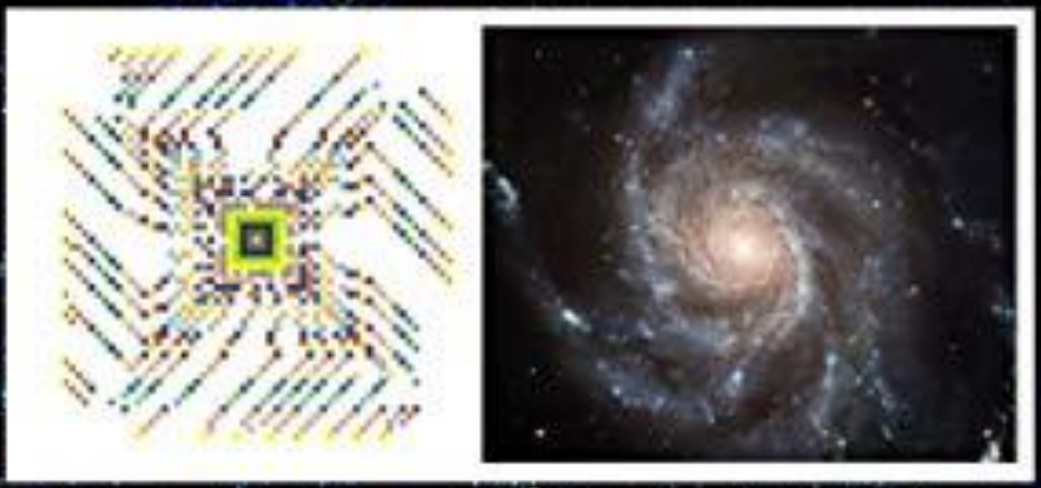
PHILOSOPHY UNSCRAMBLES

DARK MATTER



by Khuram Rafique

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Preface

Dark matter was not a mystery by the time of early twentieth century. Existence of non-luminous matter in the form of faint, cool and cold stars, clouds of gases, macroscopic and microscopic solid bodies etc. was viable and evident – the only unsettled issue was the quantitative estimation of this type of 'dark matter' and the proportional existence thereof with respect to normal luminous matter. Already there were theories and methodologies concerning how to infer presence of hidden, dark or non-luminous forms of matter by spotting rotational or orbital motion of the luminous matter in particular locality. Using these techniques, scientists had successfully discovered 'hidden' planets like Neptune and Pluto. Based on similar calculations, indications were that there should be another planet closer to the Sun beyond the orbit of Mercury. That supposed planet (Vulcan[1]) could not be found. Meanwhile Einstein presented a new type of calculations and his General Relativity equations resolved the apparent anomaly in the orbit of Mercury without requiring the existence of another planet that was not found. The successful resolution of orbit of Mercury was dubbed as victory of General Relativity and Einstein's equations were therefore declared as accurate and complete whereas Newton's Theory labeled as 'approximate' method that could still be employed for the problems where greater precision was not the matter of concern. Newton's theory also had the implication that light could be bent under the influence of gravity but calculations based on General Relativity showed that angle of deflection of light should be almost double to the one taken from calculations based on Newton's Theory. The point of view that General Relativity is complete and precise theory was authenticated in year 1919 experiment when during solar eclipse starlight passing nearby eclipsed Sun exhibited the angle of deflection that was consistent with the theory of General Relativity. By that time, few other scientists were attempting to estimate the quantity of dark matter and by the year 1930, some of them including Oort had figured out that dark matter should not be more than 50% of the available luminous matter.[2] This was the overall context when in year 1933, Fritz Zwicky announced a leading-edge 'discovery' that actual dark matter could be as high as 400

times[3] the quantity of available luminous matter. Zwicky had calculated rotation of a cluster of galaxies named 'Coma Cluster' using classical mathematical technique of 'Virial Theorem' and noted that calculated rotation speed of cluster was too high for the observable luminous matter to hold individual galaxies stay as part of the cluster. So far, the concept of dark matter was the same non-mysterious or ordinary matter with the only shortcoming of having too low luminosity or absence thereof.[4] Only after three years, similar anomaly was noted by Sinclair Smith in respect of Virgo Cluster and later on Edwin Hubble, after citing work of Smith, also regarded the discrepancy between the masses of galaxies inferred from the dynamics of clusters and those from the rotation of galaxies to be "real and important".[5] But he only acknowledged the existence of problem and did not endorse the proposal of out of proportions presence of dark matter. Almost same was the response of overall scientific community but with the passage of time 'evidence' for the greater proportional existence of dark matter was mounting through a different line of observations that outer parts of spiral galaxies were not exhibiting Keplerian drop-off[6] as outer parts of spiral galaxies were found to be rotating at extraordinary high velocities. The type of rotation curves of galaxies 'implied' existence of far greater quantity of dark matter that could be verified through all the possible means. Although these results were obtained by employing classical theories and calculations but more 'precise' theory was after all General Relativity thus whole credit of anomalous findings was assigned to the 'precise' theory and we also must assume that scientists might have verified those calculations by actually applying General Relativity also. Scientists made all the efforts to find the extraordinary quantity of dark matter but such high quantity was never traced. Primarily, scientists did not cherish doubts on those calculations as their theory was already proven correct and successful. By the time of last two decades of twentieth century, scientists had accumulated enough 'evidence' for the existence of such large quantities of dark matter that could not be found in the real world. Instead of putting their theories under serious review, they drastically changed the concept of 'dark matter'. Now onwards the same term 'dark matter' would imply an entirely different thing. The non-mysterious type of ordinary dark matter would now be categorized as part of normal baryonic matter[7] and to cover up the remaining large discrepancy, new meanings were assigned to the term 'dark matter' that it is not simple 'dark' in usual or familiar sense but actually it is completely invisible as

it does not interact with light or even whole spectrum of electromagnetic radiations and also does not interact with ‘strong force’. This ‘dark matter’ interacts only with ‘weak force’ which is gravity. We can detect this dark matter only through the gravitational influence that it draws on normal matter. Under every kind of light, this dark matter remains invisible and under every kind of test other than influence of gravity test, it remains undetectable. Upon first encounter, this ‘dark matter’ may sound like an insignificant ad hoc placeholder type of concept; like a sort of due acknowledgement that something is yet unknown. However, close interaction with Physicists would reveal that it is ‘real’ thing that actually exists despite being not directly traced. Dark Matter is not merely an idea or acknowledgement of our lack of knowledge rather is a bold assertion that we do know more than what observations could support. Equations of Einstein (General Relativity or ‘GR’) are perfect. Unexpected observations of galactic rotations did not imply that GR equations could be incomplete. Equations were impeccable and comprehensive – there had to be more than observed ‘matter’ out there – only then more than calculated speed of galactic rotation could be justified. Our mathematics cannot deceive – only observation can misguide us. What if an observable thing i.e. ‘matter’ cannot be observed? That ‘matter’ somehow must exist – though in unobservable format. We do not even need to review our equations as they already have passed ‘all’ the tests.

To the mainstream Modern Physics, dark matter is not actually an insignificant ad hoc or placeholder type of concept. It is real ‘matter’ that cannot be observed on account of the ‘fact’ that it does not interact with light because it has no EM (electromagnetic) property. Anyhow, the need to write this book arose at a time when I started planning to write second edition of my book ‘A Philosophical Rejection of The Big Bang Theory’. My main work on ‘Epistemological Realism’ is under progress and I am also experiencing the post publication scenario of my book on the Big Bang Theory. The response so far to my first book is in the form of increased interaction with qualified physicists such that at least some of them are listening to what I am saying despite whether do they openly accept my points or not. Meanwhile I also kept on constantly evaluating the whole subject from certain unconventional angles whose analysis must be added to the book; hence the need to write second edition invoked. One of those unconventional angles however warranted a

separate project which is now realized in the form of this short book which also can serve the role of Volume-II of my first book.

The general readers are apprehended enough that they avoid reading core knowledge stuff coming from non-authoritative source like me. But I am writing with the hope that some right person will eventually pick the point and my writings will serve the purpose. My first book categorically denied the notion of expanding universe and this book will also downright refute the existence of any such thing as (invisible) 'dark matter' whereas the actual non-mysterious dark matter is not on the hit list of this book as normal dark matter is a reality because after all we can see it when it is brought under light or can detect its presence using other suitable method but same is not the case with modern concept of dark matter which cannot be seen even if brought under light and cannot be detected except through gravity based calculations. I had the option in this book to first show the possibility that after all equations of gravity might not be complete or free from errors. But then I decided to frame the case against 'dark matter' by not discussing the way how actually those equations were developed. Let us accept that (GR) equations were proven successful for solar system dynamics at least. The argument of this book will be that galaxies are subject to different dynamics and solar system tested equations just could not work for the different dynamics of galaxies. The actual dynamics of galaxies would cause them to rotate exactly like they do – and without necessitating the existence of anything like 'dark matter'.

Our Physicists now rely on mathematics equations so much that they do not apply commonsense despite not being senseless, junkies or anything like that. They are basically against using commonsense. Due to certain intellectual mistakes, or may be only to maintain authority on subject, they love and promote their 'counterintuitive' theories and openly degrade commonsense. This book will show that actual high rotation speed of galaxies could be easily explained on commonsense grounds within the framework and accepted meanings of Newton's Theory of Gravity but Physicists do not like to come to the real Physical World and only want to stay in their comfort zone of equations of their choice. Let them stay there and know through this book that there is no 'dark matter' anywhere in the real world. And off course there is connected issue that Newton's Theory of Gravity is

now regarded only as an ‘approximation’ of the more accurate and precise theory of General Relativity. Once we see that General Relativity terribly failed to account for actual rotation behavior of galaxies that could be easily explained in the light of Newton’s theory, then it will also be clear regarding which theory is ‘approximation’ and which one is utterly far from capturing reality. It is also appropriate to highlight, as already has been mentioned, that scientists usually employ calculations based on Newtonian Dynamics but give credit of any sort of findings to the GR equations. The same has happened in the case of Dark Matter when first time in 1933 Fritz Zwicky employed classical mathematics and noted anomaly in the dynamics of a cluster of galaxies named Coma Cluster. He categorically floated the proposal of dark matter on ground that more than visible mass was needed to account for the observed dynamics. His proposal was not taken seriously at that time but later on similar anomalies were noted, using classical laws of Kepler (Newtonian Dynamics), in rotation patterns of individual galaxies and proposal of dark matter acquired a serious status while the credit of ‘discovery’ of dark matter was assigned to the GR equations. This book has no intention to reassign the ‘discovery’ of dark matter to Newton’s Theory. The point of this book will be to show that Newton’s Theory was not rightfully applied and the noted anomaly was only due to the incorrect application of Newton’s Theory. The correct application of the theory required a little bit application of commonsense which Physicists do not officially use. They do not even develop proper rationale or visualization of the theory or concepts rather they look at the matters only from the point of view of balancing the equations of mathematics. In the case of noted anomalies in rotation behaviors of galaxies and clusters of galaxies, scientists, as such, only tried to balance the equation. There were two options; either to propose significant addition of mass or to add a fitting parameter or modification to the equation and both these methods were ad hoc solutions basically. Scientists have adopted both these methods in separate streams i.e. those who added more mass did not introduce new parameters or modifications in equations and those who added fitting parameters or modifications did not add more mass. The first group i.e. the mainstream group is represented by dark matter regime and the second group that is a minority group is known as MOND (Modified Newtonian Dynamics) regime. We see that a minority regime was allowed to modify Newtonian Dynamics with official recognition of their work; perhaps no

one had the courage to directly review the ‘all time successful’ GR equations because any such attempt would not have been recognized. Anyways, those who added mass, they added fitting mass and those who added new parameters, they added fitting parameters. The achievement of both the groups was only that somehow equations were conveniently balanced. Now both groups will carry out expensive experiments – First group will try to find dark matter in galaxies or universe and second group will try to find supportive evidence other than galactic rotations because their parameters were fitting for galactic rotations only. In case any of the groups finds supportive material, the same will be announced as victory of mathematics. We will be told that unknown realities can be dig out only through ‘rigorous’ mathematics. Anyhow, the problem is that scientists look at the matters only from the point of view of how to balance the equation and then pursue supportive real data through costly experiments. The underlying belief is that finding realities of Physics is beyond the scope of commonsense and as such they avoid using commonsense. The subject matter of this book i.e. proper explanation of galactic rotations or rotation of clusters of galaxies was within the scope of commonsense. Off course, the already developed mathematics by Newton was to be applied but not in a way of simple fitting parameter but as a proper decision after rationalizing the whole problem. To counter the allegations against commonsense, first chapter of this book will present a case for commonsense with the objective to demonstrate that commonsense is able to dig out realities of physical world. In the later chapters the nature of the problem, rationalization, solution and conclusion shall be presented. The end of this book will be a goodbye to ad hoc regimes of dark matter and MOND both.

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I. Why did Physicists settle with a Ghost Solution?

I.I. Physicists rely only on Mathematics and- refuse to employ Commonsense

It happened that scientists tested their (GR) equations within solar system dynamics. Those equations passed the test with flying colors and acquired the status of authority. Now 'scientists' must surrender, better to say, abandon their commonsense and must submit to the authority of equations. When we have worked out 'correct' equations then there is no need to apply commonsense. Direction or line of action suggested by the commonsense is to be ignored and results of the equations must be accepted whether they make sense or not. Several areas of today's Modern Physics are thus officially regarded as 'counterintuitive'. We are told that human commonsense has been defeated by the Modern Physics. Now theories of Modern Physics belong to supra-commonsense realm and while they need not make sense from the perspective of rational scrutiny, they are correct on authority of mathematics alone. The love of Physicists for 'un-commonsense' can be seen from following comments of a senior Professor of Theoretical Physics[8]:

> In trying to understand the universe at both its smallest and biggest scales, physics and cosmology have embarked on a new age of exploration. In a sense we are attempting to cross a larger uncharted sea than ever before. …. To tell them to stay within the boundaries of common sense may be like telling Columbus that if he goes more than fifty miles from shore he'll get hopelessly lost. Besides, good old common sense tells us that the Earth is flat. …. Physicists have had no choice but to rewire themselves. Where intuition and common sense failed, they had to create new forms of intuition, mainly through the use of abstract mathematics: Einstein's four dimensional elastic space-time; the infinite dimensional Hilbert space of quantum mechanics; the difficult mathematics of string theory; and, if necessary, multiple universes. When common sense fails, uncommon sense must be created.
>
> --- Leonard Susskind (Professor: Theoretical Physics, Stanford)

Here, the question arises is that how come Physicists realized that they should rewire themselves? Had they really figured out that 'space-time' is 'elastic'? Or had they actually affirmed the existence of Dark Matter through their mathematics? Have scientists really 'rewired' themselves?

Professor Susskind is senior Professor of Theoretical Physics and author of a series of expert level books whose topics range from Classical Physics to Quantum Mechanics and Black Holes. Dark Matter specifically is not on the list of his topics of interest however he is resilient demonstrative of mathematics based counterintuitive science and offers almost official retort of science against commonsense based criticism. Theoretical Physics is generally regarded as modern transformation of centuries old 'Natural Philosophy' that was represented by works of Galileo, Newton and their successors and the tradition continued up to the early phase of Einstein. Therefore, before responding to the points of Mr. Professor Susskind i.e. a 'Theoretical Physicist', let us here figure out what this Theoretical Physics is all about and how exactly it differs from Natural Philosophy as practiced by Aristotle, Galileo, Newton and others till the time of Einstein. Well, Natural Philosophy of pre-counterintuitive era of Physics was concerned with philosophical study and interpretation of natural phenomenon where basic data could come from direct observations or reported observations and those observed facts used to be duly analyzed and explained using logic that also included mathematics. Thus Natural Philosophy used to analyze natural phenomena such as physical motion, force, energy, gravity, real orbital dynamics of planets, spherical shape of earth etc. Even hypothetical things could be proposed and explained in Natural Philosophy. For example based on Newton's corpuscular theory of light, John Michell, a Natural Philosopher, first time in year 1783 proposed[9] the existence of 'dark stars' which are now known as 'Black Holes'. Likewise John Dolton also had proposed the existence of atom i.e. hypothetical entity by way of doing Natural Philosophy where he logically inferred the existence of smallest particles out of observed facts that chemical reactions occur only with determined quantitative ratio of elements and compounds involved. We see that hypothetical entities could be proposed in Natural Philosophy but that all remained within the domain of rational logic and

commonsense based judgments. Transformation from Natural Philosophy to Theoretical Physics took place in successive steps where at first, for instance, Lorentz proposed hypothetical entity 'length contraction' by giving real status to another hypothetical thing 'Aether' whose physical existence was not confirmed through experiments. This tradition of authenticating hypothetical entities on the basis of other hypothetical entities was going to be continued in the upcoming discipline of 'Theoretical Physics' where interrelated and interdependent scheme of many hypothetical entities would be regarded as 'Mathematical Modeling' and the forthcoming real observations would be going to be 'interpreted' on the basis of already known 'Mathematical Model'[10]. Here comes the first difference with Natural Philosophy where inquiry used to be started from observations and the fallouts used to be concluded in the form of explanatory theories whereas our Modern Theoretical Physics now takes start from already held theory (Mathematical Model) and 'interprets' new observations in the light of that already held theory. This upside down difference is more complex because the old 'Natural Philosophy' was more like 'Science' whereas the modern 'Theoretical Physics' is more like 'Philosophy'. Apart from the fact that Theoretical Physics keeps on proposing hypothetical entities on the basis of other hypothetical entities, its methodology is also structured like 'Rationalism Philosophy' comparable to the Philosophy of René Descartes. The 'Theoretical Physics' has emerged in 20th century at the time when Philosophers themselves, from the platform of Analytical Philosophy (Linguistics, Logical Positivism), were dumping Philosophy by imposing undue limits on doing Philosophy. Apparently they were favoring 'Scientific Methodology' for the study of natural phenomenon but meanwhile a new 'Rationalist Philosophy' i.e. 'Theoretical Physics' was emerging under the name and pretense of science. Philosophers abandoned doing most of the Philosophy and Scientists started doing bad Rationalism Philosophy by the name and style of 'Theoretical Physics'. It happened in a way that there was an apparent real problem that electrodynamics were not seemingly obeying accepted relativity principle of that time. Then Einstein provided a theoretical framework where the problem could be resolved through Lorentz type transformation keeping in view the second postulate of his Special Relativity where he provided that relative speed of light remains constant for every reference frame. The problem of electrodynamics was real and the proposed solution, whether or not correct, should be categorized as Natural

Philosophy. Thus apparently or actually, the problem was solved and the Special Relativity was viewed as a theoretical framework that provided relativity principle equally applicable to general motion and electrodynamics both. The solution had come with packaged modifications in the fundamental concepts of time and space. Within one decade Einstein further managed to present a theory of gravity in the form of 'Field Equations' that were not only consistent with his Special Relativity but also regarded as more accurate than Newton's theory of gravity. Einstein called his new theory as "General Theory of Relativity" and the science community eventually regarded it (over time) as a general framework within which every physical phenomenon should be described. But time proved that quantum level phenomenon could not be described within the framework of General Relativity and a separate framework (set of equations) to deal with quantum level phenomenon was independently emerged.

Given the fact that scientists got two sets of equations which they regard two independent frameworks to deal with any inquiry concerning their respective domains, they actually received two independent 'first principles' or 'axioms' whereupon they started building castle of 'Theoretical Physics' by placing a peer reviewed publishing system whose main function was to ensure that no further (official) work should start from outside of the two basic frameworks and also should remain within the accepted framework. Juan Miguel Campanario and Brian Martin (2004) write following:

> The system of examinations and degrees is a sorting process; the physics PhD screens out most of those who question orthodoxy (Schmidt 2000). Once students are committed to the basic principles of the field, then it is possible to begin research and to question, within implicit limits, prevailing ideas. (*Journal of Scientific Exploration*, vol. 18, no. 3, Fall 2004, pp. 421-438)

Thus, researchers have to, or at least pretend to start from and remain within one of the two basic frameworks which are like first principles of this modern day's Rationalism Philosophy. Rationalism of René Descartes starts from axiom or the first principle and rest of the things are logically deduced. We have seen that modern Theoretical Physics has also worked out first principles[11] and there is also a 'peer reviewed' system in place whose function is that every next thing should come by way of 'mathematical derivation' from those first principles or from the previous mathematical derivations from the same. Exactly

this is the methodology of René Descartes whose philosophy starts from first principle and every next thing comes from logical deductions. Modern Theoretical Physics has only replaced 'logical deductions' part with 'mathematical equations' and this is not the vital difference. By all means, modern Theoretical Physics is a Rationalism Philosophy whose ambitions cross the boundaries of Natural Philosophy, Physics or even Science and enter into the realms of Metaphysics where now they have claims to have figured out the details of events that took place after passage of tiny fraction of first second after the so-called Big Bang start of the Universe. In contrast with topics of Natural Philosophy that were like physical motion, force, energy, gravity, real orbital dynamics of planets, spherical shape of earth, existence of atom etc. the topics of Theoretical Physics are typically hypothetical and out of proportions extraordinary big claims like Expanding Universe, Inflationary Expansion of Early Universe, Accelerating Expansion of Universe, Expansion of Space, Multiverse, Wormholes, Multi-dimensions, Infinitely dense singularities, Age of Universe, Dark Matter, Dark Energy, Quantum fluctuations, Quantum Entanglement, Quantum Locality and other like things. Most of these hypothetical entities are interlinked and interdependent of other hypothetical entities. At this point it seems appropriate to provide reliable references that tell the authentic meaning and scope of old Natural Philosophy and present day's Theoretical Physics. Following two quotes are from Newton's Principia Mathematica that comprehensively describe the method of Natural Philosophy:

> In experimental philosophy we are to look upon propositions collected by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exception. This rule we must follow, that the argument of induction may not be evaded by hypotheses. (English Translation "Principia Mathematica" – First American Edition (2007) – Page 385)

Following second quote from same book further explains the actual method of Natural Philosophy as practiced and described by Newton himself:

> In this philosophy particular propositions are inferred from the phenomena, and afterwards rendered general by induction. Thus it was that the impenetrability, the mobility, and the impulsive force of bodies, and the laws of motion and of

> gravitation, were discovered. (English Translation "Principia Mathematica" – First American Edition (2007) – Page 507)

To trace the authentic or accepted point of view about Modern Theoretical Physics, I start with Elon Musk who stated during an interview that Physics teaches to reason from first principles and that reason is not analogical (i.e. the reason then must be deductive or mathematical).

> Well, I do think there's a good framework for thinking. It is physics. You know, the sort of first principles reasoning. Generally I think there are — what I mean by that is, boil things down to their fundamental truths and reason up from there, as opposed to reasoning by analogy. (Interview with TED Curator, Chris Anderson)

Elon Musk is a successful businessman and one of his business fields relates to Astronomy and thus Physics. He is not Physicist proper but during verbal interview, he correctly described the actual method of (modern) physics which he is accustomed to and must be dealing with. Wikipedia article titled "Theoretical Physics"[12] has described this method in following words:

> Theoretical physics is a branch of physics that employs mathematical models and abstractions of physical objects and systems to rationalize, explain and predict natural phenomena.

The point of Elon Musk explains that Theoretical Physics is first principle based system of reasoning. The Wikipedia article tells that Theoretical Physics starts with mathematical models and ends with 'prediction' of natural phenomena. This is exact opposite to the Natural Philosophy of Newton which starts from Phenomena and ends with the discovery of theory.

Following is yet another interesting definition of "Theoretical Physicist" as described on CERN website[13]:

> Theoretical physicists are rather typical scientists. If you imagine them as absent-minded, egg-headed, bizarre characters scratching their chins while deeply engaged in thought... Well, most of the time you'd be right.

> What these people do is to try to figure out how Nature works. That is, why the stars shine, why water is fluid and the sky is blue, what you are made of and why does "it" weigh that much, why the universe expands, or what energy and matter actually are…

Thus CERN's take on Theoretical Physics also accepts that basically it is thought process though it is not clarified whether it is first principle based or not. MS Kirsten Hacker[14] (PhD Accelerator Physics) tells[15] that Elon Musk is right in telling that Theoretical Physics is first principle based system of reasoning:

> Musk is correct that modern physics teaches you to reason from first principles, but I would add that by reasoning from first principles, one ends up in a devil's circle with a sophistic, solipsistic, Einsteinian conflation and confabulation of basic definitions of space, time, mass, and speed.

Here, MS Kirsten Hacker not only affirms the first principle based nature of modern Theoretical Physics, she is also pointing out consequences to which she does not agree. To another PhD Physics person and a former research scientist Mr. David Cousens, I pointed out that being first principles based reasoning system, Theoretical Physics is a form of Rationalism Philosophy. To this, he humbly offered justification in the favor of Theoretical Physics in following nice words:

> Aristotle's approach of only deducing reality from first principles has been missing from science and physics for a long time. The problem with that is knowing what are the correct first principles from which to start. The first principles behind GR and QM are not just dreamed up. They arise because nature didn't behave the way we expected it to behave on what were previously assumed to be first principles or the underlying mechanisms. If the prediction is wrong then the model does not incorporate all the mechanisms which we assume to be present in the real world so we modify the model. I disagree however the modern physics is an example of "rationalism philosophy" which assumes that reason is the chief test of the validity of knowledge. In physics, observation and experiment are the ultimate test of the validity of knowledge, not reason. Reason is only a mechanism by which we arrive at something to test against what we can observe. That said some individual theoretical physicists may be so entranced by the beauty of what they have constructed they begin to believe that it necessarily has to be the way the world works. However in the scientific community at large this only lasts until experiment and observation can confirm or refute their predictions. Most theoretical physicists I have met

> are usually acutely aware that their reasoning may have started from one or more false assumptions, but they don't know a priori which assumptions are necessarily false, so they have to explore the consequences of each assumption to decide which should be rejected and which should be retained. Science as it is practiced is a constant interplay between rationalism and empiricism not simply one approach or the other but I suppose essentially rationalist in that the underlying basic assumption is that there is something we can understand even if we do not yet understand it.

