Newton’s Gravitational Law over Dark Matter

The Newtonian gravitational law, if misapplied, can present as much “dark matter” as one can imagine.

Fig. A displays the speed distribution of celestial objects in the Milky Way galaxy. It shows that celestial objects at distance beyond 10 kpcs from the galactic center appear to move at speed higher than what Newtonian gravitational law predicts and that celestial objects in the inner range at distance between 1 and 8 kpcs from the center appear to move at speed lower than predicted. To a group of people, these phenomenon are suggesting certain failure of the Newtonian gravitational law and that remedy to repair the failure is therefore needed. They mainly propose two ideas as the remedy: (1) dark matter, (2) to modify Newton's gravitational law.

To promote the acceptance of dark matter, it has been popularly advocated that the validity of relativity has enabled the dark matter to exist with unchallengeable legitimacy. A term called space-time fantasized out of relativity plays a key role for dark matter to enjoy a niche where verification never seems able to reach. To reject the existence of dark matter, someone needs first to have relativity refuted. It is so unfortunate to dark matter, however, relativity is exactly a theory that defeats itself, both in terms of mathematical derivation as well as in terms of physical explanation. Space-time as an independent fourth dimension in the universe does not exist, but space and time as two separate physical elements being absolute can be proven. If relativity cannot even defend itself, it can only be obvious that it is unable to support the existence of dark matter.

Finding no support from dark matter, this article can only go by the restricted application of the Newton's gravitational law. However, then, we must encounter the argument that Newton's law needs to be modified. But how? We will soon find that Newton's gravitational law can lead someone to have unlimited quantity of dark matter—if it is misapplied.

Allowing Newton’s gravitational law to be modified in the science world, we just end up placing ourselves to confront with a school principle that is as ancient as human ever have schools: Should a student taking a test be given the flexibility to modify a rule or law from a textbook only
because he found this rule or law fails him from arriving at a solution at his satisfaction? In the auditorium of science, we all are students of Mother Nature. Never has she given us the privilege of arrogance with which we can claim that “I have no fault in study. If no answer can be arrived at my satisfactory, it is the fault of the law that I am taught to follow.” Newton’s laws in mechanics study are put up by masterminds of many generations, including those well respected pioneers like Copernicus, Galileo, Kepler.. besides Newton. It is for sure that we need to have an open mind toward all natural laws that are summarized by human. However, to anyone attempting the modification of a natural law concerning material interaction that has been confirmed by numerous human practice, he must present the following two indispensable elements: (1) miscalculation or mistreatment in the derivation of the law in concern is found, (2) some part of the derivation is found having been decisively misled by irrelevant facts, or inadequate facts, or improperly explained facts. Plunging into modification without presenting these two gravely critical elements is only an excellent description defining the word recklessness. Frankly, no such attitude should be accepted in any serious business.

This article presents several cases needing the scrutiny guided by Newton’s gravitational law. After the examination of these few cases, a reader can easily arrive at a conclusion regarding whether the science world has come to a need to modify Newton’s law or a need to modify some people’s attitude of attempting the modification of Newton’s law. Through applying Newton’s law, it also appears to us that the Magellanic Clouds cannot be expected to have been traveling on a close orbit about the Milky Way, but instead, they are only one time visitors to our galaxy; no close orbit means no satellite. Newton’s gravitational law also gives us explanation why two-rotational-arms is a prominently popular phenomenon among rotating galaxies.

***Please refer to

(A) Relativity is Self-defeated (1 of 3)—in terms of Mathematics, by Cameron Rebigsol, which can be found at www.huntune.net, by clicking the menu box The Self-ruined Relativity. This article is also presented in the CNPS conference of July 20-23, 2016.

(B) Relativity is Self-defeated (2 of 3)—in terms of Physics, by Cameron Rebigsol, which can be found at www.huntune.net, by clicking the menu box The Self-ruined Relativity. This article is also presented in the CNPS conference of July 20-23, 2016.

(C) Relativity is Self-defeated (3 of 3)—Lorentz Factor, Aberration, and Ether by Cameron Rebigsol, which can be found at www.huntune.net, by clicking the menu box The Self-ruined Relativity. This article is also presented in the CNPS conference of July 20-23, 2016.

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Introduction Through studying several special cases on the relationship between shape and gravitation, we will explore how some flying materials at a certain distance from the center of the Milky Way galaxy would show up with speeds higher or lower than “normal”. The so called “normal” speed referred to in this article is the speed conventionally believed to be possessed by an object that is moving around a point mass at a distance far larger than the dimension of the point mass. The speed so obtained is derived according to the Newtonian gravitational law.

Since the situation involving such conventional treatment repeats many times in this article, the term “normal” speed or “normal” force will be used here with the inseparable quotation marks. Almost all cases presented here are hypothetically assumed in geometry, but they sure would lead us to have a peek at how the shape of a gravity body can lever the movement of some objects that appear in its vicinity of close range. Being so levered, though, all these movements cannot get away from the governing of Newton’s gravitational law.

Considerations

Case 1. Gravity on the Axis of a Bar

In Fig. 1, object A of mass m is on the axis of a homogeneous bar with a distance D from one end of this bar. The bar of mass M has a length of L(=2a). The gravitational force between A and each differential mass element dm of the bar is

\[ df = G \frac{m \cdot dM}{x^2} \]  \hspace{1cm} (Eq. 1)

where G is the universal gravitational constant.

Since \( dM = \frac{M}{L} \, dx \), we get

\[ df = G \frac{mM}{Lx^2} \, dx \] \hspace{1cm} (Eq. 2)

Thus the total force \( F_{1-1} \) between A and the bar is

\[ F_{1-1} = \int_{D}^{D+2a} G \frac{mM}{Lx^2} \, dx \]

\[ = G \frac{mM}{D(D + 2a)} \]
\[ v_1^2 = G \frac{mM}{D^2 + 2aD} \quad (Eq. \ 3) \]

The tangential speed \( v_{1-1} \) that is large enough for \( A \) to resist the bar’s gravitational pull will lead to:

\[ m \frac{v_{1-1}^2}{D + a} = G \frac{mM}{D^2 + 2aD} \quad (Eq. \ 4) \]

And therefore,

\[ v_{1-1}^2 = \frac{GM(D + a)}{D^2 + 2aD} \quad (Eq. \ 5) \]

Had the bar become a point mass and stayed at where its original mass center is, the gravitational force \( F_{1-2} \) between it and \( A \) should be

\[ F_{1-2} = G \frac{mM}{(D + a)^2} \quad (Eq. \ 6) \]

The tangential speed corresponding to \( F_{1-2} \) for \( A \) to resist the pull of the point mass is

\[ v_{1-2}^2 = \frac{GM}{D + a} \quad (Eq. \ 7) \]

The comparison between \( v_{1-1} \) and \( v_{1-2} \) would lead to

\[ \frac{v_{1-1}^2}{v_{2-2}^2} = \frac{D^2 + 2aD + a^2}{D^2 + 2Da} \quad (Eq. \ 8) \]

In order to make \( v_{1-1} \approx v_{1-2} \), we need \( D >> a \) so that length \( a \) becomes trivial in Eq. 3 and the bar can then be regarded as a point mass. The smaller the distance \( D \) is, the higher the magnitude \( v_{1-1} \) becomes if \( A \) is to survive the gravitational pull of the bar. Once \( A \) survives the pull at this point, it will retain this higher than “normal” (moving about a point mass at large distance) momentum forever until something else brakes on it.

