CREATION AND TESTING OF A FOUR-CHANNEL INSTALLATION FOR TESTING AT A MODERN EXPERIMENTAL LEVEL OF DISCUSSION KOZYREV ASTRONOMICAL OBSERVATIONS

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Abstract. **The work is devoted to the design, the development of a measurement technique and testing of a four-channel experimental setup for verifying the results of N.A. Kozyrev's controversial astronomical observations. It was shown that the parameters of the installation make it possible to exceed the accuracy of measurements carried out earlier by N.A. Kozyrev, and get reliable data on the existence or absence of "Kozyrev radiation".**

Keywords: **"Kozyrev radiation", non-electromagnetic properties of optical radiation, thermal conductivity, relic radiation, Wheatstone bridge**

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Contents

1. INTRODUCTION

In 1976, at the symposium in Byurakan (Armenia), Nikolay A. Kozyrev reported on the opening a new type of penetrating radiation, which he detected when scanning a celestial sphere with a telescope-reflector, closed with an impenetrable cover – the so-called "Kozyrev's radiation." The "Kozyrev radiation" sensor was a thin-film resistor located in the focal plane of the telescope and included in the shoulder of a balanced Wheatstone bridge connected to a galvanometer [1, 2]. N.A. Kozyrev found that when the telescope was pointing at certain astronomical objects (stars, star clusters, galaxies) or on their surroundings, the resistance of the resistor changed and the Wheatstone bridge became unbalanced. He was investigated more than 30 astronomical objects, which were causing the appearance of signals on the galvanometer. At the time of recording signals, the orientation of the telescope sometimes strictly coincide, but more often did not coincide with the direction on the astronomical objects visible in the telescope. The results Kozyrev's astronomical observations caused an ambiguous and rather skeptical reaction of the scientific community, although as time went on, publications appeared that confirmed experimentally the stated effect [3-5, 9-11].

N.A. Kozyrev believed that the results of his astronomical observations confirm the "causal or asymmetric mechanics" he created in 1958. The theoretical model proposed by NA. Kozyrev, did not receive the recognition of the scientific community. In 1960, under the Bureau of the Department of Physical and Mathematical Sciences of the USSR Academy of Sciences, a commission was set up under the chairmanship of Corresponding Member USSR Academy of Sciences AA Mikhailov on the verification of "causal mechanics" NA Kozyrev. It consisted of nine people, divided into subgroups, engaged in verification in three areas: theory, experiment, the problem of asymmetry of the planets. In the studies that lasted about six months, NA Kozyrev himself participated, as well as a number of other specialists. The results were announced on June 15, 1960. The general conclusions were as follows [12]:

a) the theory is not based on a clearly formulated axiomatics, its conclusions are not developed quite strictly by a logical or mathematical method;

b) the quality and accuracy of the laboratory experiments do not make it possible to draw definite conclusions about the nature of the observed effects; in the experiments, various side effects have not been sufficiently eliminated.

In the opinion of Academician A.M. Cherepashchuk, director of the State Astronomical Institute named after PK Shternberg, at the present time NA Kozyrev's theory is rejected by the overwhelming majority of physicists and astronomers in view of the complete unreasonableness [13]. Thus, the verification of the results of his experiments, carried out at his own request by two commissions of the Academic Council of the Pulkovo Observatory in 1960 and 1967, showed that the effects observed by him are at the limit of measurement accuracy and are not convincing. Nevertheless, the question of the existence of a "Kozyrev radiation" is still open, as and the problem of creating a theory explaining this effect.

The original explanation of the observed effect was suggested by AG. Parkhomov in his work in [5]. He put forward the hypothesis that the effects found in NA Kozyrev's experiments are related to gravitational focusing by astronomical objects of some cosmic radiation or a stream of particles. It allows us to explain the phenomenon "Kozyrev radiation" without the assumption of instantaneous or superluminal information transfer speed in space.

We note that the assumption of the existence of particles moving at a speed of several hundred kilometers per second and relatively weakly interacting with thin layers of metal and dielectrics (the telescope cover) [5] correlates well with the conclusions of the five-dimensional theoretical model of the expanded space (ESM) that developing since 1999 by D.Yu. Tsipenyuk and V.A. Andreev [6-8]. In accordance with this model in the five-dimensional space $(1 + 4)D$, in which the interval S is considered as the fifth coordinate (the physical meaning of the fifth coordinate is the action), massless photons can acquire mass in an external field and become carriers of new fields - one vector and one scalar in addition to the electromagnetic field. According to the ESM, photons can acquire non-electromagnetic properties reversibly upon entering in external field [7].

