INTERFERENCE OF LIGHT WAVES

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Anotation In this article, the theories about the nature of light, the interference of light, its types, the state of coherence and monochromaticity, Jung's experiment are given and reviewed.

Keywords: Light, interference, Jung's experiment, Coherence, monochromaticity, interference term.

İntroductions

Light interference - redistribution of light radiation energy in space as a result of joining two or more light waves; special case of wave interference. Light interference appears when bright or dark paths or spots (for monochromatic light) or colored areas (for white light) are juxtaposed on a screen or other surface. Light interference was studied by I. Newton in the 17th century, but his corpuscular theory could not explain this phenomenon. At the beginning of the 19th century, T. Jung and O. Frene gave a theoretical interpretation of it as a wave phenomenon. Light interference, which consists of a regular exchange of increased and decreased intensities in space, resulting from the addition of coherent light beams under the conditions of a constant phase difference, is the most common - stationary interference.

materials and disconnected

The first scientific hypothesis about the nature of light was stated in the 17th century. In 1672, I. Newton founded the corpuscular (from the Latin corpuscle means particle) theory of light. According to this theory, light consists of a stream of particles that spread out from the source. During this period, X. Ohugens developed the wave theory of light. According to H. Huygens' ideas, light consists of a wave that propagates in a separate medium and is absorbed into all objects. Both theories existed separately for a long time, and both theories explained to some extent the laws of light propagation that were known at that time from experiments. At the beginning of the 19th century, the phenomena of light diffraction (light passing around obstacles) and light interference (intensification or weakening of illumination when beams of light overlap) were discovered, and these phenomena were only the result of the movement of currents. because of its possible occurrence, the wave theory of light won by a long margin over the corpuscular theory of light. Interference is a proof of the manifestation of the wave nature of light. The word interference comes from the Latin word interfere, which means "to disturb". This very interesting and beautiful scene is observed as a result of joining of two or more waves when certain conditions are met. Two light waves are added, amplifying or attenuating each other. As a result, light and dark rings with their center at the same point are placed alternately on the screen. These are called interference maxima and minima. We have observed the phenomenon of interference a lot in our daily life. For example, the oil spilled on the surface of the water is colored in different colors, the wings of butterflies are colored, "A soap bubble blown into the air is colored with all the colors characteristic of the surrounding objects. A soap bubble can be said to be the most wonderful, the most delicate miracle of nature," said Mark Twain. It is this light interference that makes a soap bubble so pleasurable.

Jung's experiment. English physicist Thomas Jung (1773-1829) carried out the historical experiment in which light interference could be observed in 1801, which surprised all the scientists of that time. Jung places two thin-slit diaphragms D, S and Sz, in the path of light waves radiating from a source S. The size of the slits will be very small (8-0). The front of the light waves reaching the slits Si and S is split into two, and the two fronts formed, Si and S:, begin to propagate independently from both sources. A PP screen is placed at a certain distance behind the aperture D. In all areas between the aperture D and the PP screen, there is an alternation of places with maximum and minimum intensity of light, and on the PP screen there are alternating light and dark paths (bands) of the interference scene. The angle α between the surfaces is very small. Light irradiating from a point source S is reflected by two mirrors, two lights centered at Si and S:. The wave properties of light are most clearly manifested in interference and diffraction. These phenomena are characteristic of the will of any nature and are relatively easy to observe experimentally for waves on the surface of water or sound waves. Interference and diffraction of light waves can be observed only under certain conditions. One of the experiments that confirm the wave nature of light is light interference. To explain light interference, it is necessary to introduce the concept of coherent light sources. Coherent light sources are wave sources that produce oscillations with the same frequency and phase difference. Usually, a wave coming from a single light source is separated into two coherent waves by some method. Light emitted by conventional (non-laser) sources is not strictly monochromatic. Therefore, to observe interference, light from one source must be split into two beams and then superimposed. Existing experimental methods of obtaining coherent beams from a single light beam can be divided into two classes.

If the phase difference of the vibrations caused by the waves at some point in space remains constant over time, then such waves are called coherent. In the case of coherent waves, the phase difference is constantly changing, taking any values with equal probability, as a result of which the average time value cos(φ2-φ1) is zero (from changes from -1 +1).

Conslusion

We can conclude that the phenomenon of interference of light has various applications. For example, it is used to determine the refractive index of gases, to measure lengths and angles very precisely, to control the quality of surface treatment, etc. The interference in the return from thin curtains is based on the illumination of the optics. As light passes through each refracting surface of the lens, approximately 5% of the light incident on the lens surface is returned. In complex lenses, such returns occur many times, and the total consumption of the light flux reaches large values. It also causes reflection from lens surfaces. In illuminated optics, a thin film of a substance with a different refractive index is applied to each free surface of the lens to eliminate light reflection. The thickness of the screen is chosen so that the waves returning from both surfaces of the material interfere and cancel each other. Especially good results are obtained when the refractive index of the curtain is equal to the square root of the refractive index of the lens. In this case, the intensity of both waves returning from the curtain surfaces is the same.

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