.

Parallax Triangulation from Displacement in Spacetime

Arthur Eugene Pletcher
(Dated: July 12, 2015)

Abstract

By extending the classic concept of parallax as a system to triangulate distant stars, I propose that a displacement in spacetime can be used to triangulate distant galaxies. Such an empirical experiment would also validate, or invalidate, conventional relative Doppler effect theory.

The practical procedure would involve measuring SNe1 supernovae data analysis from two separate spacetime reference frames, using two (essentially) simultaneous observations, from different inertial reference frames. Both rfs observe the same two supernovae events a and b, such that b is twice the distance x from the Earth than a

I named this experiment "Spacetime Parallax", because the triangulation of distance x is from a displacement in spacetime and the resulting time dilation is compared.

This same format is then used for a quadratic accelerating reference frame, mimicking g force on the Earth's surface.

If the difference in wavelengths ($\Delta\lambda$), as measured between the two rfs, is not in proportion to the distance between the two events ($x_b = 2x_a$), it is then justified to assume some error is evident in conventional methods.

Correcting for such skewed Doppler shift observations has implications for all parameters of cosmology. This might include: dark energy, accelerated expansion, average density, the cosmic event horizon, as well as rotational velocities in general.

CONTENTS

1. INTRODUCTION

For the purpose of extrapolating a method of triangulating distance in spacetime, I begin with a review of classic 3D parallax. Few postulates are involved. Only time dilation, as a consequence of velocity, and triangulation within the framework of Lorenz transformations.

2. DETERMINING DISTANCE IN SPACETIME

To determine the distance x of supernovae in spacetime, I propose a system of triangulation, which I refer to as "4D parallax"
It is analogous to parallax. However, the displacement is between two reference frames. Instead of measuring the angular effects of subtended arcs in classic parallax, the resulting time dilation is used in spacetime parallax.
A method of triangulating between rfs, using a significantly accelerated vehicle, is considered in section 5

A. Subtended Arcs From Single Point Observation in 3D Parallax

I begin with a review of classic 3D parallax, then propose a similar approach to distance in spacetime.

B. Review of Classic Parallax, for Analogy

For the purpose of extrapolating a spacetime parallax, a review of the parallax formula is shown [1] :

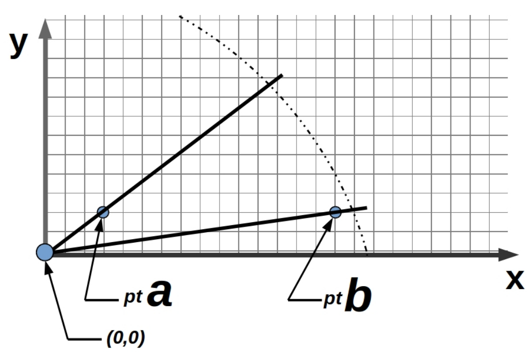

FIG. 1. 3D parallax. Subtend arc $a > b$, from $(0, 0)$

From a single point, a subtends a greater arc than does b, per the standard parallax formula:

$$d = \frac{1}{p} \tag{1}$$

or, more precise:

$$x = \frac{tan\theta}{y} \tag{2}$$

C. Triangulation of Distance x, Using Δy Displacement.

As the point of observation is displaced in y, the resulting difference of subtended arc from a is greater than the arc difference from b:

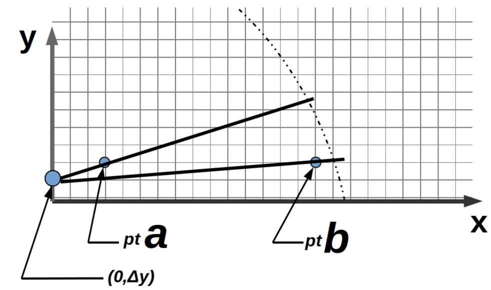

FIG. 2. Difference in subtended arc, from $(0, 0)$ to $(0, \Delta y)$

The relationship between Δp, at point a, and Δp, at point b, for the displacement Δy of an in-line observer is proportionate to the distance x:

$$\frac{\Delta p_b}{\Delta p_a} = \frac{x_b}{x_a} \tag{3}$$

3. USING INERTIAL REFERENCE FRAMES, AS DISPLACEMENT IN SPACETIME

A. Triangulation of Distance x, Using the Time Dilation of Two Inertial RF

The following diagram replaces the y coordinate with time t. a and b are events in time, along $t = 0$. The observer has accelerated to a new rf of x', with a synchronous of $t' = 0$.
Per the second relativity postulate [2] , angles x' and t' are congruent.