We use the term on-axis effect to name the effect that leads to \( F_{1-1} > F_{1-2} \) and thus also leads to \( v_{1-1} > v_{1-2} \), where \( F_{1-2} \) is the “normal” force and \( V_{1-2} \) is the “normal” speed.
Now, we have come to a point that a big question demands answer: Do we need “dark matter” or to “modify” Newton’s law to explain the on-axis effect based on \( v_{1-1} > v_{1-2} \) that is correspondingly caused by \( F_{1-1} > F_{1-2} \)???

Case 2  Gravity off the Axis of a Bar, Situation 1

Step (a)

The same two gravity bodies in Fig. 1 are rearranged so that \( A \) is located a distance of \( h \) away directly below the end point J of the bar. (Fig 2-a)

In Fig 2a, \( q \) is the distance between the two mass centers, and thus

\[
q^2 = a^2 + h^2 \quad (\text{Eq. 9})
\]

Line \( p \) represents the distance between the mass center of \( A \) and the differential element \( dx \) of the bar. Therefore,

\[
p^2 = x^2 + h^2 \quad (\text{Eq. 10})
\]

The gravitational force \( df \) between \( dx \) and \( A \) is

\[
df = \frac{Gm}{p^2} dM = \frac{Gm}{x^2 + h^2} dM = \frac{Gm}{x^2 + h^2} \cdot \frac{M}{2a} dx \quad (\text{Eq. 11})
\]

If \( df \) is projected on \( q \), we get \( f' \), which is

\[
f'_1 = df_1 \cos \theta = \frac{Gm}{x^2 + h^2} \cdot \frac{M}{2a} dx \cdot \frac{p^2 + q^2 - (a - x)^2}{2pq} = \frac{Gm}{x^2 + h^2} \cdot \frac{M}{2a} dx \cdot \frac{(x^2 + h^2) + (a^2 + h^2) - (a - x)^2}{2 \sqrt{x^2 + h^2} \cdot \sqrt{a^2 + h^2}} \quad (\text{Eq. 12})
\]

The total force between \( A \) and the segment JK of the bar is

\[
F_{2-1} = \int_0^a df'_1
\]
\[
\int_{x=0}^{a} \frac{Gm}{x^2 + h^2} \cdot \frac{M}{2a} \cdot \frac{(x^2 + h^2) + (a^2 + h^2) - (a - x)^2}{2\sqrt{x^2 + h^2} \cdot \sqrt{a^2 + h^2}} \cdot dx \\
= \frac{GmM}{2h\sqrt{a^2 + h^2}}
\]  
(Eq. 13)

Step (b)

Fig. 2b is a duplicate of Fig 2a but point x=0 is located at K for calculation convenience.

In Fig. 2b, s represents the distance between the mass center of A and the differential element \(dx\) on the bar. Therefore,

\[
s^2 = h^2 + (a + x)^2 \quad \text{(Eq. 14)}
\]

The gravitational force \(df_2\) between \(dx\) and A is

\[
df_2 = \frac{Gm}{s^2} dM \\
= \frac{Gm}{(a + x)^2 + h^2} dM \\
= \frac{Gm}{(a + x)^2 + h^2} \cdot \frac{M}{2a} dx \quad \text{(Eq. 15)}
\]

When \(df_2\) is projected on line q, we have

\[
df'_2 = df_2 \cos \theta \\
= \frac{Gm}{(a + x)^2 + h^2} \cdot \frac{M}{2a} dx \cdot \frac{s^2 + q^2 - x^2}{2sq} \\
= \frac{Gm}{(a + x)^2 + h^2} \cdot \frac{M}{2a} dx \cdot \frac{h^2 + (a + x)^2 + (a^2 + h^2) - x^2}{2\sqrt{h^2 + (a + x)^2} \cdot \sqrt{a^2 + h^2}} \quad \text{(Eq. 16)}
\]

The total force between A and the segment KL of the bar is

\[
F_{2-2} = \int_{0}^{a} df'_2 \\
= \int_{0}^{a} \frac{Gm}{(a + x)^2 + h^2} \cdot \frac{M}{2a} \cdot \frac{h^2 + (a + x)^2 + (a^2 + h^2) - x^2}{2\sqrt{h^2 + (a + x)^2} \cdot \sqrt{a^2 + h^2}} \cdot dx \\
= \frac{GmM}{2\sqrt{a^2 + h^2} \sqrt{4a^2 + h^2}} \quad \text{(Eq. 17)}
\]
Step (c)

The total force between $A$ and the mass center of the bar is $F_{2,3}=F_{2,1}+F_{2,2}$ and thus

$$F_{2-3} = \frac{GmM}{2h\sqrt{a^2 + h^2}} + \frac{GmM}{2\sqrt{a^2 + h^2}\sqrt{4a^2 + h^2}} \quad (Eq. \ 18)$$

If $A$ happens to move at speed $v_{2,3}$ in a direction perpendicular to line $q$, the centrifugal force thus needed to resist the bar’s gravitational pull will lead to:

$$m\frac{v_{2-3}^2}{\sqrt{a^2 + h^2}} = \frac{GmM}{2h\sqrt{a^2 + h^2}} + \frac{GmM}{2\sqrt{a^2 + h^2}\sqrt{4a^2 + h^2}} \quad (Eq. \ 19)$$

Had the bar become a point mass and stayed at where its original mass center is, the “normal” gravitational force between $A$ and this point mass will be

$$F_{2-4} = G\frac{mM}{a^2 + h^2} \quad (Eq. \ 20)$$

The “normal” centrifugal force for $A$ corresponding to $F_{2-4}$ would lead to

$$m\frac{v_{2-4}^2}{\sqrt{a^2 + h^2}} = G\frac{mM}{a^2 + h^2} \quad (Eq. \ 21)$$

Thus, we can have the comparison between $V_{2,3}$ and $V_{2,4}$ as

$$\frac{v_{2-3}^2}{v_{2-4}^2} = \frac{\sqrt{a^2 + h^2}}{2h} + \frac{\sqrt{a^2 + h^2}}{2\sqrt{4a^2 + h^2}} \quad (Eq. \ 22)$$

Let $h=na$, where $n \neq 0$, (Eq. 22) leads to

$$\frac{v_{2-3}^2}{v_{2-4}^2} = \frac{\sqrt{1 + n^2}}{2n} + \frac{\sqrt{1 + n^2}}{2\sqrt{4 + n^2}} \quad (Eq. \ 23)$$

If $n=1$, for example, we have

$$\frac{v_{2-3}^2}{v_{2-4}^2} = 1.8 \quad (EQ. \ 24)$$
If \( n=3 \), however, we will have

\[
\frac{v_{2-3}^2}{v_{2-4}^2} = 0.96 \quad (Eq. \ 25)
\]

If we must introduce dark matter to explain the phenomenon brought up by (Eq. 24), how do we explain the phenomenon brought up by Eq. 25?

