

As the first in the world interferometer with the mechanical division of the ray was created

The special theory of relativity (STR) was developed by Albert Einstein in 1905. At its basis are the postulates (postulate is this assertion, which starts without the proof), one of which (the so-called second postulate) says, that the speed of light is invariant, i.e., it does not depend on observation system. This means that under no circumstances the speed of light cannot exceed its standard value c , which in the vacuum is equal $299\,792\,458 \pm 1,2 \text{ m / s}$ (it is rounded $300\,000 \text{ km / s}$). Second postulate STR contradicts the common sense, since the speed is a value relative. The same projectile, released from the gun, with respect to it has one speed, and with respect to the aircraft, which flies away from the gun, it has another speed. Passenger, sitting in the railroad car of train, with respect to the railroad car is fixed, whereas according to the relation to the station buildings it moves with the speed of train. In all STR this is not thus. If inside the railroad car light beam moves with a speed c , then with respect to the station buildings it moves with the same speed.

From the moment of creation STR were carried out the numerous experiments, in which the experimenters attempted to prove the inaccuracy of the second postulate. For this they used radiation sources, which moved with respect to the observation system with the given speed, but all their attempts proved to be not successful. Values of the speed of light in the observation system obtained in such experiments proved to be equal to the standard value of the speed of light c [1-9].

Such experiments in the diverse variants were carried out and outstanding scientist Michelson, with the aid of the invented by it interferometer, but also these experiments also ended by failure.

Michelson interferometer was invented by American physicist by Albert Abraham Michelson at the beginning of past century. A number of important scientific and applied problems was solved with the aid of this interferometer, the speed of light was in particular with the high accuracy measured. However, in the experiments, conducted by Michelson, that are concerned checking second postulate STR, were significant errors. It completed these errors, toogda it attempted to prove that the speed of electromagnetic (EM) wave is added to the speed of its source, which contradicted the second postulate. Michelson considered to the end of his life that there is an elastic medium, in which are extended EM of wave. Therefore the results of the experiments, which it

conducted together with Morley [10] for the detection of this medium, were for it large unexpected contingency. Attempting to improve experiment, it attempted as the radiation source to use light of star, but it it here awaited still large failure. Studies showed that the measured speed of light, does not depend on the speed of star and is equal to the previously measured by it value, which corresponded to the special theory of relativity, which life it so did not recognize to the end.

In order to understand, in than Michaelson's error consisted, let us examine the principle of the work of its interferometer, whose schematic is given in Fig. 1.

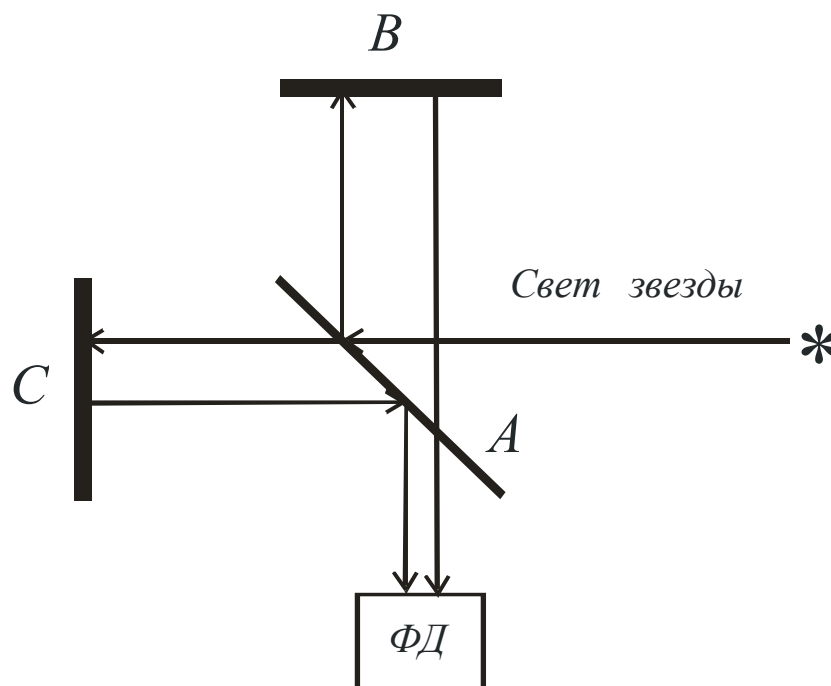


Fig. 1. Schematic of Michelson interferometer.

