

That the Same Ellipse Was Three Months Out Was the Evidence of a Different Cause

— Aberration Is **20.49552** Arcseconds Whatever the Distance, While Parallax Goes as Its Reciprocal — A Factor of **26.6442** at Proxima and **20495** at a Kiloparsec — [Paper 328]

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August 2026

— *From thinking to syncing.* —

Abstract

Over a year a star traces a small ellipse on the sky. This paper asks whether that ellipse is one thing—the answer is that there are two, and they are told apart by phase. No new mathematical theorem and no new law is claimed. First, aberration is **20.49552** arcseconds (Section 2). Second, this is the core of the paper. Aberration does not depend on distance; parallax goes as its reciprocal (Section 3). Third, even the nearest star opens by **26.6442**. At a kiloparsec, **20495** (Section 3). Fourth, amplitude cannot always separate them. At some distance the two would be equal (Section 3). Fifth, their phases differ by a quarter. That is how Bradley told them apart (Section 4). Sixth, the separator is whether the effect is set by position or by velocity (Section 5).

Scope of this paper (scope note): No new mathematical theorem and no new law is claimed——aberration, annual parallax, Bradley’s observation of 1728, and the definition of the constant of aberration are all standard. We do not build celestial mechanics——all we use is two angles and the phase between them. We do not treat this relativistically——the relativistic formula for aberration is not entered. We look only where first order in v/c suffices. We do not treat proper motion——a star’s own motion is not periodic and so separates from both of these. It is mentioned and no more. We do not adjudicate the history——who first saw what is not entered. We do not treat the distance ladder——the rungs beyond parallax belong to Paper 297. Relation to earlier papers: Paper 297 showed the cosmic distance scale to be a ladder of seven rungs with only the first measured directly——that first rung is parallax, and this paper looks at the other ellipse standing beside it. Paper 325 showed the radius not entering the angle of a rainbow——the same form, with distance not entering aberration here. Paper 300 showed whether two things share a root is decidable——this is an instance of “same shape, different root”, and what decided it was not a value but a phase. Paper 327 showed two curves agreeing to within 0.083 per cent——there the appearance is the same and the things differ; here the size can be the same and the things differ. Paper 313 showed the corpus using “synchrony” in several senses——phase is again the tool that decides. What is added is giving the constant of aberration from both a simple calculation and the literature and stating the difference, tabulating the ratio across three decades of distance, solving for the distance at which the two would be equal, and putting the separator on position against velocity.

1. Notation and the Question

Setting: Observed through a year, a star traces a small ellipse on the sky. Two causes are possible.

Name	Because of what
Annual parallax	the Earth’s position changes
Aberration	the Earth’s velocity changes

Observation 1.1

Both have a period of one year and both are ellipses. The shape does not distinguish them——some other handle is needed.

Question: By what can the two be told apart?

2. Aberration Is 20.49552 Arcseconds

Setting: Run through rain and the rain seems to come from in front. The same happens with light, at a tilt $\tan \alpha = v/c$.

Check 2.1: From the Earth’s orbital speed (computed here).

Quantity	Value
Orbital speed v	29784.8 m/s
v/c	9.935140×10^{-5}
Simple calculation $\arctan(v/c)$	20.492697 arcsec
Literature (constant of aberration κ)	20.49552 arcsec
Difference	0.002823 arcsec (0.0138%)

Observation 2.2

A point to write honestly—the simple calculation here differs from the literature by 0.0138 per cent. The constant κ is defined to include the eccentricity of the orbit and more, and is not the value from a mean circular speed—this paper uses the literature value 20.49552 arcsec, and the simple calculation is for seeing the order of magnitude.

Observation 2.3

Twenty arcseconds is small. About 1/88 of the apparent diameter of the full moon—utterly invisible to the eye.

Observation 2.4

The distance to the star is not in that formula. $\tan \alpha = v/c$ contains only the observer’s speed and the speed of light—not one piece of information about the thing being looked at.

3. The Core: One Depends on Distance and the Other Does Not

Check 3.1: The two angles by distance.Parallax is $1/d$ (d in parsecs, angle in arcseconds).

Star	d [pc]	Parallax [arcsec]	Aberration [arcsec]	Ratio
Proxima	1.30	0.769231	20.49552	26.6442
10 parsecs	10.00	0.100000	20.49552	204.9552
100 parsecs	100.00	0.010000	20.49552	2049.5520
1 kiloparsec	1000.00	0.001000	20.49552	20495.5200

Observation 3.2

This is the core of the paper.The right-hand column never moves——aberration is the same 20.49552 arcseconds for every star.

Observation 3.3

Even the nearest star is out by **26.6442**.That is the most favourable case there is——anyone hunting for parallax has an effect 27 times larger sitting on top of it, always.

Observation 3.4

Solving for the distance at which the two would be equal,

$$\frac{1}{d} = 20.49552 \Rightarrow d = 0.048791 \text{ pc} = 0.159135 \text{ light years}$$

No such star exists——even Proxima is 4.2 light years away. So on amplitude alone, aberration always wins.

Observation 3.5

Paper 325 wrote that the size of the drop is not in the angle of the rainbow.The same form——there size, here distance, stays out of the answer.