Here, Mr. David Cousens is accepting that modern GR and QM are first principle based reasoning systems though he does not accept them to be form of Rationalism Philosophy because in "Physics", the ultimate test of validity of knowledge is observation and experiment. Actually for obvious reasons, we should not expect that any Physicist is openly going to accept that Theoretical Physics is a form of Rationalism Philosophy. When asked about what is the difference between a Theoretical Physicist and an Armchair Thinker, the maximum they tell is that Theoretical Physicists do lot of mathematics and that they do not indulge in analogical reasoning[16]. Actually there is lack of clarity among supporters of Theoretical Physics regarding what it actually is and exactly how it differs from Philosophy. I asked on a famous questioning website quora.com that why theoretical physicists are not armchair thinkers[17]? I got only two replies so far. The first one posted picture of renowned Theoretical Physicist Richard Feynman who was sitting on an armchair. The other reply was a counter question "who said that Theoretical Physicists are not armchair thinkers?" Then by exploring the related questions and replies thereon, I found such answers that Theoretical Physicists do lot of mathematics and also abstain from analogical reasoning (that's why they are different from armchair thinkers).

Now we know that Rationalist Philosophers also do lots of deductions and abstain from analogical reasoning, so the only key difference between Theoretical Physics and Rationalism Philosophy is that of mathematical and deductive reasoning. And this is not crucial difference because essentially, deductive logic and mathematics are same. The other sign of Rationalism Philosophy is the presence of first principles. But mere existence of first principles does not make any system of research or inquiry into Rationalism Philosophy. The ultimate test of Rationalism Philosophy is to see whether those first principles serve only as starting point or also form a boundary or a limit on the scope of

inquiry? In case those first principles also form hard boundary and set out limitation on the scope of inquiry, then it is a definite and conclusive indication of Rationalism Philosophy. And basically Mr. David Cousens has shown disagreement with regards to the Rationalist Philosophical nature of Theoretical Physics on point that though Theoretical Physics is first principles based system of reasoning but unlike Rationalism Philosophy, the reason is not the chief test of the validity of knowledge as according to him, "In physics, observation and experiment are the ultimate test of the validity of knowledge".

We have already seen in the previous quote of Juan Miguel Campanario and Brian Martin (2004) that there do are implicit limits on questioning the prevailing ideas of physics. They further write in the same paper (*Journal of Scientific Exploration,* vol. 18, no. 3, Fall 2004, pp. 421-438):

> The most common view about how science works is that new ideas are judged on the basis of evidence and logic: if a new idea explains more data or provides more precise agreement with experiment, this counts strongly in its favor.
>
> Karl Popper claimed that science advances by falsification (Popper 1963). In his view, it is the duty of scientists to attempt to disprove theories, confronting them with experimental data and rejecting them if they do not explain the data. Theories that cannot be falsified are, according to Popper, not scientific. Many scientists believe in falsificationism.
>
> These conventional views were challenged by Thomas Kuhn (1970). Kuhn argued that scientists - and physicists in particular, since most of his historical examples were from physics - adhere to a paradigm, which is a set of assumptions and standard practices for undertaking research. If an experiment gives results contradictory to theory, then instead of rejecting the theory altogether, alternative responses include rejecting the experiment as untrustworthy and modifying the theory to account for the new results (Chia 1998; Chinn and Brewer 1993).

Above quote makes it clear that yes most common view holds that observations and experimental results should be the chief test for the validity of knowledge but within the actual circles of science authorities, now it is an outdated concept. Now there is paradigm in the form of accepted frameworks which not only serve as first principles, they also form a solid boundary crossing which even experiments can be declared invalid being

untrustworthy. In no way the framework can be rejected altogether – only theory shall be suitably modified to account for the new experimental results. While many Theoretical Physicists might be honestly doing research under the outdated impression that experiment and observation is the chief test for the validity of knowledge, the actual prevailing thing is a paradigm that intends to perpetuate and more informed scientists do call Physics as a conservative tradition where they are not going to altogether abandon their accepted frameworks rather they will only reinterpret already existing things and every contrary experimental result will be shown in conformity with the prevailing paradigm. And now it is clear that it is not science going on. They say that it is not Rationalism Philosophy because chief test is observation. Actually Rationalism Philosophy is a closed system of knowledge where you start from first principles, then you close eyes as every next thing will come through logical deductions in mind and thus there will be no role of observations. Now Theoretical Physics, being a form of Rationalism Philosophy, is also a closed system. Instead of emphasis on logical deductions, there is importance of only mathematical derivation. Since there is no essential difference between logical deduction and mathematical derivation, so to this extent Theoretical Physics completely follows the footsteps of Rationalism Philosophy.

But they insist that chief test in Theoretical Physics is observation. To this, I accept that yes there is slight variation in Theoretical Physics but I do insist that just like Rationalism Philosophy, eyes have to be closed basically. In Theoretical Physics, you open eyes not to observe new things but only to celebrate that your 'predictions' have come true.

When, in year 1929, Edwin Hubble found a new observed fact of linear relationship between redshift and distance of galaxies, it was not even treated as a new observed fact. It was treated as 'prediction coming true'. Eyes were closed – Scientists were only repeating this mantra that we already 'knew' this truth out of our 'mathematical derivations'. They opened their eyes just for a while only to celebrate the success of their so-called earlier mathematical derivations. Similarly, finding of CMB was not treated as a new observation. That was not a new thing at all as it was also already 'mathematically derived'. This is how things are 'observed' in modern Theoretical Physics. When you already know the reality in your mind then you tend to observe the actual reality through

your colored spectacles. The most obvious or even concrete form of colored spectacles which Theoretical Physicists have adopted are their equations that contain speed of light in virtually every formula and give the hard result that no other speed can be shown greater than speed of light. Here I am not challenging that anything cannot acquire speed equal or greater than speed of light. But their equations i.e. the colored spectacles, will not let even hypothetical things to acquire speed greater than the speed of light. Let's say we suppose something is moving at speed greater than speed of light, their equations won't even accommodate this supposition. Here mathematics is unnaturally greater than ability to suppose anything. Given this thing any real thing cannot be shown as having speed greater than speed of light even if it is detected in real experiment. They are already just interpreting results of experiments in the light of already held framework and they will improve the colors of their spectacles to deal with more challenging experimental results. The colored spectacle thing is true for Rationalism Philosophy and this is also true for Theoretical Physics or any other ancient mythology.

Natural Philosophy of Newton had started from axioms which are his three laws of motion. But afterwards there is no requirement of keeping your eyes closed. You independently observe the reality and logically or mathematically conclude the things. In Theoretical Physics, the purpose of observations is not to see new things**.** Here, the purpose of observations is only to celebrate that 'predictions have come true'. Within next few years NASA is going to launch James Webb Space Telescope that shall be 100x more powerful than Hubble Space Telescope. What is the purpose of that 100x extra power? Will this telescope show us some new things?

Not at all (for practical reasons). NASA already knows all the things through mathematical derivations. NASA already knows that no galaxy beyond this much distance will be seen and that after that distance there was a dark era and within this darkness was the time of creation of universe. So all the things are already known. Purpose of observations is only to celebrate the already known things.

Mr. David Cousens has further accepted that some individual theoretical physicists may be so entranced by the beauty of what they have constructed they begin to believe that it necessarily has to be the way the world works. However, he states further, that in the

scientific community at large this only lasts until experiment and observation can confirm or refute their predictions.

MS Sabine Hossenfelder[18], a Theoretical Physicist and Research Fellow at Frankfurt Institute for Advanced Studies has identified that problem of theoretical physicists getting entranced by the beauty of what (mathematical) they construct and start believing that it necessarily has to be the way the world works, is a common or large scale problem. In fact, title of her book is "Lost in Math: How Beauty Leads Physics Astray". The description of the book[19] says it all which is following:

> Whether pondering black holes or predicting discoveries at CERN, physicists believe the best theories are beautiful, natural, and elegant, and this standard separates popular theories from disposable ones. This is why, Sabine Hossenfelder argues, we have not seen a major breakthrough in the foundations of physics for more than four decades. The belief in beauty has become so dogmatic that it now conflicts with scientific objectivity: observation has been unable to confirm mindboggling theories, like supersymmetry or grand unification, invented by physicists based on aesthetic criteria. Worse, these "too good to not be true" theories are actually untestable and they have left the field in a cul-de-sac. To escape, physicists must rethink their methods. Only by embracing reality as it is can science discover the truth.

In short, the actual prevailing method of modern Theoretical Physics is far from that of good old day's method of Natural Philosophy. MS Sabine Hossenfelder writes in the book:

> The Philosophers are certainly right that we (Theoretical Physicists)[20] use criteria other than observational adequacy to formulate theories. That science operates by generating and subsequently testing hypotheses is only part of the story. Testing all possible hypotheses is simply infeasible; hence most of the scientific enterprise today—from academic degrees to peer review to guidelines for scientific conduct—is dedicated to identifying good hypotheses to begin with. Community standards differ vastly from one field to the next and each field employs its own quality filters, but we all use some. In our practice, if not in our philosophy, theory assessment to preselect hypotheses has long been part of the scientific method. It doesn't relieve us from experimental test, but it's an operational necessity to even get to experimental test. In the foundations of physics, therefore, we have always chosen theories on grounds other than experimental test. We have to, because often our aim is not to explain existing data but to develop theories that we hope will later be tested.

Thus we see that modern Theoretical Physics has not only improved upon Rationalism Philosophy, it has also taken ancient stoicism philosophy to the modern dimensionality where sense of beauty is serving as a proper method of inquiry. Basically I have no objection on this methodology as we see, that MS Sabine HossenFelder explains, that practical difficulties determine the actual methodology and practices. I have objection only in calling these practices as 'scientific methodology'. Essentially, these are the methods of different forms of philosophies. Not only the method, we see that topics of Theoretical Physics are also typically hypothetical and out of proportions extraordinary big claims like Expanding Universe, Inflationary Expansion of Early Universe, Accelerating Expansion of Universe, Expansion of Space, Multiverse, Wormholes, Multi-dimensions, Infinitely dense singularities, Age of Universe, Dark Matter, Dark Energy, Quantum fluctuations, Quantum Entanglement, Quantum Locality and other like things. Most of these hypothetical entities are interlinked and interdependent of other hypothetical entities and these "too good to not be true" theories are actually untestable and thus belong to 'Metaphysics' branch of Philosophy. Theoretical Physicists however claim that they know about these things at scientific level which has been possible through the use of mathematics and that commonsense is not helpful within this realm. They 'know' the exact age of whole Universe while not precisely knowing whether Universe is finite or infinite. One 'important' thing which they admittedly do not know is the detail of events which occurred within first quantum level moment after their Big Bang. Ideas of Big Bang and Dark Matter relate to 'General Relativity' based framework of Theoretical Physics therefore they could not figure out what happened within the very first quantum level tiny moment after Big Bang. Therefore, they have left this task open for evaluation to Quantum Mechanics based framework branch of Theoretical Physics who so far have not completed this task. Our Professor Leonard Susskind actually belongs to this second branch[21] of Theoretical Physics therefore here our analysis of his pro-counterintuitive points will have nothing to do with Dark Matter, the specific topic of this book, hence we shall be dealing with his points in general sense as equally applicable to our topic. He is saying that need to 'rewire' arose during the attempt to understand smallest and biggest scales. Well, truth is that humans have been struggling to go beyond natural limits on understanding since long but the need to 'rewire' has come along quite recently. Before the time of Einstein, science

was viewed as a refined form of commonsense and that was the accurate position. But now, with the emergence of Theoretical Physics, there are claims of having knowledge of those things where refined form of commonsense also fails. Acquisition of such knowledge has been possible because now scientists have been 'rewired' with supra-commonsense tools. At first they realized that their commonsense failed at solving biggest and smallest scales and then they 'created' un-commonsense to 'successfully' deal with those matters. And the 'un-commonsense' is not actually more than just to keep the equation balanced even if, let's say, unobservable or even untraceable mass has to be added to the deficient side of the equation. Moreover, the methodology belongs to the clan of already familiar Rationalism Philosophy whose futility in the chase of ultimate reality or final truth about Universe is confirmed.

It is also shocking to see that Senior Professors of Theoretical Physics take 'flat earth' as example of 'commonsense'. We should ask them why they not differentiate between commonsense and refined commonsense. Yes it is true that at first instance, commonsense verdict is that earth is flat. But refined commonsense is not restricted to the first or single glance. Commonsense, which this book intends to advocate, works on two things which are (i) Amount of available information and; (ii) logic. A refined form of commonsense is the one that extracts logical inferences out of maximum available or latest correct information in hand and does not remain confined to the framework of any axiomatic first principle though axioms can be employed as starting point but not as hard boundaries which is the case with Theoretical Physics as well as Rationalism Philosophy of René Descartes. Commonsense is also not limited to logic of mind which is the case with Rationalism Philosophy where a logical framework is knitted out of deductions from accepted first principle. A form of Rationalism Philosophy i.e. Theoretical Physics pretends that it is not limited to logical or 'mathematical framework' as it is fully supported by observations. Fact is that some fundamental aspects might have been confirmed through observations but on the whole observations are being 'interpreted' within mathematical framework. It is like first principle has come from or have been confirmed through observations but rest of the things are mathematically derived and those derivations are 'confirmed' by interpreting forthcoming new observations within the parameters and assumptions of already developed mathematical model and this is all about Theoretical

Physics. Commonsense, on the other hand, is broader and may go beyond strictness of deduction or mathematics but final test, in true sense, is always observation because real observations are capable to defy pure logic of mind or any already held preferred framework. As a matter of fact, pure logic of mind could not reach to the truth that heavy and light objects fall towards ground at same pace. Real observations can actually be counterintuitive but once an observation has been noted, experienced or recorded then it becomes part of commonsense. Galileo was telling a counterintuitive reality to his opponents but that was not un-commonsense because it could be easily confirmed through observation. Once observed successfully then it no more remained counterintuitive as well. Moreover commonsense never tries to interpret new observation in fitting way only to make it compatible with already held ideas or models. This is done by anything other than commonsense and that anything includes Theoretical Physics. Within commonsense, role of new observation is more thrilling as it changes the previous outlook as well as provides better clarity and accuracy about the underlying natural phenomenon. Rationalism Philosophy is a closed system of knowledge where there is no role of new observations because first principle was already known and every next thing was to be logically deduced. Theoretical Physics accommodates slight variation where new information itself is not thrilling as the actual 'excitement' is that it was already 'predicted' by their Mathematical Model and the prediction has come 'true' by way of fitting interpretation of that new observation. As stated already, mere logic of mind could never figure out that heavy and light bodies fall at same pace towards ground. But after having equipped with direct observations of double-slide experiment, projectile motion and behavior of pendulums, claim of Galileo that heavy and light objects fall with same rate does not cross boundaries of commonsense. Rather than working with any first principle or staying within a preferred framework, commonsense works simultaneously with direct or reported observations and logic of mind both and it may even include the role of axioms as adopted by Newton in his Principia. Mere logic is not commonsense and simple observation that earth looks flat is also not commonsense. The flat earth verdict is right example of correct commonsense for only those ancient times when extent of information was limited only to the immediate surroundings. But holding the view that Earth is flat was not the example of commonsense for those times when it was known that (i) Earth casts

curved shadow on moon during Lunar Eclipse and (ii) During long Sea Journey towards south, some new constellations appear on Southern Sky while some others disappear from Northern Sky. For the times when above two facts were known, flat earth view would belong to the regime of ignorance rather than commonsense. In fact, historically spherical earth was figured out by commonsense on the basis of above two and few other similar delicate observations of that time. In our philosophical or scientific discussions and writings, commonsense means refined commonsense and not the 'commonsense' of ignorant folks who apply raw judgments, may be logical, on the basis of incomplete information. Flat earthers of today are not predecessors of good old commonsense idea of flat earth. Those ancient flat earthers had correct commonsense inference about flat earth that could be extracted out of best information available of that time. But flat earthers of today tend to infer flat earth because available textbooks on physics do not present complete theory of Newtonian Motion. I have seen few Youtube videos of modern flat earthers and I understand that, in part at least, their reasoning comes from incomplete exposure to right available theory of Motion. Many modern flat earthers even present twisted logic and as such they act like promoters of a form of clever agenda and thus they are not representatives of commonsense.

Likewise, with regards to the existence of dark matter, application of commonsense is not as trivial as to only reject the notion on sole ground that it is not physically observed or directly traced or that it was introduced only to balance the equation. Commonsense, here, will be equipped with available theories of motion and gravity; only thing being that it will not surrender itself before the unsubstantiated authority of mathematics alone. For a Physicist, since equations 'predicted' slower rotation of galaxies from edges hence actual observation of higher rotation speed of galactic edges automatically implies presence of more but unobservable matter because 'already tested' mathematics could not be wrong. The Physicist is equipped with the latest available theory (GR) of gravity and he also finds that an old theory i.e. 3rd law of Johannes Kepler, also apparently verifies that in a rotational system held together by gravitational attraction, the objects farthest from the center will revolve more slowly than those closer in. Our Physicist 'knows' that Newton's Theory of Gravity is only an 'approximation' of his beloved and 'more accurate' theory of General Relativity. However, he would use the same incomplete theory for the ease of

calculations due to simplicity of the theory. He would obtain the result from simple theory but assign credit of results to more 'accurate' and 'precise' theory of General Relativity. During this process, he would wrongfully apply an important aspect of the 'simple theory' because accurately using that aspect of the simple theory would require little bit application of commonsense. Now he only knows that the result so obtained is not so precise therefore he would assign the credit of result to his beloved theory of General Relativity; partly also because he needs to project himself as talking from within the boundaries of his theoretical framework. The credibility of the result has been improved in this way. He has the claim that he fully understands his beloved theory of General Relativity. But he will not realize that he merely interpolated an incorrect and misleading result derived out of wrong application of an important aspect of the simple theory to his more accurate and precise theory. In fact he would obtain the same result if he had not even employed the simple theory. Therefore he is confident that he obtained right results from equations and the results must be certain because his beloved equations have already passed 'all' the tests. He would first be surprised by noting that actual observations did not tally with his results. He would call it an 'anomaly' and would propose that actually more than observable matter was present to which he would assign the name of 'dark matter'. He would not listen to the error message notified to him by his own commonsense. He 'knows' that he is dealing with matters that belong to supra-commonsense realm therefore he must ignore notifications of his commonsense. Not only that, he may also prefer to ridicule those who raise commonsense based objections on his finding of 'dark matter'. "They are living the life of good old days of commonsense but we the Physicists have been successfully rewired to deal with things that we don't actually understand", he would 'sensibly' justify his departure from commonsense. "We are now able to extend our theories to new dimensions without feeling the trouble that we don't actually understand them. Though our eyes are closed, we cannot fall since we are walking with the great support of 'mathematical walking stick'. We are blindly following our mathematics because our eyes can deceive us and our commonsense will cause troubles and will not let us move further in the direction that we don't actually understand." But he won't clearly accept that he does not actually understand his 'counterintuitive' theories. He would shut up the mouth of skeptic by saying that he i.e. the skeptic needs to take some

advanced courses in mathematics and then he will understand. As if he himself understands official 'counterintuitive' stuff after having been 'rewired' through mathematics. Following are the words of Professor Susskind on this point on the same page:

> Instead of dyspeptically railing against what he (i.e. the skeptic whom Prof. Susskind is replying) plainly does not understand, Horgan (i.e. name of that Skeptic) would do better to take a few courses in algebra, calculus, quantum mechanics, and string theory. He might then appreciate, even celebrate, the wonderful and amazing capacity of the human mind to find uncommon ways to comprehend the incomprehensible.
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> --- Leonard Susskind (Professor: Theoretical Physics, Stanford)

Here Prof. Susskind is coming up with bold but, rather a regularly repeated claim, that 'incomprehensible' can be 'comprehended' only through mathematics. Well, it is routine experience that we do not comprehend most of common life experiences with only few encounters or instances and it is through effort and constant evaluation that eventually we do 'comprehend' many things that were originally 'incomprehensible'. The underlying fact is that those things were not basically 'incomprehensible' in the first place. Only the sufficient evaluation was needed coupled with the individual's ability and exposure to related information to reach at the stage of reasonable comprehension. Human reasoning, whose nickname is 'commonsense', is not less powerful than mathematics. There is only one extra power of mathematics. Mathematics is not even a separate entity apart from human reasoning and logic. In fact, mathematics is 'quantitative extension' of same human reasoning and logic. Only thing that mathematics can do that simple reasoning and logic cannot do is quantitative precision. Whereas commonsense is able to sort out, keeping in view the essence of best available information, that speed of galactic rotation should be high or low but commonsense cannot tell the exact speed of rotation. Off course only mathematics can tell or 'predict' the exact speed of rotation that can be verified with measurement tools. We have seen that it was commonsense (i.e. refined commonsense) who successfully sorted out that earth is spherical and not flat. It means that logic or

reason has the ability to uncover hidden truths of nature. In fact, humans possess only two forms of knowledge which are (i) observational knowledge and (ii) reason based knowledge. Examples of observational knowledge are that earth looks flat, that earth casts curved shadow on moon at the time of Lunar Eclipse and that during long journey towards south, some new constellations appear on Southern Sky while some others disappear from Northern Sky. Reason based knowledge is actually a proper synthesis of available chunks of observational knowledge and example of reason based knowledge is that Earth is a large sphere. Fact is that so called mathematics based knowledge is also reason based knowledge because mathematics is nothing but a quantitative extension of same human reason and logic. And yes it is true that results of mathematics are 'certain' – but they are certain only within the framework of abstract mathematics. For example it is certain that sum of series of odd numbers is always a perfect square. However when mathematics attempts to describe the behavior of physical world, then results of mathematics are not certain and always need experimental verification despite the level of elegance or beauty of the theory of mathematics involved. It is through reason that we cross the boundaries of observational knowledge and here reason includes mathematics. But modern Physicists tell us that it is only through mathematics that we move beyond observational knowledge. And while reason takes us beyond observational knowledge by way of proper synthesis of available observational knowledge, mathematics, as claimed by Physicists, needs no synthesis with the observational knowledge. Unreasonable stance of Physicists is that mathematics magically rewires us and elevates our natural abilities to understand unknowable things. Therefore, with magically acquired abilities to understand, now Physicists properly 'understand' the role of 'dark matter' not only within observable universe but they also claim to know the role of dark matter towards as remote things as structure formation after (so called) Big Bang.

Now there are two basic questions that we must sort out or resolve. First question is that can mathematics find unknown facts without synthesizing observational knowledge? And (ii) Do Physicists actually understand their 'counterintuitive' theories after having been 'rewired' through mathematics?

Claim of the rationality is that unknown facts can be figured out in the form of reason based knowledge which is actually a proper synthesis of available observational or already existing reason based knowledge such that mathematics is also a form of reason and logic. Claim of Physicist is different. He favors only mathematics and even ridicules rationality. He has a shallow idea of commonsense which he equates with holding flat earth type views. He is working on biggest and smallest realities or entities after having been rewired through the un-commonsense tools of mathematics therefore insane results of his research or inquiry do not bother him. He 'knows' that reality may not make sense. What he seems to not know is that if anything is not making sense then his so called knowledge of that thing remains questionable. He is having the claim that he has correct knowledge of those things that make no sense and he ridicules those skeptics who raise objections on his (mathematical) fantasies. Those skeptics belong to an outdated evolutionary epoch whereas our Physicist has been rewired to get correct knowledge of unknowable. Within the domain of the topic of this book, the remarkable fact is however that dark matter was not even predicted by his mathematics. If dark matter were rightly 'predicted' by his beloved equations then he should have expectation of observing fast rotation speed of galactic edges specifically due to the involvement of extra mass. But actually his expectations were defied by the real observations. Rather than trying to find mistake in his beloved equations, he denied the real observations. Off course he did not deny the actually observed speed of galactic rotations. He denied the observed actual quantity of available matter and suggested the presence of such extra matter that could not be observed only to match the results of equations with the observed speed of rotation. For the case of dark matter at least, his un-commonsense tool of mathematics did not even work yet he has the claim that unknown reality of dark matter is figured out through mathematics. We note that this is utterly false claim.

If unknown reality of dark matter were figured out by (GR) equations then those equations should have predicted faster rotation speed of galactic edges despite apparent low quantity of visible matter and the 'prediction' of GR equations should have been in contrast with the 3rd law of Johannes Kepler. But no one noted the oddity between two theories simply because the two were not at odd with one another. It means that nothing new was figured out by the mathematics. Only the real observation of galactic rotations brought a

new fact to limelight that galactic rotations neither obey Kepler's 3rd law nor do they care anything about GR equations. The new fact was precisely this and source of the new fact was not even mathematics. We see that for the case of core subject of this book, mathematics had found nothing new. But for the sake of general conception we should carry on to resolve our first question. The answer to the first question is that mathematics is nothing but a quantitative extension of human reason and logic. If logic and reason cannot lead towards hidden realities without synthesizing already known facts then mathematics also follows the same mechanism. It is not true that every mathematical possibility must be physically possible as well. Mathematics can describe physical reality and mathematics also can describe what is physically not possible. The same thing is true for human reasoning, logic and imagination as all these things are capable to describe physical reality and all these things are also able to describe or visualize what is not possible physically. The scope of logic and reason is not restricted as logic and reason can explain every truth which, according to the claim of Physicists, only mathematics can explain. Logic and reason can explain every technology or scientific theory. Logic and reason also can attempt to explain abstract things like logic, love, beauty etc. which technology, science and mathematics cannot explain.

