Simple but Exact Calculations of Spiral Galaxy Velocities Solely Based upon Observed Galactic Matter (An Alternative Model)

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Abstract — The model we are proposing, based upon our research, makes exact predictions of spiral galaxy velocity profiles (stellar velocities) solely based upon a galaxy’s observed galactic matter, totally contrary to the dark matter hypothesis. Making exact predictions for all symmetric spiral galaxies is something that no other model can do, based upon our research. Based on our preconceived hypothesis, the goal of our research was to correctly explain the reasons for observed spiral galaxy velocity profiles and to propose new equations, if needed, for such calculations. In contrast, our research has shown that dark matter proposals usually make very poor predictions of stellar velocities within spiral galaxies and elsewhere based upon assumptions of normal matter distribution. Another goal of our research was to explain increased velocities observed in galaxy clusters, and velocity anomalies within the observable universe, based on the same proposed mechanism. We also explain that modified-gravity models have their own problems relating to predictions of galaxy-cluster velocities and must also propose unseen, but known matter for these calculations. The alternative model being presented proposes what can be called background Field-Flow dynamics. Its unique Newtonian-style equations, and their exact predictions concerning all spiral galaxies studied and presented, we believe are very convincing evidence in support of this model and proposal.

Keywords — Astronomy, Cosmology, Rotation Profiles, Spiral Galaxies.

I. INTRODUCTION

This research study presents new research findings and discoveries concerning spiral galaxies. Our general goal was to be able to make the most accurate spiral galaxy, stellar velocity profile predictions possible. By doing so we would be showing the validity of the alternative explanations we will present. In addition, our purpose was to propose an alternative model that could explain present observation anomalies not only at galactic scales, but also at all scales of the observable universe. We believe this paper is evidence in support of the success of that goal concerning spiral galaxies and galaxy clusters. This proposal is generally an alternative to dark matter, but also an alternative to modified gravity models, and to any model proposing to explain gravitational anomalies now primarily attributed to the existence of dark matter.

When we refer to background field-flow dynamics, we are referring to a non-observable background field like hypothetical dark matter, but instead of its mass, like dark matter, we look to the fields flow energy for the required explanations. Such known background fields are the Zero Point Field (ZPF), the Higgs field, hypothetical gravitons, quantum foam, etc. But the flow of the ZPF is only known to follow matter, not to lead it. That is what we are now proposing, the directional flow energy of the ZPF at galactic scales, never before calculated as to its exact velocities.

To test this field-flow hypothesis for spiral galaxies, we acquired what has proved to be very accurate observation and Newtonian velocity profile data for many spiral galaxies. We believe the exactness of our calculations is not only a testament to the accuracy of the spiral galaxy input data, but also to the accuracy of our unique equations derived for these calculations.

We derived these unique Newtonian-style equations based upon our background-field-flow dynamics model. These equations are mass, velocity calculating equations, not gravity calculating equations, and in this case they also calculate the proposed physical background-field-flow vortex velocities within spiral galaxies, which are their primary purpose. The vortex Pushing contact-forces accordingly would increase orbital velocities of stars while maintaining their radial positions by calculated inward-push, counteracting, centripetal vector forces. The forces and addendum energy being proposed, is not proposed as a primary force of nature, but instead as the more mundane contact pushing-force energy of a flowing...
background field such as the ZPF.

What is a ‘background field’ according to our use of these words in this proposal? In quantum physics there have been many alternative models proposed. The background field that was first known to exist over a hundred years ago is called Zero Point Energy, or the Zero Point Field (ZPE or ZPF). For more than 70 years, observations of this field assert that it is made up of very short-lived particle ripples which have been called virtual particles because of their short-lived appearance.

We call the model the Field Flow and Vortex Model (FFV). The characteristics of the background field flow we are proposing are based upon the Zero Point Field, but any physical, non-matter field would do. This “moving background field, sometimes called the quantum substrate (QS), represents locally the ultimate reference (frame) for rest and for the motion of matter and fields. This is accomplished automatically if the QS is the substrate in which all the elementary particles and fields are excited and in which they propagate according to the rules dictated by quantum mechanics or move classically according to the principle of inertia [1].”

This hypothetical field’s momentum can be generally distinguished from the classical quantum substrate in that it can have four pushing vectors to its momentum. One can be seen as linear, another as curved, another as orbital, and still another as centripetal. Many of these field vector forces appear to be a combination of these, hence the name Field Flow and Vortex model.

II. GENERAL DISCUSSION

A. The Background Field-Flow and Vortex Model (FFV) Being Proposed

The hypothesis we are proposing as a result of this research and study we call the background Field-Flow and Vortex model (FFV) which is the primary subject and proposal of this paper. This model is primarily an alternative to dark matter, but also an alternative to modified-gravity models. This model proposes a physical, flowing, but non-matter background field which is used to explain and calculate the rotation velocities of spiral galaxy disc stars and other observation anomalies.

The existence of background fields has been known to exist for about a century now such as the Zero Point Field (ZPF and ZPE) of quantum mechanics, the newly asserted Higgs Field, and theorized fields such as dark matter, dark energy, gravitons, etc. None of these hypothesized fields discuss field flow or have been proposed as being the source of the observed excess velocities of spiral galaxies by way of the pushing forces of their kinetic flow energy; this is what we are proposing. The proof of this model is in the exactness of its velocity profile calculated predictions resulting in almost exact statistical correlations with observed velocity profiles, concerning dozens of randomly chosen spiral galaxies.

B. The Big Bang Model, Dark Matter and Related Problems

For those who are familiar with the many problems and inaccuracies of dark matter modeling and wish to read ahead to our FFV proposal, can skip down to section III after the end of this paragraph, then return back here to section II C, if interested, for additional information concerning the problems with the dark matter hypotheses, and information concerning other alternatives. For the purposes and requirements of condensation and focus, we have also deleted another nine pages of our original research and the research of others with links, concerning what are described as the fallacies and failings of dark matter proposals and modeling, which we can send by e-mail to anyone interested upon request.

