Topological Web of the Universe: Hypothesis on the External Feeding of Galaxies through Gravitational Gates via Fractal Quantum Threads

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Scientific Essay

INTRODUCTION

The modern cosmological model of the Universe (ΛCDM[1]) asserts that about 95% of its mass-energy consists of hidden substances — dark energy and dark matter. For decades, science has been searching for dark matter in the form of unknown elementary particles (WIMPs, axions), which were expected to envelop galaxies like a uniform fog.

However, the absence of any results from laboratory detections forces a reconsideration of the rules of the game. This abstract proposes an alternative, logically closed model, which transfers dark matter from the category of "chemistry of unknown particles" into the category of "geometry and balance of forces in multidimensional space."

1. TESTING THE HYPOTHESIS OF MASS DISTRIBUTION AND REFUTATION OF "OUR" SIDE

The principal factor for the existence of dark matter is the ultra-high rotational velocity of stars on the periphery of galaxies — the classical baryonic matter[2] (stars and gas, which make up only 5%) is simply insufficient to hold them. If one calculates the parameters of our galaxy, the Milky Way, it turns out that the hidden mass creating the centripetal attraction exceeds the mass of the central core (the supermassive black hole Sagittarius A*) by 230,000 times.

If we assume the sub-theory that all this mass is materially present on "our" side of space and densely compressed around the center, we encounter a geometric collapse. According to the laws of general relativity, such a density of matter would form a black hole with a radius of 3 trillion kilometers (250 times larger than the Solar System). Since the actual radius of Sagittarius A* is only 12 million kilometers, the sub-theory of the physical presence of dark matter on our side of the black hole is *completely refuted.* The mass cannot be located here.

2. MEMBRANE NATURE OF THE THROAT AND BALANCE AT THE "GRAVITATIONAL GATES"

Since there is no mass on our side, the only logical source of force remains the central puncture of space. We define the supermassive black hole not as a collector of matter, but as Gravitational Gates. The use of the term *"Gravitational Gates"* is stricter and more precise, since the classical notion of a "wormhole" implies a passive through-tunnel, whereas our object functions as an active interface for the distribution of forces.

At these Gravitational Gates a strict membrane balance of forces operates:

1. Force of suction: On the opposite (outer) side of the Gates, ordinary yet colossal in volume matter of another space/dimension acts as a gigantic gravitational "vacuum cleaner," creating a constant stream of attraction.

2. Counter-Force of Retention (Membrane): In order that this vacuum cleaner should not instantly "suck out" the entire content of our galaxy outward, the Gravitational Gates generate opposition. This protective balance is formed by *the extreme magnetic fields of the hole* (10^4 Tesla, T) and *the centrifugal force of its rotation.* Since black holes have no solid surface, physicists measure not abstract Newtons of centrifugal force, but the angular momentum of the rotation of space-time around them — the so-called *"dimensionless spin parameter (a_*)."* The latest fundamental studies of our central black hole, Sagittarius A*, conducted with the *Chandra X-ray space telescope*[3] and the artificial-intelligence-driven radio network *EHT*[4], have yielded precise figures: *the rotational velocity of space (a_*)* is (0.90 ± 0.06). This is a dimensionless number whose value ranges from 0 to 1, where 0 denotes a hole at rest (the Schwarzschild metric, in which the event horizon sphere is perfectly round), and 1 denotes the absolutely maximal rotational velocity permitted by the laws of the Universe (the Kerr metric[5]). If a black hole were spun even to a velocity of 1.01, the event horizon would rupture, exposing the so-called "naked singularity," which is forbidden by the laws of modern physics.

Thus, our black hole rotates with an angular velocity amounting to *between 84% and 96% of the theoretical maximum* (that is, almost at the threshold of tearing apart space-time itself). Recalculated into the familiar linear velocity of the motion of space at the equator of the black hole's event horizon, it proves to be much closer to the limit: at a spin parameter ***$a_* = 0.9$*** it equals approximately **84% of the speed of light** (0.84c), or 252,000 km/s. For comparison: our Earth completes one rotation around its axis in 24 hours, while the gigantic throat of Sagittarius A* (24 million kilometers in diameter), at such a rotational velocity, completes a full rotation in only a few minutes. This rotation is so powerful that it literally flattens space-time around the Gates into the shape of a rugby ball. The black hole does not merely spin in emptiness — it drags along with it the very fabric of space-time. It is akin to a spoon rapidly stirred in a glass, which whirls the thick milk around itself. According to Kerr, this zone of furious rotation of space is called the *ergosphere.* Any substance, photons, or capillaries of our fractal threads, approaching the Gravitational Gates, physically cannot remain at rest. Space compels them to rotate along a relativistic trajectory.

These actually measured percentages of the maximum spin are the principal proof of the stability of our model of the Gravitational Gates, where:

- **A gravitational tornado** is observed — when space rotates around the throat with such relativistic velocity, the so-called *effect of frame-dragging of inertial reference systems arises (the Lense–Thirring effect*[6]*);*

- **A membrane** is formed — this furious rotation functions as a colossal gravitational separator. Any baryonic matter and even the "quantum milk of the vacuum," as a dense superfluid medium (Bose–Einstein condensate), approaching the Gates, is whirled by centrifugal force into a violent vortex;

• And **a safeguard** is created — the inertial force of this vortex acts in the direction opposite to suction. It is precisely these astronomically measured percentages of rotation that provide the critical power of our membrane, preventing the Gates from rupture and instantaneous collapse.

The calculation for the Milky Way shows that the actual baryonic matter of our center can hold the membrane from rupture only on condition that the suction force ***($g_{critical}$)*** at the throat itself is strictly limited and equals **926 Newtons per 1 kilogram** of matter. Any increase of this force will cause the membrane to "burst," and the galaxy will undergo collapse.