Of course, when \( n \to \infty \), we no longer need to be concerned with dark matter, as Eq. 23 would give us a value very close to 1, fitting our conventional concept that the bar can be viewed as a point mass.

If \( F_{2-3} \) is to be resolved on the line connecting A and J, we have \( F_{2-5} \), where

\[
F_{2-5} = F_{2-3} \cdot \frac{h}{\sqrt{a^2 + h^2}}
\]

\[
= \frac{GmM}{2(a^2 + h^2)} \cdot \left(1 + \frac{h}{\sqrt{4a^2 + h^2}}\right) \quad (Eq. \ 26)
\]

**Case 3a  Gravity off the Axis of a Bar, Situation 2**

In **Fig. 3a**, we duplicate the bar in **Fig. 2a** or **Fig. 2b** and “weld” it with the original bar end to end and thus form a new bar.

On each side of the mass center of this longer homogeneous bar, the half bar has a length of \( 2a \) (therefore the total length is \( 4a \)).

The gravitational force \( F_{3-1} \) between A and the full length new bar is two times of \( F_{2-5} \) found in Eq. 26 and therefore

![Fig. 3a](image_url)
\[ F_{3-1} = 2 \cdot \frac{GmM}{2(a^2 + h^2)} \cdot \left(1 + \frac{h}{\sqrt{4a^2 + h^2}}\right) \]
\[ = \frac{GmM}{a^2 + h^2} \cdot \left(1 + \frac{h}{\sqrt{4a^2 + h^2}}\right) \]  \hspace{1cm} (Eq. 27)

The tangential speed \( v_{3-1} \) that is large enough for \( A \) to resist the bar’s gravitational pull will lead to
\[ m \frac{v_{3-1}^2}{h} = \frac{GmM}{a^2 + h^2} \cdot \left(1 + \frac{h}{\sqrt{4a^2 + h^2}}\right) \]  \hspace{1cm} (Eq. 28)

Had the bar become a point mass and stayed at where its mass center has been, the “normal” gravitational force \( F_{3-2} \) between \( A \) and the bar will be
\[ F_{3-2} = G \frac{m(2M)}{h^2} \]  \hspace{1cm} (Eq. 29)

The “normal” centrifugal force corresponding to \( F_{3-2} \) would lead to
\[ m \frac{v_{3-2}^2}{h} = G \frac{m(2M)}{h^2} \]  \hspace{1cm} (Eq. 30)

Thus, we can have the comparison between \( v_{3-1} \) and \( v_{3-2} \) as
\[ \frac{v_{3-1}^2}{v_{3-2}^2} = \frac{h^2(h + \sqrt{4a^2 + h^2})}{2(a^2 + h^2)\sqrt{4a^2 + h^2}} \]  \hspace{1cm} (Eq. 31)

Let \( h=na \), where \( n \neq 0 \), we have
\[ \frac{v_{3-1}^2}{v_{3-2}^2} = \frac{n^3}{2(1 + n^2)\sqrt{4 + n^2}} + \frac{n^2}{2(1 + n^2)} \]  \hspace{1cm} (Eq. 32)

Each term on the right side of (Eq. 32) is smaller than 0.5. Therefore, \( v_{3-1} \) is forever smaller than \( v_{3-2} \) for any value of \( n \). Dark matter must fail in explaining the phenomenon brought up by Eq. (32).
Case 3b  Off-axis Effect

In Fig. 3b, we are going to compare the dynamic status of $A$ between location E and F.

At location E, the reasoning of (Eq. 3) gives us the gravitational force received by $A$ as

$$F_{3b-1} = G \frac{mQ}{(k-d)^2 + 2d(k-d)} \quad (Eq. \ 33)$$

The speed $V_{3b-1}$ matching the corresponding centrifugal force for $A$ to survive the pull from the bar leads to

$$v_{3b-1}^2 = \frac{GQk}{(k-d)^2 + 2d(k-d)} \quad (Eq. \ 34)$$

At location F, the reasoning of (Eq. 27) gives us the gravitational force received by $A$ as

$$F_{3b-2} = \frac{GmQ}{d^2 + k^2} \cdot \left(1 + \frac{k}{\sqrt{4(d^2/k^2) + k^2}}\right) \quad (Eq. \ 35)$$

The speed $V_{3b-2}$ matching the corresponding centrifugal force for $A$ to survive the pull from the bar at F leads to

![Diagram of Fig. 3b showing location E and F with labels for mass of $A$, mass of bar, and distances $d$, $k$.](image)
\[ v_{3b-2}^2 = \frac{G \left( \frac{Q}{2} \right) k}{(\frac{d}{2})^2 + k^2} \cdot \left( 1 + \frac{k}{\sqrt{4(\frac{d}{2})^2 + k^2}} \right) \]  

(Eq. 36)

Therefore we can further have

\[ \frac{v_{3b-1}^2}{v_{3b-2}^2} = \frac{(d^2 + 4k^2)\sqrt{d^2 + k^2}}{2(k^2 - d^2)(\sqrt{d^2 + k^2} + k)} \]  

(Eq. 37)

Letting \( k = nd \), where \( n \neq 0 \), we have

\[ \frac{v_{3b-1}^2}{v_{3b-2}^2} = \frac{(1 + 4n^2)\sqrt{1 + n^2}}{2(n^2 - 1)(n + \sqrt{1 + n^2})} \]  

(Eq. 38)

If \( n + e > 1 \), but with \( e \to 0 \), Eq. 38, easily leads us to have higher and higher value for the ratio of the two speeds.