The electromagnetic (EM) wave, which arrived from the star and reflected from the dividing mirror A falls on the reflecting mirror v and, being reflected from it, it falls on photodetector. The special feature of this process is the fact that the mirror v is located in the same inertial reference system (IRS), in which is located interferometer itself. This means that, whatever there was the speed EM of the wave, which arrived from the star, its speed, after reflection from the mirror v, will be equal to the speed of light in IRS of interferometer.

The second part EM of the wave, which arrived from the star, penetrating the dividing mirror A, also falls on reflective mirror C. After reflection from this mirror the wave will also have a speed equal to the speed of light in the system of interferometer. But a question consists in what speed will have the electromagnetic

wave after the passage of dividing mirror indicated. The reflecting coating, with the aid of which occurs the division of ray, is substituted to the transparent glass plate.

Let us examine the flow chart of the ray through the dividing mirror, taking into account that the fact that the reflecting layer on it is substituted to the transparent of the glass- specific thickness. Since glass- is the dielectric, which possesses the dielectric constant, different from air, the trajectory of the motion of ray will depend on the refractive index of glass. This trajectory is shown in Fig. 2

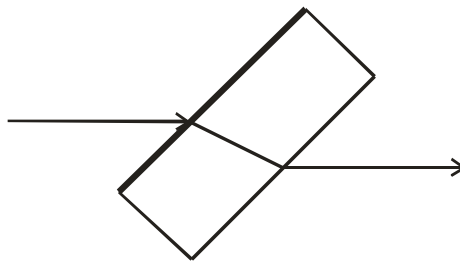


Fig. 2 Propagation of light beam through the glass plate

Light beam falls on the glass plate and, refracting twice, it leaves from it in the same direction. During the reverse motion of ray its trajectory remains constant, changes only direction of its motion. In this case the ray moves in accordance with the law Of sneliusa [11] and sharply changes its direction after entrance and output from the plate. But this refraction is connected with the fact that the electric fields of the wave, passing through the plate, make it necessary to kolebatsya the bound charges in the dielectric, which re-emit these fields. And if prior to the entrance into the plate wave had a speed different from the speed of light in the frame of reference of interferometer, then after the passage of the wave through the plate its speed will be equal to the speed of light in the system of its counting. These special features of the work of Michelson interferometer indicate that with his aid it is not possible to measure the speed EM of wave to its contact with dividing mirror. Michaelson did not consider these circumstance, of than consisted its error.

In the consequence were invented different modifications of Michelson interferometer [11], such as the interferometer of Rogdestvensky, Fabry-Perot and other instruments with repeatedly divided light beams. But in all these instruments for division and separation of light rays are used the semi-transparent layers of metals, substituted to the glass plates, or interfaces between the dielectrics with different dielectric constant. Therefore all interferometers indicated suffer the same deficiencies, as Michelson interferometer.