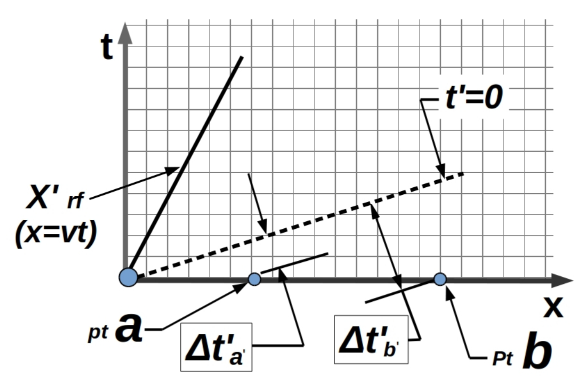

FIG. 3. Analogous to classic parallax, $\Delta t'_b > \Delta t'_a$

The difference (between rf), from $t' = 0$, for points a and b is linear, in proportion to distance x:

$$\frac{\Delta t_b}{\Delta t_a} = \frac{x_b}{x_a} \tag{4}$$

Notice that this is not a transformation, rather a triangulation between two inertial reference frames.

B. Triangulation of Distance x, Using an Accelerating RF and Proper Time

As x' accelerates to g, $t' = 0$ becomes a parabolic, correspondingly.

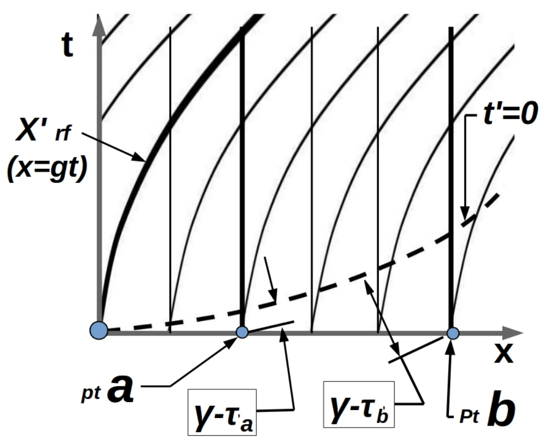

FIG. 4. x' rf is accelerating. t' is parabolic, $|\gamma - \tau|$ increases geometrically. Time-dilation is a function of distance.

Combining the equivalence principle [3] and equation 4 , time dilation γ between an observer on the Earth's surface at a gravity force of g and an observer in proper time. τ will increase geometrically with distance x (between rf):

$$\frac{\Delta t_b}{\Delta t_a} = \frac{\int g(x_b)}{\int g(x_a)} \tag{5}$$

Notice again, that this is not a transformation, rather a triangulation between two reference frames.

4. RESULTING RELATIVISTIC DOPPLER EFFECT

The relativistic Doppler effect, in a spacetime parallax shift (between accelerated rf and proper time) also increases geometrically with distance
Using the Doppler factor [4] :

$$\sqrt{\frac{1+\beta}{1-\beta}} \tag{6}$$

Resulting redshift from accelerated velocity:

$$\frac{\sqrt{1 + \frac{\int g(x_b)dx}{c}}}{\sqrt{1 - \frac{\int g(x_a)dx}{c}}} = \frac{\int g(x_b)}{\int g(x_a)} \tag{7}$$

5. PRACTICAL PARALLAX EXPERIMENT CONSIDERATIONS

The experiment involves two simultaneous (essentially, from the Earth rf) observations, from different inertial reference frames. Both rfs observe the same two supernovae events a and b, such that b is twice the distance x from the Earth than a
Measuring for special relativity effects would require an observation of events, a and b, from a significantly accelerated rf.
If feasible, an unmanned multi-stage ballistic rocket and adequately equipped to measure events a and b, in coordination with observations on Earth rf.
However, once escape velocity is achieved, the same vehicle can also be used to compare the effects of general relativity, on Earth, with proper time.

6. CONCLUSION

Skewed Doppler shifts, if verified, would have implications for all parameters of cosmology. This might include:
Accelerated expansion becoming more isotropic, as applicable to dark energy
Rotational velocities decreased, as applicable to galaxy spin rate, as well as to millisecond pulsars.
Average density and the cosmic event horizon.

[1] Fritz Benedict. Interferometric astrometry of proxima centauri and barnard's star using hubble space telescope fine guidance sensor 3: Detection limits for substellar companions. *The Astronomical Journal 118*, 1999.

[2] Hermann Minkowski. *Raum und Zeit.* Physikalische Zeitschrift, 1909.

[3] Albert Einstein. *The Meaning of Relativity.* Routledge, 2003.

[4] P. Parshin. *heoretical and Exerimental Investigation of the Relativistic Doppler effect.* Galilean Electrodynamics 12, 2001.