Appendix A. Astronomical Observations of the Physical Properties of Time

> The experiments showed that the laws of geometric optics and, in particular, the law of reflection are also valid for time.
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> *N.A. Kozyrev. In the collection: The manifestation of cosmic factors on Earth and stars. M – L, 1980, p. 86.*

In this appendix, the content of one of the two fundamental works of N. A. Kozyrev, published shortly before his death, which followed on February 27, 1983, is set out in sufficient detail [1, 2]. The experiments showed that the laws of geometric optics, and, in particular, the law of reflection, are also valid for time. These articles are small in volume, but in content they are a concentrate of completely new ideas for the perception of modern man. Therefore, they have not yet found recognition in official science.Moreover, these two works were not even included in the collected works of N.A. Kozyreva, published by his like-minded people in 1991. The formal reason that two small works (totaling 16 pages) did not find a place in a 445-page book was a link to a lack of space. In fact, the novelty of the ideas made them simply invisible even to those who have a positive attitude to Kozyrev’s basic concept that time has energy, and this energy nourishes everything that exists in the Universe.

Two works by Kozyrev, in one of which [1] sets out in detail the methodology for observing the present, past and future positions — astronomical objects: stars, globular star clusters, another galaxy, and the other [2] gives a theoretical explanation of the results — published in the collection “ “Manifestation of cosmic factors on Earth and stars” published by the Main Astronomical Observatory of the USSR Academy of Sciences (Pulkovo Observatory) in 1980. However, the circulation of this collection of 2,000 copies was almost completely destroyed by order of the academician-secretary of the Department of Physics and Astronomy of the USSR Academy of Sciences, since, in his opinion, it contained articles that did not correspond to the direction of modern science. Nevertheless, a small part of the print run, at your own peril and risk, was retained by the editor of this collection, researcher at the Pulkovo Observatory, candidate of physical and mathematical sciences Anatoly Aleksandrovich Efremov. For this they tried to fire him. And no matter how events unfold, a small number of collections in which two of Kozyrev’s works are published, one of which was written together with one of the few people who shared the ideas of Kozyrev during his lifetime, Viktor Nasonov, has been preserved. So, you can continue these studies.

Here is a brief summary, as well as specific calculations and a data table taken from an article by N.A. Kozyreva and V.V. Nasonova [1]. In the annotation to it, Kozyrev gives a brief summary of the purpose and methodology of the research conducted by the authors. “These observations were made at the 50-d reflector of the Crimean Astrophysical Observatory using the physical properties of time ... Some stars, the galaxy M31 (Andromeda nebula) and globular clusters M2 and M13 were observed. The observations consisted in measuring with a micrometer of a guide the positions of the places of the sky, which caused a change in the electrical conductivity of the resistor in the vicinity of these objects. t turned out that these changes arise from three points of the sky: 1) the position of the object at the moment, 2) the position in the past, accurate to refraction, coinciding with its visible image, and 3) the position in the future that the object will occupy when to it a signal from the Earth would come at the speed of light. Another, already physical property of time showed the features of the action on the resistor of extended objects M31 and M2. Contrary to the photometric profile, in the center of these objects, a decrease in their effect on the resistor is obtained. Most likely, this effect occurs with a large stellar population due to the interaction of time with the matter of stars and the processes occurring there.” The following is a detailed description of the sensor in some receiving system, capable of detecting the instantaneous transmission of the effect of a space object on the state of matter, as well as a description of the receiving system.

“Such a system is the Wheatstone bridge, built on 5 kΩ resistors of the OMLT–0.125 type. A change in the electrical conductivity of one of them (the sensor) disturbed the equilibrium of the bridge, which was recorded by a galvanometer with a division value of 2×10^{-9} A. This working resistor was located behind a slit 0.25 mm wide = 2,″0, located in the focal plane of the telescope.On the mirror cheeks of the slit, it was possible to see the image of a star and fix its position relative to the slit using a telescope guide micrometer. One division of this micrometer in the focal plane of the telescope corresponded to 1,″35. This technique was used without significant changes in the observations of 1978, carried out in the spring, from April 7 to 25, and in the fall, from October 29 to November 13. Only during the fall observations were some improvements to the bridge system made. The bridge resistors, taken with a large positive temperature coefficient, were well selected for the resistances and values of this coefficient. The system turned out to be well stabilized, which made it possible to remove aluminum plates from the circuit, which were introduced earlier to increase its stability, and increase the voltage in the bridge from 30 to 60 volts. As a result, the sensitivity of the system turned out to be increased by almost an order of magnitude. Only in individual cases of increased instability did one have to return to these plates again."