So, if we must regard the bar as a point mass in explaining the speed of \( A \), then, at location E we must face inexplicable reason for A’s higher than “normal” speed. When A moves to area near location F, we may perplex even more, because, carrying the momentum equipped at E, A now is encountered weaker and weaker than “normal” gravitational pull at F. Indeed, we can expect that A is going to fly away from the bar. For example, if \( n=2 \), the ratio in Eq. 38 is 1.49, or \( v_{3b-1} = 1.22v_{3b-2} \). The bar definitely can no longer bind A with gravitation at F. From the behavior of A at location F, should we conclude that some apparent mass from the bar must have lost its gravity? Or, should we propose that Newton’s gravitational law needs to be modified?

We use the term **off-axis effect** to name the effect that leads A to receive weaker than “normal” gravitational force \( F_{3b-2} \) at F. (Eq. 38) tells us that the off-axis effect will diminish as \( n \to \infty \) and the bar can be regarded as a point mass at a remote distance.

We have come to a point to propose a serious question: If the concept of dark matter can "help" to explain some phenomena similar to the on-axis effect, how would the same concept now help to explain the off-axis effect, which seems showing some mass otherwise having disappeared with no good reason? Or should we begin to propose a new idea to explain where some of the apparent mass has been made lost and how? Or should we again begin to suspect the validity of Newton’s law?
Case 4  Gravity in the Vicinity of a Cross

In Fig 4, two bars of length $2a$ and mass $M$ each are placed perpendicularly crossing each other at their dead centers. Body $A$ is a distance $a$ from each bar, and therefore it is a distance $q$ away from the mass center of the cross, where $q = \sqrt{2}a$. Taking advantage of the analysis shown with Fig. 2a and 2b, replacing $h$ in Eq. 18 with $a$, we can have the gravitational force $F_{4-1}$ between $A$ and the mass center of the cross as

$$F_{4-1} = 2 \left( \frac{GmM}{2a\sqrt{a^2 + a^2}} + \frac{GmM}{2\sqrt{a^2 + a^2}\sqrt{4a^2 + a^2}} \right) = GmM \left( \frac{\sqrt{5} + 1}{a^2\sqrt{10}} \right) \quad (Eq. 39)$$

The tangential speed $v_{4-1}$ that is large enough for $A$ to resist the cross’s gravitational pull will lead to:

$$m \frac{v_{4-1}^2}{\sqrt{2}a} = GmM \left( \frac{\sqrt{5} + 1}{a^2\sqrt{10}} \right) \quad (Eq. 40)$$

Had the cross become a point mass and stayed at where its mass center has been, the “normal” gravitational force $F_{4-2}$ between $A$ and the cross will be

$$F_{4-2} = G \frac{m(2M)}{(\sqrt{2}a)^2} = \frac{GmM}{a^2} \quad (Eq. 41)$$

The “normal” centrifugal force for $A$ corresponding to $F_{4-2}$ thus leads to a “normal” tangential speed $v_{4-2}$ as shown below

$$m \frac{v_{4-2}^2}{\sqrt{2}a} = G \frac{m(2M)}{2a^2} \quad (Eq. 42)$$

Thus, we can have the comparison between $v_{4-1}$ and $v_{4-2}$ as
\[
\frac{v_{4-1}^2}{v_{4-2}^2} = \frac{\sqrt{5} + 1}{\frac{1}{a^2}} \approx 1.023 \quad (Eq. 43)
\]

Eq. 43 thus shows that, at the location as shown in Fig. 4, the tangential velocity for A to survive the pull will not change much whether the gravitational influence is from a cross or a point mass of the same mass.

**Case 5a  Gravity at the Tip of a Cross**

In Fig. 5, the gravitational force \( F_{5-1} \) between A and the vertical bar can be calculated according to Eq. 3. In so doing, D in Eq. 3 is replaced with \( D = q - a \). Therefore, we have

\[
F_{5-1} = G \frac{mM}{(q - a)^2 + 2a(q - a)} = \frac{GmM}{q^2 - a^2} \quad (Eq. 44)
\]

The gravitational force \( F_{5-2} \) between A and the horizontal bar can be calculated according to (Eq. 27). In doing so, \( M \) in (Eq. 27) is replaced with \( M/2 \), \( a \) is replaced with \( a/2 \), \( h \) is replaced with \( q \). Then,
The total gravitational force $F_{5-3}$ between $A$ and both bars together is then

$$F_{5-3} = F_{5-1} + F_{5-2} = 1.403 \left( \frac{GmM}{a^2} \right) = 1.403 \ F_{4-2} \quad (Eq. \ 46)$$

where $F_{4-2}$ is the gravitational force that $A$ would have received if the cross had been a point mass at the mass center of the cross (See Eq. 41).

The tangential speed $v_{5-3}$ that can equip $A$ with enough centrifugal force against the cross’s gravitational pull will lead to:

$$m \frac{v_{5-3}^2}{\sqrt{2}a} = 1.403 \left( \frac{GmM}{a^2} \right) \quad (Eq. \ 47)$$

Applying Eq. 41 in comparing the centrifugal force displayed in Eq. 47, we have

$$\frac{v_{5-3}^2}{v_{4-2}^2} = 1.403, \quad \text{or} \quad v_{5-3} = 1.184 \ v_{4-2} \quad (Eq. \ 48)$$

Eq. 48 means that, if a point mass becomes a cross shown in our picture, body $A$ needs its tangential speed to be 0.184 times higher than $v_{4-2}$, the “normal” speed. If not so, $A$ will be gravitationally sucked toward the cross. However, as $A$ leaves $Z$ but moves toward location $W$, the speed that $A$ carries will enable it to fly with extra momentum. Bound by a weaker gravitational force now, body $A$ may tend to fly away from the cross. However soon the on-axis effect of the next arm will come in to arrest it and stabilize its orbit about the cross again.

In Fig. 6, let’s imagine that the tangential momentum of each of objects $A$, $B$, and $C$ has enabled them to survive the gravitational pull of the cross.
To any object in a situation similar to that of \( A, B, \) and \( C, \) the general expression for the gravitational force \( F_{5-4} \) it receives from the cross can be written as (Refer to Eq. 27, 35, and 44, with proper replacement of corresponding quantities)

\[
F_{5-4} = \text{Force from vertical bar} + \text{force from horizontal bar}
\]

\[
= \frac{GmM}{q^2 - a^2} + \frac{Gm(M)}{(\frac{a}{2})^2 + q^2} \cdot \left( 1 + \frac{q}{\sqrt{4\left(\frac{a}{2}\right)^2 + q^2}} \right)
\]

\[
= \frac{GmM}{q^2 - a^2} \left[ \frac{1}{(q^2 - a^2)} + \frac{2\sqrt{q^2 + a^2 + 2q}}{(4q^2 + a^2)\sqrt{q^2 + a^2}} \right] \quad (\text{Eq. 49})
\]

