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THERE IS NOW ROOM FOR DISSENTING OPINIONS

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The given work states that the history of modern physical science knows both the periods of taking off and many ones of falling down. The work points out that ability for being on the lookout for the latest scientific ideas admit an erroneous character of the personal scientific thoughts, theories and results is a frequent occasion on this way. The only time can give away the right answer for this eternal question.

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According to a few works of the earliest Greek thinkers, “ether” meant “upper air” (“hypothetic all-permeating medium” in Latin). It was understood as a special celestial object in the cosmos, that is, as a space-filling substance [1]. Plato in his dialogue, *the Timaeus*, writes that God created the world from ether. While Lucretius Carus in his poem *On the Nature of Things* mentions that “Ether feeds the stars”. That is, that celestial bodies consist of condensed ether.

Aristotle describes ether in more detail. He believes that planets and other celestial bodies consist of ether, which is the fifth element of nature – the quintessence. Moreover, unlike the other elements, earth, air, fire and water, ether is constant and permanent. For Aristotle, the Sun is not made of fire, but is a huge cluster of ether. The sun radiates heat by influencing its ether as it revolves around the Earth. Ether also fills the region of the universe above the terrestrial sphere, staring from the Moon’s sphere. So, according to Aristotle, ether transfers light and heat from the Sun, and light from the stars [1].

Medieval scholastics adopted Aristotle’s understanding of ether, an understanding that remained unchanged until the seventeenth century.

In 1618 Rene Descartes put forward a hypothesis of luminiferous ether, which he further developed in his *Principles of Philosophy* (1644). According to his natural philosophy, Descartes regards ether as a fine matter, similar to liquid, which determines the patterns of light distribution. For Descartes, ether fills the entire matter-free space of the universe, but it does not impede the movement of physical objects through it. Descartes, like Aristotle, does not recognize empty space as such.

As with any celestial matter, Cartesian ether is in a constant state of motion; primarily a swirling motion. Centrifugal force and an emerging, mutual pressure of particles throw ball-like ether particles off the source. An observer perceives this motion as light distribution. Descartes believed the speed of light to be infinite. He also developed his own theory of colour. According to his theory, the different speeds of rotation of ether particles generate the different colours.

In 1690 Huygens published his *Treatise on Light* in which he expanded considerably on Descarte's teaching on the subject. Huygens hypothesised that light travelled in waves in ether, and developed his mathematical formulae for wave optics.

The following unusual optical phenomena were discovered at the end of the seventeenth century, and accommodated within the luminiferous ether model:

– diffraction by Grimaldi (1665);

– interference by Hooke (1655);

– the double refraction of light by Bartholin (1669) – later studied by Huygens;

– the determination of the speed of light by Romer (1675).

As such findings began to accumulate, two dominant and contrasting models of the nature of light began to emerge.

The emission, or corpuscular, theory of light proposes that light is made up of small particles emitted by a source. This hypothesis was supported by the evidence that light travels in a straight line, which is the physical presupposition of geometrical optics. However, diffraction and interference did not fit with this theory.

The wave theory of light suggests that light travels in waves as a result of outbursts of ether. It is worth noting that in those times a wave of light was thought of as a single pulse, not the infinite periodic vibrations of today's scientific theories. For this reason it was very hard to explain light phenomena using the wave theory.

The Descartes-Huygens concept of luminiferous ether gradually came to be generally accepted in scientific circles. The seventeenth and eighteenth centuries disputes between supporters of the Cartesian and atomic theories, and those who contested the merits of the emission and wave theories did nothing to compromise the concept of luminiferous ether. Even Isaac Newton, who favoured the emission theory, conceded that ether was involved in light effects.

By virtue of Newton's scientific achievements and authority, the emission theory of light became the dominant theory in the eighteenth century. Ether was regarded as a bearer of light particles. Light refraction and diffraction were explained by the changes in the density of ether, that is, when light impinged on bodies (diffraction) or passed from one medium into another (refraction). In the course of the eighteenth century, the notion of ether as a constituent of the universe gradually receded into the background of scientific thinking. However, the theory of ether vortices lasted, and was unsuccessfully employed to explain both magnetism and gravitation.