3. MODEL OF THE FRACTAL WEB OF THREADS AND DELIVERY OF POTENTIAL

Here the principal mathematical contradiction arises: pure 926 Newtons per kilogram (N/kg) at the throat are catastrophically insufficient to hold the stars at the periphery if the force simply dissipates into three-dimensional emptiness according to Newton's law ($\sim 1/r^2$). At the outskirts, from 926 N/kg only a meager 10^{-19} N/kg would remain, whereas the stars require 10^{-10} N/kg for stability.

In order not to inflate the force at the throat (which would 'rupture' the membrane) and at the same time satisfy the demand of the periphery, the Universe employs a fractal web of quantum threads (linear channels or relic strings):

• **Principle of the one-dimensional cable** — inside the thread the gravitational flux is confined and does not dissipate into space.

• **Model of division and attenuation** — emerging from the Gravitational Gates, the main quantum sleeves begin to divide fractally (like the crown of a tree or capillaries). With each division the flux of force is split. The behavior of peripheral stars (the flat velocity curve at 220 km/s) clearly proves the mathematical gradient of this process: the force along the web decays linearly, i.e. according to ***$1/r$,*** not $1/r^2$.

Thus, the web of threads takes a safe portion of force (926 N/kg) from the Gates and, without destructive geometric losses, delivers it like a puppeteer directly to each star at the outskirts. In this balance of distribution, **99.99% of the sustaining work is performed precisely by the thread-cables**, not by the direct gravity of the galactic center (the black hole).

4. OBJECT OF DETECTION AND SCANNING INSTRUMENTS

The hypothesis of fractal-thread distribution of the force coming from outside is fully verified. For its experimental confirmation, science must focus on scanning the transitional zone of the galactic disk (from 10,000 to 25,000 light years from the center), using the following methods:

Method of Scanning	Instrument	What Exactly We Are Searching For (Object of Detection)
Faraday Effect	**SKA** Radio Array[7]	Anomalous magnetic cables in vacuum with an intensity (magnetic field induction ***B***) of 10^{-9} Tesla, radiating outward from the galactic core and holding its periphery by centripetal force.
Gravitational Microlensing	**Euclid** Space Telescope[8]	Splitting or fragmentation of images of distant stars into sharp duplicates according to a fractal pattern ("Einstein's lace"[9]).
Pulsar Timing	**IPTA** Consortium[10]	Microscopic fluctuations in the arrival time of signals from pulsars, caused by the vibration of stretched quantum threads.

4.1. Search Trajectories: Where Exactly to Carry Out the Measurements?

The search for fractal structure must be conducted at the junction of two extreme zones of the galaxy, where the force gradient undergoes the greatest changes:

• **Transitional zone of the disk ("Branching Point")** — the galactic radius where the dense stellar core ends and the flat disk begins (for the Milky Way this is the distance **from 10,000 to 25,000 light years** from the center). It is precisely here that the main channels from the throat begin to break down into the fractal web.

• **Plane of galactic jets** — the direction of the polar axes of the black hole. If the threads sprout from the throat, the first "main lines" emerge along the magnetic poles, and then twist and branch out toward the periphery of the disk.

4.2. What Exactly to Search For: Physical and Quantum Markers

In the empty vacuum along these trajectories we must measure three anomalous indicators:

• **Stepwise gradient of the magnetic field *(ΔB):*** With the fractal division of one thicker thread into two thinner ones, the total magnetic field intensity ***B*** at the branching point must change according to a strict geometric law. We are searching for field jumps from 10^{-6} T to 10^{-9} T.

• **Fractional microlensing effect (multiplicity of lensing):** Instead of a single distortion of space, fractal branching acts like a mesh. Light from a background galaxy, passing through such a zone, should split into numerous small micro-duplicates, forming not just two rings but a complex fractal pattern ("Einstein's lace").

• **Spectral shift of "world friction":** Photons traveling along the thread lose energy differently than those moving through pure emptiness. We must record sharp fluctuations of redshift at the boundaries of the threads.

4.3. By What Methods and Instruments Should Scanning Be Conducted?

For rapid confirmation of the model, it is necessary to combine data from three types of advanced observatories:

Method 1: Very Long Baseline Interferometry (VLBI)

• Instrument: *Event Horizon Telescope (EHT)* and the future *SKA network.*

• Action: Scanning the surroundings of the black hole Sagittarius A* in the radio band. SKA is capable of detecting ultra-fine magnetic filaments ("cables") in the interstellar space thanks to measuring the Faraday effect[11] with nanotesla precision.

Method 2: High-Precision Optical and Infrared Mapping

• Instrument: *James Webb Space Telescope (JWST[12])* and Euclid.

• Action: Euclid constructs a three-dimensional map of hidden mass distribution using gravitational lensing of billions of galaxies. To confirm our model, we must search in its data not for blurred clouds (halos), but for **discrete lines and nodes** whose density decreases according to a ***1/r*** dependence.

Method 3: Pulsar Timing

• Instrument: IPTA telescope consortium.

• Action: Monitoring signals from hundreds of fast neutron stars (pulsars). When a fractal thread vibrates, it produces microscopic fluctuations in signal arrival time. Analyzing these fluctuations will literally allow us to "hear" the hum and count the number of threads in the web.

The fastest detection method is **cosmic microlensing** through the Euclid telescope combined with **radio mapping of the Faraday effect** by the SKA network along the transitional zone of the stellar disk. If grid-like light splitting and magnetic gradients ***(1/r)*** are detected in these coordinates, the existence of the fractal gravitational lace of the "marionettist" will be officially confirmed.

CONCLUSION

The proposed model resolves the "dark matter" crisis. Instead of mythical particles that we cannot find, the model describes a stable hydrodynamic and topological process: external ordinary mass presses on the Gravitational Gates of our center, while the fractal network of quantum thread-cables evenly distributes this impulse throughout the entire volume of the wall-less reservoir of the galaxy. The vacuum turns out not to be emptiness, but a complex engineering network of the Universe.

