Open Access Journal of Physics
Volume 4, Issue 1, 2020, PP 1-5
ISSN 2637-5826

A Solution to the Dark Energy Problem

Donald Aucamp, Sc.D*

Professor (Emeritus), Southern Illinois University at Edwardsville

***Corresponding Author:** Donald Aucamp, Professor (Emeritus), Southern Illinois University at Edwardsville, USA.*

ABSTRACT

This is the second of three related works ondark matter, dark energy, and the General Theory of Relativity. In the firstpublicationlaw $\mathbf{L_1}$ *and corollary* $\mathbf{C_1}$*were proposed which tweaks Newton's Law of Gravity and leads to the conclusion that dark matter forces do not need to be invented to explain the motion of stars in galaxies. In this paperlaw* $\mathbf{L_2}$*is proposed which calls for a change in Einstein's second* ***STR*** *postulate, and corollary* $\mathbf{C_2}$*is derived from it which concerns an error in the relativistic Doppler shift formula. The reasons underlying* $\mathbf{L_2}/\mathbf{C_2}$*are covered in several prior papers and briefly summarized herein. Together, the applications of* $\mathbf{L_1}/\mathbf{C_1}$ *and* $\mathbf{L_2}/\mathbf{C_2}$ *lead to the conclusion that calculations concerning the inflationary nature of the universe need to be revamped. When this is accomplished, it is conjectured the universe will be found to be non-inflationary.*

Review Of law L_1 And Corollary C_1

Review of Law L_1 and Corollary C_1

In Aucamp [5] a gravitational law $\mathbf{L_1}$ is proposed which tweaks Newton's Law of Gravity (**NLG**) in an insignificant way. The theory examines the force exerted by a gravity "ray" sent at *t* by a moving body of mass *M* and subsequently received by a moving body of mass *m*. In the analysis **IFR**(*t*) is defined as the inertial frame of reference of *M* at the ray emission time *t*. The term, "ray", is used here to indicate the gravitational field emitted over an infinitesimal period of time. The following assumptions are made:

Assumptions

- All calculations are based on **IFR**(*t*).
- The ray travels from *M* to *m* at the velocity of light.
- The exerted force from *M* on *m* is in the opposite direction of the movement of the ray when it hits *m*.
- There is a reduction in this force when *m* is moving away from *M* and v.v. when it is moving toward *M*.

When *M* and *m* are permanently stationary in a given inertial frame of reference, say **IFR**(*t*) =$\mathbf{IFR}_0$, then the gravitational force, $\boldsymbol{f}$, is given by $\boldsymbol{f}=\boldsymbol{f}_0$, where$\boldsymbol{f}_0$ obeys **NLG** for stationary bodies, as follows:

$$\boldsymbol{f}_0 = -\,GMm\boldsymbol{u} / r^2 \qquad \textbf{(1.1.1)}$$

In this formula $\boldsymbol{r}$ is the constant vector running from *M* to *m* as measured in $\mathbf{IFR}_0$, and $\boldsymbol{u}$ is a unit vector given by $\boldsymbol{u} = \boldsymbol{r}/r$. The force is attractive in the direction of $-\boldsymbol{u}$. In the more general situation a ray is sent at time *t* from a moving body *M* to a moving body *m*, and the inertial frame of reference of *M* at the instant of the emission is **IFR**(*t*). The ray travels at velocity *c* and hits *m* at a future position $\boldsymbol{r}(t+\Delta t)$ at time=$t+\Delta t$, all as measured in **IFR**(*t*).It is assumed the exerted force, $\boldsymbol{f}$, at the instant of impact is in the direction of $-\boldsymbol{r}(t+\Delta t)$. If at this instant *m* is traveling at velocity $\boldsymbol{v}(t+\Delta t)$, which is at an angle φ to $\boldsymbol{r}(t+\Delta t)$. The following general law of gravity, $\mathbf{L_1}$, is postulated:

Law L_1

$$\boldsymbol{f} = \boldsymbol{f}_0(1-\alpha v\cos(\varphi)/c\,) \qquad \textbf{(1.1.2)}$$

In the above formulation α is a dimensionless constant which is assumed to be positive. This constant is discussed in [5] but not specifically evaluated. From **(1.1.2)** it is convenient to define *V* as follows:

$$V = v\cos(\varphi) \qquad \textbf{(1.1.3)}$$

Then **(1.1.2)** can be restated as follows:

Law L_1

$$\boldsymbol{f} = \boldsymbol{f}_0(\,1-\alpha\, V/c\,) \qquad \textbf{(1.1.4)}$$

