ISSN: 2639-0108

Research Article

Advances in Theoretical & Computational Physics

How Does the Galactic Center Affect the Earth?

Boris V. Vasiliev*

Independent Researcher, Russia

***Corresponding Author**
Boris V. Vasiliev, Independent Researcher, Russia.

Submitted: 2024, Nov 25; **Accepted:** 2025, Jan 06; **Published:** 2025, Jan 24

Citation: Vasiliev, V. B. (2025). How Does the Galactic Center Affect the Earth? *Adv Theo Comp Phy, 8*(1), 01-14.

Annotation

An unusual effect was discovered: a small box filled with finely dispersed iron powder was placed next to a beta radiation source, and this changed its beta decay rate.

Based on measurement results described in this article, it can be assumed that cosmic neutrinos affecting terrestrial beta sources are born in the center of our Galaxy.

1. About the Nature of Beta Decay

The discovery of radioactive decay has raised the question for the physical com- munity as to whether this phenomenon is completely accidental or it is caused by some reason?
Science has never known anything like this before. Until the 20th century, physicists assumed that all-natural phenomena must have their own cause.

The new physics of the early twentieth century gave the phenomenon of radioactive decay a quantum mechanical explanation.

N. Bohr and his associates believed that the cause of radioactive decay is the quantum mechanical tunneling effect, and therefore decays occur absolutely by chance.

But determinists, led by A. Einstein, did not agree with this point of view. However, the impeccable logic of the mathematical apparatus of quantum mechanics and the general beauty of the new approach inclined the physical community to the side of the anti-determinists.

Nowadays, quantum mechanics has become the basic tool for the theoretical study of the microcosm, and radioactive decay is considered by the physical community to be a purely accidental phenomenon.

2. Beta Decay and Neutrinos

2.1. The Falkenberg's Discovery

At the beginning of the XXI century, Professor E.D. Falkenberg discovered that the flux of solar neutrinos affects the decay rate of tritium [1].

Subsequently, this effect was repeatedly confirmed by different researchers for various beta isotopes [2,3].

Somewhat later, it was proved that the rate of beta decay increases under the influence of the flux of reactor neutrinos [4].

The solar neutrino flux can be calculated based on the fact that the total luminosity of the Sun is known.

This flux is considered to be Equation to [5]:

$$\Phi_\odot \approx 6 \cdot 10^{10} \quad \frac{\nu}{cm^2 \cdot s}. \qquad (1)$$

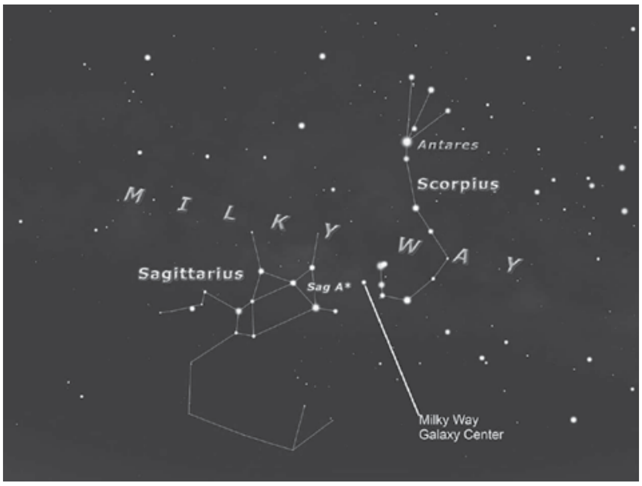

Figure 1: The super active and supermassive black hole Sag A* is located in the center of our Milky Way galaxy. Hypothetically, we can assume that it may be the main source of cosmic neutrinos falling to Earth. From Earth, Sag A* appears to be located on the border between the constellations of Scorpio and Sagittarius.

From E. Falkenberg data solar neutrinos are superimposed on the cosmic neutrino flux, which in our laboratories is approximately

Equation to:

$$\Phi_\star \approx \Phi_\odot \left(\frac{\delta_\odot}{\Delta_F} - 1 \right) \approx 4.4 \cdot 10^{11} \quad \frac{\nu}{cm^2 \cdot s} \tag{2}$$

Perhaps the main stream of cosmic neutrinos is created by the superactive supermassive black hole Sag A*, which is the center of our Galaxy. From Earth, we can see Sag A* on the border of the constellations Sagittarius and Scorpio (Figure 1).