There is however a class of fundamental facts of nature, natural processes and natural life that are so far outside the scope of reason and logic. Nature is logical but logic of nature works differently than logic of mind. Logic of nature works at the scale of attaining physical symmetry and equilibrium at sub-atomic particle levels. Logic of mind does not work even on visible scale objects. Logic of mind works on non-physical models or theories that cannot even physically interact with one another. It is due to this reason that whatever humans have already constructed whether mathematics, science or technology; all such things can be logically explained because method i.e. working with non-physical models (or theories) is the same. But what natural processes have not been understood, they cannot be logically explained because method of both these processes is not the same. Mind does not work directly with physical objects rather works with symbols, models or abstract theories that only 'refer' to those physical objects. Physicists, scientists or mathematicians – all of them work with 'models' and 'theories' who refer to ordinary objects for the cases of visible scale matters. For the cases of largest and smallest scales,

both mathematics and logic work with models or theories that refer to hypothetical objects. For example, 'atom' is hypothetical object of very small scale. Theory of atom refers to this hypothetical object and works reasonably correct logically, mathematically and also confirms to experimental observations of visible phenomena being rightly interpretable by considering the logical and mathematical implications of the concept of atom. But 'dark matter' is such hypothetical object that does not belong to smallest or largest scale. If dark matter is major component of galaxy than just like galaxy, it also belongs to visible scale category of objects. To overcome this difficulty, Physicists often 'theorize' that it could be a large quantity of special non-detectable type of tiny (sub-atomic) particles that spreads out all across the galaxy or anywhere. To move further from this point, I want to add only little comments that this is a simplified approach to overcome or resolve difficulties. Even small children are expert at this strategy. My little daughter (when she was 4 years) told us that something (in market) is 100% off (on sale). We replied that things don't get 100% off – it should be 30% or 50%. But she insisted that she saw 100% off 'very far away' that others could not see and only she saw 100% off written somewhere. So here our 'innocent' Physicists also try to justify their inability to see very large chunk of matter with the help of innocent childish cover up strategy. In the case of my daughter, it was surfaced that actually she had seen '100% pure medicine' instead of 100% off (on sale). But it also turned out that she could not understand the meaning of 'pure medicine' and triumphantly announced that she was right and 100% off does exist. Physicists, however, should not be as innocent as a real innocent child can get and they must show us or at least provide conclusive evidence of the existence of huge chunk of matter that exists only according to them. Their mathematics has not found any unknown reality for the case of dark matter and whatever other unknown reality mathematics might have found, that has to be in the form of synthesis of available information and already existing reason based knowledge and not by way of magical effect of 'rewiring' through 'un-commonsense' tool of mathematics.

The next claim of the Physicists is that they do understand their 'counterintuitive' theories as they already have taken all the advanced courses in mathematics. We have seen previously that known mathematical knowledge is not outside the grasp of simple reasoning because both deal with models or theories and there is no fundamental conflict

in the working method of mathematics and logic or reasoning. Fact is that mathematics is capable to describe reality or even fiction in the form of complex equations. Reason and logic is also capable to describe fiction by way of simple but twisted narrations. When reason or logic describes fictional things then departure from reality can be easily described again in simple narrations. However when complex mathematics describes fiction like 'n' dimensions then simple reason rightfully denies the reality of n dimensions and understands it as a form of fiction. But mathematicians manage to insist that n dimension is a mathematical reality that simple reason could not understand. Fact remains that 'n'th dimension was a fictional entity after all. Neither reason will ever accept it as a reality nor will it ever be physically found in the real world. Only because mathematically it is possible to translate 2D drawing into 3D drawing that does have real physical counterpart does not mean that mathematics also can draw 4D drawing in same way. Off course there will be no real physical 4D counterpart to that drawing. Mathematics has crossed the limits of reality and has entered into the realm of mathematical fiction. Here reason and logic asks a valid question regarding if it is possible for mathematics to describe fiction or not? What will be the reply of Mathematicians?

If they give wrong reply that mathematics is not capable to describe fiction then mathematics becomes admittedly less capable than reason and if they give correct reply that yes mathematics is capable to describe fiction then … then it makes sense why sometimes reason and logic refuse to accept mathematical narrations as description of reality. It is only physical reality that does not entertain fiction because physical reality is under laws of physical objects. On the other hand, mathematics and reason are under laws of 'models' or 'abstract theories' and as such are free to roam about reality and fiction both. Now the claims of Physicists that they do know complex reality in the form of insane mathematical interpretations and they also 'understand' those insane interpretations are false claims. It is like a fiction writer having the claim that his fiction describes physical reality in such way that only experienced fiction writers can understand this fact and actually it is nothing but a baseless claim. We are bound to conclude that wherever mathematics comes up with the claim of having described reality; that must be verified through reason and experiment both. Otherwise there will be great possibility of we all being drifted towards dark, blue or red zones of fiction under the guise of reality.

We conclude this section with remarks that mathematics is indispensable for science as it helps in detailed planning and executions concerning quantitative precision involving matter, space and time. The subject of this book i.e. dark matter was however not sorted out by the mathematics. Dark matter was not even a fiction created by the mathematics. Unfortunately, this fiction was created by commonsense under the guise of mathematics. Given this fact the excuse is not accepted that there is rewiring effect due to which only mathematicians or physicists can understand that dark matter is real and that even if it were the case of mathematical fiction, again it would only be a lame excuse because there is no such thing as rewiring effect that is able to extract hard realities out of the things that make no sense.

There is however an actual and physical rewiring effect which I have already described in section I.II of my in-process book "Descriptive Knowledge, Mind and Reality; a case of Epistemological Realism". This actual 'rewiring' comes from perception system of mind. In simple words, perception is meaningful exposure to sense data where 'meaning' comes from previous experience or exposure to same or similar things. If there is no 'meaning' there is no perception. If there is no previous exposure, there is no meaning. The 'exposure' of anything new gives us 'meanings' for the future. In a way, the exposure to new things or information gives the genuine 'rewiring' effect and enables us to 'perceive' and deal with same or similar things in future. The point has already been explained in my other work, though not published so far, I here only quote the relevant portion which is as under:

> Experience not only improves vision, it also creates vision. It is a common occurrence and must be in the notice of all the readers. Some might have identified this phenomenon already but it will make more sense if I give it a little emphasis. It is like asking to ourselves regarding exactly what do we receive physically out of our getting experience of new things. Do we gain weight or just our vision gets improved? Definitely the vision improvement is appropriate answer. But more to this, new information or experience of new things actually gives us a sort of physical eyesight. Like we physically come to light from previous state of darkness and become able to watch the things which were around us already but were invisible to us. Through the mechanism of sense perception, relevant past memory is called upon to give us understanding of the ongoing current situation. Now suppose there is no relevant past memory of a particular object which is present within the field of sensory vision. It is

> likely that attention will skip it and it will go unnoticed. Once a successful focus of attention is achieved through experience, likelihood for now onwards is that it will not go unnoticed by the attention. Often it happens that we learn some concept or vocabulary for the first time. Then afterwards, we frequently encounter with same concept or vocabulary etc. Now how come that it took ages to have first introduction of that concept or vocabulary but then suddenly it got a normal frequency of getting noticed? Most of the times the reason is that it already had been around us but due to our lack of formal introduction with that vocabulary or concept, our attention always missed it. Once formal introduction has succeeded; then onwards it came under visible spectrum of attention. I explain it with simple example. When I first time came to know that on every car bonnet, there is logo of relevant car manufacturing company; it was only after it that I became familiar to different car logos. These logos already had been around me and I always failed to notice their presence until I somehow succeeded for the first time to get their formal introduction. I told this phenomenon to my cousin and he also shared his experience that he had started learning car driving on a Suzuki Cultus car. He told me that previously he did not know about Suzuki Cultus car but then onwards he became able to see many Suzuki Cultus cars around him. Again, those cars were already around him but due to lack of formal introduction of particular makes of cars, his attention was simply skipping taking notice of them.
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> ---Khuram Rafique (Draft: "Descriptive Knowledge, Mind and Reality; a case of Epistemological Realism".

Thus we see that a natural rewiring process does exist but has nothing to do with counterintuitive mess. The path towards unknown takes its course from first resolving and getting sense of previously unknown stuff and then new things start making sense. Knowledge comes from acquiring proper sense of the subject and does not come from acknowledging senseless stuff as 'counterintuitive reality'. We do have the ability to dig out the truth of a subject that is currently unknowable. But process of digging involves making sense of the issue by acquiring further or better factual data and information on the subject. Acknowledging anything senseless as counterintuitive reality is a form of fiction that only serves as a dead end in the process of digging out unknown realities. The noted type of the actual rotation pattern of galaxies was excellent factual information and it was a lead towards knowing previously unknown aspects of differences in the type of motion of our familiar solar system and galaxies. By knowing the actual rotation pattern of galaxies,

now it was easy to dig out why apparently gravity behaves differently across the whole of galaxy. But matter was in the hands of Physicists who were believers of GR equations and they knew already that only the existence of more than observed matter could account for the different rotation pattern of galaxies. They assigned credit of 'discovery' of 'dark matter' to their beloved equations and started calling it another counterintuitive reality. With the emergence of this new counterintuitive dead end, the right path towards discovering previously unknown realities was blocked – but the path was blocked for only pro-counterintuitive Physicists and their supporters. The task of this book is to start moving towards right direction by breaking the hard obstacle of counterintuitive dead end.

Now we come to the second question i.e. do Physicists really understand their counterintuitive stuff or not? Well, they do pretend that they understand but this book will sufficiently show that they do not actually understand what is counterintuitive by character or nature. For example they pretend that they understand this counterintuitive reality of 'dark matter'. They already have built enormous sand castles of so called high profile theories of Physics where crucial role is assigned to the unsubstantiated notion of dark matter. It is so because they do not regard it as 'unsubstantiated' notion – they only call it 'directly not observed reality'. Even a number of direct experiments who failed at finding dark matter do not bother them because after all they regard it as 'directly not observed reality'. The focus on 'reality' is due to their insistence that they do understand their counterintuitive stuff. Now question is that what will happen to their claim of having understanding of counterintuitive stuff if it is proved beyond doubt that dark matter could not be observed simply because it did not exist? If it is demonstrated that there is no dark matter may be in not observable format – this book is going to do after all – then it will also be confirmed that no one actually knew or understood this counterintuitive notion of dark matter. Therefore, the answer to the second question, i.e. 'do Physicists actually understand reality of dark matter', now goes to the judgment of readers of this book. Readers of this book will decide whether do the Physicists really knew their counterintuitive stuff when they were not even feeling trouble in getting same results from their beloved 'General' Theory of Relativity and a 'particular' law i.e. 3rd law of Kepler? Actually they had wrongfully applied irrelevant aspect of the 'simple' theory and interpolated the result taken from the faulty application of simple theory to the so called

most accurate theory; their accurate theory failed in detecting that something was missing, incomplete or wrong neither did they themselves realize the same. Only thing they realized was that they had reached to another counterintuitive reality and they were having the claim that due to having been rewired through mathematics, they fully understood their counterintuitive mess.

I.II. Dark Matter was seen as a handy solution to complex problems of Theoretical Physics

The initial proposal of unexpectedly high proportional existence of usual and non-mysterious Dark Matter put forwarded by Fritz Zwicky (1933) somehow conveyed to the scientific community that an anomaly existed and that 'problem' was real. The proposal itself got serious status when upfront observations of individual galaxies started pointing out the fact that galactic rotations do not obey Keplerian Drop-off in velocities at greater distances from center. If Kepler's third law was applicable to rotation of galaxies then the type of galactic rotation was a real problem. Scientists committed the mistake of considering Kepler's third law to be applicable to galactic rotations whereas it was not applicable. The mistake was 'justified' because the 'accurate' theory of General Relativity was also (supposedly) showing the same anomaly in the rotation curves of individual galaxies. Actually no one was taking it as a mistake. They were only noticing anomalous results of galactic rotation curves that were not obeying third law of Kepler and even latest 'correct' theory of General Relativity. Scientists did all the efforts to get as accurate data of galactic rotations as possible but they did not review the applicability of their theories to the type of problem. For them, theory was applied accurately and the anomaly was real; there had to be presence of far greater quantity of dark matter than could be traced through all the possible means. Meanwhile scientists started relating different other kinds of unsolved observed facts with this baffling idea of dark matter. Scientific research papers 'successfully' explained tiny fluctuations of temperature of CMB and possibility of structure formation after so called Big Bang on the basis of unsubstantiated notion of dark matter. With so many problems being addressed at once, scientific community eventually assigned status of hard reality to otherwise unconfirmed mysterious form of dark matter that could not be traced in the real world except through a deviation of results of gravity

equations with actual observations. Scientists however do not call it as deviation of equations with reality – they only regard it deviation of possible effects of weak force (gravity) with observed reality. For them, more real than reality are the unconceivable and fanciful things like Big Bang and Dark Matter because they are results of equations of mathematics. The resultant 'best' mainstream model of Cosmology is 'Lambda CDM' where CDM stands for 'cold dark matter'. In this mainstream model, real matter accounts for only 5% and rest of 95% unknown reality is 100% known as our scientists 'know' the exact percentage of dark matter and dark energy as well as their functions and they also 'know' the exact moment of Big Bang Creation of Universe. With 95% unknown regime being 'fully known', this is clearly counterintuitive regime that will definitely be regarded in the history of science as proper dark era of science.

II. The Problem, the Comprehension and the Solution

The problem was not that there had to be greater quantity of unobservable matter or how to trace untraceable reality. The problem was only that there were misunderstood type of rotation patterns of galaxies. Problem was that apparently galactic rotations were defying third law of Kepler and problem was that scientists were expecting and also (might be) actually getting same results from a 'general' theory (GR) as they were expecting and getting from a particular law of Kepler that was not a general law but was a description of our own particular solar system. The problem in dynamics of clusters of galaxies as noted by Fritz Zwicky (1933) and then Sinclair Smith (1936) was a whole different kind of problem. Another problem was that scientists were treating dynamics of clusters of galaxies problem and the problem of rotation patterns of individual galaxies as same kind of problem with only difference of scale. Those two were different kinds of problems having different implications and if looked from correct angle then implications are poles apart than the question of the existence of large extra quantity of dark matter. The problem of gravitational lensing was subject to slightly different dynamics and by considering all the factors involved, the question of dark matter should not have arisen as well. The problems of tiny fluctuations in temperature of CMB and possibility of structure formation after Big Bang were the problems of the Big Bang Theory itself. For example, if rotation patterns of galaxies are perfectly normal and there is no need of compensating dark matter then fluctuations in temperature of CMB as well as possibility of structure formation without the role of dark matter are still outstanding problems of the Big Bang Theory and claim that all the observed facts are best explained within the framework of the Bing Bang Theory is a misleading claim. This chapter will deal with each category of problem one by one along with comprehension and solution thereof.

II.I. Clusters of Galaxies

As a possible evidence for the existence of mysterious dark matter, the problem of rotation patterns of individual galaxies is more perplexing and in fact these are rotation patterns of

individual galaxies that have finally convinced the scientific community that dark matter does exist. But original proposal of high proportional existence of dark matter had emerged out of the study of clusters of galaxies. Therefore, we shall first evaluate the problem of Clusters of Galaxies and then move on to the other ones.

II.I.I. The problem in dynamics of clusters of galaxies was a whole different kind of problem

The actual problem Fritz Zwicky dealing with was the interpretation of redshifts of far off 'extragalactic nebulae' in terms of 'velocities'. In 1929, Edwin Hubble[22] had presented his finding that there was linear relationship between 'apparent' velocities (redshifts) of extragalactic nebulae with distance. Edwin Hubble himself was skeptical about assigning the meaning of 'velocities' to those observed redshifts as he used word 'apparent' velocities in his 1929 paper and also explained picking the word 'apparent' in a letter written to de-Sitter. In the letter to de-Sitter, he writes:

> "Mr. Humason and I are both deeply sensible of your gracious appreciation of the papers on velocities and distances of nebulae. We use the term 'apparent' velocities to emphasize the empirical features of the correlation. The interpretation, we feel, should be left to you and the very few others who are competent to discuss the matter with authority.23"

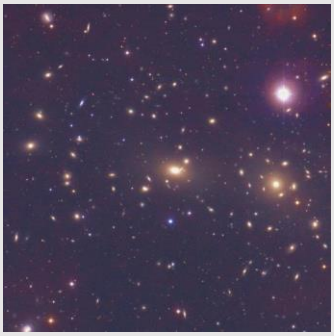
But perhaps de-Sitter had started looking into the matter in terms of 'velocities' instead of any other explanation of redshifts. Same was the general inclination within scientific community. At that time, in same year 1929, Fritz Zwicky, now known as 'father of dark matter', not only openly rejected the interpretation of redshifts in terms of velocities; he also presented alternative explanation[24] by way of proposing a new effect of masses upon light which he described as a sort of gravitational analogue of the Compton Effect. In the same paper, he also pointed out that redshifts, if described in terms of 'velocities', would give discrepancies so huge as to indicate that those redshifts could not be due to peculiar motion of galaxies and must, therefore, be accounted for in some other way. Then he proceeded to explain or suggest that other way which was a sort of gravitational analogue of the Compton Effect.

He was thinking in right direction that redshifts had to be interpreted in terms other than 'velocities'; otherwise enormous, rather- impossible kinds of discrepancies in velocities would be inescapable. Not only that the direction was right, it was based on commonsense judgment that interpretation of redshifts in terms of 'velocities' would give insane results. Few years later i.e. in 1933, he would have come to realize that his proposed gravitational analogue of Compton Effect could not have important role towards justifying the observed redshifts of those far off galaxies. The title of his 1933 paper is not like "Need of Extra Dark Matter". The title of Fritz Zwicky's 1933 paper is (English Translation) "The Redshift of Extragalactic Nebulae".[25] Zwicky writes in this paper:

> Several years ago I already attempted to consider various physical effects such as the Compton effect on stationary or moving electrons in outer space, the Raman effect, etc., to explain the redshift (F. Zwicky, Proc. Nat. Acad. Sci., Vol.15, p. 773, 1929). It turned out that none of these can play an important role. When considering effects, which have their origin in an immediate spatial interaction between light and matter, it proves impossible to explain the transparency of intergalactic space.
>
> However, I had then suggested another possible effect, which however will be barely observable on Earth, but for the existence of which some theoretical reasons can be put forward. According to relativity theory, each photon, or light quantum, of frequency {ν} can be assigned an inertial as well as gravitational of h ν/c2. Thus, there is an interaction (attraction) between light and matter. If the photon is emitted and absorbed at two different points, P1 and P2, respectively, with identical gravitational potentials, then, on the way from P1 to P2, the photon will lose a certain amount of linear momentum and will release it to matter. That photon becomes redder. This effect could be described as gravitational friction, and is caused essentially by the finite velocity of propagation of gravitational effects. Its strength depends on the mean density of matter, as well as on its distribution. In this case the redshift $\Delta\lambda/\lambda$ not only depends on distance, but also on the distribution of matter. Studies to prove these conclusions are in progress.
>
> In conclusion it has to be said that none of the currently proposed theories is satisfactory. All have been developed on extremely hypothetical foundations, and none of these has allowed to uncover any new physical relationships.

Here, in his 1933 paper which is famous for being the first ever proposal of astonishingly high proportional existence of dark matter, Fritz Zwicky is telling that his earlier attempt to explain redshifts in terms of Compton Effect turned out to be unsuccessful. Then he is describing that there is yet another possibility i.e. 'gravitational friction' that could explain redshifts but studies to prove that possibility were still under progress. He is already not satisfied with the explanation of redshifts in terms of 'velocities' and now he is almost hopeless regarding prospects and success of any alternative that he could contemplate at that time. At the end of this passage, he concludes that none of the currently proposed theories that attempt to explain redshifts is satisfactory which means that explanation of redshifts in terms of 'velocities' was also unsatisfactory for him. His own attempts of alternative explanations had either failed already or could have similar fate. By 1933, the dominant explanation of redshifts was 'velocities'. His brilliant commonsense judgment had already pointed out in previous 1929 paper that redshifts, if described in terms of 'velocities', would give discrepancies so huge to indicate that those redshifts could not be due to peculiar motion of galaxies. Back in year 1929, he was hopeful that an alternative explanation of redshifts in terms of Compton Effect might work. But in year 1933, he lost hope regarding the success of any possible explanation of redshifts that could viably substitute the dominant explanation in terms of 'velocities'. Therefore now it was high time to actually and quantitatively show those huge discrepancies that he already had cautioned of as a commonsense judgment in year 1929.

With the view to show that 'velocity' interpretation of redshifts of far off galaxies also does not work, he took data of observed redshifts of various galaxies and selected 'Coma Cluster' for his analysis.



Coma Cluster – Image Credit: NASA/ESA

Within the meanings of ‘velocities’, the redshift data suggested that average velocity dispersion of individual galaxies of the cluster along the line-of-sight was approximately 1000 km/s. Now Zwicky applied Virial Theorem (i.e. a classical mathematical theorem) and obtained the results that for the observed mass and diameter of cluster, the average velocity dispersion should have been only 80 Km/s and for the observed average velocity dispersion of 1000 Km/s, the individual galaxies should have separated apart from the cluster. Zwicky then honestly concluded that such a high observed velocity dispersion was possible only if total available mass of cluster is about 400 times the observable luminous matter. The underlying conclusion was obviously that redshifts were not actually representing the peculiar motion of galaxies. The proposal of alarmingly high ratio of dark matter was more like a warning than a ‘proposal’. An ancillary message was also that none of the available theories, including ‘velocity’ interpretation’, to explain redshifts of far off galaxies was satisfactory. Zwicky could be aware of the prevailing estimates of ratio of dark matter to luminous matter but he was also feeling the need that visible galactic arm portion of sky be investigated for the density of interstellar matter in galaxies. In this way, the attempt to explore dynamics of Coma Cluster started with the commonsense expectation of finding an impossible scenario but all the possibilities could not be ruled out at that time. The very high velocity dispersion could not automatically rule out the velocity meaning of redshifts as the high velocity dispersion could also be caused by non-luminous matter that could exist in extra large quantities and it was due to the fact that Zwicky, in his analysis, had calculated the mass of cluster on the basis of luminosity of the cluster. Therefore, Zwicky did not conclude the paper by rejecting the velocity meanings of redshift as he had realized that all the other possibilities had not yet been ruled out. Thus it is true that the proposal of very high ratio of dark matter had emerged in a serious mode that if such high velocity dispersion is confirmed then the actual quantity of available matter must be far greater than what could be inferred from available luminosity. The proposal emerged in a serious mode but with heavy reservations. Clearly, the ‘velocity’ interpretation of redshifts was not satisfactory and to assign an adequate status to this awkwardly dominant interpretation, an insanely high quantitative existence of dark matter was required to be established. The ‘velocity’ interpretation was already dominant – science community noted the verdict of Zwicky as inexplicable problem that needed not to

be addressed. ‘Velocity’ interpretation of redshifts was not seriously reviewed and even no need was felt to find out extraordinarily high quantitative presence of dark matter which could not actually be found anywhere. And although Zwicky also had already analyzed (1937) another problem in such preliminary form that Edwin Hubble had cited earlier in book “The Realm of the Nebulae” (1936), science community eventually remembered the verdict of Zwicky at a later stage when that other problem i.e. the problem of rotation patterns of individual galaxies, in mature form, started giving apparently similar anomalous results. At that time, science community completely forgot the heavy reservations of Zwicky and at last assigned him the title of ‘father of dark matter’ such that he had only indicated abnormally high quantitative existence of ordinary and non-mysterious form of dark matter that if ruled out completely would also have completely ruled out the ‘velocity’ interpretation of redshifts. The presence of ordinary form of dark matter to such extreme quantities was eventually ruled out by the scientific community. But the other line of observations i.e. rotation curves of individual galaxies started giving apparently similar anomalous results with better accuracy and even more vigor. As a result scientific community did not feel the need to rule out ‘velocity’ interpretation of redshifts and started looking those two different observed anomalies as a single problem whose solution was ‘created’ in the form of mysterious type of dark matter that is capable to gravitationally affect normal matter but cannot be traced through any other possible mean.

In the next section, we are going to see that galactic rotation curves were not anomalous and as such failure to actually trace or find extraordinary quantities of dark matter should have automatically ruled out ‘velocity’ interpretation of redshifts. But we do not really need to wait for the next section as interpretation of redshifts of all the different galaxies of whole cluster in terms of ‘velocity’ can be shown to be incorrect right here.