As for the possibility of organizing an experiment to test the Kozyrev effect, it is described in sufficient detail, for example, in [2, 3, 5] and can be repeated at the modern level with the aid of a telescope-reflector.

Having carried out a series of verification experiments on registration the unusual Kozyrev effect, it is possible, in case of confirmation of this phenomenon, to obtain a new object for a large-scale space exploration, comparable in importance to the relic radiation. In this case, the agenda will be the question of mapping the distribution of a new type of cosmic radiation in the entire space sphere with the help of ground-based instruments and, subsequently, space observatories.

2. DESCRIPTION OF THE DESIGN AND TECHNIQUE OF MEASUREMENTS IN ORIGINAL AND FOLLOWING EXPERIMENTS ON OBSERVATION OF "KOZYREV RADIATION"

In the original experiments conducted by NA. Kozyrev [1], a 50-dm telescope-reflector of the Crimean Astrophysical Observatory was used for observation. In subsequent works conducted under the guidance of Academician Lavrent'ev [9], a telescope with a significantly smaller diameter was used: "For the observation ... the telescope" MITTAR "TAL-1 (the diameter of the main mirror 110 mm) was sufficient." A.G. Parkhomov in his experiments used a telescope with a mirror diameter of about 22 cm [4, 5].

Kozyrev requirements to the simplest and most reliable sensor are formulated by him as follows: "The sensor itself should register only differential changes in its working element as compared to elements protected from the process being studied. Under this condition, the effect of the background, that is, the action of the set of surrounding processes, is largely excluded. In this sense, a sensor that is based on a change in the electrical conductivity of a resistor inserted into the Wheatstone bridge is particularly convenient and sensitive enough. The Wheatstone bridge was built on the basis of metal-film resistors of the OMLT-0.125 type with resistances of 5.6 kΩ having a positive temperature coefficient of 0.0015 (1/K). The value of the resistance of the resistors was chosen close to the internal resistance of the galvanometer (device type M-95, accuracy class 1.5), equal to 5 kOhm. The value of the galvanometer division was $2 \cdot 10^{-9}$A. A stabilized voltage of 30 V was supplied from the constant-current source to the Wheatstone bridge. To balance the bridge's shoulders at the input, a resistors store was connected from the power source side. Due to this, it was possible to estimate the galvanometer dial in the values of the resistance changes: to one division of the galvanometer corresponded a change of $1.1 \cdot 10^{-2}$ Ohm, which is $2.7 \cdot 10^{-6}$ relative change" [1].

Kozyrev observations were carried out in the focus Nesmit-Cassegrain of reflector, where the spectrograph slit with sight device was located. "... The scale on the gap was 8" in mm. From the spectrograph has been left only a bronze casing, closed on butt end by thick cardboard. The bridge resistors were mounted on a cardboard base fixed in a closed aluminum cylinder inserted inside the casing behind the slot device. The measurement procedure consisted in directing the telescope to the star under study, after which a multiple scanning of the sky around the star was carried out. After visual guidance on a star, the inlet was closed by light-tight aluminum cover thickness of about 1.5 mm. The magnitude of the measured effect was registered by the operator visually by the deflection of the galvanometer arrow with simultaneous registration of the coordinates of the section of the sky on which the telescope is aimed" [1].

A similar scheme and measurement technique was used by the authors, who later verified Kozyrev's experiments [3-5, 9-12]. We should especially note a large series of papers published in the journal DAN by a group led by Academician M.M. Lavrent'ev [3, 9, 10, 11].

In addition to the Wheatstone bridge, the authors of [3-5, 9-12] investigated the possibility of using for registration of "Kozyrev radiation" and other sensors based on a wide variety of physical and even biological processes for recording. However, this part of the researches, in our opinion, can be considered only after the "Kozyrev radiation" will be authentically and reliably fixed using the simplest, and therefore the most reliably studied and easily controlled sensor applied by NA. Kozyrev – by Wheatstone bridge.