Dark matter, dark energy, and the Inflation hypotheses are now foundation hypothesis within modern cosmology, the Concordance Lambda Cold Dark Matter model. The problem, however, is that all of these hypotheses are presently believed by most to be unknowns as to their nature and causes.

Hypothetical dark matter is believed to have the same gravitational effects as ordinary matter except for its proposed quantities, requiring more than five times more unknown dark matter than ordinary matter. Based upon accepted gravitation theory, if dark matter were generally distributed in a somewhat even mix with ordinary matter, observed velocity profiles of spiral galaxies would generally look similar to Newtonian velocity profiles except that velocities would be much greater because of the great increase in matter required. There would be few if any flat rotation curves such as those observed in most large spiral galaxies like the Milky Way.

For this reason, the most important necessary characteristic of dark matter concerning spiral galaxy velocity profile predictions would be its gravitational influences outside the galaxy. This has been called the galaxy’s dark matter spherical halo. If hypothetical dark matter could, for some reason, mostly exist outside of spiral galaxies with little or no influence inside them, then dark matter predictions would be much better in spiral galaxies. But even then, according to our research, predictions would still not be as good as most other alternative models as will be explained.

Seemingly contrary to the existence of dark matter halos, stellar clusters and small galaxies often orbit relatively close to larger spiral galaxies. Wouldn’t they be gravitationally affected by large dark matter
halos supposedly outside the observable galaxy?

Both the Milky Way and the Andromeda Galaxy have a number of adjacent stellar clusters and small galaxies orbiting primarily in a single plane somewhat perpendicular to the galaxy’s spiral disc, called the Magellanic and the Andromeda Polar Planes respectively. The existence of such somewhat perpendicular planes may also be true for many other large spiral galaxies but most such structures are just too far away to observe such relatively small, adjacent stellar clusters and small adjacent galaxies. Neither gravitation theory nor dark matter theory can explain these perpendicular galactic planes and related observations as described by Pawłowski et al [2]. Such rotating perpendicular planes, on the other hand, can be explained by the FFV model by opposing background-field vortices pushing smaller galaxies and stellar clusters together into a single plane, similar to the formation process of the discs of spiral galaxy in the first place, according to the FFV model.

In a paper published in 2018, an international team of four researchers believe they have observed the same orbiting disk formation of dwarf galaxies orbiting the elliptical galaxy Centaurus A which is relatively close, about 30 million light-years away from the Milky Way. This paper points out that “Dwarf galaxies should travel randomly around their parent, based on the standard model of how galaxies form according to accepted gravitation theory. Seeing yet another galaxy with this strange (orbiting disc) behavior is highly unlikely, and calls into question the very model that scientists use to understand the structure in our universe,” according to Müller, the lead author of the paper.

Müller also said that “perhaps the further study of the additional dwarf satellites of this galaxy may not be consistent with their initial findings, perhaps our team has found just another statistical outlier concerning large galaxies in general, perhaps isolated galaxies work differently from galaxies much closer together in large groups, or perhaps many more such galaxies with orbital discs of smaller galaxies orbiting in plains other than the galactic plane will also be discovered in time or when observation technology improves” [3].

There have been a number of different types of dark matter proposals, but if the distribution of dark matter proposed is different from the normal distribution of ordinary matter within a galaxy, then theoretical problems arise. Dark matter models that do not adhere to this principle have both logical and observational problems such as not finding adequate influences of dark matter in the galactic core, not finding dark matter influences in our solar system, etc. Such problems of logic have been called the “Cusp-Core problem,” and the related “Cuspy Halo Problem” [4], as well as other dark matter theoretical problems that so far have not been satisfactorily addressed or explained by either observation or logic, according to our analyses and critiques by others.

C. Modified Gravity Models

The most well-known alternatives to dark matter are called modified gravity models. All such models propose alternative formulations of gravity based upon increased gravitational strength at large intra-galactic distances. The most well-known of these models is called Modified Newtonian Dynamics, MOND, which was proposed by Mordehai Milgrom in the early 1980’s. Based upon our research and that of others, nearly all modified gravity models make much better predictions of spiral galaxy rotation profiles than do dark matter models. According to our research, one of the most accurate of these modified-gravity models is called Metric Skew Tensor Gravity (MSTG) proposed by Brownstein and Moffat We obtained most of our raw spiral galaxy observation data and related graphs from Brownstein and Moffat’s Journal publications [5].

But like dark matter models, modified-gravity models also have major problems associated with them: 1) Most practitioners believe that modified gravity models in general lack a justifiable rationale as to why the force of gravity should increase in the outer parts of spiral galaxies to justify their equations, and 2) These models also do not seem to be able to explain the higher rotation velocities observed in galaxy groups and clusters, or the extent of the bending (lensing) of galactic light, without also resorting to proposals of unseen matter. For these models, such matter is asserted by their proponents to be a yet unidentified form of known matter of some kind. On the other hand, we believe related observations by others concerning increased velocity observations within galaxy clusters and other observation anomalies now primarily attributed to dark matter, can be “more easily explained” by the FFV model via background-field flow, better than any other model for reasons we will continue to discuss in this paper.

D. Other Little-known Alternatives to Dark Matter and Modified Gravity

There have been many proposed alternatives to dark matter other than modified gravity models. Some of these models propose a new fundamental force of nature to explain spiral galaxy velocity profiles. Such ideas have collectively been called “fifth force” proposals [6]. They propose another fundamental force of nature beyond gravity to explain gravitational anomalies such as the excess velocities observed in spiral galaxy rotation profiles. Although the FFV model is not one of these models, its calculation results using the FFV equations could be used to justify such a model, or even for a modified gravity model or other
alternatives with different justifications for their use.

