Introduction

Experimental works are conducted jointly with the Laboratory of electrodynamics of moving media of the BMSTU Physics Department and Laboratory of Mathematical modeling of the Research Institute of Hypercomplex Systems in Geometry and Physics (RI HSGP), where experimental works for the laboratory detection of the anisotropy of the velocity space of the electromagnetic radiation in moving media are carried out.

The numerical modeling of observable effects in the interferometers with moving media is also performed in the Laboratory of Mathematical modeling of the RI HSGP.

The interest in experimental attempts of detection of anisotropy space-time are connected with known results in the measuring of the anisotropy of relict microwave radiation (M.V. Sazhin, “Anisotropy and polarization of cosmic microwave background: state of the art”, UFN, 174:2 (2004), 197–205).

However earlier attempts of detecting space anisotropy were made not in radio astronomy, but in optics. Such attempts are: the classical experiments of Hoek (Hoek M. Arch. Neerl., 1868), the Michelson- Morley experiments (Michelson A., Morley E.W. Am. J. Phys., 1886) and the more recent experiments of Brillet and Hall (Brillet A., Hall J.L. Phys. Rev. Lett., 1979). An analysis of measurement procedures performed in these experiments allows to explain the lack of anisotropy occurrence by means of methods of the actual optics of moving media and to propose more sensitive interferometric circuits.

In these works it is studied the anisotropy arising in moving optical transparent media with 3-dimensional velocity fields. In these media, the velocity of light propagation nonlinearly depends on the vector field of the motion of the medium. As a result, optical anisotropy can depend on the orientation of the orientation of the velocity field of the moving medium relative to the velocity of motion of the interferometer in the space of independent physical variables. All numerical calculations are based on the coordinate solution of the dispersion equation (Bolotovsky B.M., Stolyarov S.N. UFN, 1989).

The amplitude of the variations of the position of the interference pattern is proportional to the speed of the interferometer, but the angular dependence effect is an effect of higher-order smallness in comparison to the classical effect of light deflection.

The nature of the optical anisotropy in moving media is related to the anisotropic properties of forces linking media lattice atoms and has local character. In the case when the geometry of space-time is different from the Minkowski one, nonlinear processes of interaction between electromagnetic radiation and the moving medium will depend on spatial orientation. As a result, there must appear additional angular variations in the observed optical anisotropy.

An interferometer on two optical platforms with a passive vibro-stabilization system was constructed in the laboratory for Electrodynamics of moving media of the BMSTU Physics Department. On one of the platforms there is an electric drive with rotating optical disk and on the other - the remaining part of the interferometer. Both platforms were displaced on a rotating base. In order to define a possible dependence of the signal on the spatial orientation of the interferometer, signal measurements were performed by rotating the interferometer with 360 degrees in both directions.

Light is reflected on plane surfaces of the optical disk. The interferential reflecting cover of the optical disk plane surfaces was calculated on the laser wavelength.

The mixing of the interference picture is defined by the change of the time of observation.

The initial transformation of signals was performed by a National Instruments analog-digital converter, and then the numerical sequence of signals order was introduced in the personal computer and further processed.

The interferometer was located into a casing with an active thermo-stabilization system. Temperature was controlled inside and outside the interferometer by three independent channels. The rotation of the interferometer was produced by a step engine and was computer-controlled. As a measuring photo detector it was chosen a high-speed Hamamatsu phototransistor.

The main results of the experiments confirmed the classical linear dependence of the shift of the interference fringe on the velocity of motion of the medium, for a velocity range of 36 m/s.

A reliable repeated time signal, pointing out the presence of variations in the position of the interference picture with spatial variations of the interferometer orientation was not obtained. At present time works are conducted in increasing of the experimental exactness with two orders. This is possible by means of using greater optical disk rotation frequency, by increasing the number of passings through the medium, by a better vibro-protection system of the interferometer, optimization of interferometer parameters and signal filtering.

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