Observation 3.6

And the reason it stays out has the same shape too. For the rainbow because a sphere is similar at every size; for aberration because composing velocities never looks at where the other thing is——in both, there is no route by which the other's information could enter.

4. The Phases Differ by a Quarter

Setting: If amplitude cannot separate them, look at when each is largest.

Check 4.1: The phase of the displacement through twelve months.

Elapsed	Parallax displacement	Aberration displacement
0 months	+1.0000	0.0000
3 months	0.0000	+1.0000
6 months	−1.0000	0.0000
9 months	0.0000	−1.0000

Observation 4.2

Exactly 90 degrees, three months apart. Parallax is set by the Earth's position and aberration by its velocity——and in circular motion the velocity points a quarter period ahead of the position.

Observation 4.3

Bradley told them apart by this in 1728. Hunting for parallax he found an ellipse, in the wrong season——the phase told him it was not what he was looking for.

Observation 4.4

A mismatch in amplitude would have been weak evidence. Not knowing the distance, one has no predicted parallax to compare against—whereas the phase can be predicted without knowing the distance at all.

Observation 4.5

This is a case of deciding different roots by structure rather than by value. Applying Paper 300’s criteria.

Criterion	Result
Is there a correspondence preserving identities?	no. d enters one and not the other
Do the same quantities appear?	no. v/c against $1/d$
Do they keep agreeing as variables move?	no. Move d and only one changes

Observation 4.6

All three rows say different roots. And the quarter-period offset shows it observationally—criterion and observation return the same answer.

5. Separator: Set by Position, or by Velocity

Observation 5.1

Separator—whether the effect is set by the observer’s position or by the observer’s velocity.

	Set by	Distance dependence	Phase
Annual parallax	position	$1/d$	reference
Aberration	velocity	none	90 degrees ahead

Observation 5.2

All three columns come from that one point. Settle position or velocity and the distance dependence and the phase follow automatically—three differences that looked independent are one difference.

Observation 5.3

Stop the Earth and only one of them vanishes. At zero velocity aberration is gone, while the position is still on the far side of the sun—the separator can be moved.

Observation 5.4

A point to write honestly—a real observation carries a third motion. The star's own proper motion—though being non-periodic it separates by failing to come back after a year.

Observation 5.5

Where this stands against Paper 297.297 wrote that the first rung of the distance ladder is parallax—this paper says that immediately beside that first rung sits an ellipse of the same shape containing no distance at all. The first rung does not stand by itself.

Observation 5.6

One last thing—Bradley failed to find what he was looking for and found what he was not. And it became a measurement of the speed of light—because v/c can be read off from an angle of 20 arcseconds. A failure to find became the ruler for something else.

6. Roll Call and Closing

1. Aberration is 20.49552 arcsec (Check 2.1): The 0.0138 per cent gap is stated.
2. $1/88$ of the full moon (Observation 2.3): Invisible to the eye.
3. Distance is not in the formula (Observation 2.4): Only v and c .

4. **26.6442 at Proxima** (Check 3.1): **The most favourable case.**
5. **20495.5200 at a kiloparsec** (Check 3.1): **Parallax goes as $1/d$.**
6. **Equal at 0.159135 light years** (Observation 3.4): **No such star.**
7. **The phases differ by 90 degrees** (Check 4.1): **Position against velocity.**
8. **Bradley, 1728** (Observation 4.3): **The season was wrong.**
9. **Phase needs no distance** (Observation 4.4): **Amplitude has nothing to compare to.**
10. **The first rung does not stand alone** (Observation 5.5): **Beside 297.**

Closing: Over a year a star traces a small ellipse on the sky, and two causes are possible——annual parallax, because the Earth’s position changes, and aberration, because its velocity does. Both have a period of one year, both are ellipses, and the shape does not distinguish them. Aberration follows from $\tan \alpha = v/c$ and is **20.49552** arcseconds, about $1/88$ of the apparent diameter of the full moon——(the simple calculation here, **20.492697**, differs by 0.0138 per cent, because κ is defined to include the eccentricity, so this paper uses the literature value). And the distance to the star is nowhere in that formula——it contains only the observer’s speed and the speed of light, not one piece of information about the thing being looked at. Even Proxima is out by **26.6442**, and at a kiloparsec by **20495.5200**. The distance at which the two would be equal is 0.159135 light years, and no such star exists——so on amplitude alone, aberration always wins. What separated them was not amplitude but phase——in circular motion the velocity points a quarter period ahead of the position, so the two ellipses are exactly three months apart. In 1728 Bradley, hunting for parallax, found an ellipse in the wrong season and knew it was not his quarry. A mismatch in amplitude would have been weak evidence——without the distance there is no predicted parallax to compare against, whereas the phase can be predicted without knowing the distance at all. One thing separates them——whether the effect is set by the observer’s position or by the observer’s velocity. Settle that and the distance dependence and the phase follow automatically, so three apparently independent differences are one. Paper 297 wrote that the first rung of the distance ladder is parallax——this paper says that immediately beside it sits an ellipse of the same shape containing no distance at all. The first rung does not stand by itself. One last thing——Bradley failed to find what he was looking for and found what he was not. And it became a measurement of the speed of light, because v/c can be read off from an angle of 20 arcseconds. A failure to find became the ruler for something else.

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