3. DESCRIPTION OF INSTALLATION DESIGN AND MEASUREMENT TECHNIQUES

To carry out experiments on the detection of "Kozyrev radiation," we designed and manufactured a set of equipment containing two identical sensor heads fixed on a telescope (**Fig. 1**), as well as a board with the necessary measuring instruments connected by cables with earthed screens. The only difference between the sensor heads is that the measuring head is installed in the focus of the telescope's output eyepiece, and the control head can be fixed at a distance of 10 to 50 cm from the measuring head.

Analysis of the description of Kozyrev and his followers experiments makes it possible to assume that the imbalance of the Wheatstone bridge when the telescope was aimed at the astronomical object occurred due to a decrease in the thermal conductivity coefficient, both the material of the sensor resistor itself and of the ambient air. As a result, the temperature of the resistor increased, which was recorded during the measurements. To test this hypothesis, we added a temperature sensor, based on a platinum resistance thermometer, to each sensor head in addition to the Wheatstone bridge resistor.

This four-channel experiment schema allows us to monitor the noises of various nature present in the area of the installation and to select only those signals that are associated with the expected impact of "Kozyrev radiation" to the sensors.

The body of the sensor head (**Fig. 2**) was made of sheet polymethylmethacrylate. Inside, a Wheatstone bridge sensor resistor and a resistance thermometer were placed. The remaining resistors of the Wheatstone bridge were placed inside their own casing, spaced from the sensor head by a distance of about 40 cm.

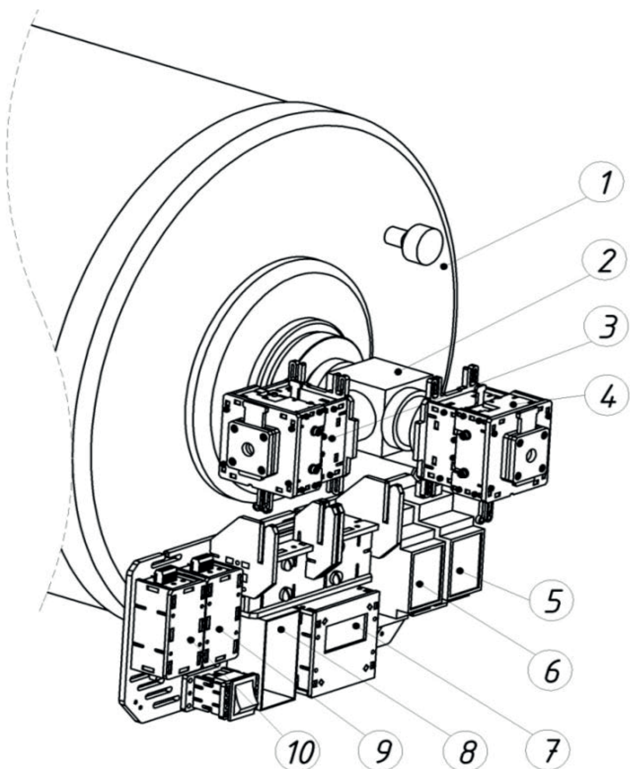

Fig. 1. *Appearance of the device mounted on the Meade telescope: 1 – telescope; 2 – node of the elevating diagonal mirror; 3 – control sensor head; 4 – working sensor head; 5 – working channel voltmeter; 6 – the voltmeter of the control channel; 7 – two-channel temperature control device; 8 – power element; 9 – working bridge casing; 10 – the casing of the control bridge.*