The preliminary thing is that original proposal of dark matter 400 times the luminous matter has been considerably reduced by revised calculations but still the value is substantially higher than what can be actually found in the real world and thus need for mysterious form of dark matter stands according to official science. Another thing generally known is that within clusters, individual galaxies do not actually move away from one another at any speed slow or high whatsoever. We may notice huge velocity dispersions of individual

galaxies belonging to any particular far off cluster in terms of redshift differences of those individual galaxies however if someone would note redshift values of different galaxies from within the cluster, he would only record small negative values of redshifts. Coma is a large cluster of galaxies with radius of 10 million light years. Meaning of large velocity dispersions is that within that radius, most of the galaxies have been found positive redshifted with respect to one another by the scientists of our earth. Now if we take the hypothetical case of scientists belonging to one of the galaxies of Coma cluster, they may actually note that all the member galaxies of their cluster are on a collision or merger course. Then they may turn their telescopes towards a small group that contains Milky Way and Andromeda as prominent members and may 'observe' velocity dispersion of let's say 400 Km/sec between Andromeda and Milky Way. They might conclude that the noted velocity dispersion is too high for the available mass of the group and now they also might be in search of 'dark matter'. Ground reality is that there is approaching velocity of almost 100 Km/sec between Andromeda and Milky Way Galaxies. The farthest galaxy from us with approaching 'velocity' is perhaps Messier 81 which is located at distance of 11.8 million light years with redshift value (-)0.000113. By considering that this distance of 11.8 million light years is almost equal or greater than total radius of Coma Cluster and also keeping in view the way too smaller mass of local group as compared with Coma Cluster, the distance of 11.8 million light years is sufficient to reasonably conclude that member galaxies of Coma Cluster are also in fact on collision or merger course. This conclusion is further strengthens by the fact that considerable number of elliptical galaxies do exist in Coma Cluster and again it is generally known that major mode of formation of elliptical galaxies is by way of merging different galaxies. What Earth based scientists are not willing to accept and what Coma based scientists might not have pondered is that redshift of far off galaxies does not indicate radial velocity of those astronomical objects. Zwicky himself had proposed various alternative explanations of redshift and the mere fact that he himself had dumped them does not mean that correct alternative explanation was not possible. I, in my book "A Philosophical Rejection of The Big Bang Theory", have proposed and explained better and likely correct explanation of cosmological redshifts in terms of Huygens' Principle according to which light propagates in a manner which necessarily results in redshifts that become noticeable at very long distances such that for

still longer distances more than linear relation of redshift and distance also becomes prominent thus so called ‘accelerated expansion’ is also successfully explained with the alternative interpretation in terms of Huygens’ Principle. Now given the fact that redshifts of remote astronomical objects do not actually represent radial velocities, there is no really high velocity dispersion within Coma or any other cluster and as such question of dark matter does not arise. The problem of clusters of galaxies was in fact the problem of meaning of redshifts of far off galaxies and the better meaning of redshifts, whose confutation is not logically possible, has been explained in my other book. If light is propagating in terms of Huygens’ Principle then light has to reach far off places with a noticeable redshift. If light is not following Huygens’ Principle then there have to be blind spots to which Huygens has assigned the name ‘cone areas’. And since actually there are no blind spots it means that light does propagate in accordance with Huygens’ Principle and redshifting is the property of propagation of light itself.

II.I.II. The actual Anomalies

Not only that redshifts of far off galaxies are not due to Doppler’s Effect and thus do not represent radial velocities, there are also genuine problems in the established distances of those galaxies. Official distances of nearer objects have been determined by using common techniques of geometry and these distances are correct. The case of far off galaxies was challenging where finally a method to use luminosity of certain kind of stars (i.e. Cepheid Variable) as indicator of distance was adopted. Theory of redshift-distance relationship was already published where distances had been determined on the basis of luminosity alone and it was afterwards that important works of Fritz Zwicky (1933 and 1937) emerged where he analyzed a huge cluster of galaxies with respect to the total size as well as luminosity and redshift profiles of individual member galaxies of that cluster. The type of Zwicky’s analysis offered a great signal concerning the applicability of straightforward geometrical technique for the determination of galactic distances but unfortunately the hint was taken up by the Expansionists (i.e. relativists) and never brought to the general view in the original simpler form because after sensing the anomaly in this aspect, Expansionists distorted the facts and implemented the hint within twisted expansionist terminology and framework to keep the anomalous results hidden from view.

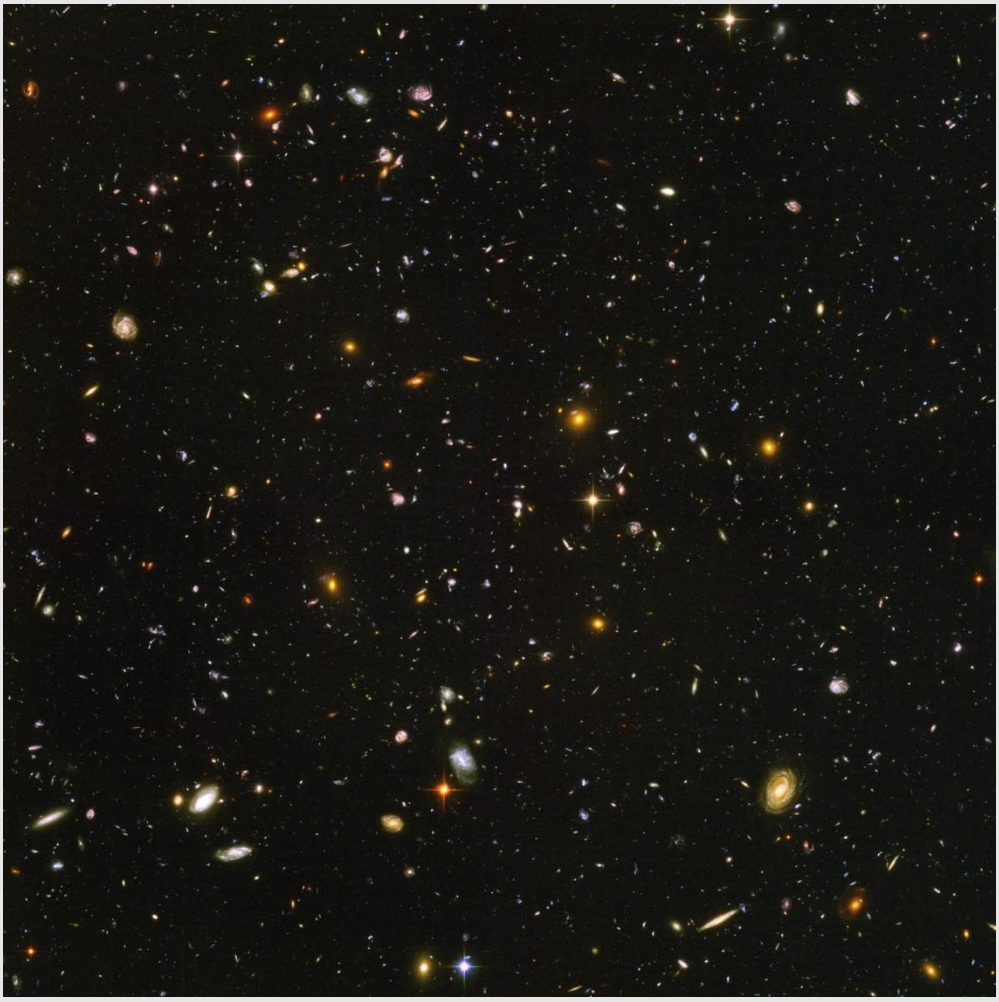
Before discussing the hint, it is better to apply simple technique of geometry to determine the distances of (i) Moon and; (ii) the Sun.

Angle of view on Sky	Heavenly Object	Unit of Distance	Diameter	Number of objects projected on 360 degree sky (360/angle of view)	Total Projected Circumference on sky [(4)x(5)]	Pi Diameter [(6) x 7/22]	Distance [(7)/2]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0.516 degrees	Moon	Kms	3,474	698	2,423,721	771,184	385,592
0.530 degrees	The Sun	Kms	1,391,016	679	944,841,057	300,631,245	150,315,623

Here we have taken standard values for 'angle of view' and 'diameters' of Moon and the Sun from online sources[26]. Our calculated distances of both the objects are only slightly different from official distances therefore we regard this method as accurate for the purpose of evaluating the distance. The hint that we get from the works of Zwicky is that he has estimated or determined the total diameter of the Coma Cluster. In his 1937 paper, he has taken radius of Coma Cluster to be only 2 million light years which is actually wrong as the up-to-date official estimate is 10 million light years and the reason of underestimation was that by that time, distance of Coma Cluster was also underestimated to be only 45 million light years which, by modern and 'finalized' standard is almost 321 million light years. The hint that now we can get is that the diameter is 20 million light years[27] that should form an ample measurable angle of view on the sky. Now, instead of relying on measurements of the distances on the basis of luminosity, let us here calculate the distances of few prominent astronomical objects on the basis of simple geometry.

We have seen that the above method of distance estimation of astronomical objects requires (i) angle of view on sky and; (ii) actual or approximate diameter of the object.

Historically, the estimates regarding distances of beyond Milky Way galaxies started in 1920s on the basis of luminosity of certain kind of stars because perhaps no data, calculation or approximation about diameters of those astronomical objects was available at that time. In 1930's, works of Fritz Zwicky and others featured estimates regarding diameters of astronomical objects located far beyond Milky Way. Initially those estimates were wrong but they were improved and corrected over time. Angles of view on sky of those astronomical objects were also not difficult to figure out that were determined eventually but matters were in the hands of Expansionists who contaminated simple techniques of geometry with formulas of redshifts,[28] possibly after having sensed the type of anomalies that must have surfaced in case the straightforward methods were implemented. As a matter of fact, so far simple distance determination method has not been applied[29] even for the case of Andromeda which is the nearest large galaxy; whose official diameter in light years is known[30] and angle of view on sky is also known[31] to be slightly larger than six times the angle of moon. Likewise the estimate regarding diameter of Coma Cluster is available and angle of view on sky is also known to be almost four times the angle of moon[32]. Here, for our analysis, we select another astronomical 'object' i.e. the famous Hubble Deep Field image that belongs to tiny section of sky whose angle of view on sky is almost 10 times smaller[33] than that of moon but contains ten times more galaxies than Coma Cluster due to which we can get a rough but safe (lower side) estimate of diameter of almost 60 million light years because with almost 1000+ galaxies, from edge to edge, there should be average 33 galaxies in Coma Cluster and with 10000 galaxies in deep field image, the number of edge to edge galaxies should be 100 which is three times greater therefore we take diameter of deep field image to be three times greater than that of Coma Cluster. We however regard it as lower side safe estimate because deep field is not a cluster of relatively compacted galaxies (having compressed in-between distances) which is the case with Coma Cluster.



Hubble Deep Field Image – Credit: NASA/ESA

By applying the straightforward geometrical method we get following ‘anomalous’ estimates of distances of these astronomical objects:

Angle of view on Sky	Astronomical Object	Unit of Distance	Diameter	Number of objects projected on 360 degree sky (360/angle of view)	Total Circumference on sky [(4)x(5)]	Pi Diameter [(6) x 7/22]	Distance [(7)/2]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3.167 degrees	Andromeda	Light Years	220,000	113.672	25,007,894	7,957,057	3,978,529
2.25 degrees	Coma Cluster	Light Years	20,000,000	160.000	3,200,000,000	1,018,181,818	509,090,909
0.05 degrees	Ultra Deep Field Image	Light Years	60,000,000	7,200.000	432,000,000,000	137,454,545,455	68,727,272,727

For Andromeda Galaxy, we notice a large discrepancy in the distance of 3.9 million light years calculated through straightforward geometry in comparison with the official distance which is only 2.5 million light years. Likewise, the official distance of Coma Cluster is only 321 million light years but geometry is telling it should be located at almost 509 million light years. And the case of Deep Field Image is particularly 'anomalous' because the calculated distance is located far beyond the permitted zone of the so-called standard model. Readers are requested to recalculate these figures by themselves to see the genuineness of the results. For instance, how come a huge cluster of galaxies that contains almost 1000 separate galaxies having large distances in-between as well, forms a smaller than a single galaxy Andromeda's angular view on sky and yet located at distance of only 321 million light years when Andromeda, a single galaxy, itself is officially located at 2.5 million light years? A very large object that is larger by ratio of many thousands and not by ratio of only many hundreds is appearing smaller – it means that distance of the object must not be as low as only 321 million light years. It is making perfect sense that Coma Cluster's actual distance is more than 500 million light years.

It is stated earlier that so far straightforward geometric method has not been applied for distance estimation even for the case of Andromeda which is the nearest large galaxy and

whose diameter as well as angle of view on sky is known. Following section of Wikipedia article explains which methods have been applied so far and anyone should wonder why simple geometry has not been applied so far[34]:

Distance estimate

At least four distinct techniques have been used to estimate distances from Earth to the Andromeda Galaxy. In 2003, using the infrared surface brightness fluctuations (I-SBF) and adjusting for the new period-luminosity value and a metallicity correction of −0.2 mag dex^{-1} in (O/H), an estimate of 2.57 ± 0.06 million light-years ($1.625\times10^{11} \pm 3.8\times10^{9}$ astronomical units) was derived. A 2004 Cepheid variable method estimated the distance to be 2.51 ± 0.13 million light-years (770 ± 40 kpc).[2][3] In 2005, an eclipsing binary star was discovered in the Andromeda Galaxy. The binary[c] is two hot blue stars of types O and B. By studying the eclipses of the stars, astronomers were able to measure their sizes. Knowing the sizes and temperatures of the stars, they were able to measure their absolute magnitude. When the visual and absolute magnitudes are known, the distance to the star can be calculated. The stars lie at a distance of $2.52\times10^{6} \pm 0.14\times10^{6}$ ly ($1.594\times10^{11} \pm 8.9\times10^{9}$ AU) and the whole Andromeda Galaxy at about 2.5×10^{6} ly (1.6×10^{11} AU).[4] This new value is in excellent agreement with the previous, independent Cepheid-based distance value. The TRGB method was also used in 2005 giving a distance of $2.56\times10^{6} \pm 0.08\times10^{6}$ ly ($1.619\times10^{11} \pm 5.1\times10^{9}$ AU).[5] Averaged together, these distance estimates give a value of $2.54\times10^{6} \pm 0.11\times10^{6}$ ly ($1.606\times10^{11} \pm 7.0\times10^{9}$ AU).[a] And, from this, the diameter of Andromeda at the widest point is estimated to be 220 ± 3 kly (67,450 ± 920 pc).[*original research?*] Applying trigonometry (angular diameter), this is equivalent to an apparent 4.96° angle in the sky.

From the above quoted text from the Wikipedia article, the very last sentence is particularly important. This sentence is not supported through citation and it seems that this sentence has been added by some curious individual who actually applied trigonometry on accepted diameter and distance of Andromeda galaxy and found that angle of view on sky should be 4.96°instead of official and observed value of 3.167°. Therefore we now put the value of 4.96° in our straightforward geometry for the case of Andromeda and note that with 4.96° angle of view on sky, the calculated distance of Andromeda galaxy tallies with the official distance of 2.54 million light years.

Angle of view on Sky	Heavenly Object	Unit of Distance	Diameter	Number of objects projected on 360 degree sky (360/angle of view)	Total Circumference on sky [(4)x(5)]	Diameter [(6) x 7/22]	Distance [(7)/2]
4.96 degrees	Andromeda	Light Years	220,000	72.581	15,967,742	5,080,645	2,540,323

Here we see that someone's independent calculations using official Trigonometry have confirmed the results of our commonsense based straightforward geometric formula. It is clear that if Andromeda is actually located at distance of just 2.54 million light years then it should form a larger angle of view of 4.96°which is larger than actually observed angle of view of only 3.167°. Therefore, the official distance of Andromeda galaxy is not supported by the known diameter and angle of view on sky as the official distance defies official Trigonometry.

The case of Deep Field Image is anomalous and complex as well because this image covers galaxies located at wider range of distances along line of sight. But if 'nearer' galaxies or objects are included in this image whose total angular diameter on sky is just one tenth that of moon then those 'nearer' galaxies also must be located very far away. For example up to the distance of Coma Cluster, only 20-30 galaxies should fill this image in complete. The angular diameter of deep field image is almost 45 times smaller than that of Coma Cluster yet contains 10 times more galaxies within a very small angle on sky. Roughly there should be only few hundred 'foreground objects' such that the 'foreground' also should be located very far away. The difficulty of 'foreground objects' however has been greatly solved through 'Extreme Deep Field Image' which is actually a close-up assessment of the core or nucleus of the same Deep Field Image where 5500 galaxies are assessed but angle of view is also reduced to become almost 14^{th} the angular size of moon. The overall implication regarding distance estimation should remain almost same. Having total 10000 galaxies with margin of few hundred 'foreground objects', the diameter from edge to edge has been taken only at 60 million light years which is a safe lower side estimate because official estimate of diameter of Coma Cluster with only 1000 and squeezed galaxies is 20 million light years. Furthermore, if we remove the foreground objects from the deep field image then even greater number of background objects will be exposed and total number of galaxies in the image will be increased. It is safe lower side

estimate also because if we consider another perspective that distance between small dot at one edge and another small dot on opposite edge should be at least the distance between Milky Way and one of the galaxies of Coma Cluster which is actually located at 500 million light years but still lies within our cosmic neighborhood then the estimate of distance of the farthest galaxy in the deep field image reaches to almost 583 billion light years from earth. The moderate estimate can be something like 20-40% of the higher side estimate thus those farther galaxies of deep field image, with moderate estimate, may be located at distance of 100 to 200 billion light years. We can attempt to get more precise result on our moderate estimate of distances. The Deep Field Image officially contains 10000 galaxies that include many foreground larger galaxies also. If we remove foreground galaxies then even more small looking galaxies are expected to be revealed from behind the foreground objects. But for the sake of our moderate estimate, we say there are only 10000 background small looking galaxies. From edge to edge, only 100 galaxies (each 80000 light years across) exist and galaxies are separated by the moderate distance of two million light years each. With these settings, we get edge to edge diameter of 208 million light years of the background visible extent of Hubble Deep Field Image. With this precise moderate estimate of diameter, the distance of those farthest visible (small looking) galaxies in Deep Field Image comes at 238.254 billion light years. Even at safer lower side estimate of 68 billion light years, this is serious discrepancy of the standard model where the viewable galaxies must not cross the distance of 13.2 billion light years only to remain conforming to the standard age of the universe of 13.8 billion years.

With huge distance scale of many hundred billion light years, the farthest galaxies 'look' small due to obvious reasons. But NASA loves to tell us that those galaxies are actually smaller in size and their 'standard' reason is also obvious because at distance of only 13+ billion light years, large galaxies should not have appeared so small. NASA very conveniently informs us that earlier galaxies are actually smaller in size in following words[35]:

> When we look at **very distant galaxies**, we see a completely different picture. Many of these galaxies tend to be **small** and clumpy, often with a lot of star formation occurring in the massive knots.

In my opinion, the farthest visible galaxies, being located at distance scale of many hundred billion light years are typically very large galaxies as smaller ones simply could not be seen from such huge distances. NASA insists that they are smaller in size only to project them on a little and unrealistic but 'standard' distance scale of just 13+ billion light years. When a galaxy actually located at distance of many hundred billion light years is declared to be located at only 13+ billion light years then 'yes' it is smaller in size and may also be 'half manufactured' sort of. In case background small looking galaxies of Deep Field Image are located at 13.5 billion light years then edge to edge diameter of background visible extent of this image should be only 11.8 million light years which is almost equal to the diameter of our small local group[36] that contains only three large galaxies along with just 50 other dwarf galaxies. Wikipedia article about current record holder of farthest galaxy[37] informs us that diameter of this farthest galaxy 'GN-z11' is only 25000 light years. If diameter of visible background extent of Deep Field Image is only 11.8 million light years then from edge to edge there are 100 small galaxies each having diameter of only 25000 light years and each separated by distance of only 93000 light years and result would be what NASA wants to tell that those background smaller galaxies are located at distance of only 13+ billion light years. These results do not match with the actual Deep Field Image whose careful glimpse reveals very sparse density of galaxies such that edge to edge smaller looking galaxies are seemingly separated by more than our previous moderate estimate of 2 million light years each. In fact the claim of standard model cosmology that early universe was 'denser' is not actually confirmed as farthest galaxies in Deep Field Image are not denser than our local density of galaxies. For this reason official people often say that early 'dense' universe can be seen in CMB only because 'early' galaxies do not show the desired high density. The actual background small looking galaxies are in fact very large galaxies and from edge to edge they are separated by very large distances – far more than our previous moderate figure of 2 million light years. By no means can they fit within diameter of only 11.8 million light years and thus by no means they can reasonably demonstrated to be located at distance of only 13+ billion light years.

The primary objective of this book is not to highlight the discrepancies of the Big Bang Cosmology. Basically two reasons persuaded me to include these anomalies in this

section of the book – firstly the readers should forget the so-called 'anomaly' of dark matter and should think about the actual anomalies. Secondly, it seemed appropriate to repeat the pattern of Fritz Zwicky in presenting apparently out of context anomaly within the discussion of a separate topic. As far as clusters of galaxies are concerned, there is no genuine anomaly of 'dark matter' because redshifts do not mean 'radial velocities' and actually there is no 'velocity dispersion' within the cluster; Zwicky was also trying to assert the same thing. The actual anomaly whose hint comes from study of cluster as a whole is the anomaly in the official distances of astronomical objects because they extensively differ from the distances that can be calculated quite easily by employing simple technique of geometry. The discrepancy starts right from Andromeda Galaxy thus any excuse of the 'curved spacetime' over very long distance will not work. Actual and strict finding of Edwin Hubble was only that there is linear relationship between 'redshift' and 'distance' and to be precise, for Hubble, the reason of redshifts is not known[38]. But unfortunately, official science has adopted 'velocity' as a valid reason of redshifts. With redshifts being interpreted in terms of 'velocity', the formula of those redshifts contains 'c' i.e. the value of speed of light. With 'c' included in the formula, 'v' (velocity) will never reach closer to 'c' or the results will be twisted may be in some other way.

Now within next few years[39], NASA is going to launch James Webb Space Telescope which is said to be 100x more powerful[40] than highly successful predecessor Hubble Space Telescope (HST). The strange aspect is that despite 100x power of upcoming new space telescope, NASA is dead sure that no galaxy beyond 13.6 billion light years will be seen[41]. NASA explains that Big Bang occurred 13.8 billion years before – although the upcoming telescope will not be able to see Big Bang itself but the very first galaxies belonging to the distance of 13.6 billion light years will be resolved whereas nothing will be seen beyond that distance because actually there was no light at all before that era.

The fact is only that due to twisted formulas, actually the 'distance' will never be shown greater than certain value. The reason behind the absolute surety of NASA that any galaxy older than 13.6 billion years will not be seen by the 100x more powerful telescope is the fact that NASA is fully aware[42] that limit on distance is imposed by the formula itself.

Please see the following table of different values of redshifts (Z) and corresponding distances of galaxies in light years:

z	Light Travel Distance (Billion Light years)	Distance to the object now
0.0000715	0.001	1 million light years
0.1	1.286	1.349 billion light years
0.25	2.916	3.260 billion light years
0.5	5.019	5.936 billion light years
1	7.731	10.147 billion light years
2	10.324	15.424 billion light years
3	11.476	18.594 billion light years
4	12.094	20.745 billion light years
5	12.469	22.322 billion light years
6	12.716	23.542 billion light years
7	12.888	24.521 billion light years
8	13.014	25.329 billion light years
9	13.11	26.011 billion light years
10	13.184	26.596 billion light years

Redshift-distance relationship that should be expected to be tabulated here in simple linear format where certain increment in redshift should result in regular (linear) increment of distance, actually has been implemented in a twisted form such that with increase of value of 'z' (redshift) after the value 2, there is decreasing trend of distance which means that distance is not being increased properly in official tables. For example with increment of 1 in the value of z from 1 to 2, the corresponding increment in the distance is almost 3 billion light years. But afterwards with the increments in z from 4 to 5 to 6 to 7; not a single billion light year is incremented on the distance scale. Clearly this is the consequence of including value of 'c' in the formula of redshift. At redshift 10, galaxies are 'moving away' at speed close to 'c'. When receding speed (if really receding) of galaxy will further approach towards 'c', the galaxy will no more be visible. While the formula intends to restrict visibility within the range of below luminal receding speeds but another factor is on the play. The sort of cosmic horizon beyond which HST cannot see is not actually determined by receding speeds of galaxies because galaxies are not in fact receding away like that. Actually there is region beyond (official) 13.2 billion light years where galaxies are considerably redshifted to near infrared zone that HST cannot see. James Webb Space

Telescope is able to see infrared portion objects but that also has limit. With these hard compulsions that come mainly from calculation methodology, NASA conveniently asserts that beyond 13.6 billion light years, there will be complete darkness and the darkness will be due to absolute absence of galaxies. Galaxies did not exist prior to 13.6 billion light years and the Big Bang Theory is directly confirmed through a powerful telescope, even before the launch of the telescope. With too expensive project of prestigious space telescope that is not even going to have long functional age, the maximum they are going to find or deliberately want to show is that galaxies do not exist beyond the distance of 13.6 billion light years; age of universe i.e. 13.8 billion years is correct; Big Bang Theory is therefore 'confirmed' at 'observational level'. Furthermore, we have already seen in first chapter that these formulas serve as colored spectacles and result is that if real or even hypothetical galaxy is located beyond 14 billion light years, the formula will tell that it is not located at distance more than 13.6 billion light years. So here need is to look at the reality with clear objective eyes and vision which is not contaminated by the colored spectacles.

MS. Tamara M. Davis is an official voice who tells these things slightly differently. In a paper titled "Superluminal Recession Velocities"[43] she and co-author write that official redshift formulas are taken within the context of Special Theory of Relativity (SR) that requires that visibility of galaxies should stop when 'v' becomes equal to 'c' i.e. when receding velocity equals velocity of light, then the galaxy permanently goes out of sight.

> Thus, galaxies with distances greater than D = c/H are receding from us with velocities greater than the speed of light and superluminal recession is a fundamental part of the general relativistic description of the expanding universe. This apparent contradiction of special relativity (SR) is often mistakenly remedied by converting redshift to velocity using SR.

Being Physicists who prefer General Relativity (GR) over SR and who are straightforward in their assertions, the authors of this paper reveal the secret that galaxies having value of redshift more than 3 are actually receding away at superluminal speeds.

> Here we show that galaxies with recession velocities faster than the speed of light are observable and that in all viable cosmological models, galaxies above a redshift of three are receding superluminally.

Afterwards this paper proceeds to explain the mechanism by which galaxies 'recede away at superluminal velocities' but still remain visible in terms of 'curved spacetime' model of GR.

Now we come back to our book where the point is not SR or GR. Cosmic Redshifts do not in fact mean 'velocity'; galaxies are not moving away at all. The actual fact is that galaxies having redshift more than 3 are located beyond the official time of Big Bang. Confidence of NASA that even 100x powerful telescope will not be able to see anything beyond the distance of 13.6 billion light years indicates that NASA is fully aware that limit is imposed by the formula itself. That is, even if they find lot of galaxies located at very far off actual distances, they will conveniently say the distance is not more than 13.6 billion light years by showing the 'calculated' distance as proof.

