

Was the Gravitational Deflection of Light Observed?

V.N. Strel'tsov <strelve@sunhe.jinr.ru>

Laboratory of High Energies, Joint Institute for Nuclear Research
Dubna, Moscow Region 141980, RUSSIA

Abstract: We pay attention to sensational Marmet and Couture's paper. This paper shows how all the experiments claiming the deflection of light by the Sun are subject to very large systematic errors, which render the results highly unreliable. Theoretical analysis of this problem (based on Minkowski's equation) is presented.

*"The deflection of light by matter, suggested by Newton in the first of his *Queries*, would in itself be a result of first-rate scientific importance; it is of still greater importance when its magnitude supports the law of gravity put forward by Einstein..."* J.J. Thomson¹

On November 6, 1919, a joint meeting of the Royal Society and the Royal Astronomical Society, dedicated to the results of expeditions on the observation of light ray deflection by the Sun during its total eclipse², was held. J.J. Thomson, O.M., P.R.S., the chairman of the meeting resembling a Congregation of Ribes³, pronounced the Einstein canonization: "This is the most important result obtained in the theory of gravitation since Newton's days, and it is fitting that it should be announced at the meeting of the Society so closely connected with him... The result is one of the highest achievements of human thought."

The gravity influence on light (electromagnetic radiation) is one of the main principles of the general relativity (GR). According to GR: "A beam of light carries energy, and energy has mass. But every inertial mass is attracted by the gravitational field, as inertial and gravitational masses are equivalent. A beam of light will bend in a gravitational field exactly as a body would if thrown horizontally with a velocity equal to that of light".⁴ And the overwhelming majority of physicists is convinced that the deflection of a light ray is confirmed reliably by experiments. However, we pay attention to the sensational paper^{5,6} where the results of existing experiments on the investigation of the influence of the Sun's gravitational field on electromagnetic radiation were analyzed. "This paper shows how all the experiments claiming the deflection of light by the Sun are subject to very large systematic errors, which render the results highly unreliable." "... no-one can seriously claim that light is really deflected by the Sun." It is cited in the paper: "Rare in the night (at most sites) when any telescope, no matter how large its aperture or perfect its optics, can resolve details finer than 1 arc second. More typical at ordinary locations is 2- or 3-arc-seconds or worse."⁷ "Dr. F. Schmeidler of the Munich University Observatory has published a paper titled "The Einstein Shift: An Unsettled Problem," and a plot of shifts for 92 stars for the 1922 eclipse shows shifts going in all directions, many of them going the wrong way by as large of a deflection as those shifted in the predicted direction!"

Thus, as elucidated, there is no reliable experimental confirmation of the indicated GR conclusion. Let us analyze this problem in detail. Recall that the conclusion expresses the law

of energy inertia (LEI) or mass and its energy equivalence. Based on it mass is ascribed to any energy (in particular, the light one). As known, this law goes back to the famous Einstein thesis: “The body mass is the measure of energy contained in it.”⁸ Although LEI is considered as a consequence of relativity theory, it contradicts its essence.⁹

According to the covariant formulation of relativity theory, the energy of any physical object is given by the known Minkowski equation

$$E=p^0c=mu^0c=m\gamma c^2 .$$

Here p^0 and u^0 are the time components of the 4-vector energy-momentum and the 4-velocity (kinetic potential), m is the inertial mass, γ is the Lorentz-factor. Whence it is directly seen that the mass is a Lorentzian invariant (4-scalar). Therefore, its equivalence takes place in the case of $\gamma=1$ only (in the rest frame). What is more, *if energy answers any mass, then mass does not answers any energy.*

For light (photon) $\gamma = \infty$. Therefore, in order to secure the E finiteness, it is necessary to assume that the inertial mass of photon $m_i=0$, i.e., the indicated equivalence does not take place at all. Thus, the ascription of the gravitational mass $m_g=E/c^2$ to photon means a direct violation of the postulate of the equality of inertial and gravitational masses¹⁰, which is the basis of GR. Whereas, the fulfillment of this postulate, i.e., $m_g=m_i=0$, means that a gravitational field does not influence on a light ray.^{11,12}

Conclusion: Taking into account the aforementioned, no one can seriously claim that light is really deflected by the Sun.

References

- [1] J.J.Thomson, Anniversary Address of the President, Proc.Roy.Soc., **96A**, 311-322 (1919).
- [2] Joint Eclipse Meeting of the Royal Society and the Royal Astronomical Society, The Observatory **42**, 389-398 (1919)
- [3] A.Pais, “**Subtle is the Lord...**”. The Science and the Life of Albert Einstein, p.305 (Oxford Univ. Press, N.Y., 1982)
- [4] A. Einstein, L. Infeld, **The Evolution of Physics**, p.239 (Cambridge Univ. Press, London, 1938)
- [5] P. Marmet, C. Couture, “Relativistic Reflection of Light Near the Sun Using Radio Signals and Visible Light”, Phys.Essays **12**, 162-173 (1999)
- [6] Ph. Tourenc, P. Teyssandier, “La Gravitation Expérimentale”, La Recherche **15**, 180-191 (1984)
- [7] A.M. MacRobert, “Beating the Seeing”, Sky and Telescope **89**, 40-43 (1995)
- [8] A. Einstein, “Ist die Trägheit eines Körpers von seinem Energienhalt abhängig?” Ann.Phys. **18**, 639-641 (1905)
- [9] V.N. Strel'tsov, “Non-Covariance of the Law of Energy Inertia” JINR D2-95-294 (Dubna, 1995)
- [10] Idem, “Gravitational Time Dilation & General Relativity”, Apeiron **6**, 243-4 (1999)
- [11] Idem, “Does a Gravitational Field Influence on a Light Ray?”, JINR D2-97-44 (Dubna, 1997) (annihilated)
- [12] P. Marmet, **Einstein's Theory of Relativity versus Classical Mechanics** (Newton Phys.Books, Gloucester, On., Canada, 1997)

[Journal Home Page](#)