On the occasion of eclipse 2017

An ex-ante prediction of starlight bending without allusion to spacetime

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Abstract

In this brief note we put forward a novel prediction of starlight bending, to be measured during Eclipse 2017. Our prediction is based on a simple, relativistic modification of Newton's physics, without allusion, whatsoever, to Einstein's concept of spacetime.

Keywords: Light Bending; Eclipse 2017; Light Deflection; General Relativity, Information Relativity.

At these very moments on August 21, 2017, a total solar eclipse is being observed by millions of people in several states in the USA, from Salem, Oregon, to Charleston, South Carolina. We are aware of groups of amateurs who stated intentions to repeat Eddington's seminal 919 experiment [1-3]. One group has been doing careful preparations for their planned experiment, with the intention of "celebrating Einstein's General relativity" [4].

In this brief note we state our prediction of the deflection angles to be measured during the current eclipse. Our predictions, summarized hereby, are based on our recent relativistic modification on Newtonian physics, termed "information relativity theory" (c.f., [5-8]).

In a recent article [9], we derived an exact term for the deflection angle of starlight by the Sun, as a function of the projected distance of the starlight from the center of the Sun. For a "grazing light", our predicted deflection is 1.66 arcseconds, which is exactly equal to the corrected result of the June 30, 1973 eclipse [10, 11]. Comparison between the predictions of Information Relativity, and General Relativity, using all previous measurements, taken during eclipses spanning from the seminal eclipse on May 29, 1919, to the eclipse June 30, 1973 eclipse, revealed that *we were able to match general relativity's successful predictions, without "throwing away" Newton's mechanics, and without any need for the concept of spacetime*.
Our analysis, detailed in [10], yielded the following equation:

$$\widehat{\boldsymbol{\theta}} = \boldsymbol{\pi}\left(\boldsymbol{e}^{\frac{\mathbf{1}}{\mathbf{4}}\frac{\boldsymbol{R_{sch}}}{\boldsymbol{r}}\frac{\boldsymbol{D}}{\boldsymbol{c}}} - \mathbf{1}\right). \tag{1}$$

Where c is the velocity of light (2.99792458 × 10^8 m/s), D is the "effective distance" for the domination of the Sun's gravity, and R_{sch} is the Sun's Schwarzschild radius given by

$$R_{sch} = \frac{2GM_{\odot}}{c^2} \tag{2}$$

where G is the gravitational constant (6.67408 × 10-11 m3 kg-1 s-2), and $M_{\odot}$ is the mass of the Sun (1.989 × 10^30 kg). Taking D to be equal to the outer sphere of the Oort cloud [12, 13], D ≈150,000 AU (or 2.37184 *ly*), and defining $\hat{r} = \frac{r}{R_{\odot}}$, where $R_{\odot}$ is the Sun's radius, we can rewrite Eq. 1 as:

$$\hat{\theta} = \pi \left(e^{\frac{2.37184}{4} \frac{\frac{R_{sch}}{R_{\odot}}}{\hat{r}}} - 1 \right) \quad \text{(radians)} \ . \tag{3}$$

Substituting $\frac{R_{sch}}{R_{\odot}} \approx \frac{3\ km}{695700\ km} \approx 0.00000431220$ in Eq. (3) and writing Eq. 3 in arcseconds yields:

$$\hat{\theta} \approx 180 \text{ x } 3600 \left(e^{\frac{0.00000255696}{\hat{r}}} - 1 \right) \quad \text{(arcseconds).} \tag{4}$$

For a grazing ray $r = R_{\odot}$, substituting $\hat{r} = 1$ in Eq. (4) gives:

$$\boldsymbol{\hat{\theta} \approx 1.66 \text{ arcseconds.}} \tag{5}$$

Figure 1 depicts the predictions for the deflection angle, by Information Relativity, General Relativity, and classical Newtonian mechanics, as a function of the starlight projected distance from the Sun's center. As could be seen, the predictions of Information Relativity and General Relativity are very close to each other for all values of $\hat{r}$, and approaches zero for very large distances from the Sun's corona.

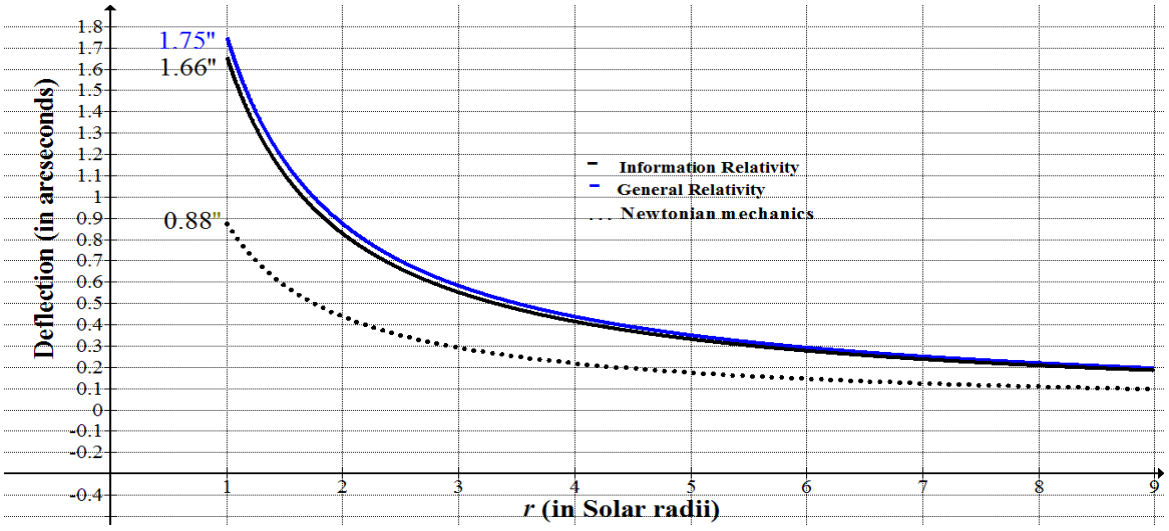

Figure 1. Predictions of three theories

We do not know exactly what stars will be observed by during the 2017 eclipse. Bruns et al. [4] plan to observe the star Regulus, located in the constellation Leo, at a distance of about 77 light years away from Earth. Light from Regulus will pass at a projected distance of 5.3 solar radii from the Sun's limb. Other observable stars are in the eclipse field are HIP-49158 (+7.8) and HIP-49328 (+7.1).

For the deflection of light emitted from Regulus, the clearest star to be seen during totality, our predicted deflection is:

$$\hat{\boldsymbol{\theta}}\ (\mathbf{Regulus})_{\boldsymbol{IR}} = \frac{\mathbf{1.66''}}{\mathbf{5.3}} \approx \mathbf{0.31''}. \tag{5}$$

For comparison, the prediction deflection by GR is:

$$\hat{\theta}\ (\text{Regulus})_{GR} = \frac{1.75''}{5.3} \approx 0.33''. \tag{6}$$

Predictions for the bending of light from stars HIP-49158, and HIP-49328 could be calculated similarly, or looked up in Fig. 1.

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