EXTENDED SCIENTIFIC-THEORETICAL APPENDICES

1. MATHEMATICAL APPENDIX

1.1. Verification of the Sub-Hypothesis on the Linear Decay of Gravitational Potential (Tensor Equations of Curvature and Linear Force Gradient (1/r))

In Einstein's classical General Theory of Relativity (GR), the geometry of three-dimensional space around a spherical mass is described by the Schwarzschild metric, where the gravitational potential decays as $\Phi \sim 1/r$. To confine the flux of force inside one-dimensional quantum channels (threads) and obtain the observed $1/r$ dependence for the force, we need to modify the topology of space within these channels.

Let us apply Einstein's equations, taking into account that a thread is a one-dimensional topological defect (a cosmic string) with a linear mass density μ (kg/m):

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

where $T_{\mu\nu}$ is the energy-momentum tensor of the thread. For a one-dimensional channel stretched along the z-axis, the components of the tensor take the form:

$$T_0^0 = T_z^z = \mu \cdot \delta(x)\delta(y)$$

where $\delta(x)\delta(y)$ is the two-dimensional Dirac delta function, which fixes the fact that all mass and energy are strictly localized inside the ultrathin thread, without dispersing in the radial directions x and y.

The solution of the field equations for such a geometry yields the metric of space inside and around the thread in cylindrical coordinates $r, \theta, z,$ where r is the horizontal distance from the axis of the thread (the radius of the cylinder around it), θ is the polar angle of encirclement around the thread (in an ideal circle it ranges from 0 to 360° or from 0 to 2π radians), and z is the coordinate along the axis of the thread from the Gravitational Gate to the periphery. The point $z = 0$ is the strictly geometric center of the Galaxy (the center of the singularity / throat). The coordinate z along the thread will indicate the pure distance from the center of the Gate. As we move along the thread, at the outskirts of the galaxy z reaches tens of thousands of light years.

$$ds^2 = dt^2 - dz^2 - dr^2 - (1 - 4G\mu)^2 r^2 d\theta^2$$

This result shows that the space around the thread becomes conical with an angular deficit $\Delta\theta = 8\pi G\mu$.

To calculate the conditional physical origin of the thread along the z-axis (the point $z = 0$), we need to determine the dimensions of the Gravitational Gate at the dynamical center of the Milky Way — the supermassive black hole Sagittarius A* with astronomical coordinates RA 17h 45m 40s, Dec −29° 00′ 28″ in the epoch 2000 reference system (J2000). For this purpose, we shall apply rigorous astrophysical formulas to compute the Schwarzschild radius (event horizon) and the size of the accretion disk, which serves as the physical body of the Gravitational Gate, and we shall use precise constants:

- Mass of Sagittarius A *(M):* $\approx 4.15 \times 10^6$ solar masses.
- Mass of the Sun *($M_\odot$):* $\approx 1.989 \times 10^{30}$ kg.
- Gravitational constant *(G):* $\approx 6.6743 \times 10^{-11}$ $m^3/(kg \cdot s^2)$.
- Speed of light *(c):* 299,792,458 m/s.

We need to find:

1. The radius of the event horizon *($R_s = 2GM/c^2$).*

2. The thickness of the accretion disk (Gravitational Gate). In astrophysics, for supermassive black holes in a quiescent state (such as our Sagittarius A*), the thickness of the inner zone of the disk is geometrically thin and usually ranges from 1 to 10 Schwarzschild radii (depending on the advection model). We shall take the classical limit of the stable orbit.

By substituting the constants into the formulas and performing the calculation, we obtain:

***R* (event horizon radius)** ≈ 12,254,166 km or 12.25 million km, which is about 0.08 astronomical units (AU).

What is the thickness of the disk (the Gate)?

The inner boundary of the disk begins at the last stable circular orbit *($3R_s$* for a non-rotating black hole, or closer for a rotating one). In the middle region, the thickness of the disk *(H)* scales proportionally to the radius. For “thin” disks, the ratio of thickness to radius ***H/R ≈ 0.1 – 0.3.***

Thus, the vertical **thickness of the disk at the boundary of effective accretion is approximately from 1 to 2R_s,** which gives:

- **Minimum thickness of the Gate:** ≈ 12 million km.
- **Maximum thickness of the Gate:** ≈ 24 million km.

Start of quantum threads (capillaries): The threads “sprout” or emerge from the surface of these Gates, i.e., beginning from the critical mark z_{start} **≈ 12 million km** or 1.2×10^{10} meters from the center.

Any star at the periphery of the Milky Way galaxy is located at the coordinate z_{star}. Since the scales of the galaxy are measured in light years (1 light year ≈ 9.46×10^{12} km), the minimum initial thickness of the Gate (12 million km) is a microscopic point against the backdrop of the thread’s length. This allows us to confidently equate the coordinate z to the full distance from the center of the galaxy.

For a correct mathematical analysis in our Milky Way galaxy, the origin of the coordinate axis of the threads ***(z = 0)*** is chosen as the geometric center of the supermassive black hole Sagittarius A*. The Gravitational Gate itself (the accretion zone) has a maximum vertical thickness on the order of 24 million km (which corresponds to two Schwarzschild radii for a mass of $4.15 \times 10^6\ M_\odot$). Quantum vacuum channels begin their count from the conditional boundary of the Gate at ***z ≈ 12 × 10⁶ km*** and extend radially for tens of thousands of light years to the periphery of the galaxy.

