

$$\mathscr{R}_{\mu\nu} - \frac{1}{2}\mathscr{R}\mathscr{G}_{\mu\nu} + \Lambda_r \mathscr{G}_{\mu\nu} = \frac{8\pi G \mathscr{T}_{\mu\nu}}{c_g^4} = \frac{8\pi G}{c_g^4}(T^m_{\mu\nu} + \mathscr{T}^r_{\mu\nu}),$$

where $\mathscr{G}_{\mu\nu}$ is the metric and also all the other quantities have an analogous meaning as in general theory of relativity. There are included both the energy-momentum tensor for the ordinary matter $T^m_{\mu\nu}$, as well as the energy-momentum tensor for the gravitational ring, $\mathscr{T}^r_{\mu\nu}$. The cosmological constant Λ_r could be computed from quantum field theory.

Beginning of the cosmological inflation

We neglect the term corresponding for $T_{\mu\nu}$ with respect to the second term on the RHS, so

$$\mathscr{R}_{\mu\nu} - \frac{1}{2}\mathscr{R}\mathscr{G}_{\mu\nu} + \Lambda_r \mathscr{G}_{\mu\nu} \approx \frac{8\pi G}{c_g^4}\mathscr{T}^r_{\mu\nu}.$$

The picture seems to be correct because there were only gravitational rings at the beginning of the cosmological inflation.

Two cosmological constants in the theory

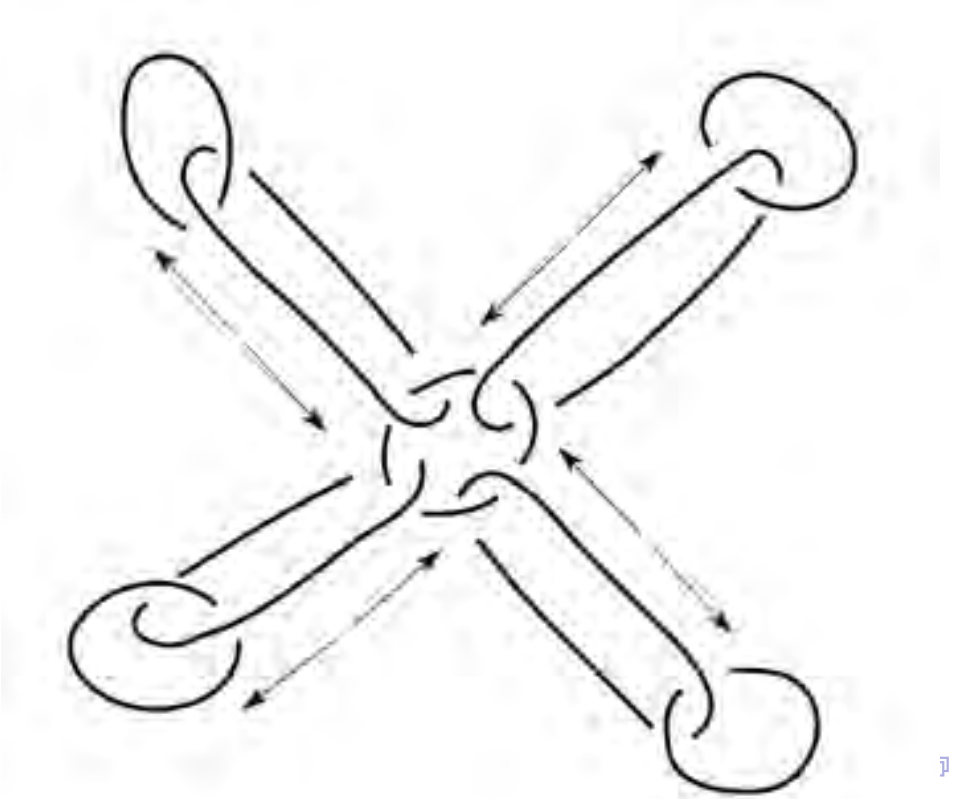
$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

A new cosmological constant term Λ appeared approximately 8 billion years after Big Bang due to the quantum gravity phenomenon:

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

Accelerated expansion of the Universe

The classical description is that the gravitational rings are effectively made from some material, which has an inner dependence on the deformation due to the stress. The "gravitational" material breaks at *Mpc* distances, which causes accelerated expansion in the Universe.



Application of the paradigm

1. singularity theorems
2. cyclic universes
3. black hole information paradox
4. dimensional reduction
5. curvature of the universe
6. determinism of physical theories

The breaking of Lorentz invariance

The violation of the Lorentz symmetry meant having difficulties for two fundamental reasons:

1. Breaking the Lorentz-invariance in the high energy sector necessary leads to the violation of the Lorentz symmetry in the low-energy sector [theory]
2. We had very good experimental bounds on the Lorentz-symmetry violation [experiment]

But both objections are answered in the ring paradigm (two velocities $c_g >> c$)!