Mr. Marco Pereira[44], MSc (Nuclear Physics), PhD (Physical Chemistry) and a Professor of Molecular Bio-Physics has also noted the anomaly of non-linear 'observations' of redshift-distance in Sloan Digital Sky Survey (SDSS) data[45]. He claims to have found fourth spatial dimension in the Universe through his self-created theory of 'Hypergeometrical Universe'[46]. He claims that his theory has rightly predicted non-linear redshift-distance pattern of Super Novas 1a which is actually observed by SDSS.

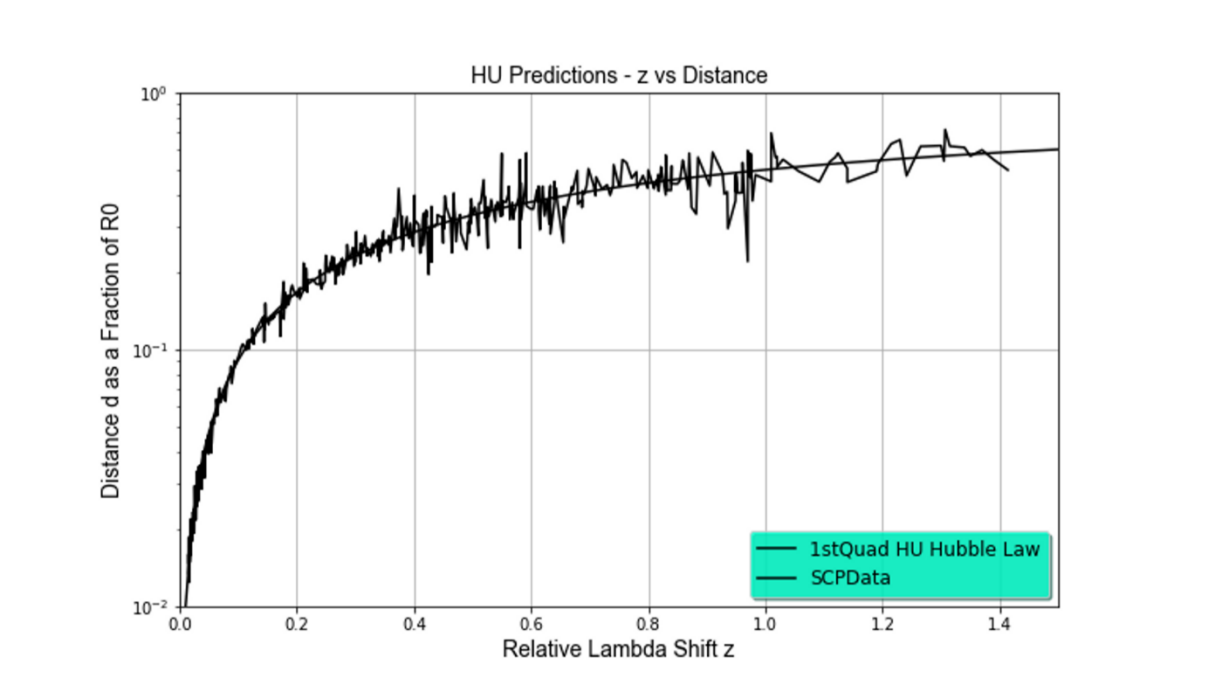


Image added with permission of Mr. Marco Pereira

Above type of non-linear observed redshift-distance relationship is claimed to be rightly predicted by his theory of Hypergeometric Universe and the same is said to be the proof for the existence of extra spatial dimension of the Universe. We have noted already that actual non-linear redshift-distance relationship is something which mainstream physicists avoid to mention and only few people like MS. Tamara M. Davis would dare to expose this kind of secret. Our finding is that Mr. Marco Pereira has not found some reality which was already not calculated by Special Relativity but he does reach to a position which is normally not told openly by the mainstream physicists. After sensing this anomaly, MS. Tamara M. Davis rejected SR based calculations and favored GR based explanation. After finding that same anomalous looking SDSS observations are consistent with his Theory of Hypergeometric Universe which accommodates SR formulas in its development, Mr. Marco Pereira declares that SDSS observations are the proof of the existence of extra fourth dimension of the Universe. Underlying fact is that SDSS has also calculated distances of 1a Super Novas using the formulas of Special Relativity. The Lorentz Transformation factor is the reason behind non-linear plotting of this data. According to simple Hubble Law, the plotting should have been linear. If it is actually linear which becomes possible if we remove Lorentz Factor from the formulas of redshifts then distances of farthest visible galaxies come at the scale of many hundreds of billions light years which are consistent with direct simple geometric calculations of distances. The ground for removing Lorentz Factor from formulas of redshifts is the fact that redshifts do not actually represent velocities. But if redshifts do represent velocities (i.e. the position which is official but not likely) then non-linear plotting of real redshift-distances data is actually an anomaly that can rightfully be accounted for by proposing a fourth dimension of the Universe. In case Universe is actually expanding and farther galaxies are more redshifted at those distances which are lesser than the expected linear distance then extra redshift might have been accumulated during the course of passage of those galaxies through the “fourth dimension” proposed by Mr. Marco Pereira. The result is that either farthest visible galaxies are located at the distance scale of many hundred billion light years or Mr. Marco Pereira may be right in his proposal of extra fourth dimension of the Universe.

But reality is not that complex as suggested by Mr. Marco Pereira who only apparently favors simplicity by attributing his complex theories as conforming of Occam's razor[47]. The proof of the assuredly far greater distances of astronomical objects as presented in this section is as straightforward as it can get and thus conforms to the Occam's razor in true sense. Readers are requested to recalculate these distances by themselves and also recheck the results with official Trigonometric Formulas whose results, with lower side estimates of diameters involved, are only slightly different as given in table below.

Angle of view on Sky	Astronomical Object	Unit of Distance	Diameter	Tangent of angle of view	Trigonometric Distance (Diameter/Tan)	Commonsense Geometry Distance
(1)	(2)	(3)	(4)	(5)	(6) = (4)/(5)	(7)
0.516 degrees	Moon	Kms	3,474	0.00900614	385,737	385,592
0.530 degrees	The Sun	Kms	1,391,016	0.00925051	150,371,817	150,315,623
3.167 degrees	Andromeda	Light Years	220,000	0.05533094	3,976,076	3,978,529
2.25 degrees	Coma Cluster	Light Years	20,000,000	0.03929011	509,033,952	509,090,909
0.05 degrees	Ultra Deep Field Image	Light Years	60,000,000	0.00087266	68,755,299,888	68,727,272,727

It is stated already that Expansionist regime is not entirely blank about these anomalies. They know these things and they hide the actual things by presenting them within twisted terminology and formulas of their favored framework. The Wikipedia article titled "Angular diameter distance"[48]contains following important, though twisted, confession about this topic:

> However, in the ΛCDM model (the currently favored cosmology), the relation is more complicated. In this model, objects at redshifts greater than about 1.5 appear larger on the sky with increasing redshift.

> This is related to the angular diameter distance, which is the distance an object is calculated to be at from ɵ and xx, assuming the Universe is Euclidean.

We have seen already that in official tables, with the increase of redshift, the increment in the distance scale becomes shorter and shorter. Formula tells that astronomical object is located at nearer than the actual distance and thus the object 'appears' (within standard model) larger on 'sky'. Appearance on sky of anything does not depend on any model. If something is looking larger on sky within Lambda CDM model, then it only means that calculated size of object is larger than what can be actually observed on sky. We also have seen earlier in this section that just how Andromeda 'appears' larger on sky. This confession, though made in twisted words, automatically validates, in principle, the calculations about tremendously larger distances of visible galaxies presented in this section. Therefore the only issue remained unsettled so-far is to check whether Universe is really Euclidean or not. The dilemma of the official cosmology is that now they have reached to the finding that at least observed universe is flat and thus the actual geometry of the observable universe is Euclidean. In a flat universe which is representable using Euclidean geometry, the two parallel lines will always remain parallel no matter how great distance is covered. To a question "Is the universe really flat, or is it just very slightly curved?" – Mr. Erik Anson, Physics/Cosmology PhD student (University of Washington) provided following insightful reply[49]:

> Yes, it's entirely possible that the Universe is only *almost* flat on large scales, as is acknowledged by the (scientific)[50] community. There is a cosmological parameter, Ω_k, that relates to the amount of large-scale curvature, and observations can constrain it to be within a *small range including* zero, but can never show it to be *exactly* zero.
>
> However, if there *is* any curvature, it's so small that it's effectively irrelevant, so we may as well model it as flat (which is simpler) unless and until we know otherwise.

Symmetry magazine[51], which is a joint publication of 'Fermi National Accelerator Laboratory' and 'SLAC National Accelerator Laboratory' published an article titled "Our Flat Universe – Not a curve in sight, as far as eye can see"[52] on date 07-04-2015. The

following introductory lines say it all that observable universe is actually found out to be flat and thus representable in Euclidean geometry:

> Mathematicians, scientists, philosophers and curious minds alike have guessed at the shape of our universe. There are three main options to choose from, in case you'd like to do some digging of your own:
>
> The universe could be positively curved, like a sphere.
>
> The universe could be negatively curved, like a saddle.
>
> The universe could be flat, like a sheet of paper.
>
> As far as scientists can tell, this third option is correct. But what do people really mean when they talk about "flatness"? Your high school math teacher would be overjoyed to tell you that it's all about geometry.
>
> In a flat universe, Euclidean geometry applies at the very largest scales. This means parallel lines will never meet, and the internal angles of a triangle always add up to exactly 180 degrees—just like you're used to.

In Lambda CDM model, as we have seen, the distances of far off galaxies are not the actual physical distances as they are superimposed and artificially constrained by the twisted formulas. In simple geometric calculations of distances, there is no artificial or twisted superimposition at work and thus actual distances of visible galaxies really are on a much larger distance scale than could be permitted by the standard model which means that the actual physical reality is not truly 'modelled' by this 'standard model'. With extremely greater distances of astronomical objects, the problem is not that there should be more than observable matter; the implication is that density of matter within the universe is far lower than the available assessments of the so-called standard model who has false claim of having explained all the observed reality because the model does not even know the right density of present day Universe and still claims to know all the details of minute fractional parts of so-assumed very first moment after the 'Big Bang'. Secondly, it is due to 'velocity' interpretation of redshifts that whole need of using 'c' in the redshift formulas arise. It is value of velocity of light 'c' which compels science authorities to stay blind with wrong lower side estimates of distances of remote galaxies. Velocity interpretation of redshifts inescapably leads towards flawed calculations of the distances of

those galaxies which is sort of mathematical proof that redshifts do not represent receding velocities of galaxies because with velocity interpretation, 'c' will be added in the formulas of redshifts; consequently the estimates of astronomical distances would be bound to be outright deceitful as no galaxy will be shown located beyond a certain distance. And although better estimates of astronomical distances have been presented in this section but this book will keep on referring to the distances of remote galaxies with 'standard' values or estimates unless otherwise specified.

II.II. Rotation Curves of Individual Galaxies

Yes – movement patterns of visible objects may serve as signature of the presence of hidden or obscure matter. Visible scale movement in objects comes only from (i) inertia, (ii) physical impact, magnetic or electric force and; (iii) gravitational influence of nearby large matter. Here inertia is intrinsic movement; how it was originally induced in the moving object – that is not relevant here. On astronomical scales, physical impacts are rare while electric or magnetic influence can be supposed to be almost ineffective thus after assuming the insignificance of electric or magnetic influence we can further assume or accept that main source of astronomical level motion of objects is the influence of gravity and the rare impacts are also, off course, caused by matter. Therefore, we acknowledge that non-inertial patterns of visible motion come from the influence of other matter and for the cases of unusual patterns of non-inertial motion that apparently do not tally with the configuration of available matter; it is reasonable to investigate the presence of hidden or non-observable matter. By no means, however, it becomes justified to insist on the presence of mysterious type of matter once the existence of real matter is completely ruled out through the application of all the possible means. The claim of the existence of magical form of matter comes from denial to review the theory that tells the patterns of movement because that theory is regarded as long-established or even final truth. Improper application of the theory coupled with non-realization of possibility of error either in theory or application thereof may result in perplexing situation that could seem suggestive of ghostly or unreal solutions to the problem. The unanticipated rotation patterns of galaxies were already known in preliminary form; Edwin Hubble discussed this problem in year 1936[53] in such mode and shape as it existed by that time. Fritz Zwicky

was noting these developments because he already had floated the proposal of unusually high proportional existence of dark matter and now he wanted to set out criteria for the determination of correct mass of galaxies. In his 1937 paper, he presented and evaluated a number of methods that could be employed to estimate correct mass of galaxies. In this paper, not only he presented revised calculations relating to Coma Cluster; among other things, he also evaluated rotation of galaxies as well as likelihood of gravitational lensing as possible methods for the determination of total mass of galaxies, though he had reservations for using galactic rotations for this task. Gianfranco Bertone and Dan Hooper sum up the stance of Zwicky regarding the use of rotations of galaxies as a possible means to determine mass in following words[54].

> Fritz Zwicky, in his famous 1937 article on galaxy clusters, discussed the possibility of using the rotation curves of galaxies to infer their mass distribution, concluding that:
>
> "It is not possible to derive the masses of [galaxies] from observed rotations, without the use of additional information."
>
> Beside the lack of information on the ellipticity of orbits, one of Zwicky's main concerns was the possible internal "viscosity" resulting from the mutual interactions of stars. Only four years later, Chandrasekhar would demonstrate in his classic paper, "The Time of Relaxation of Stellar Systems", that these interactions are completely negligible, allowing one to reliably describe galaxies as systems of non-interacting stars.

This paper is telling that Zwicky had reservations in using galactic rotations as a means to determine total mass of galaxies but those reservations were removed few years later mainly through the classical work of Chandrasekhar. Another source[55] tells us following important developments that surfaced in year 1939 and continued to proceed till year 1975:

> Six years after Zwicky's paper Babcock (1939) obtained long-slit spectra of the Andromeda galaxy, which showed that the outer regions of M 31 were rotating with an unexpectedly high velocity, indicating either (1) a high outer mass-to-light ratio or (2) strong dust absorption. Babcock wrote: "[T]he great range in the calculated ratio of mass to luminosity in proceeding outward from the nucleus suggests that absorption plays a very important role in the outer portions

> of the spiral, or, perhaps, that new dynamical considerations are required, which will permit of a smaller relative mass in the outer parts". Subsequently Babcock's optical rotation curve, and that of Rubin & Ford (1970), was extended to even larger radii by Roberts and Whitehurst (1975) using 21-cm line observations that reached a radial distance of ~ 30 kpc. These observations clearly showed that the rotation curve of M 31 did not exhibit a Keplerian drop-off. In fact, its rotational velocity remained constant over radial distances of 16 - 30 kpc. These observations indicated that the mass in the outer regions of the Andromeda galaxy increased with galactocentric distance, even though the optical luminosity of M 31 did not.

There were three important aspects of Babcock's (1939) and later findings that were (i) Outer regions of Andromeda (M31) were rotating at speeds higher than expected; Babcock, though he noted sort of anomaly in this context but he did not commit mistake of straight calling it 'Keplerian drop-off' – at a later stage (1975), this mistake would come from or get the confirmed shape out of the findings of Roberts and Whitehurst. (ii) Rotation speed was derived from study of spectral lines thus Babcock tried to justify the 'anomaly' by attributing it to possible more 'absorption' at outer regions, (iii) if 'absorption' had no important role then according to Babcock, 'new dynamical considerations' were required. And despite they treated it like 'Keplerian drop-off not observed', Roberts and Whitehurst noted another very important point which was the indication that the mass in the outer regions of Andromeda galaxy 'increased' with galactocentric distance, even though the optical luminosity of M31 did not.

These were very important developments. Babcock presented only careful assertions but by year 1975, scientists reached to the careless confirmation that rotation of galaxy M31 was not following 3rd law of Kepler. Babcock had not attributed it towards non-observed matter rather he said that role of absorption in outer regions should be checked and if this factor had no important role then perhaps 'new dynamical considerations were required'. So accurate he was. But with Roberts and Whitehurst (1975), all this was concluded with the affirmation of the possible existence of extra non-luminous matter at outer regions of spiral. In this way, Babcock presented the true facts and also outlined possible reasons that could possibly account for the observed anomaly that outer parts of M31 galaxy were rotating at higher than expected velocity. At the end, scientists altogether ignored one genuine possibility that 'new' dynamical considerations were required; rather with same

but extended, refined and 'better quality' observations of 1970 and 1975, they adopted more exotic, better to say erroneous conclusion that rotation of M31 galaxy was not following 'Keplerian drop-off' and thus explicit voices in favor of the presence of extra mass at the outer regions of galaxies began to emerge[56] within scientific writings and circles. Then onwards, gradually those explicit voices have assumed the form of dominant scientific point of view; like a hard scientific 'fact'; now mysterious form of dark matter is regarded as viable scientific interpretation of apparently anomalous galactic rotations on account of the 'fact' that a number of other 'scientific' observations also point towards the existence of (almost) same quantitative ratio of 'dark matter'. The task of this book is to show that none of those scientific observations actually point towards the existence of dark matter while the obligation of this section is to deal with the specific problem of galactic rotations to show that this main problem also has nothing to do with dark matter.

II.II.I. Why Should Galactic Rotations follow 3rd Law of Kepler?

We identified in the previous section that during 1970s, scientists had reached to a careless 'confirmation' that rotation curve of M 31 (Andromeda) did not exhibit a Keplerian drop-off. In non-technical terms, Kepler's 3rd law says that a planet farther away from sun revolves slowly in orbit in comparison with the planet whose orbit is closer to sun. It means that orbital speed for closer orbit is fast and there is 'drop-off' in speed with distance of orbit from sun.

Mathematically, Kepler's 3rd law is: $P^2 = a^3$

An online source[57] describes this law in following simple words:

> Kepler's 3rd law is a mathematical formula. It means that if you know the period of a planet's orbit (P = how long it takes the planet to go around the Sun), then you can determine that planet's distance from the Sun (a = the semimajor axis of the planet's orbit).
>
> It also tells us that planets that are far away from the Sun have longer periods than those close to the Sun. They move more slowly around the Sun.

According to another online source[58], almost following is the overall scope of this law:

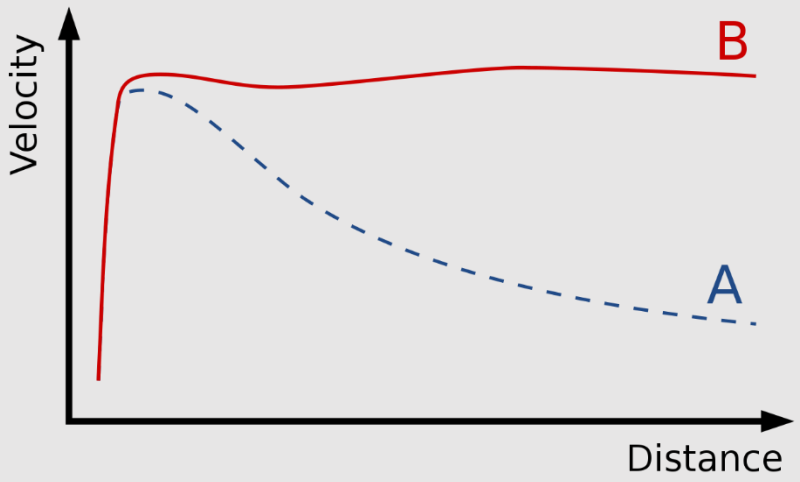
> Kepler's third law (in fact, all three) works not only for the planets in our solar system, but also for the moons of all planets, dwarf planets and asteroids, satellites going round the Earth, etc. Well, not quite; if the secondary body – a planet, say – has a mass that's a significant fraction of the primary one (the Sun, say), then the law needs a small tweak.

Please note that scope of Kepler's 3rd law (in fact, all three) does not cover 'galaxy'. Actually Kepler (1571-1630) had discovered his three laws out of study of planetary motion data of our own Solar System. Rather than 'general laws', essentially these are descriptions of systematic orbital motion behavior of planets of our own specific Solar System. The main characteristic of our Solar System is that more than 99% of the mass is concentrated at central location i.e. Sun. At the most, laws of Kepler could be generally applied to any Solar or Planet-Moon system where central mass is far superior to orbiting bodies and any secondary orbiting body does not possess mass which is significant fraction of the central body's mass

The irrelevancy of Kepler's 3rd law for the orbital motion of stars around galaxy is not disputed. Mr. Erik Anson[59], Physics/Cosmology PhD Student at University of Washington and a famous Internet Physics writer replies to a question[60] (asked by Mr.Damien Giraud[61]) regarding applicability of this solar system specific Law to whole Galaxy in following words:

> You're partially right, but you're also missing something *huge*.
>
> **The thing you're right about**: Kepler's 3rd Law indeed doesn't apply to the orbits of the stars within the Milky Way. K3 only works in the special case where the system is almost completely dominated by a single mass (e.g., the Sun for our solar system). The mass of the Milky Way is much more spread out, and so Kepler can't tell us anything.
>
> **The thing you're apparently missing**: *Physicists and astronomers aren't totally incompetent*. The evidence for dark matter that comes from the rotation curves of galaxies (which, by the way, is *far* from the only evidence there is), is not based on assuming that K3 holds. The "expected" orbital speeds, given the matter that we can see, are based on Newtonian gravity (with perhaps some small corrections from Einstein), not Kepler's Laws.

Here Mr. Erik Anson, thanks to him, accepted that Kepler's Third Law indeed doesn't apply to the orbits of the stars within galaxy. But he is not right that evidence for dark matter that comes from the rotation curves of galaxies is not based on assuming that Kepler's 3rd law holds as we have seen in the previous section that Scientists, by 1975, did reach to the careless confirmation that rotation curves of M31 (Andromeda) did not exhibit 'Keplerian drop-off'. Mr. Erik Anson has tried to justify that anticipated orbital speed was based on Newtonian Gravity with 'perhaps' some small corrections from Einstein. However, point is that even if so then it means that Newton's Gravity and General Relativity (Einstein) were giving approximately the same results for galaxy as could be expected by applying Kepler's 3rd law. But we have seen earlier that Kepler's 3rd law is not applicable to galactic dynamics. Scientists should not have expected to get 'Keplerial drop-off' by applying general theories like 'Newton's Gravity' and 'General Relativity'. Somehow they were getting same results from a particular law i.e. Kepler's 3rd law and General Theories i.e. Newton's Gravity and Einstein's General Relativity. Either the particular law had been elevated to the level of general theory or scientists were really missing something with regards to the application of general theories. If flat rotation curves of galaxies indicate the presence of dark matter then it is possible only when Kepler's 3rd law has been elevated to the level of general theory. Affirmation of dark matter has come from out of scope expectations from Kepler's 3rd law. Additional problem was that general theories were also apparently giving results similar to Kepler's 3rd law and theoretical results did not tally with the actual observations.



Expected (A) and observed (B) star velocities as a function of distance from the galactic center. (Credit: Wikimedia: Commons)

In the above graph, actual observations are represented by line 'B' whereas line 'A' represents what results we should expect from Kepler's 3rd law. Keeping in view that Kepler's 3rd law is applicable where mass is concentrated at the central point, we must conclude that for the case of galaxies where mass is distributed and spread out, the same line 'A' should not have been expected by applying general theories like Newton's theory of gravity and Einstein's General Relativity. But we see that scientists are actually expecting line 'A' from the application of general theories as well and exact this is the problematic point. By the time of publishing my first book against the Big Bang Theory, my general take on the topic of Dark Matter was that there must be something missing in equations rather than something missing in observations. By that time, admittedly, I had not reached to the actual point of the problem. But soon after I realized that scientists have based their theory of Dark Matter on non-observance of 'Keplerian drop-off' which should not have been the case due to different dynamics of galaxies than solar system. Afterwards but before reaching to the correct relevant points of the already existing theory, I was thinking that within galaxy, stars belonging to outer parts of galaxy are not in fact directly obeying the gravitational commands of galactic center. Those starts are basically drifted towards immediate next stars who are far nearer to them than the center and due to short distance, those nearer stars exert far greater gravitational pull that could have arrived from far-off central point. For the stars belonging to the outer edges of galaxy, the gravitation pull is coming from entire inward disk such that nearer stars have more influence than those who are at other side of the disk. The stars who are located at inner part of the disk are subject to more gravitational influence from one side than from the other and essentially experience the same gravity as if they are also located at the outer edge. In simple words, outer edge stars and inner disk stars should be subject to same gravity. I was thinking on these lines in a commonsense mode and it happened that eventually I reached to the conclusion that while calculating the theoretical rotation behavior of galaxies, scientists have missed to include implications of Newton's Shell Theorem in their equations and that's why they are treating absence of Keplerian drop-off as an anomaly. At this point, though I had no positive proof that Shell Theorem was

actually skipped during the official determination of theoretical rotation of galaxies, I undertook to start writing this book with the intention to debunk prevailing theory of dark matter. Afterwards, I came to know that some other people are also thinking on same lines. For example, Nikolay Sones[62] asked a question[63] on questioning website quora.com that when we have shell theorem then what the need of dark matter is. To this, I replied at that time, that they are strict mathematicians. They have shell theorem for a sphere therefore they did not apply the same on a disk structure. I also stated that if we apply the main theme of shell theorem on galactic disk then absolutely there is no need of dark matter in galactic rotations.

By that time I had made up mind to do something to explain applicability of shell theorem for the dynamics of galactic disks. But official mistake was not that simple. I found out finally that they did incorporate Shell Theorem in their formula through which they determined theoretical rotation of galaxies. But they have wrongfully applied Shell Theorem in their formulation.