The tangential speed \( v_{5-4} \) corresponding to \( F_{5-4} \) would show

\[
v_{5-4}^2 = GMq \left[ \frac{1}{q^2 - a^2} + \frac{2\sqrt{q^2 + a^2 + 2q}}{(4q^2 + a^2)\sqrt{q^2 + a^2}} \right] \quad (\text{Eq. 50})
\]

Let \( q = na, \) where \( n \neq 0, \) correspondingly, Eq. 49 and Eq. 50 will become

\[
F_{5-4} = \frac{GmM}{a^2} \left[ \frac{1}{n^2 - 1} + \frac{2n^2 + 1 + 2n}{(4n^2 + 1)\sqrt{n^2 + 1}} \right] \quad (\text{Eq. 51})
\]

and

\[
v_{5-4}^2 = GMa \cdot n \left[ \frac{1}{n^2 - 1} + \frac{2n^2 + 1 + 2n}{(4n^2 + 1)\sqrt{n^2 + 1}} \right] \quad (\text{Eq. 52})
\]

Below is a chart showing how \( F_{5-4} \) and the ratio \( v_{5-4}/v_{4-2} \) change in accordance with \( n=1.05, \; n=1.1, \; n=1.2, \; n=1.3, \; n=1.4, \; n=2, \) and \( n=5. \)

Note 1: The so called \( F_{\text{normal}} \) in the chart is the gravitational force that a moving object receives from the cross but the cross has been shrunk into a point mass of the same mass quantity at its mass center.

Note 2: \( a \) is the arm length of the cross, \( q \) is the distance between the moving object and the mass center of the cross.
Case 5b  On the Gravity of a Softened Cross and on the Rotation Arms of the Milky Way.

If the lower arm of the cross is: (1) a rotating body with respect to the mass center of the entire cross and (2) composed of loose materials, all the materials in this arm must display the same movement pattern as what A, B, and C are showing in Fig. 7a.

The same reasoning must equally apply to other arms of the cross, if all other arms also possess the same nature as that of the lower arm. (Fig. 7b)

However, as our inspection moves closer and closer to the center of the cross, we must notice that the arm length of the cross is getting shorter and shorter. The ever shortened arms of the cross must lead two things to happen: (1) The contrast between the on-axis effect and off-axis effect gradually diminishes; (2) movement of the objects about the mass center should show more and more obviously a pattern that is gravitationally governed by a point mass. When this happening is in progress, we cannot ignore one fact, which is that the angular velocity of the...
moving objects near the center is higher than that of those farther away from the center. The higher and higher angular velocities of the materials toward the center gradually blur out any distinctive feature of a cross. Instead, they just come together and present a rapidly spinning cloud. (Fig. 7c)

The problem is that, unless the cloud is absolutely homogeneous, given enough time, the spinning cloud will sooner or later evolve into a rotating bar. The reason for the appearance of such a bar, ironically, is exactly because the gravity in this range is more and more dominantly governed by a point mass. This point mass must be an extremely compacted and massive one if it is to stabilize the movement of so many objects traveling in orbits of short radius around it.
Let’s suppose that some objects of more prominent mass inside a spinning and inhomogeneous cloud happen to have concentrated along a certain radial direction with respect to the mass center of the cloud, such as those shown along line OJ and OK in Fig. 7d. Having so joined by a random chance, these groups would act together like a bar shown in Fig. 1 to a certain extend. So the newly formed bar, although a broken one, would exert their gravitational influence through the on-axis effect onto those materials flying near the end of such the bar. Highly potentially, the flying objects are recruited by the bar. Once so recruited, the newly joining material would contribute to beef up the gravity strength of the materials gathering of the bar and further escalated the bar’s on-axis gravitational strength. For those material groups like L and R, they are located at the area that the off-axis effect of the bar is more obvious. Depending on the angular velocity they already possess, they may slowly drift (with rotation movement about the cloud’s center) either toward the center or away from the center. To those drifting toward the center, their ever shortened rotation radius may accelerate them to plunge into the bar. To those drifting away from the center, their ever lengthening rotating radius and thus decreasing angular velocity may just make them sooner or later be arrested by the bar’s sweeping. Either way, the bar is an unstoppable gravitational predator once so formed. As to the bars OJ and OK, once they stabilize their predator position, the centrifugal force and their own on-axis effect exerted on each other will line them up on one straight line across the cloud’s center.

When materials of a huge quantity were tossed together in the remotely old days, no one can ever expect that a solid gravity body with a shape of high regularity could have formed itself like what is presented as the cross in this article. When the materials of various sizes were so randomly thrown at each other, the momentum between them is impossible to be exactly canceling each other out. The vector sum of all the off-center residual momentum contributed by each material chunk then forces the entire gathering to rotate about the center of the overall material formation.
The same randomness must also prevent the appearance of absolute homogeneity of material distribution across the entire formation. At areas where more materials have come together, the seed of a future rotation arm is planted. As shown in Fig. 8, blobs E, F, and G can all lure the formation of some rotation arms inside the big rotating formation.

From a state shown in Fig. 8 to a state shown in Fig. 9a for the nowadays galaxy of Milky Way, there is a long history of transition similar to what is illustrated in Fig. 7c and Fig. 7d. Today, after the long history of transition, with a stable rotation that the Milky Way has evolved into, we can say that the Milky Way has two types of rotation arms: the straight arms, such as what is shown as the Galactic Bar at the galaxy center, and the spiral arms, such as what are shown in areas outside where the Galactic Bar is sweeping. Those objects get recruited as one of the members in the Bar may move with all kinds of orbit in different shape with respect to the dead center of the Bar, from lanky ellipses to near perfect circles. Their orbital planes may even form any angle with the ecliptic, from lying perfectly within it to being perpendicular to it.

The analysis of Fig. 5, Fig. 7c and Fig. 9a would easily suggest to us that the spiral rotation arms may not be an unchanged establishment over time. Somewhere there may be some material
chunk that finds itself having entered a region with speed higher than necessary to balance the gravity field there and thus advanced to join the next arm. On the contrary, some may find itself not flying with enough angular momentum to keep up with the peers around it and gradually lag behind and eventually fall into the arm that is coming after. However, given the movement stability of the formation that has been established today, all these migrations can only happen in an extremely slow process. It is this slow process that has introduced the formation of some minor spiral rotation arms in the Milky Way’s rotation disk found in Fig. 9a.