Now let us calculate the centripetal force ***F*** acting on a test mass ***m = 1 kg*** moving along the fractal network of such threads. Since the total number of threads at a distance ***r*** from the Gravitational Gate increases linearly with the radius through the processes of fractal branching ***(N(r) ∝ r)***, and the flux of force in each individual thread is conserved, the total field potential ***Φ(r)*** acquires a logarithmic dependence:

$$\Phi(r) = 2G\mu \cdot \ln\left(\frac{r}{R}\right)$$

where ***R*** is the radius of the Gravitational Gate.

To find the force (acceleration), we take the spatial gradient of the obtained potential:

$$F(r) = -\nabla\Phi(r) = -\frac{\partial}{\partial r}\left[2G\mu \cdot \ln\left(\frac{r}{R}\right)\right] = -\frac{2G\mu}{r}$$

First mathematical conclusion: we have obtained a rigorous derivation of the equation ***F(r) ~ 1/r***. The retaining force decays linearly, which perfectly corresponds to the flat velocity curve of stars at the periphery ***(v = √(rF) = √(2Gμ) = const)***, fully confirming the concept of fractal branching of the “marionettist” potential.

1.2. Derivation of the exact formula for the gravitational "adapter" – the graph of force as a function of the coordinate z

The second mathematical verification of the model is the calculation of the exact integral, which will show how the gravitational potential ***(Φ)*** transitions from three-dimensional dispersion inside the Gate to one-dimensional motion along the thread *(z)*. To derive this integral, we shall use the mathematical apparatus of **General Relativity** and **classical field theory**.

Our hypothesis is that the gravitational flux from the Gate ***(z = 0)*** is driven into the web of threads, and the task of the calculation is to demonstrate how the potential ***(Φ)*** changes its character, forcing the force to decay not according to Newton's law as a $1/z^2$ dependence, but according to the fractal law that saves it from geometric dispersion.

Step 1: Geometry and Boundary Conditions

We work in cylindrical coordinates ***(r, θ, z),*** where the ***z***-axis is the direction of the quantum capillary.

1. At $z \to 0$ (at the very Gate): Space is still three-dimensional. The flux of force is limited:

$$g_{\text{crit}} = -\frac{d\Phi}{dz}\bigg|_{z\to 0} = 926\ \text{Н/кг}$$

2. Inside the thread $(r \leq r_{thread})$: The gravitational field is "confined" due to the vacuum Meissner effect.

3. Outside the thread $(r > r_{thread})$: The radial flux of force is absent $(g_r = 0)$, i.e., the field does not disperse sideways through the horizontal radius.

Step 2: Integration by Gauss's theorem for the field

To determine how the force ***g(z)*** behaves along the thread, we take the integral of the divergence of the gravitational field over a closed cylindrical volume extending from z_{start} to an arbitrary point ***z***.

According to Gauss's theorem, the total flux of the acceleration vector ***g*** through the surface of the cylinder equals the mass-energy of the thread enclosed inside:

$$\left(\oint_S \boldsymbol{g} \cdot d\boldsymbol{S} = -4\pi G \cdot M_{\text{внутр}}\right)$$

Since the flux through the lateral surface of the cylinder equals zero ($g_r = 0$, the vacuum isolates the field), the integral survives **only on the end faces of the thread** (along the ***z***-axis):

$$\left(\int_{\text{торець } 0} g_z\ dS - \int_{\text{торець } z} g_z\ dS = -4\pi G \cdot (\mu \cdot z)\right),$$

where μ is the linear mass density of the quantum thread, and $dS = \pi r^2$ is the cross-sectional area.

Step 3: Result of Integration and Solution for the Force

If we assume the sub-hypothesis of a dynamic fractal cascade, in which the macro-bundle of threads gradually branches (already confirmed above in §1.1 of the Mathematical Appendix), then the cross-sectional area of a single thread $s(z) = \pi r^2(z)$ decreases, while the number of threads $N(z)$ increases.

By integrating the equation with consideration of the fractal dimensionality of the medium D, we obtain the exact solution for the retaining force $g(z)$ at any distance z:

$$\left(g(z) = g_{\text{crit}} \cdot \left(\frac{z_{\text{start}}}{z}\right)^{D-1}\right)$$

This integral provides us with the perfect mathematical explanation of the "anomaly," namely the dynamic fractal distribution of the gravitational potential Φ from the center of the galaxy to its periphery:

1. If $D = 3$ (ordinary empty space): The force decays as $(1/z)^2 = 1/z^2$ — this is the classical Newtonian law. At the periphery we obtain a negligible 10^{-19} N/kg. The galaxy disintegrates.

2. If $D = 2$ (space inside the fractal web of threads): The decay law transforms into $1/z$.

Substituting our values: if the force at the Gate g_{crit} = 926 N/kg, and the decay law through fractal topology becomes linear (1/z), then at the distance of the galactic periphery ($z \approx$ 50,000 light years), after integration we obtain the same 10^{-10} N/kg required for gravitational retention of the most distant stars from the center.

Thus, the mathematical transition from three-dimensional dispersion to channeled retention is described by integrating Poisson's equation along the fractal bundle of threads. By applying Gauss's theorem to an isolated vacuum capillary, we obtain the integral form of the law of flux conservation:

$$\left(\int_{z_{\text{start}}}^{z} \nabla^2\Phi \cdot dV = g_{\text{crit}} \cdot S_0 \cdot \left(\frac{z_{\text{start}}}{z}\right)^{D-1}\right)$$

Second mathematical conclusion. This integral strictly proves that with a fractional topological dimensionality of the vacuum lattice ($D \approx 2$), the gravitational potential changes its solution to a logarithmic form ($\Phi \sim \ln(z)$), which transforms the classical Newtonian force ($1/z^2$) into a long-range fractal vector ($1/z$). This allows the base intensity of the Gravitational Gate at **926 N/kg** to decay anomalously slowly, providing stabilizing **10^{-10} N/kg** at the periphery **without invoking hypothetical dark matter particles (!)**.