II.II.II. Wrong application of Shell Theorem in the Official Theory

The main question is that why are scientists getting same result about galactic rotations from general theories (Newton's gravity and Einstein's GR) as they expect from applying a particular law i.e. Kepler's 3rd law? Clearly, their anticipation of applying Kepler law to the problem of galactic rotations was misleading and the results taken from applying general theories are incorrect because correct result from applying general theories should not tally with the one expected from applying Solar System specific law of Kepler. There is a definite mistake in the official application of general theories in this matter. And following quote from the "Galaxy Rotation Curves" section of the Wikipedia article[64] titled "Dark Matter" gives the true hint about the actual point of mistake.

> The arms of spiral galaxies rotate around the galactic center. The luminous mass density of a spiral galaxy decreases as one goes from the center to the outskirts. If luminous mass were all the matter, then we can model the galaxy as a point mass in the center and test masses orbiting around it, similar to the Solar System.[d] From Kepler's Second Law, it is expected that the rotation velocities will decrease with distance from the center, similar to the Solar System. This is

not observed.[48] Instead, the galaxy rotation curve remains flat as distance from the center increases.

If Kepler's laws are correct, then the obvious way to resolve this discrepancy is to conclude the mass distribution in spiral galaxies is not similar to that of the Solar System. In particular, there is a lot of non-luminous matter (dark matter) in the outskirts of the galaxy.

In the above given quote, after the sentence "then we can model the galaxy as a point mass in the center and test masses orbiting around it, similar to the Solar System", there is a footnote "[d]" which reads as "This is a consequence of the Shell Theorem and the observation that spiral galaxies are spherically symmetric to a large extent (in 2D)".

First thing we note here is the information that general theory (GR) has modelled gravity similar to Solar System. The general theory assumes that all the luminous matter of galaxy is located at center and the basis for this assumption is the shell theorem. It also has been explained that application of Shell Theorem on disk structure of galaxy is justified because spiral galaxies are spherically symmetric to a large extent.

Thus, apparently or on the face value, our main question regarding specific law (Kepler's 3rd law) and general theories giving same result about galactic rotations has been responded. But – my reaction is that it is complete incorrect application of Shell Theorem. Yes Shell Theorem is applicable to disk structure of galaxy but it is applicable in a whole different way.

Before explaining the faulty application of Shell Theorem in the official theory, it is important to note second thing that applicability of Shell Theorem upon disk structure of galaxy has been admitted and explained by the official theory which means that now we are in no need to explain whether correct application of Shell Theorem is applicable to disk structure of galaxy or not and that for the forthcoming proceedings of this section, it will be taken for granted that Shell Theorem is applicable to disk of galaxy and that this issue is not disputed and thus term 'sphere' shall be treated as equivalent to 'disk' for the practical reasons.

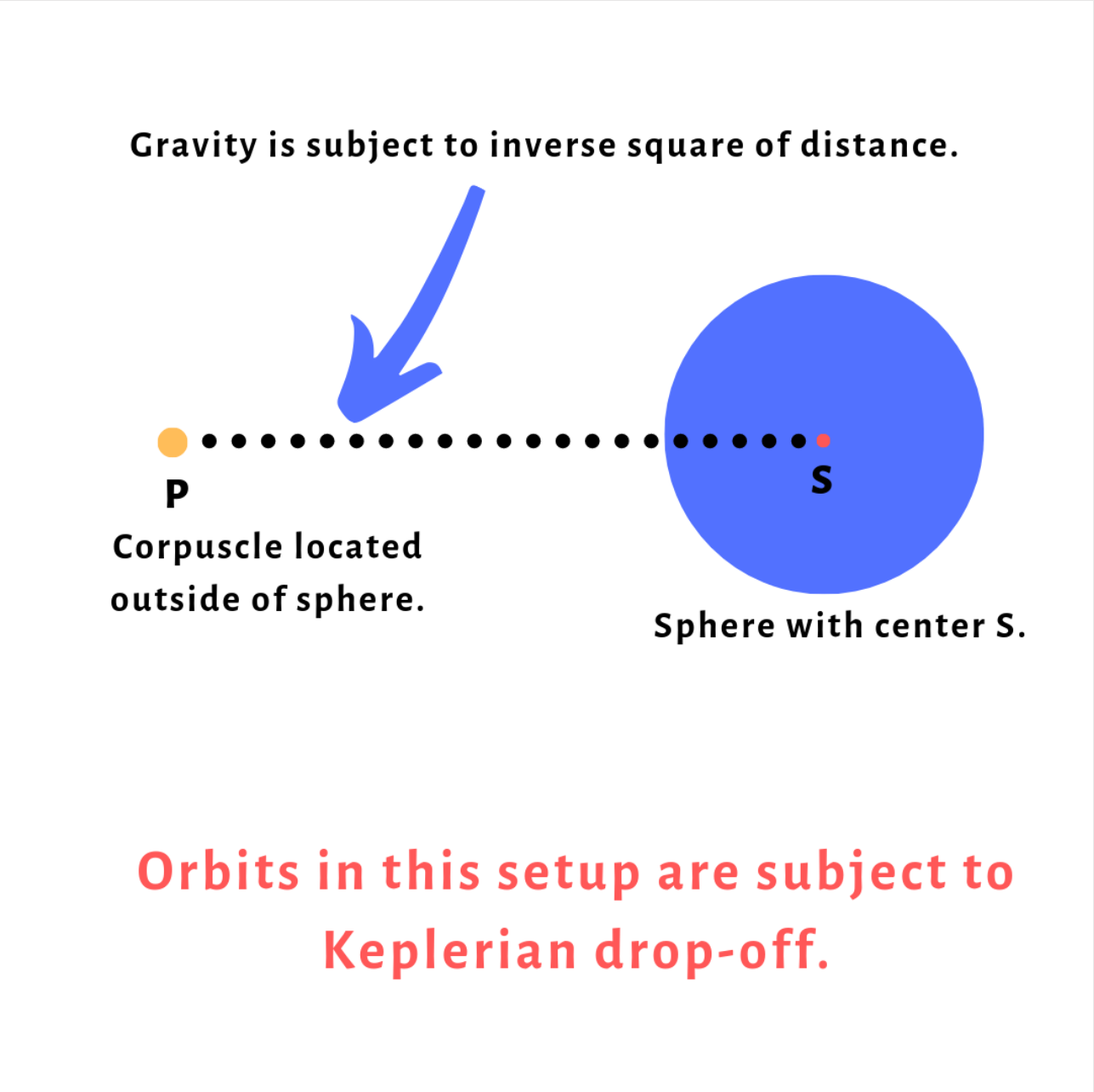
Newton's Shell Theorem does not simply state that the test particle will be attracted towards center of the spherical source of gravity by such and such force. In fact, it is not a single Theorem. In Principia Mathematica, Newton has presented more than dozen Theorems that all deal with gravitational effects of spherical bodies under different conditions. Basically, some of these Theorems are known as Shell Theorem such that the title 'Shell' is not assigned to them in the Principia.

Without going into the irrelevant details, we identify that it is Theorem XXXI of Principia which has been officially applied while determining the motion of stars within the disk of galaxy. This Theorem is actually applicable to a test particle which is located outside of the sphere i.e. like in Solar System. The Theorem XXXI says that gravitational attraction on test particle will be inversely proportional to the square of distance (of test particle) from center (of spherical body). And let me now assert that this Theorem is not applicable to rotation of stars within galaxy because stars are located inside of the disk.

Following is operative part of the Theorem XXXI from the English Translation (American Edition: 2007) of the Principia:

> Theorem XXXI: A corpuscle placed without the spherical superficies is attracted towards the center of the sphere with a force reciprocally proportional to the square of its distance from that center.

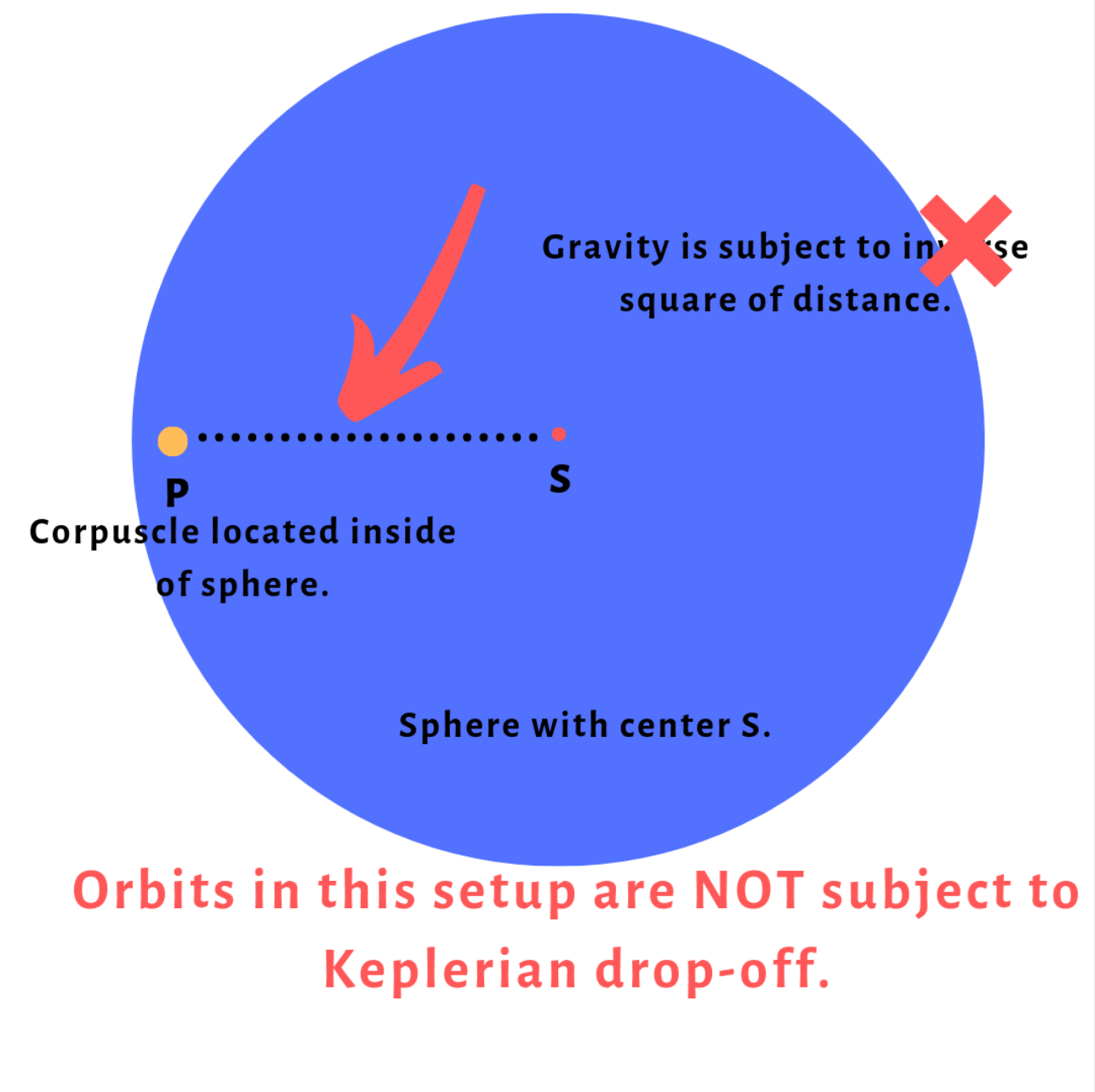
This Theorem describes typical cases of Solar System and Planet-Moon systems etc. where principal gravitating mass is concentrated at the center and 'test particles' i.e. planets and moons are subject to gravity with a force reciprocally proportional to the square of the distance from the center of central mass. The following diagram depicts the situation where this Theorem XXXI is applicable and also explains implications thereof.



Above is the usual case of gravity which is applicable to solar system as well as Earth-Moon and other like systems. Due to the presence of inverse square distance law, orbits under these systems are subject to Keplerian drop-off. However, we have seen already that galaxy is a different kind of system where rotation of galaxy is the rotation of stars within the disk of the galaxy. To such a system where test particle is located within sphere (or disk), Theorem XXXIII is applicable which states following:

If to the several points of a given sphere there tend equal centripetal forces decreasing in a duplicate ratio[65] of the distances from the points; I say, that a corpuscle placed within the sphere is attracted by a force proportional to its distance from the center.

This Theorem is telling that for a test particle located within a sphere, inverse square distance with center law vanishes and instead, inverse distance with center (linear) law prevails. The following diagram explains the meaning and implications of this Theorem.



This Theorem also explains that if test particle is located at a particular depth within the sphere, the repercussion will be that the complete upper portion layer of the sphere will have no gravitational effect at all. Thus we see that for a test particle, movement from surface to the center of the sphere, the total mass will keep reducing in a linear mode such that the effect of gravity will reduce to zero at the point of center i.e. movement from surface to center will cause reduction of gravitating mass in a linear mode. At the same time, same movement from surface to center will cause linear increase of gravitational effects of inner available (though reduced) mass i.e. mass of only the inner layers is exerting total gravity from the center and that total gravity effect (of reducing available mass) is linearly increasing because distance from center is reducing and the result will be that any depth will be subject to almost same gravity that was available at the outer surface. The overall effect will be that at every point, orbiting will be subject to almost same orbital velocity i.e. neither there will be Keplerian drop-off from center towards surface nor there will be Keplerian increase in the orbital velocity at points closer to the center. In our Solar System, orbital velocity of Mercury is far greater than that of Pluto. It is so because more than 99% of the mass of Solar system is located at the central point. In case our Solar System disk had uniform distribution of mass, then Mercury and Pluto would be having almost identical orbital velocity. Mercury would have been subjected to very low gravity and thus despite being close to the central point, it's orbital velocity would be almost as slow as that of Pluto. Therefore, rather than the case of the absence of Keplerian drop-off, in the galaxies, actually we are noticing the absence of Keplerian increase in orbital velocity near the center. Moreover, it is not the case of increase in mass as we move from center to the edges of the galactic disk, as we noted in a previous section and we copy here also:

> Roberts and Whitehurst (1975) noted another very important point which was the indication that the mass in the outer regions of Andromeda galaxy 'increased' with galactocentric distance, even though the optical luminosity of M31 did not

Because now we are discerning that rather than the case of 'increase' in 'mass' in the outer regions of the galaxy, more appropriately it is the case of 'decrease' in 'gravitational mass' (i.e. mass having positive gravitational effect) towards the central regions of the

galaxy. At the same time, it is also equally correct that mass of outer regions 'increases' with galactocentric distance. Because if 'gravitational mass' is decreasing from surface to center then it equally means that 'gravitational mass' is increasing from center to surface. But more appropriate, as we noted earlier, is the case of 'decrease' in 'gravitational mass' in the central regions of the galaxy because the actual galaxies near to central regions depict lowest point of rotational curve of velocity.

II.II.III. Implications of Theorem XXXIII are officially recognized but somehow they were not incorporated within the study of Galactic Rotations

Official science accepts that within a sphere, the gravity is subject to inverse distance from center law and that the fact of vanishing of the inverse square distance law within the sphere is not disputed. Wikipedia's article titled "Shell Theorem"[66] states following:

> Isaac Newton proved the shell theorem[1] and stated that:
>
> A spherically symmetric body affects external objects gravitationally as though all of its mass were concentrated at a point at its centre.
>
> If the body is a spherically symmetric shell (i.e., a hollow ball), no net gravitational force is exerted by the shell on any object inside, regardless of the object's location within the shell.
>
> A corollary is that inside a solid sphere of constant density, the gravitational force within the object varies linearly with distance from the center, becoming zero by symmetry at the center of mass.

Following stackexchange.com page[67] explains some relevant points about effects of gravity within Earth:

> Assuming spherically symmetric mass distribution within Earth, one can compute gravitational field inside the planet using Gauss' law for gravity. One consequence of the law is that while computing the gravitational field at a distance $r < R$ (with R being the radius of the Earth), one can ignore all the mass outside the radius r from the center

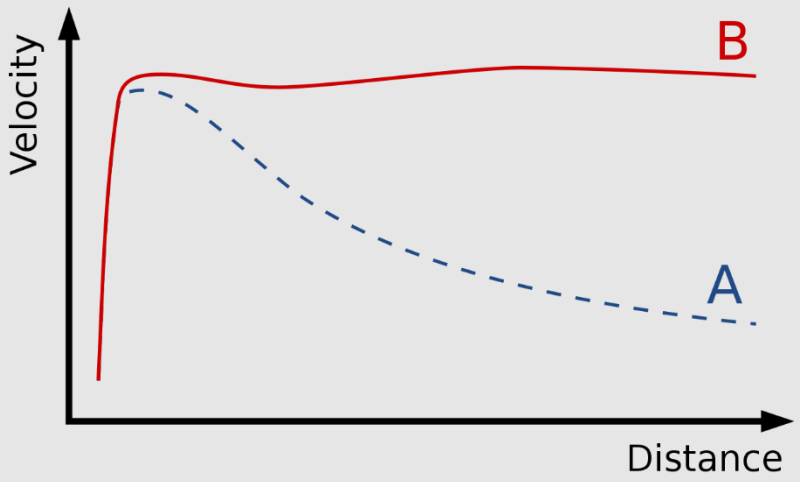
Actually Gauss' law of gravity is essentially equivalent to Newton's theory and we have already seen that Newton's Theorem XXXIII also had explained that at a depth r, the mass above r is to be ignored as it will have no gravitational effect.

The above-referred stackexchange.com page also refers to a graph taken from Wikipedia[68] which is clearly showing that from the surface of Earth towards center, for the case of constant density, the gravity drops linearly and becomes zero at the central point.

Thus replacement of square distance law with linear distance law and the reduction of gravitational mass as one goes deeper inside the sphere are officially accepted stances. Official theory also accepts that galactic disk is spherically symmetric thus Shell Theorem is applicable to the disk. However, somehow, during the study of galactic rotations, official theory never realized that rotation of galactic disk is in fact the rotation of stars within disk and that the applicable Theorem was XXXIII according to which galactic disk should have depicted flat rotation curves and thus no discrepancy with the theory would have surfaced. Not only that there would have been no need of dark matter, the velocity meaning of redshift also might have been discarded by now due to the failure of having found out such huge quantities of normal kind of dark matter that was pointed out by Fritz Zwicky out of the study of Coma Cluster.

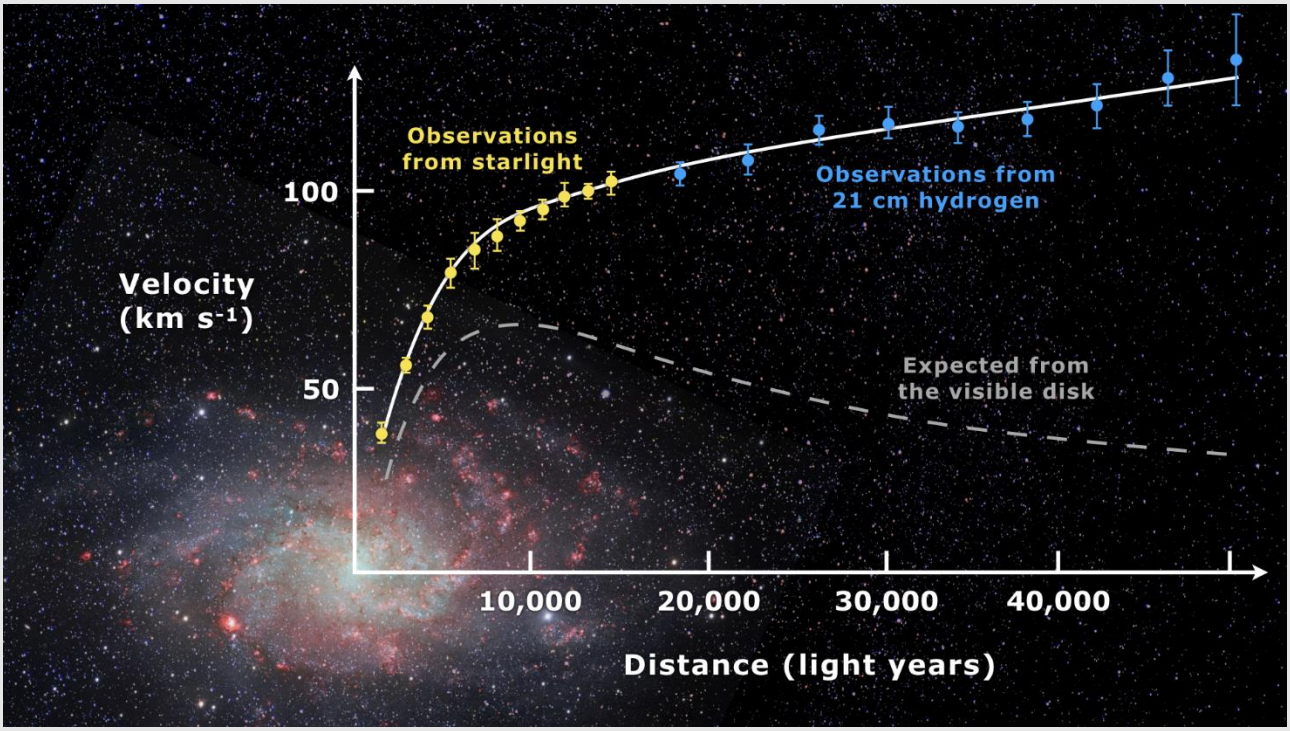
II.II.IV. Flat Rotation Curves of Galaxies – Proper Interpretation

After having seen that galactic rotations should have been described in the light of Theorem XXXIII of Newton's Principia Mathematica, let us therefore try to do it now.



Expected (A) and observed (B) star velocities as a function of distance from the galactic center. (Credit: Wikimedia: Commons)

The prerequisite here is that we must completely forget the so-called 'Expected' line (A) because within the right context of Theorem XXXIII, we simply do not expect line (A). Line (B) is the actually observed line and the same is anticipated by applying Theorem XXXIII. Regardless of what official theory tells us about the existence of super massive black hole at the center of galaxy, this graph is actually telling that closer to the center, orbital speed is lowest. Within a disk of uniform density of mass, we should expect zero orbital velocity at the center of the disk. The lowest orbital velocity at point close to the center is consistent with this theory which means that law of inside of sphere (or disk) is being demonstrated. Non-zero but lowest orbital velocity near the center of disk may or may not indicate the presence of super massive black hole at the center. Afterwards, over a very short distance, there is substantial increase in the orbital velocity as the velocity curve moves up quite sharply. Our interpretation is that this area is the central bulge of the galactic disk and over this short distance, actual mass is substantially increasing layer upon layer such that density of each layer almost remains the same. Following actual graph confirms the idea that area of sudden increase of orbital velocity approximately relates to central bulge of the galaxy M33.



M-33 Galaxy Rotation Curve, Credit: Wikimedia Common – Source link[69]

M33 is not very large galaxy as the diameter of galactic disk is only about 60000 light years. We see (or assume) in this picture that radius of the central bulge of the disk spans about 5000 light years and within this distance of 5000 light years, there is sharp jump in the velocity curve. This actual graph is showing gradual upward movement of velocity curve even beyond this point but for the sake of simplicity, we shall assume that after this point, velocity curve becomes flat.

Basically there are two distinct portions of the Rotation Curve of Galaxy. Up to the distance from center towards the edge of the central bulge, there is sharp increase in orbital velocity of stars within disk. The lowest orbital speed is found in the area closer to the center of the disk. It means that area close to the center is subject to lowest gravity and this thing is in harmony with the Shell Theorem as applicable within the sphere (or disk). In the example of galaxy M33, we see that radius of central bulge is almost 5000 light years. For the sake of our analysis regarding why orbital velocity is increasing very sharply over this distance, we suppose that there are 5 layers within the radius of central bulge and the width of each layer is 1000 light years. Our interpretation will not depend on the existence or absence of super massive black hole at the center of galactic disk. So the

interpretation goes that for the five layers of central bulge, a huge quantity of mass, let's say 1 billion solar masses, is concentrated in the innermost layer that may or may not include super massive black hole. The second layer is orbiting around inner most layer with the lowest velocity. The second layer has same width of 1000 light years but due to being outer layer of the circle, the area is far greater than the innermost layer. The second layer has almost equal density of mass which means that total mass of the second layer may be around, let's say, 8 billion solar masses i.e. just approximate number only to explain the point.

Now the third layer is orbiting a total mass of 9 billion solar masses. Therefore, within the third layer, orbital velocity has increased quite sharply. Width of third layer is also same 1000 light years but area is still far larger than that of second layer. And again, the density of mass remains the same and thus total mass of this layer may be let's say 16 billion solar masses.

Now this setup repeats up to the fifth layer which is subject to the highest orbital velocity of stars within the disk so far and also marks the boundary of the central bulge of the galactic disk. The central bulge area is therefore the first portion of the Rotation Curve of Galaxies. The important thing of the first portion is that mass is considerably increasing layer upon layer and reaches to, let's say, 32 billion solar masses for the fifth and outermost layer of the first portion.

The central bulge area was characterized by layer upon layer successive and substantial increase in mass such that overall density of the bulge remained uniform. The outermost layer of the central bulge contains greatest quantity of mass so far which is 32 billion solar masses (i.e. approximate number just to explain the point). Next to the central bulge area, the second 'flat' portion of the Rotation Curve of Galaxies begins.

If the radius of M33 galaxy is 30000 light years wide then this second portion starts from 5000 light years from center of the disk and ends at 30000 light years from the center of the disk. For the sake of simplicity, here again, we divide this second portion into 25 layers each having width of 1000 light years.