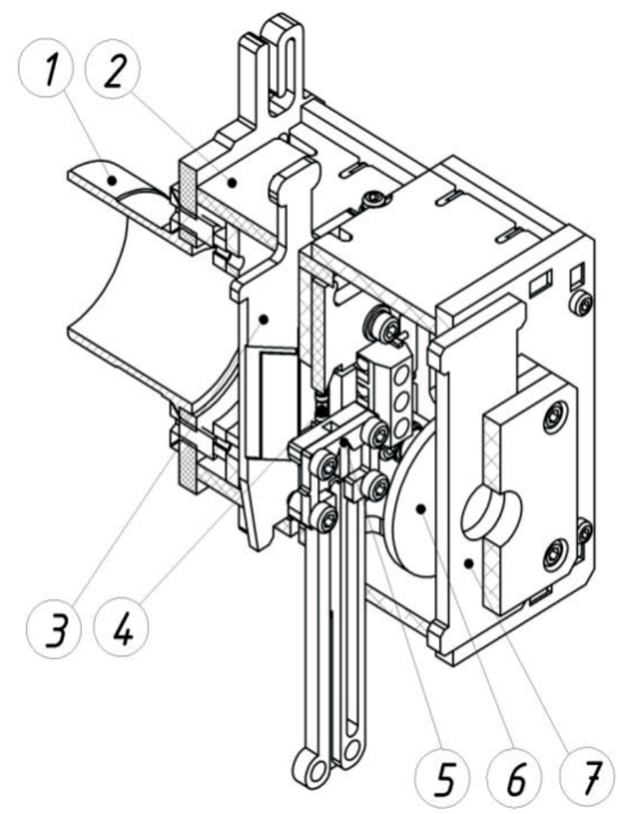

Fig. 2. *Sensor head device (cut): 1 – landing bush 1.25", 2 – sensor head corpus, 3 – replaceable slit, 4 – sensor resistor, 5 – platinum thermometer mounting, 6 – eyepiece, 7 – eyepiece blind.*

The unbalance of the bridge was registered using the digital millivoltmeter AME-1102 manufactured by Aktakom, which was connected to the laptop via a USB interface. The resistance thermometer Pt1000 was connected to the two-channel temperature controller DX5100 manufactured by RMT company, connected to the laptop via the RS-485 interface. The temperature controller DX5100 is an industrial sample used, for example, to maintain the temperature in a nonlinear crystal with an accuracy of at least 0.01°C. The DX5100 system with a Pt1000 resistance thermometer is calibrated during manufacture and has a built-in mechanism of calibration, that allows measuring the temperature with an accuracy of 0.005°C. The values of the unbalance voltage of the Wheatstone bridge and the temperature value obtained from the operating and control sensor heads, were recorded synchronously into one data array using specially designed software.

From the point of view of the maximum use of the measurement range of the digital millivoltmeter AME-1102, the most convenient resistance nominals for resistors used in the bridges of our installation are about 1 kΩ. Wheatstone bridges were made of metal oxide film resistors of type C2.23 with a rated power of 0.25 W with a temperature coefficient of resistance of $0.1 \cdot 10^{-3}$ (1/K). The spread of resistance values of resistors from 985 to 1007 Ohm made it possible to obtain voltage on the measuring diagonal of the Wheatstone bridge from 20 to 180 mV when applying voltage from 8 to 20V on the diagonal of supply from the DC power supply unit B5-30.

Following the description of the experiment given by NA Kozyrev [1], the sensor resistor was fixed so that its cylindrical surface touched the meridian plane of the telescope's optical system. The slit in front of the resistor was made up of two steel plates 0.5 mm thick and was replaceable from 0.3 to 2.0 mm. The coincidence of the focal plane of the main mirror of the telescope with the plane of the resistor was controlled visually by means of the eyepiece built into the body of the head. To screen the resistor from the focused parasitic light during the measurement, the eyepiece was closed by a movable blind. The platinum resistance thermometer Pt1000 was mounted on a copper foil plate with an area of 1 cm^2 and was shifted from the optical axis by 1 cm. The placement of the control head on the second exit of nodule of the telescope lifting mirror assembly made it possible to equalize the air temperature in the volumes of the sensor heads.

The general scheme of the experimental setup is shown in **Fig. 3**.

4. TESTING OF INSTALLATION PARAMETERS

Within the experimental study of the response time, sensitivity and intrinsic noises of the installation, we conducted more than 30 measurement series, as in laboratory conditions, so and in the case of installation of equipment on two telescopes-reflectors Meade LX-200-ACF with the diameters of the main mirror 14"