If, following Einstein, we believe that beta decay is a forced phenomenon and its cause is the effect of a neutrino flux, then considering Equation (2), the cross section of this reaction turns out to be approximately Equal.

$$\sigma_\star \approx 4 \cdot 10^{-22} \quad cm^2 \tag{3}$$

Such a large cross-section for a neutrino-induced process should not be perplexing.

All other neutrino-induced processes are endoenergetic reaction. They come at the expense of the energy that neutrinos transfer to other particles involved in the reaction.

The beta decay is exoenergetic reaction. Apparently, this is the only ex-oenergetic reaction induced by neutrinos. It comes at the expense of the decay energy of neutron, whose mass is greater than the total mass of the decay products - proton and electron. The neutrino inducing this reaction only destroys the equilibrium in the energetically unstable proton+electron system [6].

2.2. Measurements with Reactor Neutrinos

The advantage of reactor experiments is the controllability of their conditions. During experiments on a pulsed reactor (IBR-2, Dubna), it was found that the neutrino flux Φ_r created by it caused an increase in the decay rate of ΔV_r in a beta source consisting of N atoms ^{63}Ni.

According to the measurements of [4], this effect had a cross-section

$$\sigma_r \approx 1.5 \cdot 10^{-22} \quad cm^2 \tag{4}$$

The value of this cross section, up to experimental errors, can be considered consistent with the data obtained from Falkenberg measurements (Equation 3).

Thus, in full accordance with A. Einstein's foresight, experiments show that beta decay is a forced phenomenon. Its cause is the effect of the neutrino flux.

3. Is It Possible to Protect Against the Neutrino Flux?

Due to the fact that, according to J.J. Thomson, the absorption or scattering of an electromagnetic wave occurs on electric charges. Neutrinos in matter propagate without loss of energy due to the fact that there are no magnetic monopoles in nature [7,8]. However, the substance has some effect on the neutrino flux without direct energy exchange.

The neutrino flux passing through a substance induces a short-term diamagnetic reaction in it, corresponding to its magnetic susceptibility [7].

The excitation of the diamagnetic reaction leads to the fact that the velocity of neutrino propagation in matter becomes less than in vacuum. It is similar to the flow of ordinary photons in a substance transparent to them, which has a refractive index different from one.

Since neutrinos do not carry electric fields, they can be called clusters of purely magnetic energy [8]. Therefore, the electric polarization of the medium does not occur during their propagation.

However, when entering a granular medium as a result of refraction, the neutrino flux must dissipate.

Although all granules of the medium are completely transparent to neutrinos, each granule will act as a small lens with the refractive index $n \neq 1$.

The refractive index of a substance for a neutrino is determined by its magnetic permeability:

$$n = \sqrt{\mu}, \tag{5}$$

Which can be expressed through its magnetic susceptibility:

$$\mu = 1 + 4\pi\chi \tag{6}$$

All substances have diamagnetic properties, since diamagnetism is the re- action of closed atomic electron shells to an externally applied magnetic field H.

Since the precession frequency of the electron shell [9]:

$$\omega = \frac{e}{2m_e c} H. \tag{7}$$

As a result of this precession, an atom having Z electron shells acquires a magnetic moment directed against the applied magnetic field.

So the diamagnetic susceptibility of the substance turns out to be Equational [9]:

$$\chi \approx -\frac{NZe^2}{6m_e c^2} R_a^2. \tag{8}$$

Where N is the density of atoms, R_a is the radius of the electron shell.

4. Neutrinos in a Granular Medium

As a result of the random nature of scattering in a granular medium, the neutrino trajectory should become "entangled".

The motion of neutrinos in a granular medium with a refractive index different from 1 should resemble the wandering of a drunken sailor from the well- known task of Brownian motion.

The intensity of the scattered radiation, as well as its absorption, is deter- mined by Bouguer's law. At weak scattering:

$$I = I_o e^{-\frac{L}{f}} \approx I_o \left(1 - \frac{L}{f}\right), \quad (9)$$

where L is the thickness of the scattering layer, I_o and I are the intensity of the incident and transmitted radiation.