Other models have proposed electromagnetic influences to explain increased velocities within spiral galaxies [7]. Another alternative proposes that spiral galaxy rotation profiles can be explained by General relativity and Quantum cosmology in the absence of dark matter, using combined equations of both [8]. Another proposal asserts that the mechanics of the calculations themselves are the problem for determining the correct spiral galaxy rotation profiles rather than the amount of matter in the galaxy, its distribution, or the formulation of Newtonian gravity. Still another group of proposals are called Emergent or Conformal gravity [9]. These models propose that space-time is made up of small elements whose collective motions produce the force of gravity. Modified gravity and Emergent gravity models are the most well-known mainstream models arguing this position, contrary to dark matter proposals. Criticisms of these proposals generally involve their perceived inability to address other gravitation anomalies that dark matter proposes to explain such as velocities of galaxies in a cluster, the extent of gravitational lensing, the additional motions and supposed gravitational influences concerning the universe as a whole.

The FFV model, on the other hand, separates Field flow effects from gravity, the velocity of this effect, and the related equations to exactly calculate this effect in spiral galaxies separate from gravity.

Another alternative to dark matter has been suggested by many sources over time. There suggestion has been: If we cannot directly discover dark matter, we should then start looking for presently unknown dark forces within galaxies and clusters.

We have confidence this is a good idea since we believe we have discovered such a “dark” force which is the basis of the FFV model. This model proposes such mundane pushing forces of background-field-flows, a quantum substrate that when calculated and added to the forces of gravity, make “undeniably” exact predictions for spiral galaxies, and likely better explanations and predictions for all venues where good observation data is available.

III. THE FFV MODEL AND THE BACKGROUND-FIELD FLOWS BEING PROPOSED

Maybe the key to realizing the validity of the FFV model would be the recognition of its almost perfect predictions. This would be difficult for readers without performing or analyzing the calculations which yield exact predictions. This can be done by requesting the extensive calculation data for the 18 randomly selected spiral galaxies that we have available for review, and possible calculations of your own chosen spiral galaxies. But also the accuracy of this model can also be understood by the related correlation statistics which show an almost exact correlation between calculated galaxies and their observed velocity profiles.

To understand the logical basis of this model and its calculations, one can realize the simple mechanisms of the proposed background-field flow model explained below.

These calculations showing the model’s validity are based upon the velocity profile data of spiral galaxies, which include their observed velocity profiles and their calculated Newtonian velocity profiles. All of our data concerning spiral galaxies for calculations in this study were obtained from a publication by Brownstein and Maftat 2005 [8]. We believe the exactness of our calculated results is also a testament to the great accuracy of their velocity profile data. From this data we have calculated our proposed velocity profilea of field flow for 18 randomly chosen spiral galaxies, from the many more spiral galaxies for which they have published Newtonian and observed velocity profile data. Like dark matter, the FFV model proposes something physical that is not seen. But instead of matter, we are proposing the field-flow energy of a background field such as the ZPF, calculating its velocity and adding it to the calculated gravitational influences of Newtonian gravity. The results were the same as the observed stellar velocity profile with almost certain accuracy.

In accord with the FFV model, the strength of the aetherial-like vortex proposed within spiral galaxies, would depend upon a number of different factors. Younger, larger, brighter, bluer, and denser galaxies would tend to have stronger and faster background field vortices within them. Older, smaller, dimmer, redder, and more spread out galaxies would tend to have less or little apparent background field flow within them. A galaxy’s relative position within a cluster would also be a factor. Those galaxies closer to large galaxies would likely have less predictable background field flow strengths. Some of these field flow vortices would be stronger and some weaker than similar, more separated galaxies. Even so, surprisingly these differences do not hamper exact predictions which we will explain.

Generally, cores of most spiral galaxies rotate similar to a rigid-body vortex up to their peak velocities surrounding the core, but these velocities can generally be more accurately calculated based upon the observed core mass. Outside the core and into the galactic disc, according to the FFV model, vortex velocities would progressively increase.

Linear field flow velocities between galaxies accelerate toward the gravitational centers of the closest galaxies and would be at their greatest velocities when they first enter a galaxy. Linear flows would be bent
by the circular form of spiral galaxies as they enter them, moving towards their centers of gravity. The field’s circular form within spiral galaxies accelerates the galactic matter it encounters within the galaxy because its greater velocity than the matter it encounters. This can be called the tangential force of the field-flow within the galaxy.

This force is somewhat counteracted by a field-flow force toward the center of the galaxy. This can be called the field’s centripetal vector inside galaxies. The circular vector forces plus the centrifugal vector forces can be called vortex forces. The centripetal force within a spiral galaxy would keep accelerated galactic matter within its same radial position.

This vortex field’s angular momentum would be progressively absorbed in direct proportion to the galactic matter it encounters in the galactic disc. Therefore, these vortex forces would be at their greatest on the galactic exterior, and because of matter absorption of angular momentum velocities, these forces would become close to zero at the galactic center.

Within the large scale structure of the universe, there also would be even faster field flows within galaxy clusters and superclusters, as well as between them.

Aetherial background field flows in general could relate to background field-pressure differences within the background field, inside and outside of galaxies. At the largest scales of the universe, field flows would first relate to the overall directional flow of the galaxy cluster itself as to its proper motion, and then to the individual field flows between galaxies.

Proposed as the ZPF, background field would be a known and proven entity at cosmological scales, unlike dark matter which is only considered via its supposed gravitational influences. The ZPF is known to flow within galaxies and clusters to satisfy the cosmological principle. To be able to calculate its exact velocities other than via the matter that it encompasses, is an unknown that we are proposing calculations, as well as its presently unknown centripetal force vector.