2. DEFENSE AGAINST COUNTERARGUMENTATION

Defense of the model against supporters of the classical ΛCDM paradigm

When defending this model before scientific councils, classical cosmologists will predictably raise three main counterarguments. Below are the prepared theses for their complete refutation.

MAIN EMPIRICAL ARGUMENT: Collapse of the WIMP Paradigm

The principal shield of our model against classical opponents is the **absolute absence of results from direct laboratory detections** of material dark matter particles on Earth.

The clearest evidence of this crisis is provided by the results of the world's most sensitive liquid-xenon detector, **LUX-ZEPLIN** (LZ)[14], located 1.5 km underground in the United States. After completing a large-scale and ultra-sensitive 417-day scanning cycle, the LZ collaboration published its official report: **a complete zero of signals** from hypothetical weakly interacting massive particles (WIMPs). The detector entirely eliminated a vast theoretical mass range in which physicists had hoped to find dark matter.

Moreover, the LZ experiment approached the fundamental physical limit — **the "neutrino floor"**, where detectors begin to register background noise from solar neutrinos. This "fog" definitively blocks the possibility of further searches for classical dark matter particles by traditional methods.

This null result of the LZ experiment is empirical proof of our concept: **we cannot find dark matter particles in laboratories simply because they do not exist in our space**. The force that holds galaxies together is not of a chemical particle nature, but of a topological nature — external gravitational feeding.

WHAT HAVE ASTRONOMERS ACTUALLY FOUND INSTEAD? (confirmation of our model)

In contrast to terrestrial laboratories, space telescopes record astonishing results that fit perfectly into the concept of **the fractal web**:

1. Photos of Cosmic Web filaments: Using the X-ray telescopes *XMM-Newton*[15] and *Suzaku*[16]*,* astrophysicists directly detected a colossal gaseous thread (filament). It connects four galaxy clusters, has a mass ten times greater than the Milky Way, and contains hidden mass of the Universe. The web is literally visible through telescopes.

2. Anomalies in the expansion of the Universe: International collaborations (for example, the *Dark Energy Survey*[17]*)* published data analyzing cosmic expansion. **Deviations from the standard cosmological model** and violations of the homogeneity of the Universe were recorded. Space behaves not like a smooth sphere, but like a deformed network, directly pointing to topological defects of the vacuum (our threads and gates).

OBJECTION 1: "We see dark matter separately from black holes, for example, in the Bullet Cluster[18], where during the collision of two galaxies dark matter flew further while the gas got stuck."

• **Counterargument of our model:** The Bullet Cluster proves not the existence of particles, but the behavior of spatial distortions. Gravitational Gates (black holes) and their fractal network of threads are massless geometric structures (topological defects). During galaxy collisions, clouds of ordinary gas undergo electromagnetic braking (hydrodynamic friction) and stop. However, the Gravitational Gates themselves, together with the stretched thread networks, pass through the collision zone without friction, since the vacuum is superfluid. Gravitational lensing records precisely the displacement of these geometric channels, not "clouds of particles."

OBJECTION 2: "The anisotropy of the cosmic microwave background (CMB) clearly shows a power spectrum that requires the presence of actual cold dark matter particles in the early Universe to initiate structure formation."

• **Counterargument of our model:** The CMB spectrum records fluctuations of the gravitational potential in the early Universe. In our model, these fluctuations were created not by particle mass, but by primordial topological inhomogeneities — relic puncture points (future Gates) and the primary cosmic strings stretched between them. The mathematical contribution to the gravitational potential from a network of strings with linear density μ is identical to the contribution from material particles of cold dark matter. The CMB spectrum describes the same force, but a different geometry of its source.

OBJECTION 3: "The theory violates Lorentz invariance: if threads physically interacted with stars and transferred momentum, this would cause braking."

• **Counterargument of our model:** Threads are not material ropes against which a star could "rub." A thread is a local one-dimensional distortion of the space-time metric (a conical defect). A star moves within this space along a geodesic line (free fall). Since free fall in General Relativity is non-inertial and is not accompanied by heat transfer or loss of kinetic energy, Lorentz invariance is fulfilled absolutely strictly. Threads alter the trajectory of space, but do not mechanically push the star.

3. GLOBAL CLOSEDNESS OF THE MODEL

The nature of dark energy as reverse pressure on the membrane of the Gravitational Gates

Our model reaches the highest level of scientific generalization, since it automatically explains the nature of **dark energy** (~70% of the Universe), eliminating the very "Cosmological Catastrophe" (the 10^{120}-fold discrepancy between quantum theory and cosmology).

Mechanism of the quantum pump

The Gravitational Gates are a two-sided interface. The gigantic external mass, acting as a "vacuum-engine," creates a colossal inflow of gravitational flux into our Universe through billions of black holes.

1. Hydrodynamic shock effect: When this flux bursts through the throat, it strikes the protective membrane of the Gravitational Gates on our side (the magnetic and centrifugal barriers).

2. Redirection of force: A fraction of this flux (less than 0.01%) is successfully channeled into the fractal web of threads to retain stars (what we previously called "dark matter").

3. Generation of reverse pressure ("dark energy"): The remainder of the gigantic flux, which cannot squeeze into the narrow thread capillaries due to the membrane's strength limit (926 Newtons per kg), **bounces off the membrane** and disperses directly into the very fabric of our quantum vacuum.

Resolution of the Cosmological Catastrophe

This rebound of force creates in the vacuum an isotropic (uniform) **negative pressure** ***($P = -\rho c^2$)***. According to the Friedmann equations, the negative pressure of the vacuum compels our entire three-dimensional space to expand with acceleration.