Output from the prevailing situation was to be searched for on the way of creating the interferometer, in which dividing mirrors would be absent, and the division of ray would be accomplished by another method, with which was not lost the information about the beam velocity, which entered the interferometer. And this output was found in the work [12], where the division of ray it was achieved by a mechanical method. The operating principle of interferometer can be understood from the diagram, represented in Fig. 3

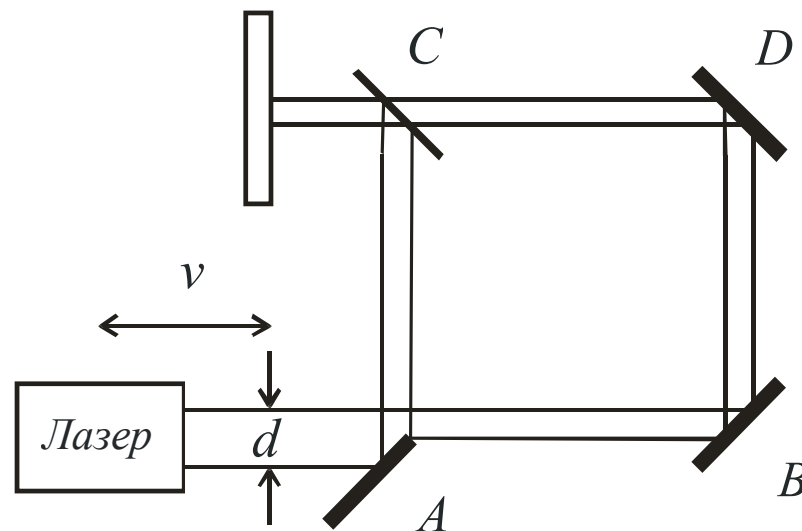


Fig. 3. Schematic of interferometer with the mechanical division of laser beam

Laser beam, whose diameter is equal d , it partially overlaps the reflecting mirror a . This mirror the part of the ray it located so that reflects in the normal direction with respect to the primary direction of the motion of ray. The second part of the ray continues to move in the perezhnem direction with the previous speed and, falling on the reflecting mirror v , it is reflected in the normal direction with respect to the initial direction of motion. Further rays, after passing ways indicated in the diagram, where A, B, D - the reflecting mirror, and C – dividing mirror, fall on the screen, where is reproduced the picture of their interference. In the diagram examined the laser, which is radiation source, can be fixed or move with the given speed. On the spot laser also can be located the mirror, which reflects the ray of fixed laser, in this case the mirror also can be fixed or move according to the assigned law.

The schematic of interferometer with the mechanical division of the ray, in which is used the fixed laser, whose ray is reflected from the fixed or moving mirror, it is depicted in Fig. 4. On this diagram the laser beam has the assigned diameter, which is equal to the distance between the lines, which emerge from the laser.

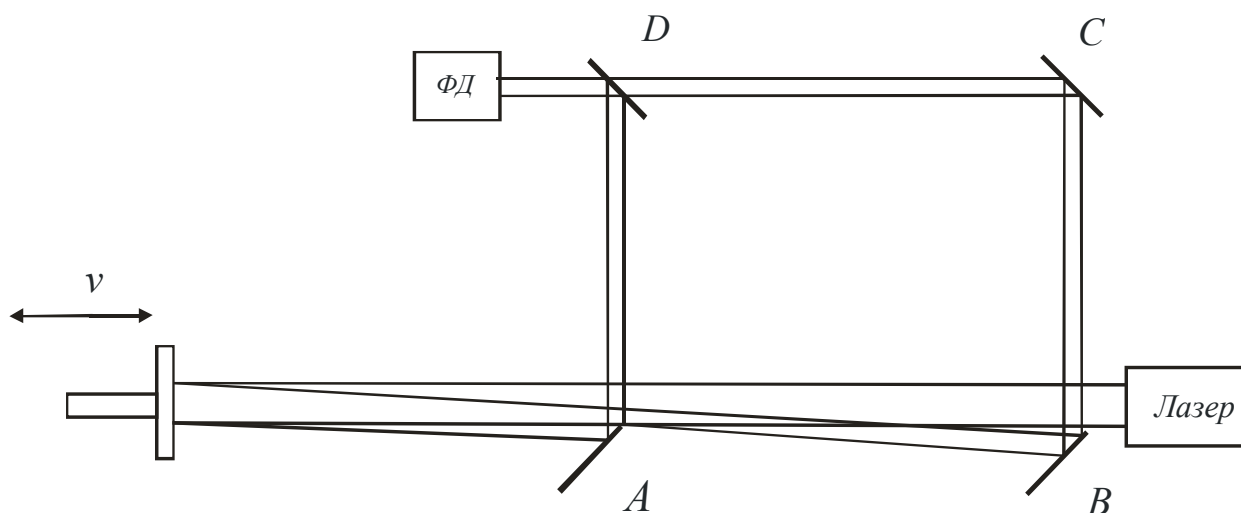


Fig. 4. Schematic of interferometer with the reflective mirror.