The bottom line here is that aside from all of the separate galactic influences, whether discussed or not, stellar disc velocities can be calculated for all radial positions of the observable galaxy based upon a single (often 2 is better) observed spiral-galaxy disc velocity, averaged at any chosen radial disc location. From this the total galactic mass can be calculated, and thereafter the total observed stellar velocity profile of the spiral galaxy can be calculated solely based upon the information from the Newtonian gravity velocity profile.

This use of one or two data points from the observed velocity profile is also necessary for dark matter modeling and all other models to make their best predictions. The method used is called the least-mean-square statistical evaluation, which can also vary the angle of the prediction. Another widely used prediction adjustment method is to vary the galactic mass as needed, usually to vary the height of the predicted velocity profile. We expect this would always be necessary for dark matter modeling since so much additional mass (dark matter) is added to the galaxy for predictions.

A. Background Field Flows Within and Outside Galaxy Clusters

According to the FFV model, the average stellar velocities within spiral galaxies, as well as the average galactic velocities within galactic clusters, would roughly average twice the velocity as those calculated solely based upon conventional gravity; again these increased velocities are now mostly attributed to dark matter.

A study recently published in The Astrophysical Journal, October 2019, found hundreds of galaxies rotating in sync with each other, in the same general direction and on similar planes of rotations. These are galaxies tens of millions of light-years apart from each other in the same cluster.

According to a quote from the lead author of this paper concerning the statistical coherence between the rotation directions and orbital planes of galaxies within the cluster: “The observed coherence must have some relationship with large-scale structures because it is impossible that the galaxies separated by six mega-parsecs [roughly 20 million light-years away from each other] directly interact with each other,” according to lead author Joon Hyeop Lee the lead astronomer and author of the study at the Korea Astronomy and Space Science Institute [10]. In such cases we propose that the “large scale structures” he is referring to is the directional, internal background field flows within the cluster.

Background-field-flow (as the quantum substrate) can readily explain what has been observed concerning galaxy cluster anomalies as explained above, and we believe similar future cluster observation anomalies. According to our research, no other model can explain the cluster anomaly described above. Such cluster observations along with our spiral galaxy calculations, as we have statistically shown, we believe provide the strongest possible evidence for the validity of the FFV model over dark matter or any other model concerning galaxy rotation and cluster rotation velocities and related anomalies.

B. The Mechanics of Spiral Galaxies Based on the FFV Model, Exemplified by Figures 1 & 2

We will begin with a generic spiral galaxy rotation curve shown below, typical of most large galaxies including the Milky Way. As one can see by figure 1, this is very similar to the proposed form of the Milky Way.
Way, Fig. 2 below. The top line shows the observed velocity profile. The bottom line shows the Newtonian predicted velocity profile. The horizontal measurement line shows distances expressed in kiloparsecs, and the side vertical line usually shows the velocities of stars in kilometers per second.

Fig. 1. Velocity profile of a typical large spiral galaxy like the Milky Way [11].

Fig. 2. Distances in kiloparsecs (kpc).

C. The Milky Way Galaxy

The observed velocity profile of the Milky Way, Fig. 2 line B, was taken from an Ohio State website [11]. The Newtonian velocity profile, line A, was taken from a University of Michigan website [12]. No credit was given for their astronomy authors. From our research, there is no agreement in astronomy as to the form of these velocity profiles. This composite of the two was made by us because we found no single data source that showed consistency between these two velocity profiles and figure 1 above, which exemplifies in form, the standard form of large spiral galaxy velocity profiles like the Milky Way, concerning all galaxies we have studied. This figure also shows the proposed calculated vortex velocity profile of the Milky Way, line C, The calculations of the proposed vortex velocity profiles of spiral galaxies, like the Milky Way are the foundation of the FFV model. The velocity profiles of other galaxies of our study, however, do not include any matter beyond the visibly observable galaxy. For the Milky Way, the visible stars do not extend beyond 18 kpc. from the galactic center, based upon our generally “local” telescopes.

The Milky Way and most spiral galaxies have close to a flat rotation curve. The average peak velocity of its stars lies just outside the galactic core and generally remains the same for all observable disc stars regardless of their radial distance from the galactic center. This velocity can be denoted as $V_M$. For these flat-rotation curve galaxies, the vortex velocity surrounding disc stars at the same radial distances from the galactic center, can be estimated as the maximum average stellar velocity of the galaxy, minus the average observed stellar disc velocity at any chosen radial distance $V_R$, $V_M - V_R = C$, C being the vortex velocity at that chosen radial distance.

D. The Unique Equations, Hypotheses, and Predictions of the FFV Model

Unique equations have been derived and used to calculate all the spiral galaxy rotation profiles in this study. Of the eight equations used in this study, four are unique (theoretical physics) to the FFV model and were derived based upon the tenets of the FFV model only.

The crux of the FFV model is almost entirely based on the exactness of its calculations. Because some unique equations are needed for exact calculations, readers should consider the justifications for deriving
these equations (theoretical physics). The bases for these equations relates to our discovery of the unknown characteristics that all spiral galaxies have in common, based upon tens of dozens of spiral galaxies with adequate data for our study. The application of this knowledge and calculations would specifically apply to the 18 randomly chosen spiral galaxies we specifically display in this study including the Milky Way.

There were two major discoveries we made concerning spiral galaxies, both were expected – but one more so than the other. The validity of a decades-old hypothesis of the lead-author of the study was the primary guide and expectation of this study. The hypothesis was that the flowing forces of a background field vortex could explain the excess velocities observed in spiral galaxies, and the primary candidate to be considered was the little-known flow forces of the ZPF. From this hypothesis the two new discoveries we made were relatively simple.