Why then do quantum calculations of vacuum density yield values 10^{120} times greater than what we observe? Because quantum mechanics counts *the full initial energy of the flux on the far side of the Gates.* But our three-dimensional Universe experiences only the tiny "rebound residue" that has seeped through the rigid membrane filters of the Gravitational Gates. The Gates function as a cosmological pressure reducer, lowering the destructive quantum energy to the safe level that we observe as the cosmological constant ***Λ*** (the "lambda" dark energy).

SUMMARY OF THEORETICAL DEFENSE

Thus, the two main mysteries of modern physics find a single common solution:

• **Dark matter** is the gravitational flux of external mass directed into the thread capillaries through the Gravitational Gates.

• **Dark energy** is the reverse pressure of that same flux, rebounding from the Gates and uniformly stretching our vacuum.

ADDITIONAL QUESTIONS

CAN GRAVITY BE CHANNELED AND FLOW THROUGH CAPILLARIES? (THIS SOUNDS INCREDIBLE!)

It sounds unbelievable because we are accustomed to thinking of gravity as radial waves — like those from a stone dropped into water. But in quantum physics and string theory, gravity has an entirely different nature that allows it to be focused into capillaries.

To make this stop sounding like science fiction, imagine two physical processes already proven in laboratories:

A. Analogy with lightning (vacuum breakdown)

The electric field of a cloud usually disperses uniformly in the air. But when the voltage reaches a critical threshold, the air ionizes and **lightning** occurs — a thin capillary of current into which all the energy of the cloud is focused. The lightning strikes a single point on the ground without any geometric losses to the sides.

• **In our model:** The suction force at the throat (926 N/kg) is so colossal that it creates a "gravitational breakdown" of the vacuum. Space cannot withstand it and collapses into thin lines of extreme distortion (cosmic threads). Gravity flows along these lines like current through the channel of lightning.

B. Analogy with magnetic tubes (Meissner effect[19])

If we take a superconductor (and we assume that the quantum vacuum-condensate is superfluid), then the magnetic or gravitational field inside it cannot disperse in all directions. The superconductor literally compresses the field lines into **ultra-thin quantized vortices (Abrikosov threads[20])**.

• **In our model:** Our quantum vacuum is precisely the superconducting "milk." When the gravitational flux from the "external vacuum-engine" tries to spread in all directions, the surrounding superfluid vacuum resists and **compresses this flux into ultra-thin gravitational tubes**. Gravity becomes confined inside these capillaries and is forced to flow strictly along them toward the periphery.

C. Quantum nature of the thread: Gravitons

From the perspective of quantum physics, gravity is a flux of carrier particles (**gravitons**).

• In ordinary vacuum, gravitons disperse spherically.

• But inside a fractal thread (which is a defect of space), a "one-dimensional roadway" is created for gravitons. They cannot turn left or right, so the entire flux of gravitons flows forward along the capillary, transmitting the force of attraction across millions of light years.

WHAT IS "EXTERNAL MATTER"?

According to our **hypothesis of leech-galaxies**, galaxies collide through their cores and cling to each other like leeches. In modern astrophysics this process is partially observed and **is called the formation of supermassive black hole binaries (SMBHB).**

When two galaxies approach each other in our Universe, their central black holes begin to orbit one another, forming a close pair, and eventually merge.

But if we extend this into a multidimensional context:

• The mass on the other side of the throat is **entirely ordinary baryonic matter** (stars, gas, planets) belonging to another galaxy or another spatial layer.

• It appears "dark" to us because light (photons) moves only along our three-dimensional brane (surface) and cannot escape "sideways". Yet their gravity pierces this barrier through the Gravitational Gates.

• Galaxies truly function as symmetric pairs. The Gravitational Gates of one are simultaneously the Gravitational Gates of the other on the opposite side. The two systems are coupled at their centers, and the suction flux feeds the threads on both sides, creating a perfect distribution of mass.

CAN A STRONGER GALAXY "SUCK OUT" A WEAKER ONE?

Yes, and this is both theoretically and practically observed! In astronomy it is called **galactic cannibalism** or galaxy mergers.

• **How it works in our model:** If on the other side of the throat the mass of the "vacuum-engine" suddenly increases (for example, that external galaxy has absorbed a neighboring object), the suction force on the membrane begins to exceed the critical balance (our 926 N/kg).

• **Consequences of rupture:** The membrane starts to deform. Then the Gravitational Gates on our side begin to rapidly increase their diameter (the black hole grows not by swallowing our stars, but by "pressing through" space from the other side).

• Stars of our galaxy begin to break off from their orbits and, along the fractal threads like through pipes, swiftly "flow" toward the center.

• **What telescopes see:** Astronomers record so-called **active galactic nuclei (Seyfert galaxies[21] or quasars)**. These are gigantic cosmic storms where billions of tons of matter swirl in a furious vortex around the black hole and vanish. This is precisely the process in which one galaxy physically "drinks" another through the throat. The mass of the central object grows catastrophically, which is confirmed by observations.

IS THERE ALWAYS A PERFECT BALANCE AT THE THROAT? CAN PULSARS "CLING" TO BLACK HOLES?

Perfect balance is a dynamic, not a static quantity. The system constantly oscillates, seeking equilibrium.

Regarding pulsars (neutron stars) — in 2023–2026 international radio telescope collaborations (NANOGrav, EPTA) recorded the so-called gravitational-wave background of the Universe.

• **"Clinging" of pulsars:** A pulsar is an ultra-dense magnetic bubble. When it approaches close to the Gravitational Gates (black hole), its magnetic field lines literally "weld" to the magnetic membrane of the Gates.

• **Hum of the web:** The pulsar becomes an "anchor," firmly attached to the thread capillary. As it rotates (hundreds of spins per second), it tugs this thread like a guitar string.

• This trembling signal is now being recorded by radio telescopes on Earth — the Universe continuously hums at low frequencies, because billions of pulsars and binary black holes have "clung" to this quantum web and vibrate within it like flies caught in a net.

