# Non gravitational deflection of light in Special Relativity

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We show that even Special Relativity predicts, as a consequence of length contraction, a kind of light's deflection for an observer having a relativistic speed relative to the source.

Let S a source of light at a distance L and a height h from an observer O at rest. The horizon angle ϕ must verify :

$$\tan \phi = \frac{h}{L}. \tag{1}$$
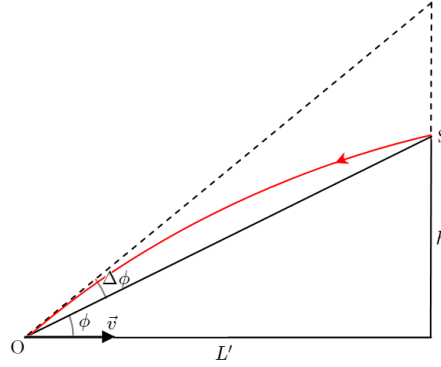
If the observer O starts an inertial motion at a relativistic speed v along L (the figure above), according to Special Relativity, the distance L is contracted to become :

$$L' = L\sqrt{1 - \left(\frac{v}{c}\right)^2}, \tag{2}$$

which gives to the angle ϕ a new value ϕ' that verifies :

$$\tan \phi' = \frac{h}{L'}. \tag{3}$$

Let us put :

$$\Delta\phi = \phi' - \phi. \tag{4}$$

Together, Eqs. (1,2,3,4) lead to :

$$\Delta\phi = \arctan\left(\frac{\tan\phi}{\sqrt{1 - (v/c)^2}}\right) - \phi. \tag{5}$$

One can note that more ϕ is near 0 more $\Delta\phi$ is greater.
Thus, objects appear higher-deeper-larger when faced by a relativistic observer.
For example, a vertical meter at a distance 1 km gains 1 mm for an observer at the speed :

$$v \simeq \frac{c}{22.38} \simeq 13397 \text{ km/s}.$$

To conclude, light's deflection is not exclusive to General Relativity, it arises also in Special Relativity as a consequence of length's contraction. But such effect is very difficult to be verified since the needed experience must display high relativistic speeds.