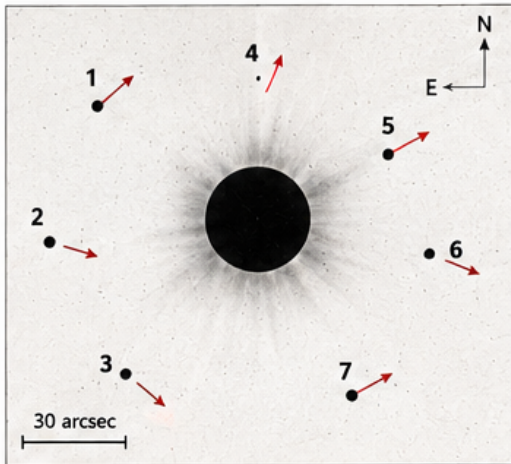


3. FROM MEASURED COORDINATES TO EINSTEIN'S DEFLECTION: THE ANALYSIS

They did not see a star move by 1.98". They measured seven tiny shifts at different distances from the Sun and solved for the single value that best fitted the complete pattern.

1. MEASURED DISPLACEMENTS ON THE PLATE

For each of the seven stars the differences between eclipse and comparison plates gave Δx and Δy (after conversion to arcsec). Arrows show the raw displacements (before removal of plate effects).



The scale is approximate. The true distances of the stars from the Sun's centre (r) are given in Table I.

THE SEVEN STARS (Sobral 4-inch, Plate I)

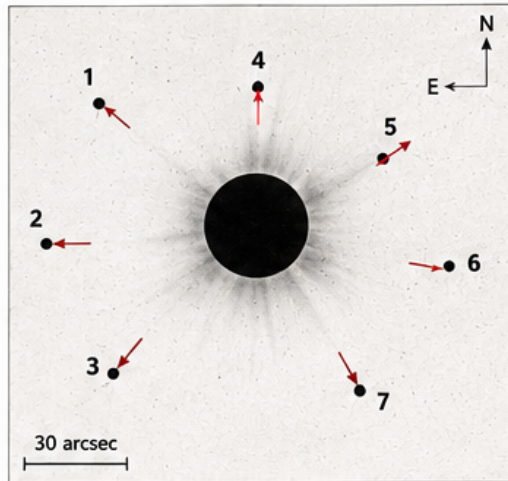
No.	Star	r (arcmin)	r (arcsec)	Raw shift (arcsec)
1	θ^1 Tauri	7.37	442	0.54
2	θ^2 Tauri	6.10	366	0.64
3	ι Tauri	5.49	329	0.74
4	κ^1 Tauri	7.18	431	0.50
5	κ^2 Tauri	6.18	371	0.60
6	λ Tauri	6.46	388	0.58
7	μ Tauri	6.29	377	0.66

(r = angular distance of the star from the Sun's centre)

2. REMOVE PLATE EFFECTS (TRANSLATION, ROTATION, SCALE)

Using all seven stars, the plate constants were solved (first-order plate equations) so that the residuals are the displacements caused by gravity alone.

After correction the shifts are radially outward from the Sun.



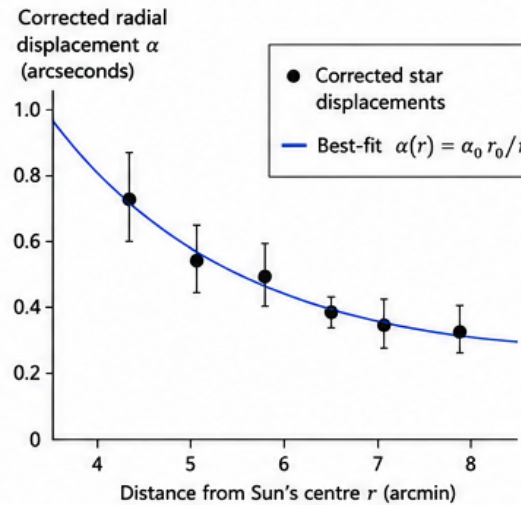
What was removed

- Translation of the plate (shift in x and y)
- Rotation of the plate field
- Change of scale (magnification)

Only the common radial pattern remains.

3. FIT THE RADIAL LAW $\alpha(r) = \alpha_0 (r_0/r)$

General relativity predicts that the deflection is radial and inversely proportional to r . Fitting this law to the seven corrected displacements gives the single best value α_0 : the deflection at the solar limb (r_0).



Fitted law: $\alpha(r) = \alpha_0 \frac{r_0}{r}$
where r_0 = solar limb distance = $1.75' = 105''$
 α_0 is the deflection at the solar limb.

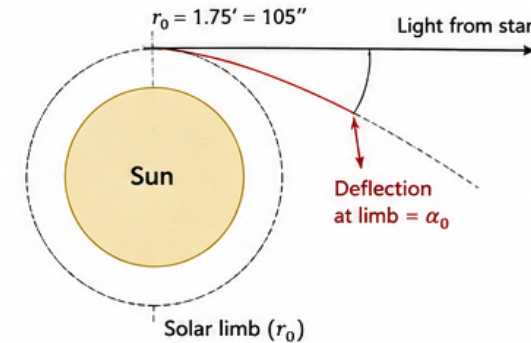
Best-fit result

$\alpha_0 = 1.98'' \pm 0.12''$
(probable error)
for the deflection at the solar limb

This value comes from the pattern of all seven stars together, not from any single star.

4. THE VALUE AT THE SOLAR LIMB

The fitted value α_0 represents the deflection of a light ray grazing the Sun ($r = r_0$). This is what was compared with theory.



THE EXPERIMENTAL TEST

	Predicted deflection at the solar limb (arcseconds)
Newtonian theory (Soldner, 1804)	0.87''
General Relativity (Einstein, 1911)	0.87''
General Relativity (Einstein, 1915)	1.75''
Sobral 4-inch result (Dyson, Eddington & Davidson, 1920)	1.98'' $\pm$ 0.12''

The observed value agrees with Einstein's 1915 prediction and is far larger than the Newtonian prediction.

The quoted uncertainty ($\pm 0.12''$) is the authors' probable error from the scatter of the seven stars about the fitted law. It does not include possible systematic errors, which were the subject of later debate.