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On The Biased Calculation of the Inflationary Universe

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ABSTRACT

*This is the third of five related works on electromagnetic theory, special relativity, relativistic mass, inflationary universe theory, and the general theory of relativity. In two of the prior papers the special theory of relativity (**STR**) was shown to be untenable and an alternate theory proposed. In this work it is shown that **STR** tends to overestimate stellar escape velocities. As a result the universe is less inflationary than is generally thought, and it may in fact not even be inflationary at all.*

Introduction

In 1905 Einstein [3] introduced in his special theory of relativity (**STR)** the following two postulates: (1) when properly formulated, the laws of physics have the same form in all inertial systems and (2) the measured speed of light in a vacuum is *c*, independent of the movements of the source and the observer. His second postulate is shown in Aucamp [1,2,3] to be in error, and an alternate theory of relativity (**ATR**) is developed which is independent of the inertial frame of reference (I**FR**). For the purposes of this paper, the following aspects of **ATR** will be assumed:

ATR Assumptions Needed in This Paper

1. **STR** is untenable.
2. The speed of light is *c* with respect to the source.
3. Length and clock times do not depend on *v* and **IFR.**

This theory is applied to the following problem: Assume a photon is emitted at time *t* and the inertial frame of reference $\mathbf{IFR}_0$ is taken as that of the source (S) at that instant. Further assume at some later time the photon is detected by an observer (O) at ***r***, where the component of observer velocity moving toward the source (i.e., in the direction of –***r***) is *v*, all as measured in $\mathbf{IFR}_0$.Under**ATR**the measured photon velocity by the observer will be *c*-*v*, whereas in **STR** it is *c*. Now assume the wavelength of the arriving photon at the observer is measured as λ_O, and from chemistry assume it is known that this wavelength at the source is λ_S. Further assume that *v* is calculated by the observer using **ATR** and *V* using **STR**. It is noted that *v* is the true value and *V* is an estimate which will turn out to be biased. The purpose of this paper is to compare these values.

Evaluation of *V* Using ATR in the Stellar Case

Consider a photon moving at velocity *c* with respect to its stellar source(S) which is stationary in $\mathbf{IFR}_0$at the instant of emission. Define f_S, T_S and λ_S as the photon frequency, period and wavelength, respectively, all as based in $\mathbf{IFR}_0$. These variables are related by the following well-known formulas:

$$\lambda_S = c\,T_S \qquad \textbf{(2.1)}$$

$$f_S = 1 / T_S \qquad \textbf{(2.2)}$$

If it is assumed that λ_S is known by the astronomer from the chemistry of the emitting star, then from **(2.1)** and **(2.2)** both T_S and f_S are also known.

Now suppose that photons having the above properties are viewed by an observer moving at velocity *v*towardthe source as measured in $\mathbf{IFR}_0$. Let the frequency, period, and wavelength at the observer bef_O, T_O, and λ_O, respectively, and assume λ_O can be measured. From standard theory:

$$f_O = 1 / T_O = (1 + v/c)\, f_S \qquad \textbf{(2.3)}$$

Thus, from **(2.1)**, **(2.2)** and **(2.3)** the following obtains:

$$T_O = 1 / f_O = 1 / [\, f_S(1+v/c)\,] = T_S/(1+v/c) \qquad \textbf{(2.4)}$$

Assuming the photon wavelength in **IFR**$_0$, λ_S, is its length, and assuming it takes a time $T_O$to pass by the observer, then its length, D, in **IFR**$_0$ is:

$$D = \lambda_S - vT_O \quad \textbf{(2.5)}$$

According to **ATR** this length D in **IFR**$_0$ is the same as what the observer sees. Thus, from **(2.5)** and **(2.1)**:

$$\lambda_O = D = \lambda_S - vT_O = cT_S - vT_O \quad \textbf{(2.6)}$$

Inserting **(2.4)** into **(2.6)** yields, after a little algebra:

