The Terrell-Penrose Effect when Photographing a Sphere at Rest with a Moving Camera

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The Terrell-Penrose effect [1-2] relates to relativistic effects, which attract the attention of those dealing with special relativity. The component parts of this effect are the turn of the fast-moving sphere and independence of its form from the speed of motion. This behavior of the fast-moving sphere is often perceived as something strange and contradicting the fact of the Lorentz contraction of moving bodies.
Being very simple the Terrell-Penrose effect proves to be tangled under traditional examination. Teachers and methodologists fear that acquaintance with this effect may cause difficulty in understanding the essence of the Lorentz contraction. However, there is no contradiction of the effect of the independence of the visual form of a sphere from the speed of motion to the Lorentz contraction, having in mind that the independence of the photographically recorded form of a sphere from the speed is theoretically described by Terrell and Penrose having taken the Lorentz contraction of the moving sphere into account. The imperfection of the description of the effect given by Terrell and Penrose lies in the fact that it was carried out in a reference frame with the stationary camera and the moving sphere. This choice of a reference frame results from a tradition that examination of relativistic effects is to be carried out in reference frames wherein observers or measuring instruments are at rest and the objects of observation are in motion. Aberration of light [3] is perhaps the only phenomenon, the explanation of which allows a moving observer or a moving instrument. At the same time, as regards description of the physical side of relativistic phenomena and effects, it is often expedient to use a reference frame wherein the observed object is at rest and the observation facility is in motion. In the present work, preference is given just to the reference frame wherein the sphere is at rest and the camera (camera obscura) is in motion. Such choice of a reference frame makes the Terrell-Penrose effect simpler and more visual and shows that the independence of the form of the moving sphere from the speed as well as its turn are optical illusions. With this choice of the reference frame the mentioned optical illusions may be accounted for by aberration of light reflected from the stationary sphere, which has formed the image on the photoreceptor of the moving camera. In the case of semitransparency of the sphere and the presence of markers at the points of the sphere, which lie on the line of its motion, the Lorentz contraction of the moving sphere would also be revealed by way of photography.

References

[1] R. Penrose. (1958) The Apparent Shape of a Relativistically Moving Sphere, Proc. Camb. Phil. Soc., vol. 55, Jul.
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