1) When vortex forces are added to the Newtonian forces of gravity, exact predictions of spiral galaxy velocity profiles can be made, without exception.

The next consideration of the hypothesis was that field pressures reach their maximums between galaxies, like a high pressure area of the background field, and from there, steadily accelerate toward galactic matter reaching their greatest velocities just before they enter galaxies, and their least velocities at the galactic center, like at the eye of a hurricane vortex.

2) The next discovery first became another hypothesis: that from its maximum field-flow velocity upon entering the galaxy, field flows velocities would decrease in direct proportion to the galactic matter it encounters on its route to the galactic center. For instance, upon entering the galaxy, the fields velocity is X. After encountering 27% of the total galactic matter, from the outside of the galaxy moving inward, the field flow velocity will then be 83% the velocity the value of X, 0.83X. This hypothesis was tested and shown to be valid over more than a hundred spiral galaxies of all sizes.

From this hypothesis, an equation was derived that can calculate the total galactic mass, separate from what can be observed. From these discoveries and the calculation of the total galactic mass, exact calculations of the velocity profiles of all symmetrical spiral galaxies tested were made and verified.

For a more complete listing of these equations, their derivation, the galactic graphs and calculations of the 18 extensively studied galaxies of the formal study, along with the statistical analyses showing almost perfect correlation of these calculated predictions with observation data, please make an email request to us and we will send the entire research to you.

Although calculation methods and predictions of the FFV model are the only indispensable part of the proposal, our purpose is not related to making predictions since the observed velocity profiles of the spiral galaxies of our study were already known, as they are for all model evaluations. Instead, our purpose for calculations is the same as for all other models, to show evidence for the validity of the model.

For the FFV model, we use at least two ‘tools’ to determine the validity of the model. One is our unique equations which when applied; exactly calculate the observed stellar velocities of spiral galaxies. The second method and tool we used were the correlation statistics between the observed velocity profile and the stellar velocity profile predicted. We believe no other model can come close to the statistical accuracy, shown below, obtained from our analyses based upon the large number of randomly chosen spiral galaxies in our research.

This paper is a summary version of our research, therefore the explanations given are often brief. To fully realize the value of our proposal and equations a reader or group must be able to do the calculations to fully understand these equations. This can only be done by requesting our full-length study via email.

All calculations of this proposal relate to spiral galaxies and our proposed background-field vortex within them. These vortex velocities when added to the calculated Newtonian velocity of spiral galaxies, exactly calculates the observed velocity profile. Since no calculations are shown within this summary version, the equations that follow are not numbered. For our calculations we have formulated and use this beginning equation: $V_{V} = O_{V} - N_{V}$. It states that the vortex velocities, $V_{V}$, are equal to the Observed velocities of the galactic disc minus the Newtonian calculated velocities. Conversely, if one has the Newtonian velocities and adds the proposed, calculated vortex velocities to them, then the sum will always equal the observed velocity profiles.

The basis for all our velocity equations is the Newtonian equation $V = (GM/r)^{2}$ and its rearrangement $M = v^{2}r / G$, where ‘$M$’ is the calculated mass, ‘$V$’ is the observed velocity for a specified radial distance, ‘$r$’ is the radial distance being calculated, and ‘$G$’ is the gravitational constant never needed in any of our calculations, as explained below.

The equation $\sum(v^{2}r) / G$ is the sum of all the bin locations where the mass is being calculated, and the equation $(\sum(v^{2}r)) / (\sum(v^{2}r))$ represents the relative mass of a particular bin at its radial bin location. Notice that the gravitational constant ‘$G$’ cancels out in this relative-mass ratio calculation. The equation $M_{0} = 1.5 rv^{2}$ is used as a good approximation of a spiral galaxy’s core relative mass, although a more precise estimate might be made by telescopic observations of the galactic core. But for our study, we found that this extra precision made little or no difference concerning the accuracy of our velocity profile calculated predictions.

To calculate the total relative mass of a spiral galaxy including unseen matter above and below the
galactic plane and disc, we derived this formula \( M_{AF} = \frac{V_2}{V_1} \left[ \frac{P_2}{(P_2-P_1)} \right] \). We have discovered that this additional mass can be calculated since it affects, and is necessary calculating the rotation velocities of the galactic disc, our “prediction” calculations. Notice that \( V_2 / V_1 \) are two velocities of the galactic disc whereby \( V_2 \) is greater than \( V_1 \), so their ratio will be greater than 1. ‘\( P_2 \)’ is also greater than ‘\( P_1 \)’, and both are radial distances of their bin locations from the galactic center. Therefore the ratio \( P_2 / (P_2-P_1) \) is also a number greater than 1. The result of these combined ratios of the equation is a number which is a multiplier of the observed galactic mass of the galactic disc. Roughly speaking it is usually a number between 1 ½ and 2 ½.

How velocity calculations are made: A galaxy’s observable matter can be divided into 5 bins based upon the bin’s radial distances from the galactic center. If the total mass of the galaxy is ‘\( X \)’, and if the central bin’s mass is \( X/5 \), then the velocity of the incoming vortex will also drop \( 1/5 \) more from its entry velocity upon passing that radial position, transferring its own velocity to the matter it encounters upon contact. Looking from outside the galaxy inward, vortex velocities will drop in direct proportion to the matter it encounters. Looking from the inside of the galaxy outwardly, stellar velocities will increase directly proportional to the increase in field flow (vortex) velocities. Adding the calculated field flow velocities to the calculated Newtonian gravitational-influence velocities, yields the exact calculation of the observed velocity profile of the spiral galaxy.

