

The Light Deflection and the Anomaly near the Sun

by Walter Orlov

This year celebrates the 100th anniversary of the confirmation of general relativity by observing the light deflection. In 1919 the result was in agreement with Einstein's prediction of $1.75''$. However, the next expeditions have measured a noticeably higher value.

In 1931 Freundlich, Klüber and Brunn presented the results of three expeditions, which took place 1919, 1922 and 1929 [1]. They came to the value of $2.24''$.

In 1953 Freundlich pointed out this impurity again [2]. He presented the following table:

Expedition	$L_{\text{beob.}}$	mittl. Felder	Bemerkungen
Greenwich 1919	1,98''	$\pm 0,16''$	2,16'' genauere Reduktion
Lick 1922	1,72''	$\pm 0,15''$	2,05'' uncorr. Resultat 2,2'' bei strengster Redukt.
Potsdam 1929	2,24''	$\pm 0,10''$	Skalenwert unabhängig und genau genug bestimmt
Moskau 1936	2,71''	$\pm 0,26''$	Einzelheiten nicht bekannt
Yerkes 1947	2,01''	$\pm 0,27''$	Skalenwert nicht unab- hängig bestimmt

Three years later Mikhailov published the similar results [3]. Bouet recalled an unsolved problem once again in 1982 [4].

Schmeidler was the last one to deal with the matter [5]. He proposed the following correction to the Einstein formula:

$$\delta r = 1.75''/r + 0.3''/r^2$$

His reasoning was:

"The optical excess is caused by stars so near to the Sun that radioastronomical observations are impossible. Optical and radioastronomical measurements both make it likely that there is an additional term inversely proportional to a power higher than the first of the distance from the Sun."

Schmeidler has specified as limit 5 sun radii. Closer to the sun the relativistic dependence is violated. The gravitational field becomes stronger than calculated by the general relativity. But interesting that at this distance the force of gravity of the Sun corresponds approximately to the force of attraction on the surface of the Earth.

Therefore I think it is in principle possible to test the limit of general relativity even in the earth laboratory.

[1] Freundlich E., Klüber H.V., Brunn A.V. Über die Ablenkung des Lichtes im Schwerefeld der Sonne. Zeitschrift für Astrophysik, Vol. 3, p.171. 1931

[2] Erwin Finlay-Freundlich. Der heutige Stand der empirischen Bestätigung der allgemeinen Relativitätstheorie. Physikalische Blätter, Volume 9, Issue 1, Januar 1953, Pages 14-23,

[3] Михайлов А. А. "Наблюдение эффекта Эйнштейна во время солнечных затмений". УФН 59 51–66 (1956)

[4] Bouet J. Light deflection during solar eclipses. Solar Physics, vol. 78, June 1982, p. 385-387.

[5] F. Schmeidler. Zur Interpretation der Messungen der Lichtablenkung am Sonnenrand. Astronomische Nachrichten (ISSN 0004-6337), vol. 306, no. 2, 1985, p. 77-80.