Observations made by Kozyrev earlier showed that the resistor fixes not only the true position of the star at the time of observation, but also its visible position, i.e., the position in the past when the light came out of it, reaching the observer at the moment when he looks at this a star. Then Kozyrev goes on. Intuition tells him that if from the Earth you can see the present and past of a star, then it is just as possible to observe its position in the future. And he intends to find the position of the star in the future at a distance equal to the observed gap between the visible and true positions. In this case, the future image of the star should be on the continuation of the visible trajectory of its movement forward, into the future. Theoretical explanations of this assumption by Kozyrev, made by himself, are given in Appendix 2. Here we are talking about the observational side of things.

Kozyrev observed only those stars for which the distance from the Earth is known. Otherwise, it would be impossible to calculate the path of the star along its trajectory during the passage of the light signal from it, reaching the observer at the moment when he looked at her. Distances to relatively close stars astronomers are measured by the method of *trigonometric parallax*. Parallax of a π star is the angle at which the average radius of the Earth's orbit could be seen from the star (assuming that this radius is perpendicular to the line of sight). Since the stars, even the closest, are very far from us, even for the closest star, this angle is less than a second of arc.

To better imagine this angle, we can give the following example: the angular second (1″) corresponds to the length of a pencil viewed with the naked eye from a distance of 1.5 km. The distance to the Proxima star closest to the Earth (closest) from the constellation Centaurus is such that the light passes through it for 4 years, 3 months and 20 days. Parallax π is a very convenient measure of the distance D, since it is related to it by the relation

$$D = 1/\sin \pi,$$

where the distance D is expressed in astronomical units. An astronomical unit is a measure in astronomy equal to the average distance from the Earth to the Sun and amounts to 149.5 million km. Since the angle π for stars is always small, in the calculations sin π is replaced by π. Parallax stars are measured by observing it for a year. During this cycle, stars close to the Earth draw ellipses in the sky called parallactic, in contrast to distant stars whose positions in the sky for this period for the observer remain unchanged. The large axis of each parallactic ellipse is always parallel to the plane of the Earth's orbit (ecliptic plane), and its magnitude depends on the distance from the star (the smaller the distance, the larger the axis); the magnitude of the minor axis depends on the astronomical latitude of the star, equal to the angular distance of the star from the plane of the Earth's orbit. So, for nearby stars, the distance can be found by determining its parallax by observation, which can be done by comparing its two positions in the sky, separated by a time period equal to half a year.

Since the stars move in the galaxy in their galactic orbits, their motion is visible in the form of movements in the celestial sphere, called the proper motion of the stars. The proper motion μ is the projection of the total spatial velocity of a star on a plane tangent to the celestial sphere, expressed in seconds of arc per year. Own movements of the stars were discovered in 1718 by Halley, when he compared the current positions of some bright stars to him with their coordinates in the Ptolemy catalog. Own movements of stars are invisible to the eye; the familiar form of constellations changes only for tens of thousands of years. But the stars in the galaxy rotate at different speeds, depending on their location, therefore, along with the movement in the celestial sphere, they also move relative to each other along the line of sight, i.e., they either approach the solar system or move away from it — they have radial motion. Thus, the complete motion of a star is made up of its motion along the sphere (tangential) and motion along the radius of the sphere (radial). Accordingly, stars have a tangential (tangent) velocity V_t and a radial (radial) velocity V_r. The latter range from tens to hundreds of km/s. The tangential velocity, an idea of which you must have in order to understand the essence of Kozyrev's astronomical observations, is the star's own motion, expressed, like radial velocity, in km/s. It can be obtained by knowing the distance to the star D and its parallax π.

In addition to parallactic displacement, all stars also make an aberrational motion, an idea of which you also need to have in order to understand the essence of experiments. The aberration ellipses described by the stars all have a large axis equal to 41″, and the magnitudes of their minor axes depend on the astronomical latitude of the star. Aberrational displacement is the result of adding the speed of the Earth's orbit around the Sun (an average of 29.8 km/s) with the speed of light propagation (300,000 km / s). Simply put, the aberration is caused by the fact that the Earth has time to move forward from the place in orbit for the time until it reaches a ray of light that left the star at the time of observation. At each given moment, the star shifts in the direction of the Earth’s movement to the so-called apex, i.e., to the point in the sky where the Earth’s movement is directed. The apex of the Earth's annual motion is always located in the plane of its orbit at a right angle to the Sun to the west of it, i.e., 90^o to the right of the visible disk of the Sun.