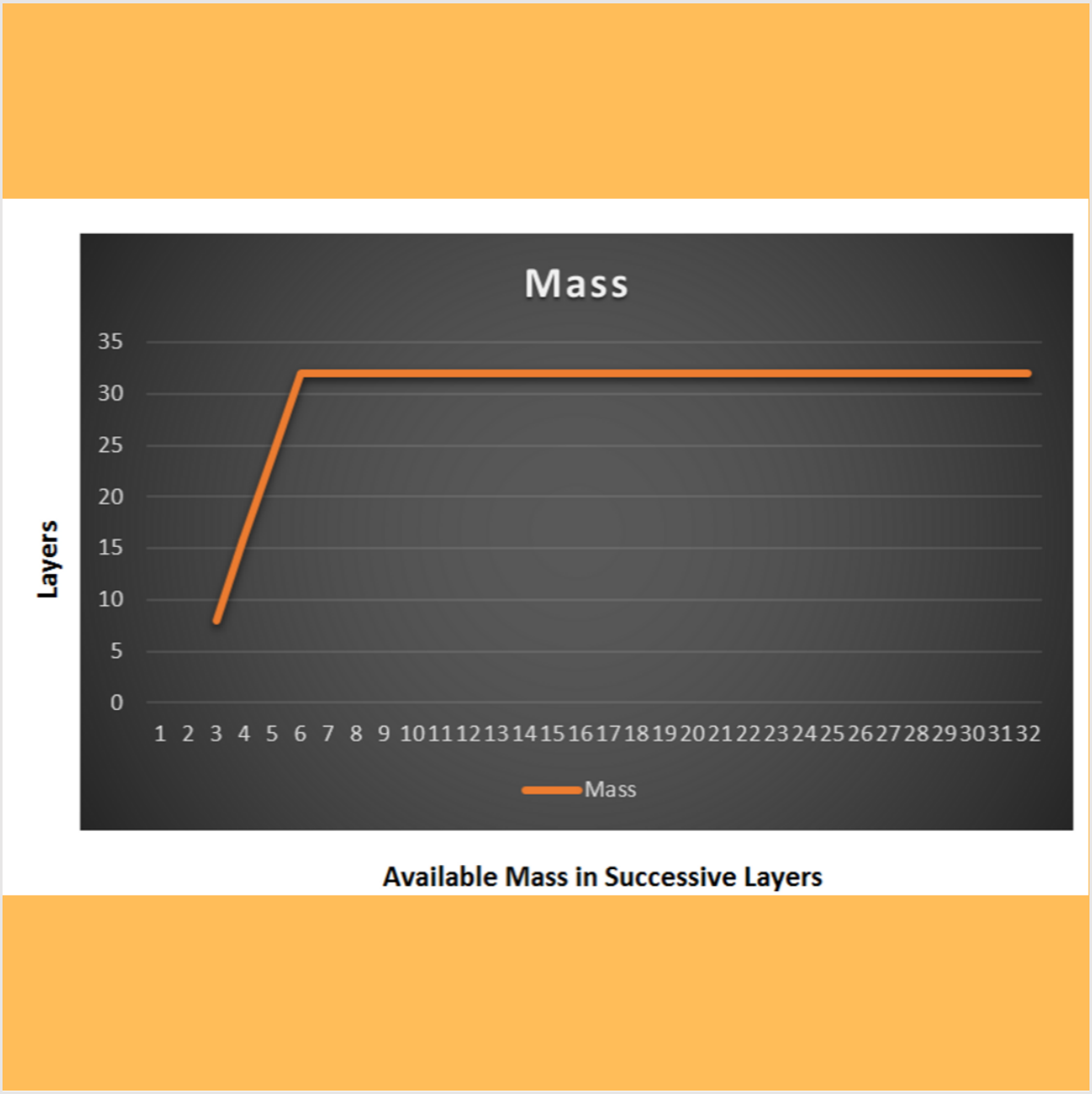
We know that outer layer of central bulge had mass of 32 billion solar masses. Now we interpret the start of flat curve portion by saying that inner layer of this portion contains almost same mass i.e. 32 billion solar masses. In this way, the innermost layer of the second portion is having same mass as the outer layer of the central bulge had. However due to larger area, the density and luminosity (per unit area) of this layer is lower than that of central bulge. Due to the fact that previous layer i.e. the outer layer of the central bulge had the greatest mass, our present layer i.e. the inner layer of outer area has the greatest orbital velocity and the rotation curve moves still higher. Therefore, flat portion of curve has not actually started yet.

Now comes the second layer of the outer portion of galactic disk. Again mass will remain the same i.e. 32 billion solar masses and due to larger area, there will be slight reduction in the density and luminosity (per unit area) across this layer. Because previous layer had augmented a constant mass, therefore, keeping in view the applicable inverse distance law of gravity, orbital velocity curve will remain horizontally flat across the current layer.

If this pattern repeats up till 25th outermost layer, each successive layer will get equal quantity of mass however slightly lesser and lesser density and (per unit area) luminosity will be added and the overall galactic rotation, keeping in view the simplified assumptions, should show up as a flat curve on graph. It is possible that same pattern of successive layers, up to few more, may continue even after 25th layer but that outer portion of galaxy may remain invisible or normally undetectable due to low density and (per unit area) luminosity over there.

An important thing to be noticed is that let's say when an object moves from 10th layer to 11th one, the object will be subject to gravity of the mass available in all the inner layers including central bulge and up to 10th layer (or even 11th layer). Objects placed in 11th layer will not be subject to gravitational effects of still outer layers i.e. 12th and rest of the outer layers because according to Theorem XXXIII, an object placed at certain depth within sphere (or disk) will not be affected by the gravity of outer surface area. With this setup, availability of constant mass in each successive outer layer will give the result of flat rotation curve because law of inverse square distance is also replaced with the law of linear inverse distance within the sphere (or disk).

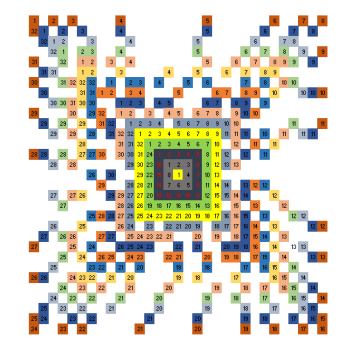
The following is the graph of mass available in successive layers and it is similar to the rotation curve graph of galaxies.



The above scheme of the things is actually based on oversimplified assumption of two dimensional setup of mass. In reality, galactic disk has thickness that is usually more or less or almost 1000 light years. Thus within central bulge, in reality, there should be far greater increment of available mass than by the factor of just 8 which is being presented in this 2D scheme. Moreover, onward from central bulge, the quantity of mass may get

slightly increased layer upon layer i.e. only as much that density of the layer should remain lower than that of previous layer and the net effect may be slightly upward velocity curve which is the case we have seen in the diagram of M33.

However, for the purpose of our analysis, we carry on with the simplistic two dimensional assumption and constant increase of mass for area onward from the central bulge. Following schematic diagram with inner five layers of central bulge with uniform density and outer (only) eleven layers each having mass equal to the outermost layer of central bulge shows that such a structure not only explains the observed flat rotation curves of galaxies, it also develops the spiral structure of galaxies.



Blocks placed in successive layers

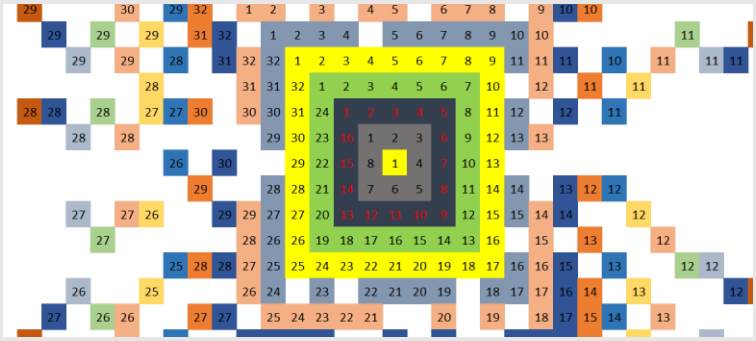
The above diagram is made up of equal size squares or blocks. The central yellow mark is the innermost layer of the central bulge and the other prominent yellow square is the outermost layer of the central bulge such that this layer consists of 32 small blocks which means that outer layer of the central bulge is 32 times massive than the innermost layer. Following is close up view of above diagram up to only the fifth layer and covers the complete central bulge area.

1	2	3	4	5	6	7	8	9
32	1	2	3	4	5	6	7	10
31	24	1	2	3	4	5	8	11
30	23	16	1	2	3	6	9	12
29	22	15	8	1	4	7	10	13
28	21	14	7	6	5	8	11	14
27	20	13	12	11	10	9	12	15
26	19	18	17	16	15	14	13	16
25	24	23	22	21	20	19	18	17

Blocks placed in successive layers – Bulge area close up. Outermost layer is 32 times massive than central layer.

In this schematic diagram, each small square represents equal quantity of mass let's say 1 billion solar masses. If there is mass of 1 billion solar masses in the innermost layer, then second layer contains 8 billion solar masses and overall density remains the same. The fifth layer is the outermost layer of the central bulge.

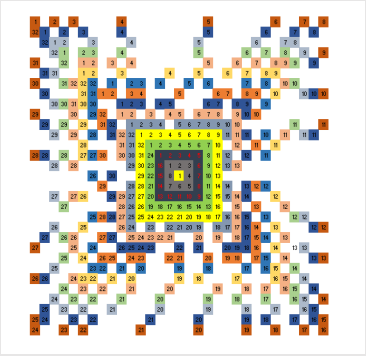
Following close up shows what would eventually look like spiral structure from a far-view:



Blocks placed in successive layers – Outside of Bulge area close up

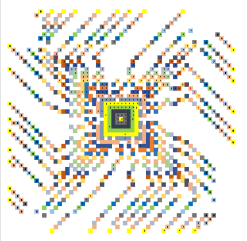
Here we see that outer layer of central bulge had mass of 32 billion solar masses whereas the total mass of the central bulge was (1+8+16+24+32) = 81 billion solar masses.

Next to the yellow layer starts the second portion of galaxy whose just eleven layers are shown in the image that starts looking like a spiral galaxy. In this portion, each layer contains 32 billion solar masses. While density remained uniform throughout the central bulge but beyond the central bulge, now mass is constant per layer and density per layer is getting reduced layer upon layer. A random placement of 32 blocks in each successive layer would give the overall shape of a spiral structure.



Blocks placed in successive layers – total 11 layers after Central Bulge

Note that this schematic diagram is based on square blocks and yet the basic shape of spiral has been achieved. Here, equal number of blocks have been randomly placed in each successive layer of the second portion of galaxy which is outside of the central bulge and the result is a crude or basic shape of galaxy. In a real galaxy, matter is not randomly arranged as the actual shape is determined by the overall scheme of the larger structure as well as quantity and placement of nearby mass or the availability of local structures. After eleventh layer, if we add next layers up to 25th layer by placing the blocks in accordance with the already emerging shape, the following final shape is achieved.



Blocks placed in successive layers – total 25 layers after Central Bulge

The real galaxies are often arranged in spiral shapes such as following.

Pinwheel Galaxy. Image also displayed in cover of this book. Image Credit: NASA/ESA

In real galaxy, there is no empty space between spiral arms. But it does not mean that Spirals are merely illusions. In the schematic diagram, one billion solar masses was represented by just one square box. But in a real galaxy, mass of one billion solar masses is spread out in the form of fog of stars. Secondly, one box actually represents the compacted mass of central bulge area. For the outward area, mass should remain the same layer upon layer but one billion solar masses, being non-compact area, actually takes space of more than one box and this would be the reason why in-between spiral arms areas are not empty for the real galaxies. The in-between spaces of spiral arms are not empty or devoid of matter but however spiral arms are the places where greater mass is concentrated and thus spiral arms are real (i.e. not illusion) and assume their shape due to slightly greater mass but overall reduced density of the successive outer layers of galaxy. Within an actual galaxy, each successive layer may get more than slightly greater mass which seems to be the case with M33 galaxy where flat rotation curve is actually a slightly upward curve. It is also possible that in any galaxy, each successive layer may get slightly reduced mass than the previous layer and dark matter regime 'scientists' may identify such a galaxy as 'dark matter free' galaxy. Scientists do have identified two such galaxies so far but firstly they have not measured the rotation speed of stars within galaxies rather they have taken the velocity dispersions of globular clusters around them therefore inside of sphere or disk rule does not apply. Secondly, they also assert that these are not the confirmed cases of dark matter free galaxies as with 'latest' observations, they have considerably reduced the distance of those galaxies[70] and have started saying that these are not dark matter free galaxies. Therefore it seems appropriate to not discuss this issue here at length.

As for as mainstream Astrophysics goes, standard interpretation accepts that there seems to be increase of available mass as one moves from inner parts of galaxy towards the outer ones. But within the standard interpretation, the total mass of galaxy is theorized to be concentrated at the center and test particles (stars) are orbiting around the center. Test particles are facing full gravity subject to inverse square distance law while the source of gravity is the central point of galaxy and there is no distinction between inner or outer layers and also it is not deliberated that mass belonging to outer layers has no actual gravitational bearing on this setup and thus, due to non-consideration of important factors,

Keplerian drop-off is expected for this system. But since actually observed rotation curve is flat therefore they theorize (or hypothesize) that extra mass, over and above the total mass of galaxy is increasing with increase of distance from the center and to this supposed extra mass they assign the name 'Dark Matter'.

II.II.V. Case of Dwarf Galaxies

According to the standard interpretations, observations have shown that dwarf galaxies are rich in dark matter. To the question, "Why are dwarf galaxies dark matter rich?"[71] Mr. Stephen Perrenod[72], PhD Astronomy from Harvard, provided the following answer:

> Dwarf galaxies are more representative of the first, smaller galaxies to form, as large galaxies represent those that cannibalized their neighbors (other dwarf galaxies) most effectively. Galaxies formed initially as concentrations of dark matter since dark matter is 5 times more abundant by mass, and they also pulled in some ordinary matter.
>
> The first stars formed in dwarf galaxies tended to be quite massive, evolve very rapidly and go supernova, throwing off lots of material (ordinary matter) into the intragalactic media at high speeds. Some of this would have cooled down and remained in the dwarf galaxy, however...
>
> Since the dwarf galaxies have weaker gravitational fields, it was easier for much of that matter to escape the galaxies in question and such ordinary matter might still be in intergalactic space, or have been pulled into a larger galaxy.
>
> This meant that dwarf galaxies have been less efficient at holding onto intragalactic gas that can be used for formation of subsequent generations of stars, and that helps to explain their low luminosities.
>
> There may be additional reasons, but this is one generally favored scenario, a lot of research is going into detecting more dwarf galaxies and modeling their evolution.

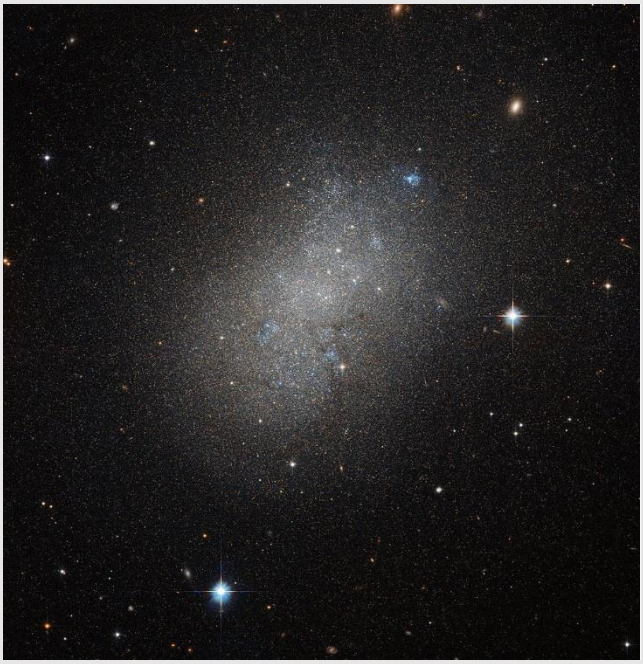
Mr. Stephen Perrenod is a stanch supporter of the standard Lambda CDM model. We see that standard interpretations are based on false confidence that birth as well as conditions, shape, form and state of evolution of the early Universe are exactly known. They know such astounding things as initially galaxies formed around clumps or concentrations of dark matter and those early galaxies were dwarf galaxies which later on merged to form

larger galaxies. The standard interpretations, we see, are coming from outside of the world. In the real world, the existence of dark matter is not even confirmed; there is no proof of dark matter in large galaxies and richness of dark matter in dwarf galaxies is also like a conceptual illusion. We have seen that within central bulge area of large galaxies, there are sharp upward rotation curves. Therefore, based on sharp upward rotation curves, within standard interpretations, there should be high concentration of dark matter within central bulge areas of larger galaxies as well. In other words, central bulge areas of large spiral galaxies should be rich in dark matter. Simple fact however is, that there is just layer upon layer substantial increase in available mass such that overall density across the whole area of the central bulge remains the same.

Actually almost same is the case with dwarf galaxies. Some of the dwarf galaxies seem like remnants of large galaxies where spiral arm area seem to have been disbursed due to greater gravitational influence by nearby large galaxy which appear to be the case with Large Magellanic Cloud. For the case of some other dwarf galaxies, it appears that only central bulge area was formed that was not powerful enough to attract outer spiral layers of stars or star forming gas which is likely the case with Small Magellanic Cloud.

Large and Small Magellanic Clouds over Paranal Observatory. Image Credit: ESO[73]

Following further examples show that dwarf galaxies usually only lack high luminosity and great density however they are similar in structure and overall uniformity in density with central bulge areas of the large spiral galaxies.



NGC 5264 – dwarf galaxy. Image Credit: NASA/ESA

A dwarf galaxy. Image Credit: NASA/ESA

The typical structure of dwarf galaxies is only telling that mass is considerably increasing for the outer layers but not increasing as much to give perfect uniform density and luminosity for the whole of the structure. This structure will give slightly less sharp upward rotation curve than the central bulge areas of large spiral galaxies and thus for the standard model supporters, it will be the case of greater quantity of dark matter.

II.II.VI. Is Dark Matter the failure of Theory?

We conclude that Newton's Theory, subject to correct application, would have rightly described the rotation pattern of galaxies. Accurate theory already existed but problem of rotation curves of galaxies was never interpreted in the light of relevant part of the available theory. By 1920, when on the basis of famous 1919 solar eclipse experiment,

Arthur Eddington and co-authors wrote in their paper that Einstein's General Theory of Relativity was found superior theory of gravity to Newton's theory, at that point in time, Relativity Theory did not even have Shell Theorem. Relativistic Shell Theorem was presented in year 1923 or as early as 1921[74]. Yes – it should mean that relativistic shell theorem was available at the time when scientists were dealing with the problem of dark matter. But it seems like the Birkhoff's Theorem i.e. the Relativistic Shell Theorem does not consider the specific case of gravity field experienced by a test particle which is placed inside a sphere having uniform density which mean that till date relativistic counterpart of Newton's Theorem XXXIII does not exist. But overall implication of this Birkhoff's Theorem is that general relativity reduces to Newtonian gravitation in the Newtonian limit[75].

The problem of rotation curves was within the Newtonian limit and the theory to be applied was Newton's Theory thus we can accept that, in principle, theory was complete; rotation patterns could have been rightfully interpreted without invoking the need of dark matter. But – it did not happen; rotation curves were not rightfully interpreted. Theoretical Physicists did apply Newton's theory but missed an important aspect i.e. Theorem XXXIII of the theory. Instead, they applied irrelevant Theorem XXXI. The wrong application of theory was dubbed as incredible discovery of 'dark matter' which was basically a ghost object; an unprovable hypothesis that was also found out to be seemingly supportive of few other unprovable conjectures relating to the Big Bang Cosmology and credit of those farfetched findings was assigned to the 'more accurate' theory of General Relativity. In this way, Theoretical Physicists extended the wrong application of (Newton's) simple theory to their so-called 'precise' theory (GR) without realizing that they merely interpolated the results of incorrect application of simple theory to their 'precise' theory and this thing casts serious doubt on their claim that they do understand their counterintuitive theories.

Dark Matter was thus not the failure of theory. Precisely, it was the failure of correct application of the theory whereas the theory itself was capable for the task. What happened was like that while first time noting the rotational pattern of galaxies, scientists were naturally anticipating Keplerian drop-off in the rotation curves because by that time, it was the only observed pattern. But deviation of actual finding from the expectations did not spark the willingness to review the dynamical considerations even though Babcock (1939)

had pointed out the need for the same. Scientists focused their attention towards getting better accuracy of observed data regarding rotation of galaxies but no one questioned in official papers concerning why Keplarian drop-off should be expected at all when galaxy is a whole different structure than solar system. Experimental Scientists were doing their job well as their task was really to gather correct observational data. But Theoretical Physicists were not using their commonsense because commonsense is a despised thing which they officially do not use. At least they should have seriously reviewed the relevancy of Keplerian drop-off for the dynamics of the galaxy.

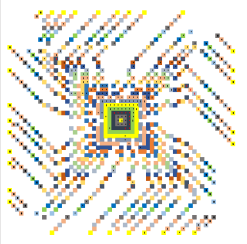
Experimental scientists were doing their job well and they were presenting their findings along with judgments regarding what they had observed. In 1939, Horace Babcock reported in his PhD thesis that measurements of the rotation curve for Andromeda suggested that the mass-to-luminosity ratio increased radially[76]. Yes – it was accurate judgment because at least gravitational mass does increase radially in terms of Theorem XXXIII. Babcock was accurate also because he pointed out that new dynamical considerations were required; a right proposal that was not taken seriously. Off course, whole new theory was not required; only requisite thing was to get rid of the Keplerial drop-off anticipations and to reach to the relevant Theorem XXXIII of the already available theory. Likewise, following quote out of Wikipedia article titled "Galaxy Rotation Curve"[77] also informs that MS Vera Rubin (1970) not only reported her observations but also came up with accurate judgment that observations had the implication that galaxy masses grow approximately linearly with radius well beyond the location of most of the stars.

> In the late 1960s and early 1970s, Vera Rubin, an astronomer at the Department of Terrestrial Magnetism at the Carnegie Institution of Washington, worked with a new sensitive spectrograph that could measure the velocity curve of edge-on spiral galaxies to a greater degree of accuracy than had ever before been achieved.[13] Together with fellow staff-member Kent Ford, Rubin announced at a 1975 meeting of the American Astronomical Society the discovery that most stars in spiral galaxies orbit at roughly the same speed,[14]and that this implied that galaxy masses grow approximately linearly with radius well beyond the location of most of the stars (the galactic bulge). Rubin presented her results in an influential paper in 1980.[15] These results suggested that either Newtonian gravity does not apply universally or that, conservatively, upwards of 50% of the mass of galaxies was contained in the relatively dark galactic halo. Although initially met with skepticism, Rubin's results have been confirmed over the subsequent decades.[16]

Here we note that MS Vera Rubin said in year 1970 that galaxy masses grow approximately linearly with radius well beyond the location of most of the stars.

We know that according to Theorem XXXIII, a test particle placed at a particular depth within a sphere of uniform density will not be gravitationally affected by the outer layers of the sphere (or disk). It means that 'gravitational mass' of outer layers can be regarded as non-existent. Now suppose that test particle was placed at the edge of the galactic bulge and then starts moving towards outer area of the disk. This movement towards outer surface will cause regular 'growth' in the gravitational mass which according to MS Rubin, will be approximately linear with increase in radius. And yes, MS Rubin was talking about regular linear growth in mass over and above the total luminous mass that, for the purpose of determining the influence of gravity, was already theorized to be located at center. Theorem XXXIII, on the other hand, have the implication of regular linear growth in gravitational mass such that at every depth, the available (gravitational) mass is exerting full gravity from the center. This gravitational mass is not over and above the luminous (observable) mass. One thing Experimental Scientists missed was that they only radially determined the luminosity of disk. Yes radially the luminosity decreases over large distances but great distance with low (per unit distance) luminosity when projected in complete circumference of the outer belt, band or layer then 'total' luminosity also should remain the same layer upon layer just like total mass also remains the same layer upon layer. For example, Roberts and Whitehurst (1975)[78] also concluded the same that mass increases linearly towards the outer edge of the M31 galaxy. They had studied southern end of M31 and observed rotation and luminosity, off course, relating to only that southern end and observed, for that part of the galaxy, that luminosity decreases with no decrease of rotational velocity. The Astrophysical Journal (Aug:2011) has published a paper titled "The Luminosity Profile and Structural Parameters of The Andromeda Galaxy"[79]. This paper presents bell shaped graphs of luminosity of Andromeda as recorded along major and minor axis of the disk. Thus luminosity is decreasing only along the line of diameter and so far there is no realization that total luminosity of the outer bands or layers should be almost equal to total luminosity of inner bands or layers. Therefore, there may actually be no increase of mass to luminosity ratio taking place for the outer parts of galactic disks.

Now we can recall our schematic diagram where mass increased linearly with radius well beyond the central bulge.



Outer edge of central bulge have 32 square boxes (representing mass). Each succeeding outer layer also has 32 boxes which means that mass is increasing linearly with radius i.e. exact wording of MS Vera Rubin.

This schematic diagram is based on idea that in accordance with Theorem XXXIII, after central bulge, mass should linearly increase so as to give flat rotation curve like graph. The outer layer of the central bulge consists of 32 equal size boxes. Now onward mass should increase linearly therefore each succeeding layer also consists of exact 32 boxes. By random placement of boxes in succeeding outer layers up to 11^{th} layer (after bulge), the basic shape of spiral started to emerge. Rest of the layers, up to 25^{th}, were arranged by placing the boxes in accordance with already emerging shape of spiral.