$$\lambda_O = cT_S\,[\,1 - (v/c)/(1+v/c)] \quad \textbf{(2.7)}$$

Simplifying **(2.7)** yields, on noting $\lambda_S = cT_S$, the following:

$$\lambda_O/\lambda_S = 1 / (1 + v/c) \quad \textbf{(2.8)}$$

Thus, from **(2.8)** and a little algebra:

$$v= c\,[(\lambda_S/\lambda_O) - 1] \quad \textbf{(2.9)}$$

Based on **(2.9)** and the known values of λ_S and λ_O, v is known.

STR Relativistic Calculation of *V*

As astronomers assume **STR** is the applicable theory, the observer in the above example is viewed as stationary. As the calculation of the source approach velocity is in error, V will be used as the estimate rather than the true v. From **STR** the velocity of light at the observer is postulated as c. The wavelength λ_O at the observer is measured, and it is assumed here that the wavelength λ_S at the source is known. Based on **STR**, the observer frequency f_O and source photon frequency f_S are given as follows:

$$f_O= c /\lambda_O \quad \textbf{(3.1)}$$

$$f_S= c /\lambda_S \quad \textbf{(3.2)}$$

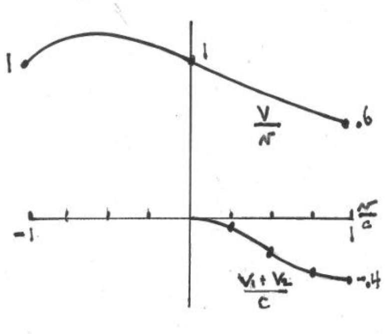

Figure1. *Showing Str Stellar Bias*

The top line in **Figure 1** is a plot of V/v versus v/c. It is seen that V overestimates v when V/c<0, or when the star is moving away from the observer, and v.v. when it is moving toward the observer. However, when it comes to paired observations from two stars when v_1= -v_2, it will be shown there is a bias toward underestimating the approach velocities.

These frequencies are related in **STR** by the following well-known relativistic Doppler equation:

$$f_O = f_S\sqrt{(c+V) / (c - V)} \quad \textbf{(3.3)}$$

Substituting **(3.1)** and **(3.2)** into **(3.3)** yields:

$$(\lambda_S^2 /\lambda_O^2) = (c+V) / (c-V) \quad \textbf{(3.4)}$$

Routinely solving **(3.4)** for V yields:

$$V= c\,(x^2 - 1) / (x^2+1) = c(x - 1)(x+1)/(x^2+1) \quad \textbf{(3.5)}$$

Where, x is defined as:

$$x = \lambda_S/\lambda_O \quad \textbf{(3.6)}$$

Bias in STR Calculations

It is shown here that stellar approach velocities are undervalued, not individually but on the average. This bias may be what is behind the findings that the universe is inflationary. From **(2.9)** and **(3.6)**:

$$v= c\,[(\lambda_S/\lambda_O) - 1] = c\,(x - 1) \quad \textbf{(4.1)}$$

Thus, from **(4.1)** and **(3.5)**:

$$V=c(x - 1)(x+1)/(x^2+1) = v(x+1)/(x^2+1) \quad \textbf{(4.2)}$$

Rewriting **(4.2)** yields :

$$V/v = (x+1)/(x^2+1) \quad \textbf{(4.3)}$$

From **(4.1)**x=1+v/c. Substituting this value into **(4.3)** yields:

$$V/v = (2+v/c) / [\,(1+v/c)^2 +1\,] \quad \textbf{(4.4)}$$

From **(4.4)** a plot of V/v versus v/c for -1≤ v/c ≤1 can be found. This is plot is shown as the upper curve in **Figure 1**. It is seen that V/v=1.0 at v/c= –1. Then V/v rises to a maximum value of 1.207 at v/c=(√2)-2= –.5857.Then it falls back to 1.0 at v/c=0, and finally continues on down to .6 at v/c=1.The bottom curve showing a clear bias will be explained in the next section.