It is noted that *V* is the scalar component of the velocity of *m* in the direction of the ray at the instant of impact, and that all quantities are evaluated in **IFR**(*t*). In **(1.2.3)** φ is the angle between $\boldsymbol{r}(t+\Delta t)$ and $\boldsymbol{v}(t+\Delta t)$. If at this instant $\boldsymbol{v}$ is precisely in the direction of $\boldsymbol{r}$, then $\varphi=0$ and $V=v$. Conversely, if $\boldsymbol{v}$ is in the $-\boldsymbol{r}$ direction, then $\varphi=\pi$ and $V=-v$. It is assumed that V/c is small, so that $\boldsymbol{f}$ is a linear perturbation of $\boldsymbol{f_0}$.In the unusual event that V/c happens to be large, it may be that **(1.1.4)** may need to be amended by adding on nonlinear terms. This is a planned feature of an upcoming paper which deals with photons, where $v=c$.

Assuming $\alpha V/c<<1$, then$\mathbf{L_1}$ differs very little from **NLG**, but as shown in Aucamp[5] this law proves to be useful in explaining the dark matter problem when huge time spans are considered. From $\mathbf{L_1}$ the following corollary $\mathbf{C_1}$ is shown in [5] to be an immediate consequence:

Corollary C_1

When m is moving away from M at the ray arrival (i.e., $\cos(\varphi)>0$), the gravitational attraction is reduced due to the α term and therefore m is slowed less than under **NLG**. Alternatively, when m is moving toward M, the gravitational attraction is increased and therefore m is accelerated more than under **NLG**. Thus, in either case the speed of m is increased relative to what it would be under **NLG**.

From $\mathbf{C_1}$ planets and stars moving in any direction under the primary influence of a single large mass M will move faster everywhere than they would if only **NLG** were in effect. It is noted that the energy to increase the velocity of m comes from the gravitational field of M and not from any dark energy or dark matter forces. This energy gain plays a primary role in analyzing the dark matter problem in [5].

LAW L_2 AND COROLLARY C_2

Law L_2

Einstein's second postulate in his Special Theory of Relativity (**STR**) assumes the measured velocity of light is independent of the source. This postulate is viewed as erroneous, and an alternate postulate is given below as law $\mathbf{L_2}$.

Law L_2 Concerning STR

The measured velocity of light is c with respect to the source.

Reasons for Rejecting STR

The conclusions drawn in Aucamp [1][2][3] which reject Einstein's second postulate in his **STR** will be summarized here. First, in Aucamp [1] a theory of electromagnetism (**EM**) is developed where the electric field is identical in formto$\mathbf{L_1}$ in **(1.1.2)**, at least in the linear case involving small v/c. Instead of $\boldsymbol{f_0}$ in **(1.1.1)**, a similar coulomb law equation for the force $\boldsymbol{F_0}$ between two stationary charges, q_1 and q_2 is as follows:

$$\boldsymbol{F_0} = q_1\, q_2\, \boldsymbol{u} \;/\; (4\pi\varepsilon_0\, r^{\,2}) \qquad \textbf{(2.1.1)}$$

Then the linear law$\mathbf{L_1}$for the electric field force $\boldsymbol{F}$ is postulated as:

$$\boldsymbol{F}= \boldsymbol{F_0}(\, 1-\alpha v\, cos(\varphi)\,/c\;\;) \qquad \textbf{(2.1.2)}$$

This force law is very similar to $\mathbf{L_1}$ as given by**(1.1.2)**. Defining $V=v\; cos(\varphi)$ yields the same $\mathbf{L_1}$ law form as**(1.1.4)**:

$$\boldsymbol{F}= \boldsymbol{F_0}(\, 1-\alpha V\,/c\;\;) \qquad \textbf{(2.1.3)}$$

In Aucamp[1] the following conclusions are theoretically and experimentally drawn: (a) magnetic forces are in reality electric field forces,(b) Maxwell's force laws and his equation for c can be derived from **(2.1.3)**, and (c) α=3/2. As the velocity of electric fields is measured in this **EM** study with respect to the source, it is clear that Einstein's second **STR** postulate concerning the measured velocity of light being independent of the source is invalid. Though the value of α is mathematically and experimentally shown to be 3/2 for **EM** forces, this doesn't mean the same value applies to gravitational forces because **EM** fields are different.