This case is equivalent to the case examined with the only difference that it is used the ray, reflected from the moving reflective mirror. The advantage of interferometer with the mechanical division of ray is the fact that in it for the separation of ray are not used the dividing mirrors, but the division of ray is produced by the method of its overlap. This method allows to split ray in any proportions with the way of the mechanical displacement of the first mirror, without requiring in this case the replacement of dividing mirror.

But to propose new idea this still not all, was required to prepare the mock-up of interferometer, and with its aid to prove the inaccuracy of the second postulate.

That who dealt concerning the interferometers, knows how not simple this task. Standard interferometers use the massive steel bed, where are cut by T – descriptive grooves, on which can be moved the clamps with the dividing and reflecting mirrors, laser and photodetector. Fastening mirrors on these clamps must allow their fixed turning in two planes to the preset angle with the accuracy several tens of seconds. All these complex technical problems under the force only to important Scientific Research Institute, which has the appropriate production base.

But I did not have this base, he lived in the two-room apartment and nothing did not have besides hand tool. And nevertheless how ended this history, and it did be possible to prepare interferometer with the necessary parameters and to conduct so the long-awaited experiment. Yes it succeeded, and in this me sincere and honest friendship helped.

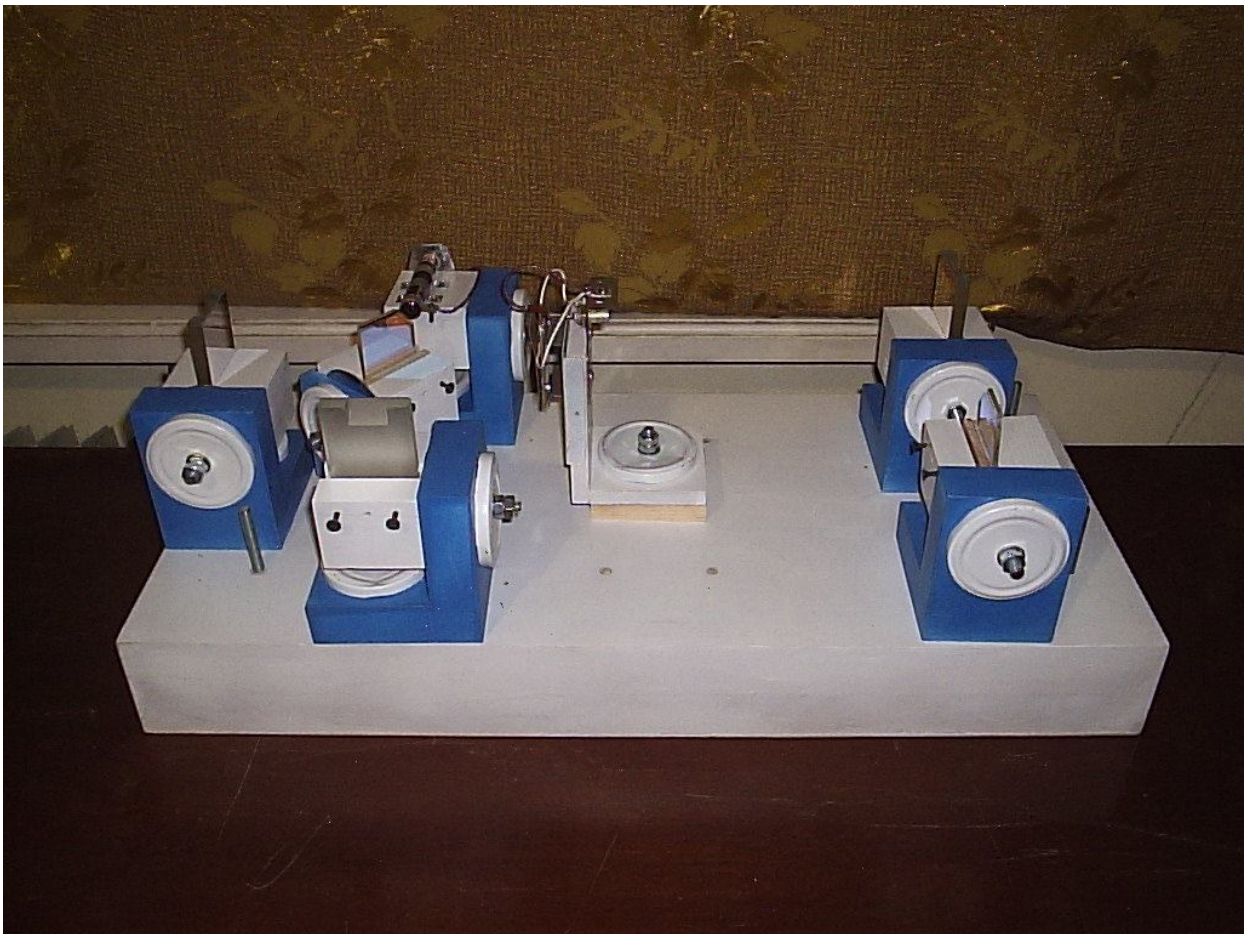
Earlier I worked in the physicotchnical institute of low temperatures of AS Ukraine (FTINT AS Ukraine) and passed there way from the young specialist to the deputy director for the scientific work SKTB FTINT. This was large Scientific