To analyze the accuracy of our galactic calculations in our study we used the Pearson correlation coefficient equation – where ‘\( r \)’ represents the degree of correlation (1).

\[
r = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_i - \bar{y})^2}}
\]

Strength of Association and correlation
Positive Negative:
- Small 0.1 to 0.3 -0.1 to -0.3
- Medium 0.3 to 0.5 -0.3 to -0.5
- Largest 0.5 to 1.0 -0.5 to -1

The Pearson correlation coefficient, averaged together for all 18 randomly chosen spiral galaxies in this study, was calculated to be 0.98. No individual galaxy had a correlation less than .96. Referring to the positive correlation indication numbers shown above, this is an almost perfect correlation between the calculated and observed velocity profiles, and also between the observed galactic matter and the observed velocity profiles of the 18 spiral galaxies with the added vortex velocities. For this correlation equation , ‘\( x \)’ is the observed set of data, and ‘\( y \)’ is the calculated data set.

This result is totally contrary to the dark matter hypothesis since only the observed galactic disc matter is needed for exact calculations of the observed galactic velocity profiles for the many dozens of galaxies analyzed, and the 18 random spiral galaxies calculated and presented in the expanded version of this paper.

To reiterate what we have said above, the purpose of these calculations for our model, or for any model has nothing to do with making predictions since the observed velocity profiles are already known beforehand. The sole purpose for the calculations of this and all models, the FFV, dark matter, modified gravity models, etc. is to show the validity of the model being evaluated.

Since the first acknowledged gravitational anomaly was the excessive velocities of spiral galaxies, many of most believe the primary test of any proposed model is its calculations of spiral galaxy velocity profiles.

According to our research, dark matter modeling of a number of spiral galaxies cannot even be found in a mainstream journal. Proponents only predict the velocity profile of a dark matter halo, but not how it can be integrated with the observed matter to produce observed velocity profiles. The biggest problem for dark matter modeling is that this is something that the many dozens of competing models can do far better than dark matter models.

Since a longer explanation of the FFV equations and their derivations take up an additional 4 pages, and their calculations and statistical evaluation of the 18 chosen spiral galaxies take up an additional 22 pages, readers need to request the additional information from us as needed to enable a more comprehensive, but lengthier evaluation of this proposal.

The same principle and calculations should apply to lenticular galaxies, although observation data is very scarce and probably more difficult to determine the velocities of the stars within them.

As to elliptical galaxies, their insides cannot be observed because they are three dimensional. Even so, the same FFV field-flow principles should apply for rotating elliptical galaxies. But 3D internal velocity calculation predictions would expectedly be very difficult or impossible, even if the internal velocities of
some elliptical galaxies might be observable via infra-red astronomy.

For irregular galaxies, the distribution of matter usually has no pattern to it which generally leads to some or many unpredictable stellar velocities by any model.

Additionally in our research, we found observational evidence and statistical analysis by others that we believe is also very important in that it supports our field flow proposal and expectations concerning the widest-ranging background field flows at the largest scales of the observable universe, as will be shown in the text below. We believe this is very important in that these observations are not consistent with dark matter or any other known model.

IV. LIMITATIONS OF THE FFV MODEL AND RELATED EXPLANATIONS

Before we get to the general conclusions of this paper, we will discuss some limitations and comparative analysis of the FFV model. The FFV model proposes that two spiral galaxies of exactly the same galactic mass and mass distribution will not necessarily have the same vortex velocities, although the variations of the vortex strength would be the same if the mass distribution is the same. This would be because galactic mass, density, and size would not be the only determinants of vortex strength and velocities. This accordingly would be because the vortex strength of spiral galaxies would be also a function of various factors such as the age of the majority of its stars, the galactic luminosity, the variations of its radiation spectra, its density, its relative position and orbital motion within a group or cluster. Also the clusters position and motion relative to its surroundings, possible counter-rotating stars within the galaxy, the possible counter-rotation of the galaxy itself concerning its proper motion, etc. Some of these variable relationships are not unique in that all astronomers know of the Tully-Fisher relationships which can closely estimate the relationship of spiral galaxy brightnesses to their peak velocities, and its mass, to its peak velocities, etc.

But none of these variables can affect calculations for the FFV model because our vortex velocity profile calculations include the influences of all such variables without their separate determinations. Like all velocity profile calculations and their predictions, the FFV model requires at least one set point from the observed spiral disc as a reference point to calculate the galactic variable mass which eliminates all the other variables according our study.

We do not attempt to predict the mass distribution within spiral galaxy cores since it does not improve our exact predictions of the stellar disc velocities. An equation is given within this paper to “accurately estimate” the variable core mass of spiral galaxies. The FFV model asserts that core vortex velocities steadily decrease inward to the galactic center where vortex velocities can be close to zero.

V. COMMENTS, SUMMARY CONCLUSIONS, AND EPILOGUE

A. Comment

There is a big difference described between the forces of gravity and the forces of field flow. Gravitational forces are spherically equal around matter and move at the speed of light. Field flow forces are linear, curved, single directional and move at the speed of the elements of the field they encompass. Hey move at the speed of stars in a galaxy, at the speed of the galaxies in a cluster, or maybe even faster speeds between galaxy clusters. The bottom line of this is that the proposed filed flow forces are very different from the forces of gravity.

B. Summary Conclusions

Based on the above study, the summary conclusions of this paper are as follows:

1) The Field-Flow and Vortex model and the dark matter proposals both add an unknown entity to the universe, but this research explains the big advantages of the FFV model and its energy addendum over dark matter. First, the FFV model displays almost indisputable accuracy concerning their calculated rotation profiles, for all spiral galaxies examined, far better than dark matter or any other model. Second, the mass equivalence value of the energy addendum to the universe proposed by the FFV model is only about 1/5th of the mass addendum required by dark matter. Third, the energy addendum needed for the FFV predictions and its locations can be precisely calculated for each galaxy where the amount of dark matter required and relative location varies greatly from one galaxy to the next. Forth, at the largest scale of the universe concerning galaxy clusters, observation anomalies that presently seem inexplicable based upon dark matter, are both expected and predictable by the FFV model. Fifth, both dark matter and background field flow propose their own means by which galaxies and galaxy clusters could have created their beginnings, but the formation of galaxies and galaxy clusters via background-field-flow would have been a many-times faster process than dark matter via gravity, more in line with observed reality.