When scattering radiation on a fine-granular substance, in which each gran-ule scatters radiation like a small lens, the parameter f is the focal length of these lenses

$$f \approx \frac{r}{1-n}, \quad (10)$$

Where r is the radius of the lens, i.e. the radius of the scattering powder granule, which can be considered spherical.

5. Iron Powder as A Neutrino Flux Diffuser

To carry out further assessments, we will need data on the basic properties of iron:
$R_a F_e \approx 1.2 \cdot 10^{-8}$cm, is the radius of atomic shells,
$N_{Fe} = 8.5 \cdot 10^{22}$ atom/cm^3 is the density of atoms,
$Z = 26$ is the charge number.
Hence, the diamagnetic susceptibility of the electron shells of iron atoms is Equation:

$$\chi_{Fe} \approx -1.5 \cdot 10^{-5}. \quad (11)$$

That is, the refractive index of iron for neutrinos should differ from the vacuum by a small amount

$$1 - n_{Fe} \approx 10^{-4}. \quad (12)$$

If we use iron powder with a granule size of $r \approx 4 \cdot 10^{-2}$cm (40 Mesh), then scattering of neutrinos on a powder layer with a thickness of $L \approx 5$cm should lead to a decrease in their flux:

$$\left[\frac{L}{f}\right]_{Fe} \approx 10^{-2}. \quad (13)$$

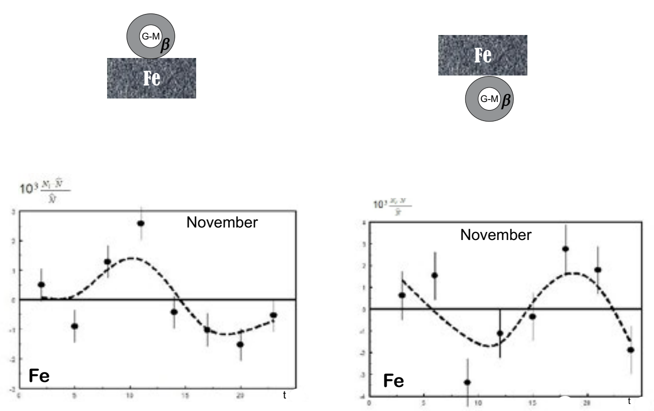

Figure 2: The daily course of changes in the effect of the iron powder screen on the beta decay rate.

On the left, the powder screen is placed under the Geiger-Muller counter. On the right - the screen is located above the counter. The graph shows the time in hours along the abscissa axis, and the relative deviation of the measured value multiplied by 10^3 along the ordinate axis. N_i is the result of a separate measurement, $\widehat{N}$ is the averaged account per the entire measurement cycle.

The measurement result can be considered consistent with a rough estimate (Equation 13) and the assumption that the source of cosmic neutrinos may be the black hole SagA*.

5.1. Measurement Results of Neutrino Passage Through Iron Powder

Measurements of the effect of the iron powder screen on the beta decay rate were carried out in two positions.

In the first position (as shown in the upper part of Figure 2 on the left), the powder screen was placed from below, and on top of it was a Geiger-Muller counter (indicated in Figure.2 as G-M) with a beta source.

In another position (as shown in the upper part of Figure 2 on the right), the powder screen was placed above the Geiger-Muller counter.

The measurements were carried out in November-December, when the Sun passes from the constellation of Scorpio to the constellation of Sagittarius for an earthly observer. At this time, the neutrino flux, if it comes from the center of the Galaxy, falls on the Earth laboratory from above during the day, and at night, passing through the Earth, from below.
Since the rate of beta decay is determined by the magnitude of the neutrino flux incident on this beta source, we should expect a change in this rate during the day.

Experience has shown that the maximum decay rate is observed in the left position (Figure 2) during the day, and in the right position at night.

This is the result of the powder screen attenuating the neutrino flux passing through it.
The obtained approximate estimate of the decrease in the beta decay rate by the iron shield (Equation.13) can be considered correct because it is consistent with the measured value.