Now, knowing the necessary information from astronomy, we quote the article. “With the known proper motion of the star μ and parallax π, the tangential velocity can be calculated

$$V_t = 4{,}74\ \mu/\pi,$$

which determines from the position of the Sun a shift in the apparent position of the star relative to the true

$$\Delta_1\alpha_\odot = V_t(t/R) = V_t/c,$$

where t is the time during which the light travels the distance R from the star to the Sun. Expressing the offset in seconds of the arc, from these formulas we find

$$\Delta_1\alpha_\odot = 2/3\ V_t = 3{,}16\ \mu/\pi.$$

To calculate the displacement observed from the Earth, it is necessary to take into account the aberration

$$\Delta_1\alpha = \Delta_1\alpha_\odot + A.$$

The value of A in this expression is the aberration taken with the opposite sign, that is, the difference between the average and visible, shifted due to aberration, the star’s location” [1].

These formulas are obvious. Indeed, knowing the location of an object, its speed V and direction of movement, we can always find out where it will be located after a period of time t, i.e., find the distance R using the simple formula $R = Vt$. The main question arises: what is the time interval t? Kozyrev answers him: t - this is the time during which the light (photon) reaches the Earth that left the star at the moment we looked at it. Photons fly at the speed of light c = 300,000 km/s, hence $t = R/c$. In other words, during the time that light flies from the star to the Earth, it will move to another place. Both formulas for $\Delta1\alpha/$ result in an offset calculated for an observer on the sun. And in order to move to a frame of reference connected with the Earth, one must also take into account the correction for aberration. The last formula, which includes aberration A, makes it possible to calculate the displacement of a star observed from the Earth.

The following is a summary of the table from the aforementioned collection. The first column shows the observed stars with the Latin names of the corresponding constellations. The second column gives, taken from the directories, the parallax values π for these stars, expressed in arc seconds. The third column also shows the values of the proper motions of the stars taken from the directories, where the sign depends on whether the component of the spatial velocity of the star is directed clockwise or counterclockwise. The fourth column contains the values of the displacements of the stars calculated by Kozyrev, which make it possible to find their true positions relative to the Sun, the fifth contains the values of the aberration correction taken from the reference books, and the sixth contains the displacements that allow them to find their true positions already from the Earth. The seventh column contains the values of the displacements of the true positions of the stars relative to the visible ones that Kozyrev observed on those nights, the dates of which are indicated in the ninth column. The eighth column shows the results of Kozyrev's observations of future positions of stars! According to his assumption, along with the true one, one can also observe the position of the object corresponding to that place in the sky where the ray of light emitted by the star at the moment of observation will fall after it reaches the Earth and is reflected from it!

The table shows a good agreement between the calculated results and those obtained by measurement. Indeed, with a good degree of accuracy, three images of a star — the past, present, and future — are located in the sky along the direction of its movement in the celestial sphere. Moreover, the images of the star in the past and the future are symmetrical with respect to its image in the present, which is shown in the table: the measurements of the 8th column are approximately 2 times larger than the results of the 7th column. as required to install!

“When observing the future, the speed of light c and, therefore, aberration should have the opposite sign to the usual one. Therefore, aberration does not break symmetry with respect to the position of the star in the present, and the condition of double displacement with respect to the apparent position of the star is preserved".

This phrase should be commented. Its meaning is that for Kozyrev the propagation of the radiation, which he called time, in the direction from the future to the past is a very real fact, so that he confidently considers the aberration, which takes place at the same time, to be a negative value. In chapter 3 of this book, as well as in Appendix D, it is described in detail what the negative speed of light is and how it is associated with the world through the looking glass. Light and, therefore, aberration should have the opposite sign to the usual one. Therefore, aberration does not break symmetry with respect to the position of the star in the present, and the condition of double displacement with respect to the apparent position of the star is preserved.

Table 1. Time Properties

Star	**π''**	**μ''**	**$\Delta\alpha''_{/}$**	**A**	**$\Delta\alpha''_c$**	**$\Delta_1\alpha''_{ob}$**	**$\Delta_1\alpha''_{ob}$**
10 UMa	0.071 ± 5	–0,436	–20	–9	–29 ± 1	–28	–57
α Leo	0.039 ± 7	–0,248	–20	–12 –4	–32 ± 4 –24 ± 4	–35 –26	–70 –50
γ Boo	0,016 ± 7	–0,115	–23	–20	–43 ± 7	–50	–97
ε Boo	0,013 ± 7	–0,049	–12	–20	–32 ± 6	–35	–67
α Lyr	0,0123 ± 5	+0,200	+5	–2 –18	–3 ± 0 –13 ± 0	+5 –12	–23
ι Per	0,084 ± 5	+1,266	+48	–17	+31 ± 2	нет	+59
τ Per	0,012 ± 5	0,000	0	–20	+20 ± 0	–27	–46
ζ^2 Aqr	0,013 ± 5	+0,204	+50	–11	+39 ± 1	+42 +38	+80
β Peg	0,015 ± 5	+0,188	+39	–14	+25 ± 1	+26 +35	+60

In observations, the gap was perpendicular to the diurnal motion of the star (along the declination δ); therefore, the measured positions of the star determined its displacements from the right ascension α. It is measured in the plane of the celestial equator, which is a continuation of the plane of the earth's equator until it intersects with the celestial sphere. We can say that the celestial coordinates (α, δ) are an analogue of the geographical coordinates — latitude and longitude.