Group of symmetries

The group of symmetries of the ring paradigm is

$$\mathbb{R}^{1,3} \ltimes O(1,3)^+_c \cup O(1,3)^+_{c_g}.$$

$$t' = \frac{t - \frac{x}{v}\frac{v^2}{c^2}\epsilon - \frac{x}{v}\frac{v^2}{c_g^2}}{\sqrt{1 - \frac{v^2}{c^2}\epsilon - \frac{v^2}{c_g^2}}},$$

$$x' = \frac{x - tv}{\sqrt{1 - \frac{v^2}{c^2}\epsilon - \frac{v^2}{c_g^2}}}, \tag{1}$$

where $\epsilon = \epsilon(v)$ denotes some step function defined by the prescription

$$\epsilon(v) = \begin{cases} 1 & \text{for } v \leq c, \\ 3(v/\delta)^3 - 2(v/\delta)^2 & \text{for } c < v \leq c + \delta, \\ 0 & \text{for } v > c + \delta. \end{cases}$$

"No-go" and "let's go" theorems

The main tasks will be now on mathematicians:

1. Coleman-Mandula theorem
2. Haag-Łopuszański-Sohnius theorem

Generalization of the Haag-Łopuszański-Sohnius theorem

One possibility, how to generalize the "let's go" theorem is to consider more general algebras: generalization of graded Lie superalgebras are **color Lie algebras** or **Lie algebras of the order** F

R. Campoamor-Stursberg, M. Rausch de Traubenberg, Color Lie algebras and Lie algebras of the order F, arXiv:0811.3076

Color Lie superalgebras

Definition

Let Γ be an Abelian group and N be a commutation factor. The (complex) graded vector space $g = \oplus_{a\in\Gamma} g_a$ is called a color Lie superalgebra if

1. g_0 is a complex Lie algebra.
2. For all $a \in \Gamma \setminus \{0\}$, g_a is a representation of g_0. If $X \in g_0$, $Y \in g_1$, then $[|X, Y|]_N = [X, Y]$ denotes the action of X on Y.
3. For all $a, b \in \Gamma$ there exists a g_0 equivariant map $[|\ ,\ |]_N : g_a \times g_b \to g_{a+b}$ such that for all $X \in g_a$ and $Y \in g_b$ the constraint $[|X, Y|]_N = -N(a, b)[|Y, X|]_N$ is satisfied.
4. For all $X \in g_a$, $Y \in g_b$ and $Z \in g_c$ we have the following Jacobi identitites:

$$[|X, [|Y, Z|]_N]_N = [|[|X, Y|]_N, Z|]_N + N(a, b)[|Y, [|X, Z|]_N|]_N$$

Lemma

There is an isomorphism between color Lie (super)algebras and graded Lie (super)algebras.

Lie superalgebras of order F

Definition

Let $F \in \mathbb{N}^*$. A $\mathbb{Z}_F$ graded $\mathbb{C}$ vector space $g = g_0 \oplus g_1 \oplus g_2 \oplus g_3 \oplus ... \oplus g_{F-1}$ is called a complex Lie algebra of order F, if

1. g_0 is a complex Lie algebra.
2. For all $i = 1, ..., F-1$, g_i is a representation of g_0. If $X \in g_0$ and $Y \in g_i$, then $[X, Y]$ denotes the action of X on Y for any $i = 1, ..., F-1$.
3. For all $i = 1, ..., F-1$ there exists an F-linear, g_0-equivariant map $\{\cdots\} : \mathcal{S}^F(g_i) \to g_0$, where $\mathcal{S}^F(g_i)$ denotes the F-fold symmetric product of g_i.
4. For all X_i in g_0 and Y_j in g_k the following "Jacobi identities" hold:

Definition

$$[X_1, [X_2, X_3]] + [X_2, [X_3, X_1]] + [X_3, [X_1, X_2]] = 0$$

$$[X_1, [X_2, Y_3]] + [X_2, [Y_3, X_1]] + [Y_3, [X_1, X_2]] = 0$$

$$[X, \{Y_1, ..., Y_F\}] = \{[X, Y_1], ..., Y_F\} + ... + \{Y_1, ..., [X, Y_F]\}$$

$$\sum_{i=1}^{F+1} [Y_i, \{Y_1, Y_2, ..., Y_{i-1}, Y_{i+1}, ..., Y_F, Y_{F+1}\}] = 0$$

Interstellar travel

Ring paradigm would have one day big technical applications to interstellar travel, because we could possibly send signals by superluminal velocity!!

3 big impulses to modern theoretial physics:

1. Phantom fields (cyclic model of the Universe)
2. No-go theorems
3. Kerr-Schild or Weyl double copy research

Quote from our article arXiv: 2505.22553:

'And we will certainly remember the words of one of the most prominent mathematicians of 20th century, Alexander Grothendieck, that the speed of light had been corrupted by the devil. Therefore, we need more angels, who will free us from this curse.'

Thank You for paying attention!
Vielen Dank für Ihre Aufmerksamkeit!
Merci de Votre attention!
¡Gracias por prestar atención!
Grazie per aver prestato attenzione!

(Some pictures were taken from the web and some were created by myself...)

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