The specificity of the detected change in the beta decay rate day and night (Figure 2) can be explained if we assume that the source of cosmic neutrinos is located in the center of our Galaxy.

5.2. Neutrinos in Cement Powder

In addition to measuring the effect of the iron powder screen on beta decay, similar measurements were carried out with the dry cement powder screen. This choice was due to a hope to create a more efficient screen as grains of cement powder are much smaller than the grains of iron powder and a larger volume of cement is available.

Measurements showed that the screen made of cement powder had only about twice as strong an effect on the beta source as the screen made of iron powder, despite the fact that the thickness of the cement screen was almost an order of magnitude larger than iron (Figure 3).

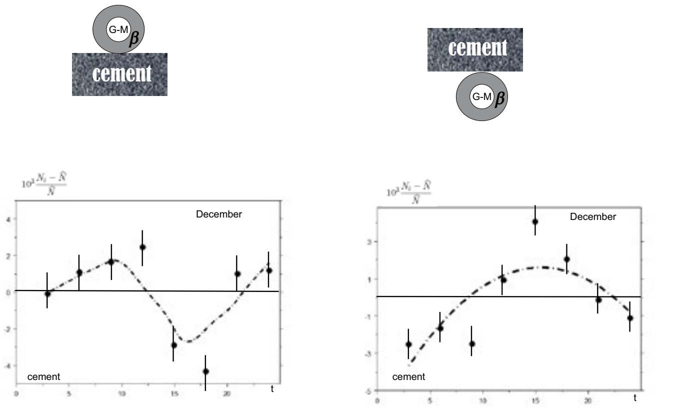

Figure 3: The results of measuring the effect of dry cement powder on the rate of beta decay.

6. Conclusion

The great physicists of the last century actively argued about whether radioactive decay is accidental or not. Now this discussion can be considered to have ended unexpectedly because all were right.

In this dispute, the opinion of the physical community leaned towards the rightness of the supporters of the randomness of decay after the work of G. Gamov, who created the quantum mechanical theory of alpha decay.

However, in our century, E. Falkenberg showed that the rate of beta decay is influenced by the flux of solar neutrinos [1].

From the experiments at the reactor, in which measurement conditions were controlled, it was concluded that beta decay is a forced phenomenon [4].

That is, beta decay has a reason, which A. Einstein was sure of. It turns out that beta decay is caused by the action of a neutrino flux. At the same time, as it follows from E. Falkenberg's measurements, the main neutrino flux falling on Earth is created by a source located outside the Solar System. The method of scattering neutrinos by a fine-grained screen described in this paper allows us to approximately find the direction to the main source of neutrinos falling on the Earth. Based on the obtained measurement data, it can be assumed that this source may be located in the center of our Galaxy.

References

1. Falkenberg, E. D. (2001). Radioactive decay caused by neutrinos. *Apeiron, 8*(2), 32-45.
2. Jenkins, J. H., Fischbach, E., Buncher, J. B., Gruenwald, J. T., Krause, D. E., & Mattes, J. J. (2009). Evidence of correlations between nuclear decay rates and Earth–Sun distance. *Astroparticle Physics, 32*(1), 42-46.
3. Parkhomov, A. G. (2010). Researches of alpha and beta radioactivity at long-term observations. *arXiv preprint arXiv:1004.1761.*
4. Vasiliev, B. V. (2020). Effect of reactor neutrinos on beta-decay. *Journal of Modern Physics, 11*(01), 91.
5. Giunti, C., & Kim, C. W. (2007). *Fundamentals of neutrino physics and astrophysics*. Oxford university press.
6. Vasiliev, B. V. (2021). What Neutrino Reaction Has a Large Cross-Section. *Advances in Theoretical and Computational Physics, 4*(2), 121-128.
7. Vasiliev, B. V. (2022). Is neutrino lensing possible. *Adv Theo Comp Phy, 5* (4), 629, 636.
8. Vasiliev, B. V. (2017). Neutrino as Specific Magnetic Gamma-Quantum. *Journal of Modern Physics, 8,* 338-348.
9. Ya. I. Frenkel', *Electrodynamics* [in Russian], Vol. 2, ONTI, Moscow-Leningrad, 1935.