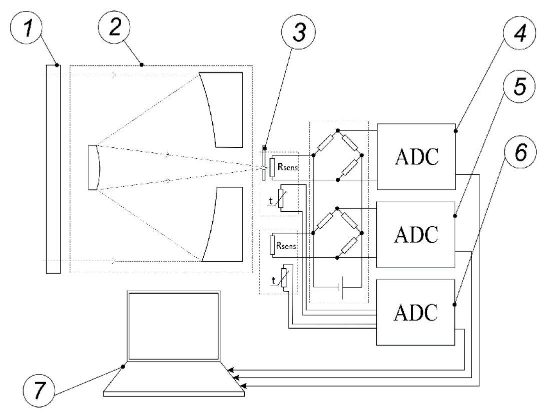

Fig. 3. *Basic diagram of the experiment: 1 – opaque screen; 2 – telescope; 3 – slit; 4 – measuring channel; 5 – control channel; 6 – temperature channel; 7 – computer. Scheme of measuring four-channel installation consisting of identical measuring and control channels mounted in two identical sensor heads. Each channel consists of two sensors - a Wheatstone bridge based on metal oxide film resistors such as C2.23 and resistance thermometers based on the Pt1000 platinum resistor. The digital millivoltmeters AME-1102 measured the mismatch voltage by R_{sensor}; Two-channel temperature controller DX5100 measured data from Pt1000.*

and 16". The total data accumulation time in the various series of measurements was usually from 40 to 480 minutes. The operating frequency of the measuring channels was about 3 Hz.

Experiments to measure the response time of the installation to an external action (blowing the head with a hot or cold gas flow for 1 s) showed that the reaction time is of the order of 0.2-0.3 s in all four channels. The relaxation time after the impact on the sensors based on the Wheatstone bridge was 25-30 seconds. For sensors based on the Pt1000 platinum resistance thermometer, the relaxation time is much longer – about 230-250 s. The difference in the relaxation time of the sensors based on the Wheatstone bridge and the Pt1000 resistance thermometer is caused, apparently, by the difference in thermal energy, which is scattered by the sensors per unit time.

An experimental determination of the sensitivity of sensors based on Wheatstone bridges was carried out with a slow heating of a closed volume into which both measuring heads were placed. The obtained graphs of depending of the bridge imbalance voltage and the current temperature inside the head from time allowed estimating the accuracy of the temperature measurement with the help of Wheatstone bridges in 0.01 *C*, while the error of measuring the imbalance voltage of the Wheatstone bridges was less than 1 mV.

As an example of test measurements of astronomical objects in **Fig. 4** the data received on February 9, 2016 when the Wheatstone bridge was installed on a telescope-reflector Meade LX-200-ACF with a mirror diameter of 14"are given.

The measurement frequency was about 1 Hz, each counting is the arithmetic mean of 100 measurements of the misalignment signal. Fig. 4 shows both the data of the Wheatstone bridge misalignment signal (left scale) and the measured rms deviation of each counting for 100 measurements (right scale). The amplitude of the change in the misalignment signal during the test tests was from 0.023 to 0.025 V, and the measured rms deviation of each measurement was about 0.001 V.

The telescope is located in the Moscow region in a rotating automated dome with heating and