Second, in Aucamp [2] **STR** is further discredited. The reader is directed to this work for the detailed reasoning. What is given here is just a brief summary. Of primary importance is the proof derived by Einstein [6] concerning his length and time transformations, where only round-trip paths of reflected light rays are considered. If Einstein had also considered one-way paths, he would have seen that his transformations would not have worked. Also, his $m=\gamma m_0$formula for mass, which is based on **STR**, is mathematically untenable. In it γ depends on velocity, which in turn depends on an arbitrary definition of the **IFR**. Though he discusses this problem of the arbitrariness of velocity in [6], it is argued he wanders around in the analysis and draws conclusions that do not follow from his equations. In the end, it is clear that his equation for mass depends on v, which in turn depends on an arbitrary definition of the **IFR**. If physical properties are defined to be independent of the **IFR**, then it is clear from the arbitrariness of the definition of velocity that his mass is not a physical property, and it cannot be treated as such. Further, not only is Einstein's kinetic energy dependent on the arbitrary definition of the **IFR**, it is also shown in Aucamp [2] that even changes in kinetic energy in the Einstein formula for mass depend on the **IFR**.I n addition, while Einstein's version of mass has very nice relativistic attributes, a theory concerning mass is given in Aucamp [3] that explains this phenomenon without the need for an increase in mass. Finally, the experiments which presumably confirm **STR** do not deliver as promised. As discussed in Aucamp [2], perhaps the most common and persuasive type of confirmation involves the use of interferometers that are firmly set on the same base structure as the source and detector. Tests of this kind cannot differentiate between **STR** and $\mathbf{L_2}$ as given above.

Corollary C_2

Based on $\mathbf{L_2}$ it is shown in Aucamp [4] that the relativistic Doppler shift formula, which depends on **STR**, is not correct. It overestimates the velocities of stars which are moving away from the observer, and v.v. Thus, red shifts will be erroneously exaggerated in the case of receding stars. This theory is briefly summarized as follows, where V is defined as the scalar velocity component of the emitting source away from the Earth. If λ_O is the measured photon wavelength as determined by the observer and λ_S the assumed known wavelength of the photon emission after it escapes from the star, then the following obtains from Aucamp [4]:

$$V_{SRT} = c\,(1\text{-}x)\,(1+x)\,/\,(1+x^2) \qquad \textbf{(2.3.1)}$$

Where V_{STR} is the calculated outgoing velocity of the star using **STR** and

$$x = \lambda_S\,/\,\lambda_O \qquad \textbf{(2.3.2)}$$

Based on $\mathbf{L_2}$ the correct formula for the outgoing velocity V is given as:

$$V = c\,(1\text{-}x) \qquad \textbf{(2.3.3)}$$

From the above:

$$V_{STR}\,/\,V = (1+x)\,/\,(1+x^2) \qquad \textbf{(2.3.4)}$$

Now suppose the star is receding, so that $V>0$. Then $\lambda_S<\lambda_O$ and therefore $x<1$. Accordingly, from **(2.3.4)**$V_{STR}/V>1$ and it is concluded that V_{STR} is overestimated. From this analysis the following corollary $\mathbf{C_2}$ is proffered:

Corollary C_2 Concerning Doppler Shift Calculations

The relativistic Doppler shift formula overestimates the scalar velocity component V_{STR} of a star moving away from the Earth by a factor of $V_{STR}/V = (1+x)/(1+x^2)$, where $x = \lambda_S/\lambda_O$, λ_S is the wavelength of the emission from the star, and λ_O is the wavelength of the emission received by the observer.

DARK ENERGY

Introduction

Dark energy is a term used in connection with astronomical observations which conclude that the farthest galaxies are accelerating outward into space (inflationary universe theory, or **IUT**). This theory was announced in separate studies in 1998 by Nobelists Saul Perlmutter [7], Adam Riess, and Brian Schmidt. These studies were based on type Ia supernovae which explode with the same luminosity. Thus, by observing the brightness of an emission one can determine its distance D from the earth, which in turn leads to the travel time T as given by $T=D/c$. The results of these studies indicated that the more distant stars were fainter than expected, and this was viewed as evidence of **IUT**. Since then, in spite of more data and intense scientific effort, no explanation has been offered for these findings. It is noted that **GTR** has not been helpful in this regard. Based on$\mathbf{L_1/C_1}$ and $\mathbf{L_2/C_2}$, it is argued below that at least three mutually self-supporting amendments should be made in the **IUT** calculations, and that all of three reduce the amount of inflation. Accordingly, it is conjectured that the inflationary universe problem will be eliminated when these changes are included in the calculations. The three amendments are discussed below.