But not only stars shine from the sky, but also other galactic and extragalactic objects. Moreover, their speeds are an order of magnitude higher than the speeds of the nearest neighbors of the Sun, the distances to which are measured by determining trigonometric parallax. And first of all, Kozyrev turned to the closest neighbor of our Galaxy — the Andromeda Nebula. On clear autumn nights, it can be seen even with the naked eye in the sky in the form of a foggy blurry spot in the constellation Andromeda. It is part of the Local Group of Galaxies and is 1.5 times larger than our Milky Way in mass. The Andromeda nebula is a spiral galaxy similar to ours and located from the Earth at a distance of about 2.2 million light years. It should be noted that the distances to such distant space objects are determined, of course, by other methods than to the nearest stars. In particular, distances to objects containing stars are determined with the help of stars of a special type called *Cepheids*. They got this name by the name of a typical δ star from the constellation Cepheus. It is a variable star, i.e., its brightness varies according to the periodic law, which is due to the fact that for stars of this type, called *physical variables*, the spectrum, sizes, and surface temperature change during the period. In this case, the maximum gloss corresponds to the minimum gloss and maximum surface temperature. Cepheid periods range from 0.06 days to 60 days, and they themselves belong to giants and supergiants. In this case, the Cepheids obey the law: *the longer the period, the greater the luminosity.* This fundamental dependence makes it possible to find the luminosity of a star by the period and by the known luminosity to find the distance to an object in which there are Cepheids, and they are present in galactic star clusters and in other galaxies. That is how the distance to the Andromeda nebula was found. The speed of its movement relative to our Galaxy, according to astronomers, is approximately 300 km/s.

Observations of the Andromeda Nebula in right ascension were carried out repeatedly over several nights. The results of the observations are shown in the Table taken from Kozyrev's article.

Table 2. Results of observations of the Andromeda Nebula

II–I	III–I	Average	Date
147	129	138	30.10.78
137	147	142	01.11.78
142	145	144	02.11.78
134	134	134	03.11.78
140	139	140	Среднее

The 1st and 2nd columns show the differences between the true position of the nebula and its past and future images, expressed in micrometer divisions. Column 3 shows their average value, and column 4 shows the observation dates. Knowing the value of aberration for the observation period $A = -16''$ and using the observation results given in the table, Kozyrev accurately determines the magnitude of the nebula velocity from the right ascension $V_\alpha = 256$ km/s using the above formulas.The declination of the nebula in declination was measured only one night on November 4, 1978. But this observation turned out to be extremely important, since it allowed, firstly, to establish that the detected radiation is not subject to the action of refraction (refraction), which the beam of light inevitably undergoes, and secondly, it gave the exact value for the velocity of the Andromeda nebula in declination: $V_\delta = +71$ km/s. This made it possible for the first time to determine for the galaxy the full velocity vector, in this case $|V| = 384$ km/s.

Here it is worth quoting the words of the author of these amazing observations: “This observation convincingly shows that it is not light that causes action; it only coincides with the world line of light propagation in the void. At the entrance to the earth’s atmosphere, the light descends from this world line, but along which the action of time continues.”

Observations of extended objects, which include the Andromeda nebula, whose visible diameter is 1,º5, i.e. 3 visible diameter of the Sun (Moon), have their own characteristics. “During observations, the galvanometer reacted to the central region of a nebula of a significant size — 1,º5. Therefore, we had to evaluate and set a certain average position on the slit, which was then fixed by pointing the micrometer thread to the center of the visible image. It turned out that the maximum effect is caused not by the middle of the active region, but by its edge. Therefore, it seemed very important to obtain a complete profile of its activity for the nebula.” It was a difficult task, but the authors of the article coped with it. Profiles of all three images were obtained, and in the center of each was a failure. In other words, the profile of the “brightness” of the nebula created by the “rays of time” turned out to be the opposite of its profile in the optical range, where the brightness of the galaxy increases from its edges to the center. Kozyrev explained this fact by saying that the central regions of such extended objects as star clusters and galaxies, being more populated than peripheral ones, absorb time. Similar observations were made for the galactic globular clusters M2 in Aquarius and M13 in Hercules. The results were similar, but for the cluster M2 it was possible to determine the tangential velocity from the right ascension $V_\alpha = 210$ km/s.

Thus, these seemingly fabulous experiments provide practical applications that can be used in observational astronomy: firstly, they make it possible to obtain images not distorted by refraction, and secondly, a way to accurately determine the speeds of the observed sources with respect to the observer.