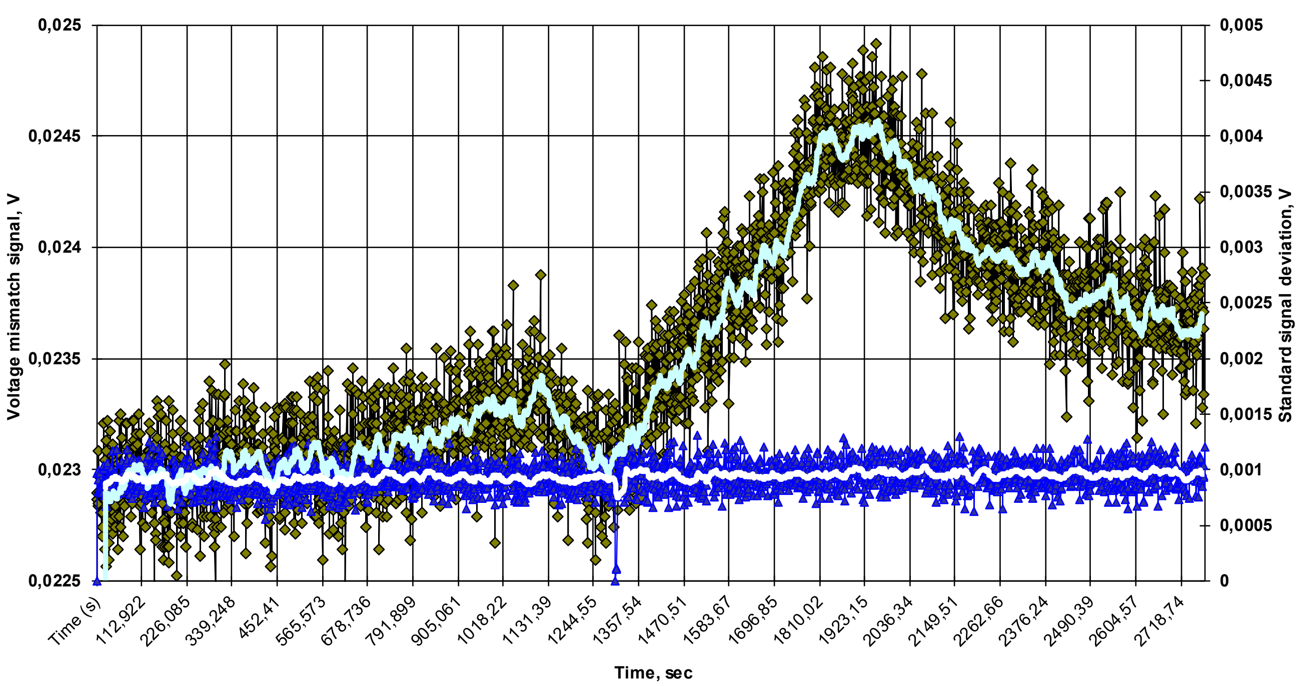

Fig. 4. *Test measurements on a telescope reflector Meade LX-200-ACF 14". 02/09/2016 - Set of backgrounds up to 1300 sec. -The telescope is closed by cover and directed along the horizon. From 1300 to 2700 seconds the measurement of the Wheatstone bridge mismatch signal. Telescope cover removed and telescope direxted per star.*

power supply built especially for astronomical observations.

The time of the experiments from 11.00 to 12.00 Moscow time. The weather conditions at the site of the experiments on 09.11.2016 were as follows: air temperature –3°*C*, wind 2 m/s, cloudy, humidity 81%, pressure 748 mm Hg.

After installing the equipment on the telescope at 11.15 the installation was switched on and warmed up. The measurements were started in 11.32. The total time of the test measurements was 2700 s.

At first the telescope for 1300 s was oriented along the horizon line and directed to the dome wall, with a standard aluminum cover 1.5 mm thick on the telescope. From 1300 to 2700 s the telescope was aimed at the star Alpha Ursa Major Dubhe (Dubhe α UMa) with the dome open and the lid removed. For observation, a region was chosen in the vicinity of this star, since it was indicated in the works of NA Kozyrev, as one of the objects of observation, in the study of which a positive result was obtained.

By directing the telescope to the star region, we performed various manipulations with the focusing of telescope on the star, and also scanned 2 minutes of the region 5 degrees "to" the star and 5 degrees "after" the star.

As can be seen from Fig. 4, a statistically significant increase in the misalignment of the Wheatstone bridge signal was recorded when the telescope was pointed at the Dubhe star from 1300 to 2700 seconds, compared to the control set of background from 0 to 1300 seconds of measurement.

5. CONCLUSIONS

A compact four-channel installation has been created and tested in laboratory and field conditions, allowing at the present level to carry out research to verify the discussion NA Kozyrev experiments. The results of the test tests of the installation allow improving the accuracy of measurements and planning the experimental procedure for obtaining reliable results. The design of the device allows us to verify the authors' assumption that the effect of "Kozyrev radiation" leads to a decrease in the thermal conductivity coefficient of the material, from which comprises the resistor, and of its surrounding air, as a result the temperature in the measuring channel of the Wheatstone bridge increases as compared to the control channel.

In the case of obtaining positive experimental results of registration of "Kozyrev radiation" on the agenda will be the task of continuous scanning the firmament for create a star map of "Kozyrev's radiation" similarly to how the discovery of relic radiation led to large-scale experiments on mapping the cosmic relic radiation of the universe.

After working out the experimental technique at the modern level and creating of basic experimental set including special software, it is possible to set the task of realizing the massive project "Creation by the joint forces of amateur astronomers and professional laboratories of Kozyrev's radiation star.

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