Amendment#1 Based on L_2

Assume in the supernova experiments that an exploding star **S** is moving away from the earth with a velocity component $V_0>0$, so that the photons received at the Earth show a red shift. Further suppose that at the instant of the emission the actual distance from **S** to the Earth is D_0 and that it is desired to determine the travel timeT_0 based on the formula, $D_0=cT_0$. From $\mathbf{L_2}$ this emission actually travels a distance D which is farther than D_0 because the Earth is moving away from the emitting star at velocity V_0. If the actual travel time is T, then the actual travel distance D satisfies the following relationship:

$$D = D_0 + V_0T \qquad \textbf{(3.2.1)}$$

From $\mathbf{L_2}$ the burst travels at c relative to the **IFR** of **S**. Thus:

$$T = D\,/\,c \qquad \textbf{(3.2.2)}$$

Then, from **(3.2.1)** and **(3.2.2)**, the value of D_0 can be found as follows:

$$D_0 = D\,(1 - V_0 / c) \qquad \textbf{(3.2.3)}$$

As V_0 is assumed positive, it is seen from **(3.2.3)** that the true separation distance D_0 at the instant of the emission is less than the measured distance D as calculated by the luminosity. If the wavelengths λ_S and λ_O of a received photon are known, then from $\mathbf{C_2}$ the true outbound velocity component can be determined by setting V_0as follows:

$$V_0 = c\,(1 - \lambda_S / \lambda_O) \qquad \textbf{(3.2.4)}$$

From **(3.2.4)** it is seen that $1\text{-}V_0/c=\lambda_S\ /\ \lambda_O$, so that **(3.2.3)** becomes:

$$D_0 = D\,\lambda_S / \lambda_O \qquad \textbf{(3.2.5)}$$

As **S** is assumed moving away from the earth, then $V_0>0$, $\lambda_S<\lambda_O$, and therefore $D_0<D$. Now assume an experiment attempts to find T_0, whereT_0 is given as follows:

$$T_0 = D_0 / c \qquad \textbf{(3.2.6)}$$

If instead of **(3.2.6)** T_0 is incorrectly assumed to be T, then an error will result, call it δt, as follows:

$$\delta t = T - T_0 = D/c - D_0/c = (D_0 + V_0T)/c - D_0/c \qquad \textbf{(3.2.7)}$$

Thus, from **(3.2.7)**:

$$\delta t = V_0 T / c \qquad \textbf{(3.2.8)}$$

It is seen the error as given by **(3.2.8)** becomes extremely large for distant supernovae moving away from the earth because T is large in this case. As $\delta t\,/T=V_0/c$, it is noted that the fractional error is small. However, if a large number of observations are made involving different bursts, then it is argued that the big δt errors and even the small percentage errors given by $\delta t/T$ will result in statistical significance in any reasonable test.

Amendment#2 Based on the Doppler Shift Formula and L_2

As shown in Aucamp[4] and restated as corollary $\mathbf{C_2}$above, the **STR** Doppler shift formula overestimates the velocities of stars moving away from the observer, so that there is a positive redshift bias. In particular, the true outgoing velocity V_0 is related to the **STR** velocity V_{STR} given by $\mathbf{C_2}$ as follows:

$$V_{STR} / V_0 = (1+x) / (1 + x^2) \qquad \textbf{(3.3.1)}$$

Where

$$x = \lambda_S / \lambda_O \qquad \textbf{(3.3.2)}$$

In **(3.3.2)** λ_S is the wavelength of the emission as measured at the star and λ_O is the wavelength as measured by the observer. It is seen in the case when the star is moving away from the earth that $\lambda_O>\lambda_S$ and therefore $x<1$. Thus, when $V_0>0$the following obtains from **(3.3.1)**:

$$V_{STR} > V_0 \text{ (when } V_0>0) \qquad \textbf{(3.3.3)}$$

It is then concluded that V_{STR} is overestimated when $V_0>0$ and there is a resulting red shift bias in this case.

Amendment #3 Based on the Big Bang and L_1

Edward Hubble in 1929 found that distant galaxies tend to be moving away from the earth at faster speeds than those closer in. This result agrees with the Big Bang theory, in that higher velocity galaxies will move further away from the universe c.g. than those with lower velocities. Now, assuming $\mathbf{L_1}$ is correct, galaxies which are moving away at high velocities will experience less gravitational pull toward the c.g. than those with low velocities, so that over millions of years the higher velocity stars will be further away and moving faster than expected from **NLG**.

Dark Energy Conclusion

It is concluded that experimental **IUT** calculations should consider the above three mathematical amendments. It is conjectured that adhering to them will result in the conclusion that the universe is in fact not inflationary.

Final Conclusions

In this work law $\mathbf{L_2}$is proposed which represents a fundamental change in classical physics, and an important corollary $\mathbf{C_2}$ is derived from it. Also, $\mathbf{L_1/C_1}$from an earlier work is summarized herein. Based on a combination of $\mathbf{L_1/C_1}$ and $\mathbf{L_2/C_2}$ it is shown that calculations concerning the outbound velocities of galaxies/stars should be amended to take into consideration these laws and corollaries. When this is done, it is conjectured that dark energy forces will not be needed to explain experimental observations.

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Citation: *Donald Aucamp, "A Solution to the Dark Energy Problem", Open Access Journal of Physics, 4(1), 2020, pp. 1-5.*

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