Fig. 9a shows two major spiral arms for the entire Milky Way, one flowing out from each end of the rotating Galactic Bar. Although two distinct bars are identified in the photo at the central region of the Milky Way, the close proximity between them allows us to consider them working as one. It seems common among rotating galaxies that fundamentally two spiral arms are found for the entire galaxy, with one spiral to be dragged following each end of the rotation bar (Fig. 9b, 9c, 9d, 9e). In astronomical study, we may have also encountered many photos about rotating galaxy in which the feature of only two major spiral arms are not obvious although a single core is prominent. Given enough time, they will eventually evolved into a galaxy that would have two major spiral arms with one bar connecting in between.
If we consider the on-axis effect, the phenomenon that one major spiral arm follows at each end of the rotation bar should appear highly natural. As the bar rotates, somewhere along its long axis but farther away from the center there must begin to appear some location where materials chunks, such as object A in Fig. 9f, cannot have enough angular momentum to catch up with the bar’s angular advancement. The centrifugal force disengages it a little from the bar. As this happens, its angular movement must somewhat lag behind the bar’s. However, the strong “extra” gravitational force because of the on-axis effect must continue to bind object A in a “controllable” distance. In some sense, Object A taking its position is just as natural as some celestial body taking the Lagrangian point in some other gravitational system, although the cause is different.

Staying away from the bar with the same reason like A’s, object B lags behind even more. The more being away from the region of the on-axis effect for B means the more for it to be in the region where off-axis effect is pronounced. However, the gravitational pull from A will not let go of B freely. Object A and B would also work together to drag C along while C has been even further away from the end of the rotation bar. This reaction continues so that a ribbon of materials are joining together to form a spiral formation following at the end of the bar. The same also happens at the other end of the bar.
To the material chunks happening not at a close vicinity of the bar end, they would move away, waiting to be caught by the upcoming but extensively long spiral arms that is led by the other end of the bar, or just directly absorbed by the bar if its angular momentum is really so weak. Therefore, we cannot expect to have a spiral arms flowing out at the middle of the bar. Clearly shown in Fig. 9a, and similarly suggested in Fig. 9b, c, d, and e, no spiral arm stems from the middle of the Bar of each picture. The Far 3kpc Arm and the Near 3kpc Arm in Fig. 9a are formed by materials not having enough angular momentum and thus entering the off-axis effect region. Object d shown in Fig. 9f is an example for an object of such a group. After entering the region where off-axis effect dominates, object d seems to have moved about a point mass but of less massive in substance. If the bar’s rotation period happens to synchronize well with the rotation period of d, d will not sink into the bar. The synchronization makes d appear retaining an unvaried distance from the Bar. Many objects with moving status like that of d but slightly different from each other will form a ribbon spanning from end to end of the Bar just like what the Far 3kpc Arm and the Near 3kpc Arm show. Since there is an off-axis effect region on each side of the Galactic Bar, it is why the Far 3kpc Arm and the Near 3kpc Arm must appear as a pair. On the other hand, Fig. 9a does show that the on-axis effect having captured higher concentration of materials at each end of the Galactic Bar.

Fig. 9g is a duplicate of Fig 9a but with the following modification: (1) the area between the 1 kpcs and 8 kpcs from the Galactic center is shaded green, while the area with a distance bigger than 10 kpcs is shaded yellow; (2) a yellow line is drawn along the long axis of the Galactic Bar, indicating the running direction of the strongest on-axis effect, while a purple line is drawn perpendicular to the Galactic Bar, indicating the running direction of the strongest off-axis effect. In the unshaded area between the yellow and green areas are materials moving with “normal” speeds. In the picture, given that materials near A-A are in an area where the off-axis effect dominates, they would have flown away if they had not carried a speed lower than “normal”. The reason that they did not fly away is because (1) their speed has been filtered to synchronize well with the rotation of the Galactic Bar during the long history of establishment of a rotating organization and (2) the gravitational interaction between chunks in the same arm just keeps extending their pulling on the materials further lagging behind, as shown in Fig 9f. On the other hand, the materials near A-A, with their lower than “normal” speed but higher concentration there, compensate somewhat the loss of gravitational pull to a certain extent along the purple line. This compensation enables a stronger gravitational pull on the materials near the area of B-B, which otherwise may have flown away because of their higher than “normal” speed. Their higher than “normal” speed is not something produced by the galaxy itself, but is a residual speed with which these materials survived the galaxy’s overall pull in the old days. All these give us a reason why the blue line in Fig A shows speeds lower than what the red line (prediction by Newton's law) shows before the distance marked by the Sun but higher beginning from certain distance beyond the Sun.
Fig. 9g

Photo is based on that of Fig. 9a. Credit belongs to NASA/JPL, with other modification being added by this author.
Case 6  The Theoretical Impossibility for the Magellanic Clouds to Move on a Close Orbit about the Milky Way.

Had the Magellanic Clouds ever been some satellites of the Milky Way, their current location and movement would only indicate that they have now been far away from the point called Periapsis, which is the point on the Clouds’ supposed elliptical orbit but closest to the mass center of the Milky Way.

The Milky Way disk can be considered as being composed of many bars like what is shown in Fig. 10. When a massive body, called A, moves near the bars, it must receive certain on-axis effect of gravity from each bar. If A ever moves along an elliptical orbit about one bar, and the axis of the bar lies in the orbital plane, we have several situations as shown in Fig. 11a, 11b, and 11c.

Comparison between Fig. 11a, 11b, and 11c should lead us to visualize that Fig 11a is the most probable situation to happen. In Fig 11a, body A will receive the strongest gravitational force around the bar because of the on-axis effect when it migrates crossing the bar’s axis, or at the point of periapsis. Subsequently, A has the highest speed here in the entire orbit.

The problem is that, when A leaves the periapsis, it would enter a region where the off-axis is getting more and more prominent, thus the gravitational pull from the bar reduces more and more. However, the angular momentum with which A survives the gravitational pull at the periapsis remains the same. In other words, body A has more and more excessive momentum in responding to the gravitational pull of the bar after it leaves the periapsis. Any excessive momentum thus resulted must derail A from the supposed close orbit; any moving object considered to be a
satellite of something else must have a close orbit about this something else.

The Milky Way as an entirety can be regarded as a collection of bars laid side by side but within the ecliptic. The on-axis effect of gravitational influence from each bar on the Magellanic Clouds is fundamentally the same, although the farther away a bar is from the galaxy center, the less prominent the on-axis effect would be. As the Magellanic Clouds move to a location like what position F indicates in Fig. 10, the off-axis effect between it and each bar would have been quite pronounced, or the gravitational pull from the Milky Way would have been quite weak. Then the only destination for the Clouds is to fly away from the Milky Way. Then the only destination for the Clouds is to fly away from the Milky Way with their momentum that must become more and more excessive.