Research Institute with its experimental production and by experimental plant, in which worked more than 3000 colleagues. Since most work, carried out by SKTB, concerned defense orders, after the disintegration of the USSR and the disappearance of such orders entire association remained without the work. Without the work it remained and I. In order to feed family it was necessary to throw science, also, for the elongation of more than 10 years to be occupied by questions of sushchki of wood. This is a separate question, and stop I will not be on it. But from those times remained familiar and the friends, whose fate it was very similar to my. One of similar he proved to be Valery Alexandrovich Nevolnichenko, who at the present time grew to the chief of the joiner production of firm Lana in Kharkov. But here joiner production and interferometer, indeed in joinery steel bed and component interferometers do not mill with than. And the call of the entire history of the creation of interferometers was here cast, and it was decided to prepare all components of interferometer from the solid rocks of the wood of oak or ash. And Valery Alexandrovich this task lustrously it managed, and it made this with the large enthusiasm and it is completely unselfish. And if not its friendly aid, then this uncommon interferometer would not be born.

But now I will show the common form of interferometer, and also his separate units, and then I will describe about the very significant history, by which ended the studies, carried out on the interferometer.



The common form of interferometer with the mechanical division of ray is depicted on this photograph, in the photograph is not shown the vibrator, on which is located reflective mirror. Vibrator is located on the separate plate, which is placed on the separate table.