2) Based upon our research, dark matter is not needed to explain spiral galaxy rotation profiles, and by implication, it is not needed to explain any other observation anomalies now attributed to dark matter. Non-
baryonic dark matter probably does not exist according to our research.

3) Strong evidence supporting the FFV model is in its superior accuracy of spiral galaxy velocities over dark matter, predictions which have been determined by statistical analysis to be very accurate. But maybe of equal importance are the observations by others of vast universe scale directional cluster flows having a strong statistical correlation between the directional flows of these large scale galactic clusters, and the galactic rotational directions, axes of rotation, and the alignments of galaxies within the cluster. We believe these observations are strong evidence for the reality of background field flows, evidentiary support for the FFV model, and unexplainable based upon dark matter modeling [2]. The related links below concerning galaxy cluster flows is the most often cited research in this paper. The most well known example of cluster flow is called the anomalous “dark flow.” The anomalous quasar polarization alignments within galaxy clusters is another example suggesting congruent field flows within galaxy clusters [10], [14].

4) According to the FFV model astronomers and theorists alike are using the wrong model of the universe and related equations to explain the motions of galaxies and of the universe as a whole by only using Einstein’s Cosmological Equations. Instead, background-field flows, herein proposed, would be a substantial competitor to gravity in explaining the form, motions, and structure of the universe. Upon this realization, equations for field-flow at the galaxy cluster level could likely be added to gravity influences equations, as done in our study of spiral galaxies, to test the large-scale field flow hypothesis concerning the entire universe. Our expectations is that a far more accurate mathematical model of the universe can be created with these separate from gravity equations as in our spiral galaxy vortex model and equations.

5) It is seldom discussed that the effects of increased gravity do not increase velocities within spiral galaxies or galaxy clusters, or anywhere else for that matter. Gravity can only control pre-existing velocities and slow matter down. For increased velocities, additional forces or momentum are required in the first place and assumed by all models based upon matter interacting with each other mostly during galaxy formation. If not then why haven’t some spiral, elliptical, and irregular galaxies that may have had comparatively little formation momentum collapsed into primarily central galactic black holes instead of maintaining their spiral or other form for tens of billions of years? If there are internal field flows within these galaxies, as in the FFV model, then such flows would work contrary to the gravitational collapse of galaxies and clusters, as well as within the universe as a whole, better explaining the forms and motions of the universe as we now observe them.

6) For spiral galaxies, the FFV model predicts velocity profiles of stars far better than any other model, to the extent that statistically, it’s close to a certainty, which has been shown in the statistical calculations of our extended paper.

7) The FFV model shows statistically that only baryonic matter is needed to accurately predict spiral galaxy rotation profiles, and by implication, all other observation anomalies now attributed to dark matter.

8) At the largest scales of the universe, background field flows would be both curved and linear and generally be gravity-centered. Field flows would have a calculated mass equivalence that roughly would average 2/3rds the mass of the galaxy. Another quantity of roughly 1/3rd of the total galactic mass or more of field-flow energy would happen outside and between galaxies, and accordingly would contribute to the increased velocities of outside matter being pushed toward these galaxies. Field-flow would greatly increase galactic velocities within a cluster over those velocities calculated solely based upon the observable matter and mainstream gravity equations, but field-flow accordingly would also cause galaxy and cluster formation at a much faster rate than gravity alone.

9) Very-large-scale directional galactic flows have recently been observed that correlate with the angle of the galactic planes and the directional orientation of the galaxies within them [9]. These observations by other groups can be readily explained by field flow, but seem to be contrary to all other models studied [13], [14].

10) The FFV model is able to calculate the total galactic mass based solely upon the observed galactic matter of the spiral disc its rotation velocities, even if roughly only half the galactic matter can be observed.

11) A primary consideration concerning both the separation and complement between the gravitational mechanism and field flow mechanism being proposed “is that the moving background field, sometimes called the quantum substrate (QS) represents locally the ultimate reference (frame) for rest and for the motion of matter and fields. This is accomplished automatically if the QS is the substrate in which all the elementary particles and fields are excited and in which they propagate according to the rules dictated by quantum mechanics or move classically according to the principle of inertia [1].”

According to our proposal, both gravity and background-field-flow would often work in tandem at galactic and larger scales of the universe, as generally equal forces directed towards the centers of gravity.

12) The FFV model also predicts a far more rapid creation mechanism for both galaxies and galaxy clusters in the first place as a result of large-scale external field flows towards mutual centers of gravity. Our estimates propose that these, and all other large-scale structures of the universe, would have been created many times faster than by the effects of gravity alone.

13) Distinguishing Field Flow forces from gravity: regarding related hypothesis. Gravity moves at the
speed of light toward local centers of gravity. Field Flow moves at the speed of stars within galaxies, and at the speed of galaxies within a cluster. It also moves towards the centers of gravity on much larger scales transferring its built-up momentum to the matter it encounters upon contact.

C. Quaries

So which is more likely, The FFV model that proposes an entity known to exist, one that makes much better predictions without contradictions, one that requires 1/5 the input of an unknown than its competitor, and one that also explain the directional plane and axis of rotation correlation within galaxy clusters. The fields unknown characteristic being proposed is its vortex form within spiral galaxies.

Or dark matter which requires five times more unknown matter than ordinary matter, a model that makes poor predictions concerning spiral galaxy velocities, and a model with many acknowledged and published contradictions.