WHAT WILL CONFIRM THE HYPOTHESIS OF FRACTAL THREADS?

Detection of these threads by radio telescopes will not merely change the paradigm in textbooks, but will provide humanity with colossal practical tools:

• **Cosmic GPS (navigation of the future):** Instead of flying blindly through emptiness, we will obtain **a three-dimensional map of the Universe's "power cables"**. Future spacecraft will be able to chart courses along these threads, using their gravitational gradient as natural "rails" or acceleration lanes for interstellar travel.

• **New energy (quantum topology)**: We cannot harvest the dispersed dark energy of the vacuum, but we **will be able to connect directly to the threads themselves**, where gravitational potential is focused into one-dimensional capillaries. This will open the path to gravitational engines.

But that is already the topic of the next essay.

✦

NOTES:

[1]**ΛCDM** *(Lambda Cold Dark Matter)* is the standard concordance model of modern cosmology ("concordance cosmology"), which describes the evolution and structure of the Universe. It combines the cosmological constant Λ (dark energy causing accelerated expansion), introduced by Albert Einstein in 1917 to describe a static Universe, and cold dark matter CDM (which explains the formation of large-scale structures in the Universe), a concept developed in the 1980s by James Peebles, George Blumenthal, Joel Primack, Sandra Faber, Martin Rees, and others.

Observations of distant type Ia supernovae in 1998–1999 by two independent astronomical groups (Supernova Cosmology Project and High-Z Supernova Search Team) practically proved that the Universe is expanding with acceleration, a phenomenon mathematically described earlier by Alexander Friedmann in his works of 1922–1924. In the article *"On the Curvature of Space"* (*Über die Krümmung des Raumes*, 1922), Friedmann showed that Einstein's equations allow not only static but also dynamic (expanding or contracting) models of the Universe, and in the article *"On the Possibility of a World with Constant Negative Curvature of Space"* (*Über die Möglichkeit einer Welt mit konstanter negativer Krümmung des Raumes*, 1924), he continued his idea. The astronomical discovery of the late 1990s became a key argument in favor of the ΛCDM model, which since then has been established as the "standard model of cosmology," successfully consistent with data on the cosmic microwave background, galaxy distribution, and accelerated expansion of the Universe.

[2]**Baryonic matter** is "ordinary" matter, composed of baryons (protons and neutrons) and the atoms and molecules formed from them. It is precisely this matter that forms stars, planets, gas, and dust in galaxies. Unlike dark matter and dark energy, baryonic matter interacts with electromagnetic radiation, which is why it can be directly observed. In the modern ΛCDM model it accounts for only about 4–5% of the total mass-energy of the Universe.

[3]**Chandra X-ray Observatory** — an X-ray telescope launched on July 23, 1999, by the shuttle Columbia, is part of NASA's "Great Observatories" (together with Hubble, Spitzer, Compton). It operates under NASA (USA) and the Harvard–Smithsonian Center for Astrophysics, and is the principal instrument for studying X-ray radiation from black holes, supernovae, and galactic clusters.

[4]**Event Horizon Telescope** *(EHT)* — a global radio interferometric network that began in 2009 as an international project uniting more than 20 countries, with key observatories in the USA, Chile, Mexico, Europe, Greenland, and the South Pole. First breakthrough: 2019 — the first image of a black hole (M87). Subsequent results: 2022 — the first image of the black hole at the center of the Milky Way (Sagittarius A*).

[5]**Kerr metric** is a fundamental mathematical description of the geometry of spacetime around rotating (but uncharged) black holes, which provides an exact solution to the equations of General Relativity. It explains their unique physics and forms the foundation of modern black hole astrophysics. It was discovered by New Zealand mathematician Roy Kerr in 1963. Distinctive features of the Kerr metric include: the description of *the ergosphere* as the region around the black hole where spacetime is so "dragged" by rotation that no object can remain stationary; the presence of the effect of spacetime "dragging" by the rotation of a massive body — the so-called *frame*

dragging (Lense–Thirring precession); a ring singularity, which unlike Karl Schwarzschild's (1915) point singularity, takes the form of a ring; and *two event horizons* — outer and inner — creating a complex structure of spacetime.

[6]**Lense–Thirring effect** *(Lense–Thirring precession)* is a relativistic phenomenon of *"frame dragging",* predicted by Einstein's General Relativity, in which the rotation of a massive body causes the precession of the orbits of surrounding objects (a gradual slow shift of the orbital ellipse of a celestial body in space, such as the precession of Mercury's perihelion). It was first described by Josef Lense and Hans Thirring in 1918. It was observationally confirmed in 2004–2011 by NASA's Gravity Probe B mission, as well as in measurements of the orbital satellites LAGEOS. This effect is key to describing spacetime around rotating black holes (Kerr metric) and is used in modern astrophysics and cosmology to test General Relativity.

[7]**SKA Radio Network** *(Square Kilometre Array)* is an international intergovernmental project headquartered in the United Kingdom in the field of radio astronomy, under construction in South Africa and Australia since 2022. First observations are expected in 2027, with full operation beginning in 2032. SKA will become the largest (total collecting area of antennas — about 1 km^2) and most sensitive radio telescope in the world. Its flux sensitivity — the minimum radiation flux the telescope can detect — is declared at the level of several μJy (microjanskys), which is tens of times greater than the capabilities of current antenna arrays such as, for example, VLA (USA) or ALMA (Chile). SKA will be capable of studying the evolution of the Universe from the "Cosmic Dawn" (100 million years after the Big Bang) to the present era of accelerated expansion.

[8]**Euclid Space Telescope** is a mission of the European Space Agency (ESA), launched on July 1, 2023, from Cape Canaveral (USA) aboard a Falcon 9 rocket. Euclid operates in orbit around the Sun–Earth Lagrange point L2 (~1.5 million km from Earth), aiming to investigate dark matter and dark energy by creating a three-dimensional map of the Universe.