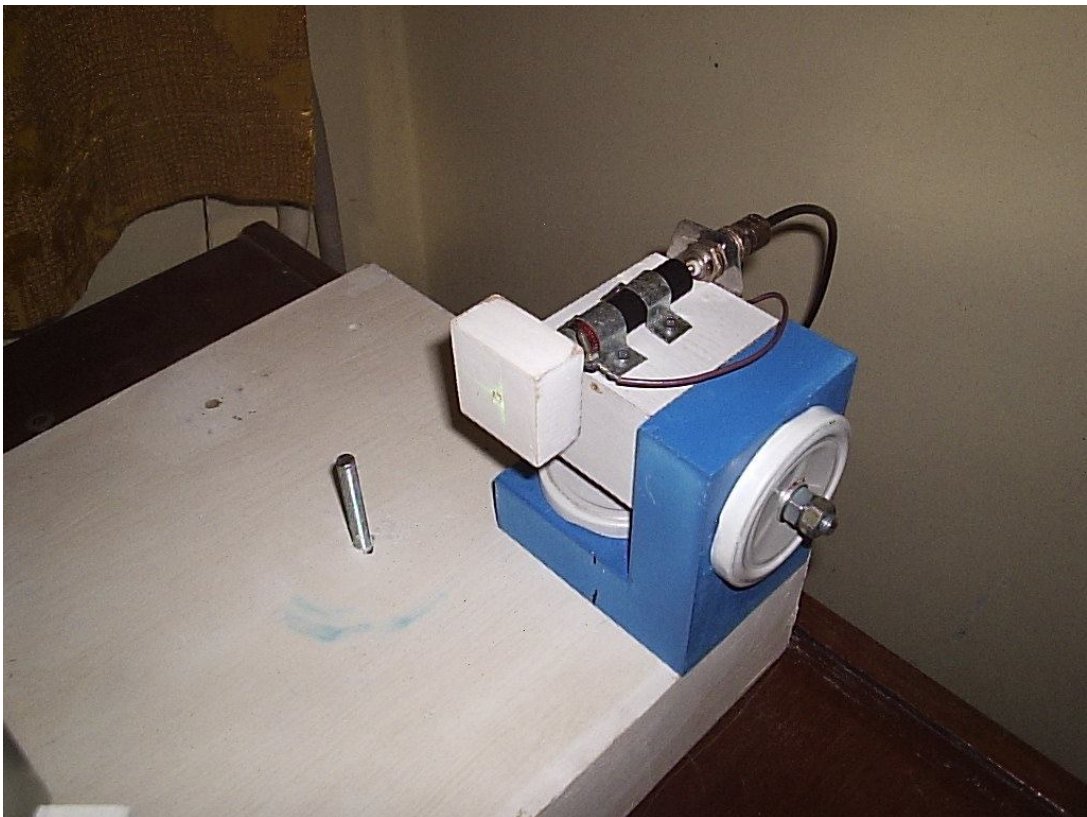
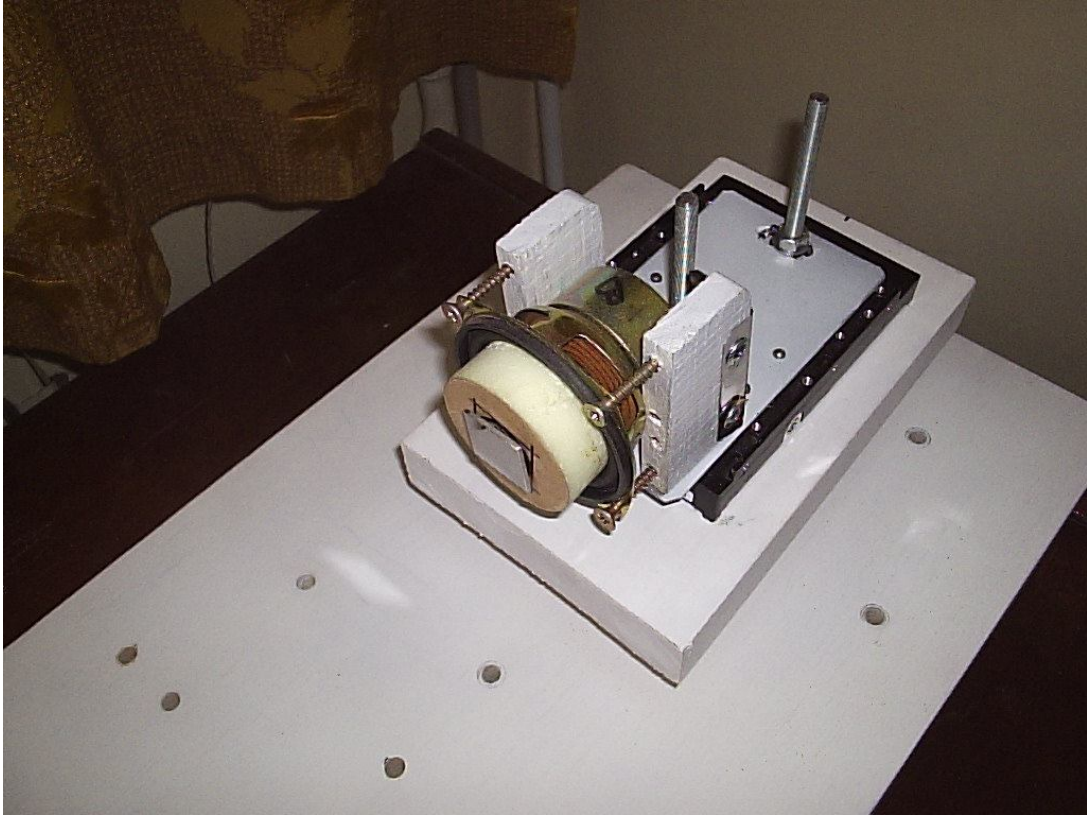