Bias in Paired Observations

It is instructive to consider the case of a pair of two related stars, where the true stellar approach velocities are v_1=v andv_2=–v where v>0. In this case star #1 is moving toward the observer at velocity v, and star #2 is moving away from the observer at v. Sincev_1+v_2=0, there is no average movement in the pair of stars toward the observer, so that the situation under study is unbiased. If it is a priori assumed there is no bias in the distribution of the velocities toward the earth (i.e., that the expected value of v is zero), then an analysis of V_1+V_2isimportant.

The value of $(V_1+V_2)/$ c can be calculated and plotted versus v/c. This is done as follows. First use **(4.4)** with $v_1=v$:

$V_1/v_1= (2+v_1/c) / [(1+v_1/c)^2 +1]$ **(5.1)**

$V_1/v = (2+v/c) / [(1+v/c)^2 +1]$ **(5.2)**

Next use **(4.4)** with $v_2= - v$:

$V_2/v_2= (2+v_2/c) / [(1+v_2/c)^2 +1]$ **(5.3)**

$V_2/v = - (2 -v/c) / [(1-v/c)^2 +1]$ **(5.4)**

Now combine **(5.2)** and **(5.4)**:

$(V_1+V_2)/v =(2+v/c) / [(1+v/c)^2 +1] - (2 -v/c) / [(1-v/c)^2 +1]$ **(5.5)**

Finally, rewrite **(5.5)** as follows:

$(V_1+V_2)/c =(v/c) \{(2+v/c) / [(1+v/c)^2+1] - (2-v/c)/[(1-v/c)^2+1]\}$ **(5.6)**

The result given by **(5.6)** is totally a function of v/c, where $0\le v/c\le 1$. It is seen that $(V_1+V_2)/c=0$ when $v/c=0$, and that $(V_1+V_2)/c= -.4$ when $v/c=1$. The plot of $(V_1+V_2)/c$ is shown as the bottom curve of **Figure 1** for $0\le v/c\le 1$. Note that v is a dummy variable satisfying $0\le v\le c$. It is seen that $(V_1+V_2)/c$ is negative for all $v/c>0$, so there is a negative bias when pairs of stars are considered. Thus, the true approach velocities tend to be underestimated when they are considered in pairs. This bias is zero when $v/c=0$ and becomes increasingly negative when v/c increases. The maximum negative bias of $(V_1+V_2)/c$ is shown in the figure to be 40%.

Final Conclusions

In conclusion, **STR** calculates the stellar approach velocity as V rather than the correct value of v. Depending on v, the value of V may satisfy $V>v$ or $V<v$. However, it is shown than V tends to underestimate v when related pairs are considered, where the true stellar approach velocities are $v_1 =v$ and $v_2 =-v$, with $v>0$. In this case star #1 is moving toward the observer at velocity v, and star #2 is moving away from the observer at v. Since $v_1+v_2=0$, there is no average movement in the pair of stars toward the observer. It is shown that $V_1+V_2<0$ for all v/c, so that the universe is less inflationary than is thought. This bias is considerable when $v$in the above calculation is large. Thus, to the extent that the distribution of approach velocities is somewhat symmetric, neither strongly favoring positive or negative values, the universe is less inflationary than is generally thought. It is conjectured this bias may account for the perplexing inflationary universe mystery, as well as the strange supernova groups found by Milne [6]. Also, as the bias errors increase with large escape velocities (i.e., with $v<<0$), and as these situations correspond to greater distances from the earth, this may explain why dark energy density appears to be strangely large in these far regions. Also, as attractive forces decrease significantly when relative velocities get large, perhaps this might explain something about the expansion of galaxies. It would therefore be interesting to test what would happen if non-relativistic Doppler equations were used in astronomical calculations rather than the usual relativistic versions.

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