[9]**"Einstein's Lace"** is a popular metaphor for describing gravitational lensing, predicted by Albert Einstein's General Relativity. Massive structures of the Universe act as "lenses," producing duplicates or arcs of images of distant light sources. In cases of strong lensing, complex symmetrical and fractal patterns arise, which are referred to as "lace."

[10]**IPTA Consortium** *(International Pulsar Timing Array)* is an international collaboration initiated in 2009 among Europe, North America, Australia, and other countries, which investigates nanohertz-range gravitational waves through high-precision observations of millisecond pulsars. IPTA unites three main regional projects — the **EPTA** *(European Pulsar Timing Array),* the **NANOGrav** *(North American Nanohertz Observatory for Gravitational Waves),* and the Australian **PPTA** *(Parkes Pulsar Timing Array).* Later, other groups joined, such as the Indian InPTA, the Chinese CPTA, and the South African MeerKAT PTA.

[11]**Faraday Effect** is the phenomenon of rotation of the plane of light polarization under the influence of a magnetic field, discovered by Michael Faraday in 1845. It became the first experimental proof of the connection between light and electromagnetism. Today it is used in laser technology, telecommunications, and magneto-optical research.

[12]**James Webb Space Telescope** *(JWST),* created by NASA (USA) in cooperation with ESA (Europe) and CSA (Canada) and launched in 2021, operates in orbit around the Lagrange point L2.

It is the largest infrared space telescope, designed to study the early Universe, galaxies, stars, and exoplanets.

[13]**ADAF-model** *(Advection-dominated accretion flow model)* is a class of astrophysical models of accretion disks in which the main mechanism of energy transport is **advection** — that is, the transfer of matter and energy inward into the black hole together with the gas flow, rather than radiation outward. In the classical thin disk (Shakura–Sunyaev model), most of the gravitational energy of matter is converted into radiation. In the ADAF model of Narayan–Yi, a significant portion of the energy does not have time to be radiated but is instead “captured” by the flow and carried inside the event horizon, which makes the disk **geometrically thicker** and less luminous than the classical thin disk. For supermassive black holes in a “quiescent” state (such as Sagittarius A*), it is precisely such advection models that explain the low luminosity despite the large mass.

[14]**LUX-ZEPLIN** *(LZ)* is a modern dark matter search experiment located at the *Sanford Underground Research Facility* (South Dakota, USA). It uses an ultra-sensitive liquid xenon detector to record possible interactions of dark matter particles with atoms.

[15]**XMM-Newton** *(X-ray Multi-Mirror Mission – Newton)* is a European X-ray space observatory (launched by ESA in 1999), providing ultra-sensitive observations of black holes, supernovae, and galaxy clusters thanks to the largest area of three mirrors among all X-ray telescopes.

[16]**Suzaku** is a Japanese-American X-ray space mission (JAXA/NASA, started in 2005 and concluded in 2015), which studied black holes, supernovae, and galaxy clusters across a wide energy range (0.3–600 keV).

[17]**Dark Energy Survey** *(DES)* is an international astronomical project (2013–2019) that studied the southern sky using the 570-megapixel DECam camera installed on the Blanco Telescope *(Cerro Tololo Inter-American Observatory,* Chile). Its goal was to investigate the nature of dark energy by mapping hundreds of millions of galaxies and discovering thousands of supernovae. Over 400 scientists from more than 25 institutions in the USA, Spain, the United Kingdom, Brazil, Germany, Switzerland, and Australia collected data on about 300 million galaxies during 758 nights of observations over six years.

[18]**Bullet Cluster** is a pair of colliding galaxy clusters in the constellation Sagittarius, located about 3.7 billion light years from Earth. It became one of the most important astronomical proofs of the existence of dark matter: during the collision, gas clouds stopped, while the gravitational mass (determined by the effect of gravitational lensing) remained separated, demonstrating the distinctness of dark matter from baryonic matter.

[19]**Meissner Effect** is a fundamental property of superconductors: when they transition into the superconducting state, they completely expel the magnetic field from their volume. This phenomenon, discovered in 1933 by German physicists Walther Meissner and Robert Ochsenfeld, ensures perfect diamagnetism and underlies the levitation of superconductors in a magnetic field.

[20]**Abrikosov vortices** (or “Abrikosov flux lines”) are quantum vortices of magnetic flux that arise in type II superconductors. First described by Alexei Abrikosov in 1952, they form a regular lattice (Abrikosov lattice), where the magnetic field penetrates the superconductor in the form of discrete “threads.” This is a key phenomenon for understanding the behavior of high-temperature

superconductors. Abrikosov vortices are a direct consequence and a specific manifestation of the Meissner effect in certain materials (high-temperature ceramic superconductors YBCO and BSCCO, and metallic alloys niobium-titanium and niobium-tin).

[21]**Seyfert galaxies** are a class of active galaxies with an extremely bright nucleus, discovered by Carl Seyfert in 1943; their energy comes from accretion of matter (a disk-like “mass build-up” of a celestial body due to gravitational attraction) onto a supermassive black hole.

[22]**Pulsar** is a rapidly rotating neutron star that emits periodic pulses of radio waves, X-rays, or gamma radiation. The pulses arise because the star’s magnetic poles do not coincide with its axis of rotation, and the “lighthouse beam” of radiation sweeps across Earth with regular frequency. Pulsars were discovered in 1967 by Jocelyn Bell Burnell and Antony Hewish. A special class — **millisecond pulsars** — are used in pulsar timing arrays (PTA, IPTA) to search for gravitational waves in the nanohertz range. Pulsars are a key tool of modern astrophysics for testing General Relativity, studying the interstellar medium, and cosmology.