On this photograph is depicted the Michelson interferometer assembled on the mounting plate. It is to the left in the foreground visible two reflecting mirrors, dividing mirror is located between them. The laser is visible after the dividing mirror, to the right of dividing mirror is located photodetector. On right to edge located two spare mirrors. Mirrors are located on the hinges, which make it possible to revolve mirrors in the ortoganalnykh directions. Hinges I provide the possibility to achieve angular turning of mirrors with the accuracy of the order

several tens of seconds. Any desired configuration of interferometer can be assembled on the platform.



The working Michelson interferometer is depicted on this photograph. Ray from the laser (to the right in the background) comes to the reflecting mirror (to shine by green color) and, after being reflected from it, it comes the dividing mirror (in the center in the foreground). Then, after being reflected from two mirrors, through the dividing mirror, and then the objective falls on the reflecting mirror (in the background round mirror with the opening). After being reflected from it, rays are projected on the oppositely located screen, where is formed interference picture.



The vibrator and laser are depicted on these photographs.



The vibrator, which ensures the vibration of laser, is depicted in these photographs in two foreshortenings.

Epilogue

When at the beginning of November of this year I sent article on the interferometer to the editor in chief of periodical engineering physics A. A. Rukhadze, it during the same day wrote to me, that the article greatly was pleased to it and it will be published out of order in 12- that number of periodical. But soon after this from the side of the instructors of the Moscow physical-technical institute (MFTI) of Zhotikov and Milanich began the bitter campaign on the discredit article and me as her author. They did not have claims to its content, but accused they me of the plagiarism, referring to that that, allegedly, still in the 80-tenth years of past century, this interferometer was created in Leningrad GOI, and these given be contained in the reports of institute. But when I required to give references to such reports, to make this they flatly refused. After a certain time began to lie Rukhadze, asserting that saw such of interferometer in the institute of physical problems, but it refused to also give references. Actions of Zhotikov and Milanich they are intelligible. Some pensioner invented the new type of interferometer, house, literally on the elbow, prepared it and obtained meaningful results, and the entire institute, where laboratory work on this thematics reads course on the interferometers and are conducted, make this I could not. Certainly disgrace, here and by wolf you will howl. Why in this situation Rukhadze was also joined to the abuse campaign also clearly. It did not want to quarrel with this by bonzami. Here is this beautiful history. 4 November I obtained from the editorial staff of periodical failure in the publication of article.

In this situation to me anything it remained to make as to publish article with the description of the construction of interferometer in the international periodical, that I made. To the content of article it is possible to be introduced according to the reference http://fmnauka.narod.ru/Mende_Interferometer.pdf

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