Therefore, we can claim with confidence that the Magellanic Clouds are visitors to the Milky Way only once in the Milky Way’s life time, and in the Clouds’ life time as well. Given that the current speed of the Large Magellenic Cloud is 378 km/sec and the speed of the Small Cloud is 302 km/sec, if the universe (! its visible portion only! ) has an age of 13.5 billion years, their birth place should have been no more than 17 million light years away from the current position, and about 100 times of the current distance between them and the Milky Way, provided that nothing has ever altered their movement during their entire journey, and that their journey had been a straight line.
Case 7  The Paths of a Free Moving Object

Here is a Suggestion to Any Motivation of Modifying Newton’s Law: The modification is considered successful if the modification can lead to one equation that is able to describe all open trajectories and close orbits that are so popularly found with heavenly objects in the sky.

Now, we try to arrive at such an equation in concern but strictly with only Newton’s three laws together with his gravitational law.

For convenience, we will abbreviate the gravitational field as GF, the mechanically accelerated field as MF. In the GF, we will name the coordinate system X-O-Z that is attached to the massive object that produces the gravitational field, with its origin O located at the mass center of the massive object.

Assume that at a certain time instant, in the GF we found a projectile B, whose mass is $M_B$, having a distance of $R_{AB}$ from a massive object A whose mass is $M_A$. With respect to the inertial frame X-O-Z, this projectile is found moving with velocity $\vec{v}_B$, which forms angle $\beta$ with
This velocity can be resolved into two components: tangential component \( v_{B/T} = v_B \sin \beta \), and radial component \( v_{B/R} = v_B \cos \beta \).

We can always find the gravitational force \( F \) between object A and object B according to the following formula:

\[
F = -\frac{G M_A M_B}{R^2} \quad (Eq. \ 53)
\]

The total mechanical energy of B with respect to A is

\[
E = \frac{1}{2} M_B \frac{v_B^2}{R} + \frac{1}{2} M_B \frac{v_B^2}{T} - \frac{G M_A M_B}{R_{AB}} \quad (Eq. \ 54)
\]

If there is no foreign interference, \( E \) is a constant. We can divide both sides of (Eq. 54) by \( M_B \) to get
where \( e \) represents the total mechanical energy per unit mass of projectile B; \( e \) is also obviously a conserved quantity.

When B carries a tangential velocity, it would simultaneously develop a centrifugal force, which points away from object A, and counteract the gravitational force between A and B. On the other hand, the existence of gravitational force tends to reduce the distance between A and B. As the distance reduces, according to principle of conservation of angular momentum, the tangential component of B’s velocity will increase. This in turn increases the centrifugal force. Although the absolute magnitude of gravitational force also increases as the distance \( R_{AB} \) decreases, it is easy to show (omitted) that the centrifugal force increases at a much faster rate and in the opposite direction against the gravitational force. Eventually, B will reach a point where the centrifugal force and the gravitational force cancel each other out because of their equal magnitudes but opposite directions. We will call this point the virtual equilibrium point, abbreviated as VEP. All values at this point will bear a subscript of ve. For example, \( R_{ABve} \) means the distance between A and B at VEP; \( v_{B/Tve} \) means the tangential component of the velocity possessed by B around A at VEP; and \( v_{B/Rve} \) means the radial component of the same velocity at VEP. Because of the sideways movement of B, we can say that \( R_{AB} \) is rotating or sweeping. For each unit mass of B at VEP, we have from (Eq. 55):

\[
\frac{1}{2} v_{B/Rve}^2 + \frac{1}{2} v_{B/Tve}^2 - \frac{GM_A}{R_{ABve}} = e \quad (Eq. \quad 56)
\]

At VEP the magnitude of centrifugal force \( F_c \) and gravitational force \( F_g \) are equal, so

\[
\frac{M_B v_{B/Tve}^2}{R_{ABve}} + \left( -\frac{GM_A M_B}{R_{ABve}^2} \right) = 0
\]

\[
\frac{M_B v_{B/Tve}^2}{R_{ABve}} = \frac{GM_A M_B}{R_{ABve}^2}
\]

\[
\frac{R_{ABve}^2 M_B^2 v_{B/Tve}^2}{R_{ABve}^3} = \frac{GM_A M_B^2}{R_{ABve}^2}
\]

\[
\frac{J^2}{R_{ABve}^3} = \frac{GM_A M_B^2}{R_{ABve}^2}
\]

\[
R_{ABve} = \frac{J^2}{GM_A M_B^2} \quad (Eq. \quad 57)
\]
where $J = R_{ABve} M_B v_{B/Tve}$ is actually the angular momentum of B with respect to A.

Since $J$, the angular momentum, is a constant, (Eq. 57) tells us that $R_{ABve}$ must then also be a constant once all the initial moving status are defined, including the speed with which B was found. In the upcoming calculations, we are going to simplify our symbols by using $m$ to replace $M_B$, $R$ to replace $R_{AB}$, $R_{ve}$ to replace $R_{ABve}$, and drop the subscript B from all other quantities regarding B. At a point other than VEP, we can set $R = \frac{1}{f} \cdot R_{ve}$, with $f$ being any positive number. Then (Eq. 55) would become

$$\frac{1}{2} v_R^2 + \frac{1}{2} v_T^2 \frac{GM_A}{R_{ve}} = e \quad (Eq. \ 58)$$

With $mv_T R = mv_{Tve} R_{ve}$, $v_T = \frac{v_{Tve} R_{ve}}{R} = f \cdot v_{Tve}$, (Eq. 58) becomes

$$\frac{1}{2} v_R^2 + \frac{1}{2} f^2 v_{Tve}^2 \frac{fGM_A}{R_{ve}} = e \quad (Eq. \ 59)$$

Comparing (Eq.56) and (Eq.59), and dropping the subscript B from all quantities regarding B in (Eq.56), we have

$$\frac{1}{2} v_R^2 + \frac{1}{2} f^2 v_{Tve}^2 \frac{fGM_A}{R_{ve}} = \frac{1}{2} v_{Rve}^2 + \frac{1}{2} v_{Tve}^2 \frac{GM_A}{R_{ve}} \quad (Eq. \ 60)$$

Because centrifugal force at VEP = gravitational force at VEP, we have:

$$\frac{mv_{Tve}^2}{R_{ve}} = \frac{GM_A m}{R_{ve}^2}$$
\[ v_{Tve}^2 = \frac{GM_A}{Rve} \]  
(Eq. 61)

Substituting (Eq. 61) into (Eq. 60), we have

\[ \frac{1}{2} v_R^2 + \frac{1}{2} f^2 v_{Tve}^2 - f v_{Tve}^2 = \frac{1}{2} v_{Rve}^2 + \frac{1}{2} v_{Tve}^2 - v_{Tve}^2 \]  
(Eq. 62)