At the beginning of the nineteenth century, the wave theory of light, which defined light in terms of waves in ether, produced a decisive victory over the emission theory. As early as 1800, the emission theory was attacked by Thomas Young, an English scientist. He was the first to propose and coin the expression “a wave theory of interference” based on his own principle of superposition. On the basis of his experimental findings, Young provided accurate assessments of light wavelengths for various spectra of coloured light.

At about the same time, Augustin-Jean Fresnel performed a series of ingenious experiments, which demonstrated that purely wave effects could not be explained by the emission theory.

From the beginning, Young and Fresnel regarded light as elastic, longitudinal vibrations of rarefied but very resilient ether, similar to that of sound in the air. They held that any light source causes elastic vibrations of ether. The frequency of such vibrations is huge, and is not recorded anywhere else in nature. The vibrations propagate at tremendous speed and any physical object draws ether in, which penetrates it and concentrates inside it. The index of light refraction depends on the density of ether in a transparent object.

However, the polarization effect still called for an answer. In 1816 Fresnel had suggested that the light vibrations of ether were not longitudinal but transverse. This would easily explain the polarization. Earlier, however, transverse vibrations were recorded only in incompressible solids, while ether was considered as having something like the sorts of properties displayed by gases or liquids.

The advent of the nineteenth century saw a sharp growth of interest and trust in the concept of ether.

After it became clear that light vibrations are strictly transverse, it was necessary to establish the sort of properties ether would have to have to allow for transverse vibrations and exclude longitudinal ones. In 1821 Henri Navier developed general equations to describe the propagation of disturbances in an elastic medium. Navier’s theory was expanded by Augustin-Louis Cauchy (1828), who stated that, generally speaking, longitudinal waves should also be present.

Fresnel hypothesised that ether was incompressible, but provided for transverse shearing. But such an assumption is hardly reconcilable with the complete permeability of ether to substance. George Gabriel Stokes addressed this problem by likening ether to resin. During quick deformations involving light emission it behaves like a solid, whereas during slow deformations involving planetary movement, for example, it is plastic.

Fresnel even suggested that ether consists of particles, the size of which is relatively similar to the length of a light wave.

After Maxwell presented his equations on classical electrodynamics, the theory of ether was reconsidered. Maxwell neither developed specific models of ether nor did he take into account any other properties of ether in his calculations, except for ether’s supposed ability to maintain the displacement of a current, that is, electromagnetic vibrations in space.

In a scientific article of 1905, Einstein reviewed two principle postulates: the general principle of relativity and the invariance of the speed of light. The adoption of these postulates immediately involved the Lorentz's transformations (not only for electrodynamics), the contraction of length and the relativity of simultaneity. In the same article, Einstein pointed out that, because no physical attributes could be assigned to it, it was not necessary to posit ether. And that other dynamic properties were taken into account as part of the kinematics of the Special Theory of Relativity. The electromagnetic field has been viewed as an independent physical object [2], and not as an energy process in ether ever since.

The introduction of this notion caused a number of difficulties. Einstein had experienced some problems (as shown in the foregoing example) when his findings showed that he needed to add a certain amount of energy (hence mass) to the empty space of the universe.

Other reasons for denying the relevance of the concept of ether included its ambiguous attributes: the impalpable character of the supposed substance; its transverse elasticity; its extraordinary wave propagation velocity when compared with gas, liquid, et cetera. Also there was the difficulty of proving the quantum nature of the electromagnetic field, which is incompatible with the continuous ether hypothesis.

Later, after his creation of the General Theory of Relativity, Einstein revived his use of the idea of ether by stipulating his own meaning for the notion. According to his new meaning, “ether” refers to “physical space” as defined by the General Theory of Relativity. Unlike luminiferous ether, Einstein's physical space is not substantial. For example, it is impossible to assign self-motion and an identity to points in such a space. This notion of space, unlike that of Lorentz and Poincare, is in keeping with the General Theory of Relativity. However, most physicists have chosen not to revive the obsolete term.

Einstein, to his credit, admitted that his scientific idea was erroneous; an admission confirmed by the provisions already referred to as well as by practical experience [2]. Despite the time lost to scientific mistakes, it is pleasing that there is now room for dissenting opinions.

References

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К содержанию