Similarly for galaxies in clusters, estimates of velocities are poorly predicted by dark matter models. The galactic motions observed in a cluster, ad hoc dark matter quantities and locations are proposed to explain it. Few if any symmetrical dark matter addendums are proposed to match observed velocities. This, of course is a type of retrodiction rather than prediction.

But for the FFV model, a symmetrical field flow proposal for galaxy clusters might be justifiable, especially if a number of galaxies are orbiting in a similar plane.

D. Epilogue

For the background field flow proposal to be considered more likely than dark matter or modified gravity, we believe it necessary for other groups to evaluate our calculations, and to perform their own calculations on other spiral galaxies. Contact us by phone or e-mail and we will send you the necessary research information which is about five times longer than this summary. The complete paper shows all the equations, their derivations, and the calculations of 18 randomly chosen spiral galaxies. These are exact calculations that we believe “prove” that dark matter is likely a fantasy, as readers can consider.

We would expect that larger scale studies would continue to verify the FFV model and provide even more insight into the model.

Upon general agreement with our findings and conclusions, we also believe we could help others to acquire funding for their own studies.

The mass equivalence of the FFV model’s energy addendum to spiral galaxy velocities is roughly the same as the matter of the galaxy. Although this would be considered a large hypothetical addendum by most standards, it is only 1/5th the mass addendum required by dark matter models, with incomparably better predictions.

E. Responses

All readers are encouraged to ask questions they might have regarding this paper and the related study. We will be happy to answer any questions as well as consider comments and corrections.

F. Availability of Data and Material

Upon an email request by readers, we will send back to you via email the complete study paper including all the equations, graphs and calculations for all of the 18 spiral galaxy velocity profiles shown and calculated for this research. The research paper also includes a number of additional pages concerning observations contrary to the dark matter hypotheses in its various forms (80 total pages of our research summary).

We expect to be able to provide help for all those interested in testing these equations and the FFV model, performing calculations, have new or different insights, or need additional explanations. We will be happy to discuss any-and-all aspects of this research and its relationship with related papers the authors have published. Contact Forrest Noble at pantheory.org@gmail.com, or phone (562) 331-3334 or (562) 924-3313 in the U.S.A. for all response requests:

REFERENCES

[1] Schaff J. The nature of space and gravitation. Journal of Modern Physics, 2012; 3(8). http://file.scirp.org/Html/11-7500749_21681.htm.
[2] Pawłowski MS, Famaey B, Jerjen H, Merritt D, Kroupa P, Dabringhausen J, Lüghausen F, et al. Co-orbiting satellite galaxy structures are still in conflict with the distribution of primordial dwarf galaxies. Monthly Notices of the Royal Astronomical Society, 2014; 442(3): 2362–2380. https://doi.org/10.1093/mnras/stu1005.
[3] Müller et al. Satellite galaxies defy dark matter model. Science Journal, 2018. https://physicsworld.com/a/satellite-galaxies-of-centauro-a-defy-dark-matter-model/.
[4] De Blok W.G., de Blok W.J.G. The Core-Cusp Problem. Advances in Astronomy, 2010: 1–14. https://doi.org/10.1155/2010/789293.
[5] Brownstein, Moffat. Galaxy rotation curves without non-baryonic dark matter. [Internet] 2005. MSTG Retrieved from: https://arxiv.org/pdf/astro-ph/0506370.pdf.
[6] Wikipedia. *Fifth force of nature.* https://en.wikipedia.org/wiki/Fifth_force.

[7] Moffat JW. *Cosmological Observations in a Modified Theory of Gravity (MOG).* *Galaxies,* 2013;1(1):65-82. https://www.mdpi.com/2075-4434/1/1/65/htm.

[8] Stabile A, Capozziello S. *Galaxy rotation curves in f(R,ϕ)-gravity.* [Internet] (n.d.) Retrieved from: https://arxiv.org/abs/1302.1760.

[9] Conformal Gravity. *PrPNP 56, 340.* 2006 [Internet] (n.d.) Retrieved from: http://star-www.st-and.ac.uk/~kdh1/eq.html.

[10] Lee JH, Pak M, Song H, Lee HR, Kim S, Jeong H. *Mysterious Coherence in Several-megaparsec Scales between Galaxy Rotation and Neighbor Motion.* *Astrophysical Journal,* 2019;884(2). https://iopscience.iop.org/article/10.3847/1538-4357/ab3f63.

[11] Ohio State University. *Velocity Profile Milky Way,* [Internet] (n.d.) Retrieved from: https://www.google.com/search?q=velocity+profile+of+the+milky+way+ohio+state+&tbm=isch&ved=2ahUKEwj61jRsl6v6AhX-mWoFHVF5B5gQ2-cCgQ1ABAA&oq=velocity+profile+of+the+milky+way+ohio+state+&gs_lcp=CgNpbWcQDDoECJCMQJ1DiDlj3R2COc2gBcAB4IABywGIAdM0kgEGMTUuMy4xmAEAoAEBggELZ3dzLXdpel1pbWfAAQE&sclient=isch&ei=DugtY_qVCv6zqtP0fKdwAk&bih=587&biw=1366Z.

[12] Colorado State University. *Milky Way Velocity Profile, Images,* [Internet] (n.d.) Retrieved from: https://jila.colorado.edu/~pja/astr1120/lecture20.pdf.

[13] Astronomy & Astrophysics (A&). *Alignment of quasar polarizations with galaxies and large-scale structures* [Internet] (n.d.) Retrieved from https://www.aanda.org/articles/aa/abs/2014/12/aa24.

[14] Astronomy & Astrophysics (A&). [Internet] (n.d.) Retrieved from https://www.aanda.org/articles/aa/abs/2014/12/aa24.