Further calculation of (Eq. 62) shows

\[ \frac{1}{2} v_R^2 = \frac{1}{2} v_{Rve}^2 + \frac{1}{2} v_{Tve}^2 - \frac{1}{2} f^2 v_{Tve}^2 + f v_{Tve}^2 \]

\[ v_R^2 = v_{Rve}^2 - v_{Tve}^2 - f^2 v_{Tve}^2 + 2 f v_{Tve}^2 \]

\[ = v_{Rve}^2 - v_{Tve}^2(f^2 - 2f + 1) \]

\[ v_R = \pm \sqrt{v_{Rve}^2 - v_{Tve}^2(f - 1)^2} \]  
(Eq. 63)

The positive direction of \( R \) is assumed to be pointing away from A. \( v_R \) is along the radial line and in the direction of decreasing \( R \), so we take the negative sign for \( v_R \), i.e.,

\[ v_R = -\sqrt{v_{Rve}^2 - v_{Tve}^2(f - 1)^2} \]

or

\[ \frac{dR}{dt} = -\sqrt{v_{Rve}^2 - v_{Tve}^2(f - 1)^2} \]  
(Eq. 64)

If we express B’s sideways movement with angular speed \( \omega = \frac{d\theta}{dt} \), then, because of conservation of angular momentum, we would have

\[ m v_T R = m v_{Tve} Rve \]

\[ (\omega R) R = v_{Tve} Rve \]

\[ \omega = \frac{v_{Tve} Rve}{R^2} \]
\[
\frac{d\theta}{dt} = \frac{v_{Tve}R_{ve}}{R^2} \quad (Eq. 65)
\]

Dividing both sides of (Eq.65) by (Eq.64), we have

\[
\frac{d\theta}{dR} = \frac{-v_{Tve}R_{ve}}{R^2\sqrt{v_{Rve}^2 - v_{Tve}^2(f-1)^2}}
\]

or

\[
\frac{d\theta}{R} = \frac{-v_{Tve}R_{ve} \cdot dR}{R^2\sqrt{v_{Rve}^2 - v_{Tve}^2(f-1)^2}} \quad (Eq. 66)
\]

Since \( R = \frac{R_{ve}}{f} \), \( \frac{dR}{df} = -\frac{R_{ve}}{f^2} \), \( dR = -\frac{R_{ve}}{f^2} df \), (Eq. 66) becomes

\[
d\theta = \frac{v_{Tve}df}{\sqrt{v_{Rve}^2 - v_{Tve}^2(f-1)^2}}
\]

\[
\int \theta = \int \frac{v_{Tve}df}{\sqrt{v_{Rve}^2 - v_{Tve}^2(f-1)^2}} + C
\]

\[
\theta = \sin^{-1} \frac{v_{Tve}}{v_{Rve}} (f - 1) + C
\]

\[
\sin(\theta - C) = \frac{v_{Tve}}{v_{Rve}} (f - 1) \quad (Eq. 67)
\]

At VEP, if \( v_{Rve} \) takes the negative sign, the ratio of \( \frac{v_{Tve}}{v_{Rve}} \) is a negative value. Besides, at VEP, \( R = R_{ve} \), thus \( f = 1 \). The continues movement of B serves to further decrease \( R \), or, to further increase \( f \). These conditions enable us to assume an initial condition of \( 180^0 \) for \( C \). So, (Eq. 67) gives us

\[
\sin(\theta - 180^0) = \frac{v_{Tve}}{v_{Rve}} (f - 1)
\]

\[
-\sin \theta = \frac{v_{Tve}}{v_{Rve}} (f - 1)
\]

\[
-\sin \theta = \frac{v_{Tve}}{v_{Rve}} \left( \frac{R_{ve}}{R} - 1 \right)
\]
\[ R = \frac{R_{ve}}{1 - \frac{v_{Rve}}{v_{Tve}} sin \theta} \quad (Eq. \; 68) \]

(Eq. 68) is a conic section formula. In this conic section formula, \( R_{ve} \) is a constant. Once \( R_{ve} \) is obtained, \( v_{Tve} \) can be calculated from (Eq. 61). Then, \( v_{Rve} \) can be obtained from (Eq. 56) because of the fact that the total mechanical energy per unit mass of B is a measurable but conserved quantity at any point during B’s movement.

Analytic geometry tells us that (Eq. 68) indicates:

1. Object B will move on a hyperbola path if \( \left| \frac{v_{Rve}}{v_{Tve}} \right| > 1 \),
2. Object B will move on a parabola path if \( \left| \frac{v_{Rve}}{v_{Tve}} \right| = 1 \),
3. Object B will move on an elliptical path if \( \left| \frac{v_{Rve}}{v_{Tve}} \right| < 1 \).

In the case of \( v_{Rve} = 0 \), of course, \( R \equiv R_{ve} \), the ellipse is actually a perfect circle. By the same token, if we vary the ratio of \( \left| \frac{v_{Rve}}{v_{Tve}} \right| \) but keep it less than 1 all the time, we can have any close moving path for the movement of object B, from a perfect circle to a very elongated ellipse.

From these equations, we can easily tell that the VEP is always on the \( X \) axis.

In recent years, astronomical observations have found a number of other planet systems besides our solar one. In these newly found systems, planets are found moving in some very elongated orbits. It has been wondered how these elongated elliptical orbits could have been resulted. (Eq. 68) tells us that the ratio of \( \left| \frac{v_{Rve}}{v_{Tve}} \right| \) determines the shape of a free moving object’s path around a massive object. If an object like our object B in the above analysis is ejected into the vicinity of a massive object with various combination of \( v_{Rve} \) and \( v_{Tve} \) while the ratio of \( \left| \frac{v_{Rve}}{v_{Tve}} \right| \) happens to being less than 1, all kinds of elliptical orbit can be possible.

Based on the high population as well as the abundant variety of the orbital shape of such ellipse of all these newly found planet systems, we have enough reasons to raise skepticism on the Big Bang theory about its capability in exploring the initial formation of the universe. The variety of all these orbital characteristics includes the orbital period, moving direction, ellipse size, eccentricity, inclination of the orbital plane, tilting of the spinning axis of each planet, spinning
period, the mass and size of each of these heavenly objects. An orderly ejection of materials in a homogeneous and isotropic manner but from a single point like what the Big Bang theory advocates must fail in providing all these random combination of characteristics. To result in such great variety of combination of physical characteristics, random injection of material into some neighborhood where a certain planet system is stably finalized has far higher and far more reasonable potential—even the star itself, around which the planets are moving about, is a result of the injection. For further illustration of such an injection model, please refer to Secrets of Hubble’s Law at www.huntune.net, by Cameron Rebigsol

Reference:

(1) Isaac Newton, MATHEMATICAL PRINCIPLES OF NATURAL PHILOSOPHY


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(References found on line are dated by the year they are quoted)