Here basic spiral shape was achieved but actual spirals of real galaxies are denser and in-between spiral areas are also not empty. Therefore, in real galaxies, mass increases more than linearly and 'flat rotation curves' may actually be slightly upward curves throughout most of the disk as we see in the case of M33 which seems to be usual case and these curves are accomplished due to offsetting caused by the inverse distance (from center) law of gravity as applicable within the sphere (or disk). The galaxy rotation is actually an excellent confirmation of the astonishing accuracy of Newton's Theory. Here we are dealing with the inside of sphere or disk scenario and if we wrongfully consider inverse square distance law, we shall get Keplerian drop-off even though gravitational mass grows linearly. The flat or slightly higher rotation curves and usual spiral structures of galaxies are in great harmony with Theorem XXXIII of Newton's Principia.

'Dark Matter' is thus not the failure of the Theory but can be regarded as failure of counterintuitive regime. It is failure of overrated understanding level of the theory and it is the failure of the idea that counterintuitive ideas are correct and are actually understood

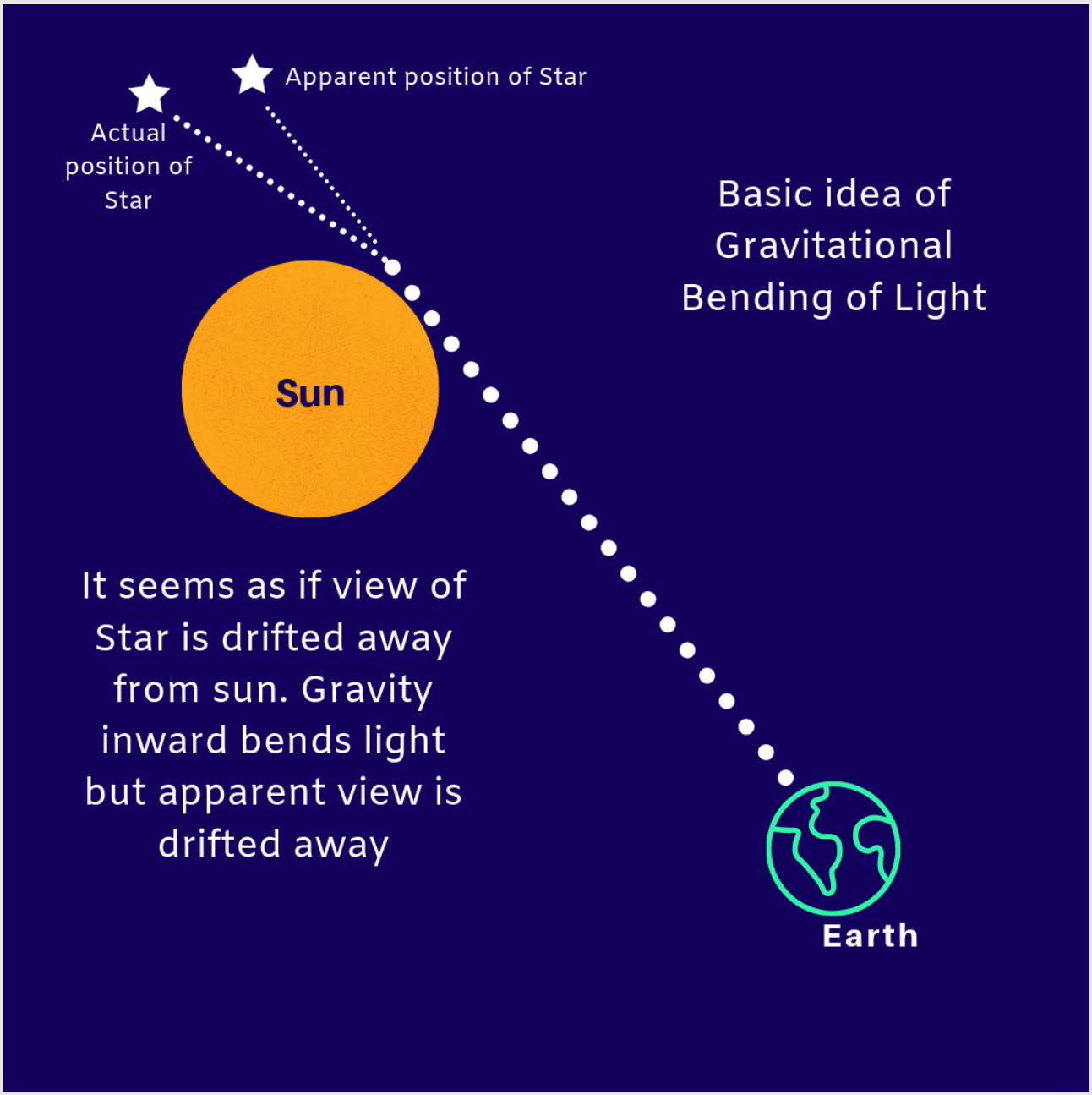
when they, intrinsically being ‘counterintuitive’ were not actually comprehensible. Failure was in the unscientific method that assigns reality status to ghost objects. For example, following paragraph from Wikipedia article titled ‘Dark Matter’ shows that they do not treat this ghost object just as a placeholder only to denote a shortage of proper explanation but they take it for a real object that cannot be traced in the real world:

> **Dark matter** is a form of matter thought to account for approximately 85% of the matter in the universe and about a quarter of its total energy density. The majority of dark matter is thought to be non-baryonic in nature, possibly being composed of some as-yet undiscovered subatomic particles.[a] Its presence is implied in a variety of astrophysical observations, including gravitational effects which cannot be explained by accepted theories of gravity unless more matter is present than can be seen. For this reason, most experts think dark matter to be abundant in the universe and to have had a strong influence on its structure and evolution. Dark matter is called dark because it does not appear to interact with observable electromagnetic radiation, such as light, and is thus invisible to the entire electromagnetic spectrum, making it undetectable using existing astronomical instruments.[1]

II.III. Gravitational Lensing as ‘Proof’ of Dark Matter

II.III.I Background – Gravitational Bending of Light

Gravitational lensing is a particular kind, form or variation of a basic phenomenon which is Gravitational Bending of Light, therefore, let us first go through the principal concept of Gravitational Bending of Light.



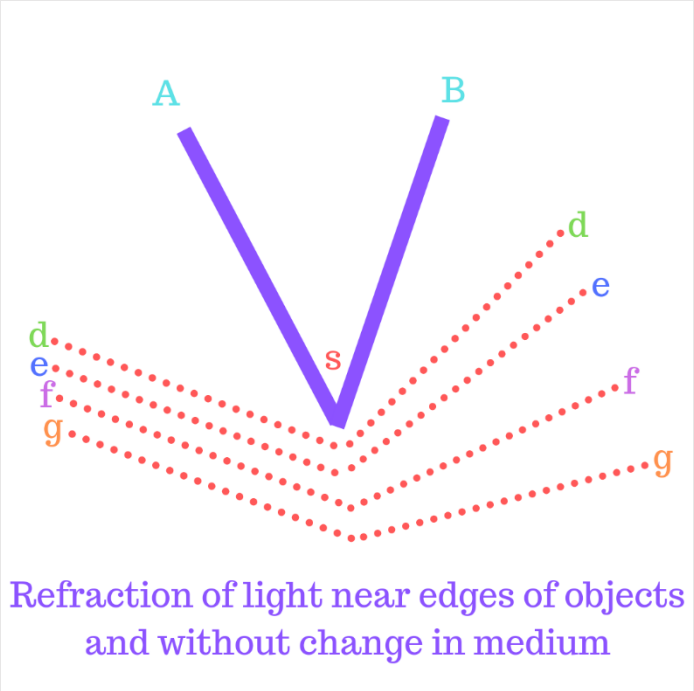
Bending of light by gravity. Official type depiction.

Here let us accept the idea at face value that gravity deflects light by certain angle as depicted in above diagram. Official sources inform us that gravitational bending of light was acknowledged by the Newton's theory but Einstein's General Relativity Theory predicted the better or correct angle of deflection that was almost double to what could be premeditated using Newton's theory. The experiment conducted during 1919 solar eclipse confirmed that angle of deflection as predicted by the General Relativity was accurate and

that's why (along with another reason relating to the orbit of mercury) General Relativity Theory was declared to be superior to the Newton's Theory.

Here I only want to add a side note that although Newton's Theory had not ruled out the gravitational bending effect of light, nevertheless, it has to say yet another important thing about refraction of light near edges of bodies that functions as if light is being 'attracted' by those bodies. Principia Mathematica – English Translation (2007) narrates following about this type of refraction on page number 246:

> "… . These attractions bear a great resemblance to the reflexions and refractions of light made in a given ratio of the secants, as was discovered by Snellius; and consequently in a given ratio of the sines, as was exhibited by Descartes. For it is now certain from the phenomena of Jupiter's satellites, confirmed by the observations of different astronomers, that light is propagated in succession, and requires about seven or eight minutes to travel from the sun to the earth. Moreover, the rays of light that are in our air (as lately was discovered by Grimaldus, by the admission of light into a dark room through a small hole, which I have also tried) in their passage near the angles of bodies, whether transparent or opaque (such as the circular and rectangular edges of gold, silver, and brass coins, or of knives, or broken pieces of stone or glass), are bent or inflected round those bodies as if they were attracted to them; and those rays which in their passage come nearest to the bodies are the most inflected, as if they were more attracted; which thing I myself have also carefully observed. And those which pass at greater distances are less inflected; and those at still greater distances are a little inflected the contrary way, and form three fringes of colors. In the figure, s represents the edge of a knife, or any kind of wedge AsB[80]; and gg, ff, ee, dd are rays inflected towards the knife; inflection is greater or less according to their distance from knife.



Refraction of light near edges of objects and without change in medium

> Now since this inflection of the rays is performed in the air without the knife, it follows that the rays which fall upon the knife are first inflected in the air before they touch the knife. And the case is the same of the rays falling upon glass. The refraction, therefore, is made not in the point of incidence, but gradually, by a continual inflection of the rays; which is done partly in the air before they touch the glass, partly (if I mistake not) within the glass, after they have entered it. Therefore because of the analogy there is between the propagation of the rays of light and the motion of bodies……."

Thus Newton informs us about a form of refraction of light that was experimented by himself and that this type of refraction takes place near edges of objects and occurs without change in the medium of light. The purpose of mentioning this type of refraction was to highlight that 1919 solar eclipse experiment had not ruled out this type of refraction. The 1919 experiment was reported by Arthur Eddington and co-authors vide a 1920 paper titled "A Determination of the Deflection of Light by the Sun's Gravitational Field, from Observations Made at the Total Eclipse of May 29, 1919". The ruling out of refraction of light due to corona of sun has been discussed at page 2 and 3 in the following words:

> "It seems clear that the effect here found must be attributed to the sun's gravitational field and not, for example, to refraction by coronal matter. In order to produce the observed effect by refraction, the sun must be surrounded by

> material of refractive index 1 + .00000414/r, where r is the distance from the center in terms of the sun's radius. At a height of one radius above the surface the necessary refractive index 1.00000212 corresponds to that of air at $1/140$ atmosphere, hydrogen at $1/60$ atmosphere, or helium at $1/20$ atmospheric pressure. Clearly a density of this order is out of the question."

This paper has nothing more to say on the issue of refraction. Clearly, all the forms of refraction were not ruled out by this experiment. Here, we take another side note that 1919 gravitational bending was also a form of gravitational lensing but this experiment was 'tallied' with the calculations and no question about extra mass (dark matter) was surfaced at that time. Experts can easily justify this thing by saying that dark matter is spread out across very large area and thus within the area of solar vicinity there was only negligible dark matter. Thus according to them the question of dark matter would arise only for large scale settings where light of whole galaxies is bent through the intervening large galaxy or cluster of galaxies. Therefore, now we see the case of gravitational lensing.

II.III.II Gravitational Lensing and how it is linked with the issue of dark matter

Admittedly I had hard time in the struggle to rationalize what gravitational lensing is and I genuinely learned this concept on simplified and sensible footings through an answer[81] of Mr. Erik Anson, Physics/Cosmology PhD Student, to a question about dark matter where he fabulously clarified this concept and also discussed its link with dark matter. Following was the relevant portion of his reply:

> In General Relativity, whenever light passes through a gravitational field, that field bends its path slightly. This acts like a Gravitational lens, and can produce, for example, "Einstein Rings", like this image from Wiki:

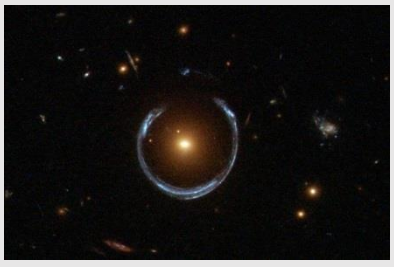


Image credit: NASA/ESA

The "ring" is a distorted image of a single blue galaxy located behind the red galaxy at the center. Light from the blue galaxy goes out in all directions, but is bent by the red galaxy's gravity. This means that the light that starting out on a "direct path" to us never reaches us, but light that was originally missing us by a specific amount (in any direction) gets bent back towards us, which makes it look like it's coming from a bunch of different directions, resulting in the ring image seen here.

This is a highly dramatic example of gravitational lensing, but there are much more subtle effects that can still be useful. In weak gravitational lensing, statistical analysis of distortions in the light we receive allows us to "map out" the gravitational field between us and distant galaxies. Often, this just shows more mass than we know how to account for, but that could be explained away by just assuming that our understanding of gravity is off.

I accept this explanation in entirety and emphasize that though it was difficult to streamline this concept for me but Erik Anson has explained it within the parameters of commonsense. I am also deep admirer of Einstein for coming up with this commonsense (though difficult) notion of Einstein Ring even before having observed this phenomenon. Mr. Erik Anson's research project for PhD is about dark matter. In this particular answer to a question, he has summarized almost all the so-called 'proofs' of the existence of dark matter. He is firm supporter of dark matter and is of the view that eventually scientists would directly detect this dark matter[82]. Here in the quoted answer, he has not bestowed much prominence on gravitational lensing as proof for existence of dark matter by saying that statistical analysis of various gravitational lenses give different results however 'often' more mass is needed to account for the observed lensing which can even be explained away by just assuming that our understanding of gravity is off.

Gravitational lensing due to gravity may be a hard reality but light can be bent through variety of other reasons that include different forms of refraction of light due to change in medium or the one described by Newton where refraction takes place when light passes by edges of objects while medium may not change. We also see that for the 1919 solar eclipse experiment, only one form of refraction was ruled out. Keeping in view that just one glass of water or even edge of a knife can bend the course of light then who knows what

exists out there in the immediate vicinity of large elliptical galaxies or within the boundaries of large clusters of galaxies that can act like a refracting agent and can magnify the effect of gravitational lensing. To rule out involvement of refraction for the solar eclipse experiment, such reasons were provided that solar atmosphere density is too low as compared with that of earth or that coronal material would disturb light in some other way instead of refraction etc. But these reasons do not apply to immediate surroundings of large elliptical galaxies or inner or outer areas of large clusters of galaxies as these astronomical environments are often predominated by large accumulations of gas and dust that can have good refractive index.

Moreover, gravity itself functions in multi-tier settings. For example, earth is bound by the gravity of Milky Way galaxy while source of this gravity is theorized at center of galaxy which is very far away. But same earth is even more bound by the gravity of sun. When scientists calculate theoretical lensing around a large galaxy or cluster, they take total gravity of cluster or that large galaxy and calculate effect of gravity from the central location. While the light of the background galaxy is affected by this much calculated gravity of whole large galaxy or cluster but we know that light also can be gravitationally affected by a single nearby sun. When light of the background galaxy passes quite away from the center of the intervening large galaxy or cluster, it definitely also passes by many nearer astronomical objects. Just like moon is affected by earth, then sun and then by the galaxy in the multi-tier settings, so light of background galaxy is also affected not only by the intervening large galaxy or cluster as a whole, it is also affected by many other astronomical objects who being nearer to the course of light, can have considerable influence on the path of light. Angle of deflection of light is also considerably affected by the actual path of light being nearer or far from the center of intervening large galaxy or cluster and precise details thereof are hard to know, maybe not even possible.

Above all, as we have noted in section II.I.II of this book that official distances of far of galaxies are way too shorter than the actual distances that can be calculated through simple Euclidean geometry – the implications are that (i) the official estimates of masses of intervening large galaxies or clusters of galaxies, being based on observed luminosity for the official distances, are understated which means that actually there is more mass

available and stronger than officially calculated lensing is justified and; (ii) since actual distances are greater, the angle of deflection of background galaxies is also larger. Both factors (i) and (ii) combined give the illusion of too strong lensing to be explainable on the basis of (official) available mass. Thus we conclude that gravitational lensing also does not serve as proof or indicator of the existence of dark matter. Moreover, we assert here that rather than signal of the presence of dark matter, these "too strong" looking cases of gravitational lensing are the indicators of the fact that officially calculated distances of far off galaxies are way too shorter than the actual distances.

II.IV. Bullet Cluster and Dark Matter Ring

II.IV.I Bullet Cluster

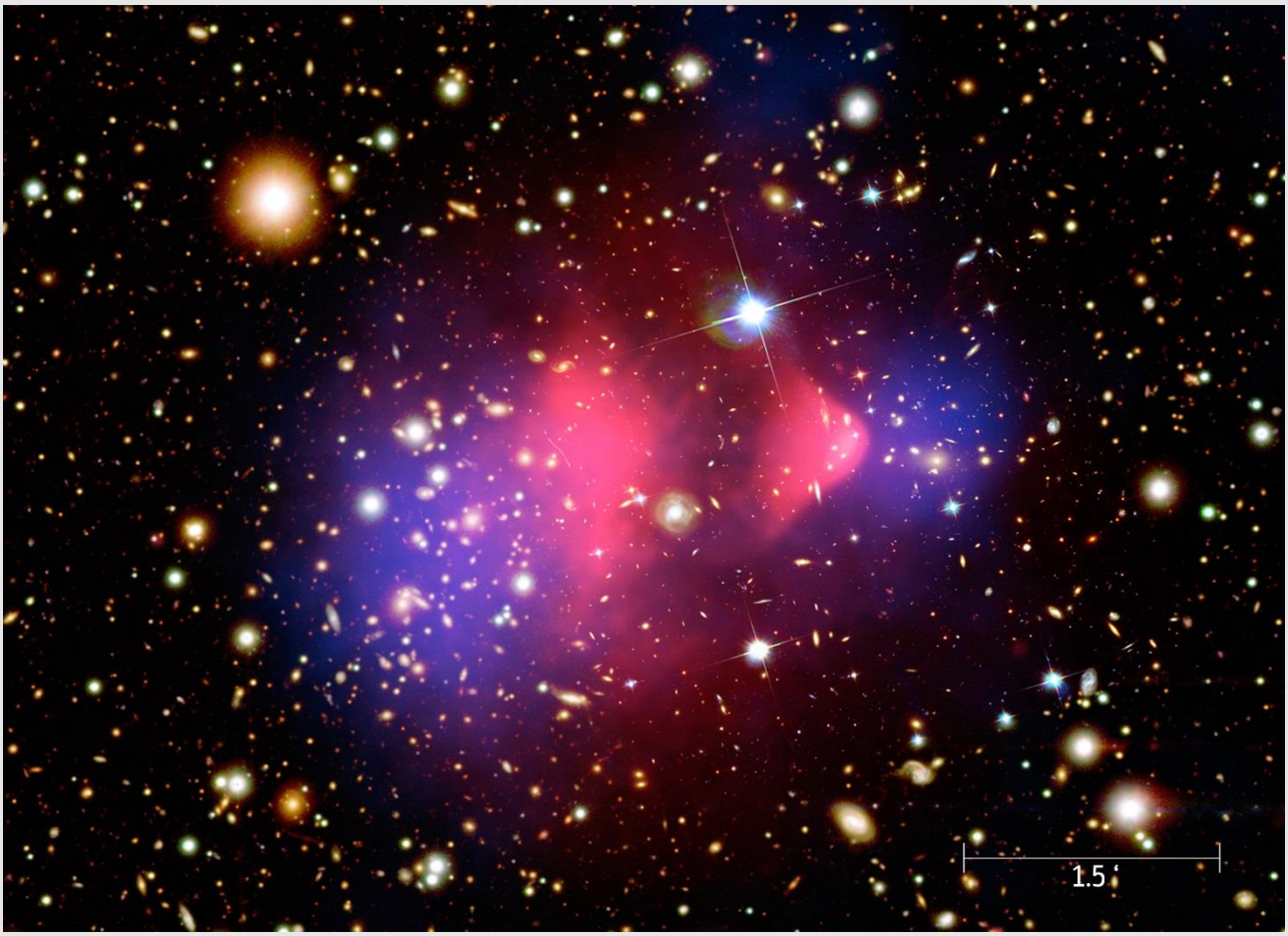
By the time I started writing this book and even until reaching to the previous section of gravitational lensing, I did not take the case of Bullet Cluster seriously. I had the simple confidence that if dark matter is successfully excluded from cluster dynamics, galactic rotations and gravitational lensing then it must also not actually be found in the case of Bullet Cluster. I almost reached to this topic under the impression that Bullet Cluster section would be a simple task and not going to pose much problem.

But the case of Bullet Cluster actually appeared quite impenetrable. At time, I even thought to write that though Bullet Cluster problem seems like a fool proof case in favor of dark matter regime but I still disagree on account of the fact that after all dark matter is not found in problems bigger in ranking to this one.

The case for the Bullet Cluster in support of dark matter regime was published by a group of Astronomers in a 2006 paper titled "A Direct Empirical Proof of the Existence of Dark Matter"[83] and NASA website had released the news about this upcoming research finding in advance[84]. The paper almost starts with the assumption that stellar component of galaxies make up only 1 ~ 2% of the mass. I checked this point – and found that the up-to-date estimate is around 4% stellar mass, 12% gas and 84% dark matter[85]. In principle, the assumption was right but the baffling thing was that the presentation of so-called proof of dark matter had already assumed the presence of dark matter in galaxies. But the later

study showed that the results of the paper did not depend on pre-supposition of the existence of dark matter. The story line was perfect – and the conclusion based on the given story line does reach to the affirmation of dark matter. So let us first go through the official story:

The story is largely inspired by some famous action movie and following is the action scene:



X-ray image (pink) superimposed over a visible light image (galaxies), with matter distribution calculated from gravitational lensing (blue). Image credit: NASA

The action story is that right side sub-cluster originally belonged to the left side and then penetrated to the larger sub-cluster at very high speed of few thousand KM/sec. Like a fast moving bullet, the small sub-cluster entered into the larger one from left side and came out from the right side. We now see this cluster when the collision is already over; now the

high momentum of both sub-clusters is taking them away from one another on opposite directions, though at reduced speed than before; and at the tail of the small sub-cluster now moving towards right side, shape of “bullet” can be seen even now.

Plot of the story is that two sub-clusters were heading towards one another at very high velocity like few thousand KM/sec. Both sub-clusters were made of three components (i) Stars of Galaxies, (ii) Dark Matter and; (iii) Hot Gas of galaxy clusters.

As these sub-clusters collided, (i) galaxies with stars and (ii) dark matter simply passed through one another as both these entities behaved like collision-less particles for this enormous scale collision. However the third component i.e. hot gas or plasma of both sub-clusters physically collided with one another; applied drag or ‘ram pressure’ on one another then slowed down and congested in the central (pink) location while the first two components (blue on both sides) have now reached quite away from one another on opposite directions. Aftermath of this collision is that central (pink) location is now jam packed with hot gas or plasma and emitting x-rays on enormous scales and due to x-rays, this area has been marked in pink color.

Theory is that central gas portion should represent majority of baryonic matter (normal matter other than dark matter) because gas component of clusters is regarded as far more massive than the stellar component.

It is held in this paper that this is the unique setup where dominant baryon component has been physically separated from the potential dark matter area and therefore provides an opportunity to physically check mass profiles of both these separated areas. The argument is that if dark matter does not exist then central gas area will show up as more massive.

In order to physically check the mass profiles or mass distribution of these two separated areas, the research team employed the methodology of analyzing weak gravitational lensing of background galaxies and found that actually galaxies component is more massive which is possible only if something like dark matter does exist.

Plot of the story seemed perfect. We cannot question the collision because of astounding x-ray emitting middle component and the results do not depend on the pre-supposition of the existence of dark matter.

I noticed, however some issues like other than the x-ray emitting middle component, there was no other trace of such a complete progression of two complete sub-clusters from within one another. But this point had a 'proper' cover-up in the form of the assumption that galaxies and stellar mass behave like collision-less particles for such enormous scales. I could point out other missing gravitational effects such as absence of physical disturbance or deformation of individual galaxies or whole sub-clusters but these facts could be used as supporting points only once a bigger loophole comes to surface.

Eventually, I found a clue that hot gases of clusters do normally emit x-rays and that the thermal radiation of those gases is normally around 10 million K. An academic paper[86] about hot gases of clusters contains following important information:

> Rich (Abell-like) clusters have X-ray luminosities ranging from as low as those of individual bright galaxies up to 1000 times higher: 10^{42} - 10^{45} ergs sec^{-1} (Jones et al. 1979; Abramopoulos and Ku 1983; Jones and Forman 1984). Gas temperatures range from a few 10^7 to 10^8 K (Mushotzky et al. 1978) and gas masses can exceed 10^{14} $M_\odot$ within the central few Mpc. The gas densities in the cores of rich clusters lie in the range 10^{-2} - 10^{-3} cm^{-3} and the inferred cooling times of the gas can be as small as 10^9 years (Fabian, Nulsen and Canizares 1982).

According to the Wikipedia article titled 'Bullet Cluster', the x-ray emitting gas temperature of this cluster is 70 million K which is within the range of 10^7 to 10^8 K.

In another online source[87], a PhD in Galaxy Clusters person Mr. Kholay Elgeneina has provided following crucial information:

> Clusters' gas is in the region of a few to tens of millions of degrees Kelvin. (our local)[88] Group's temperature are much lower, in the regions of 10's of thousands of Kelvin. It should just depend on the mass of the object you're talking about. Larger masses compress the gas to higher temperature. But it also depend on how long this object has existed, and did have enough time to thermalize the gas in it.

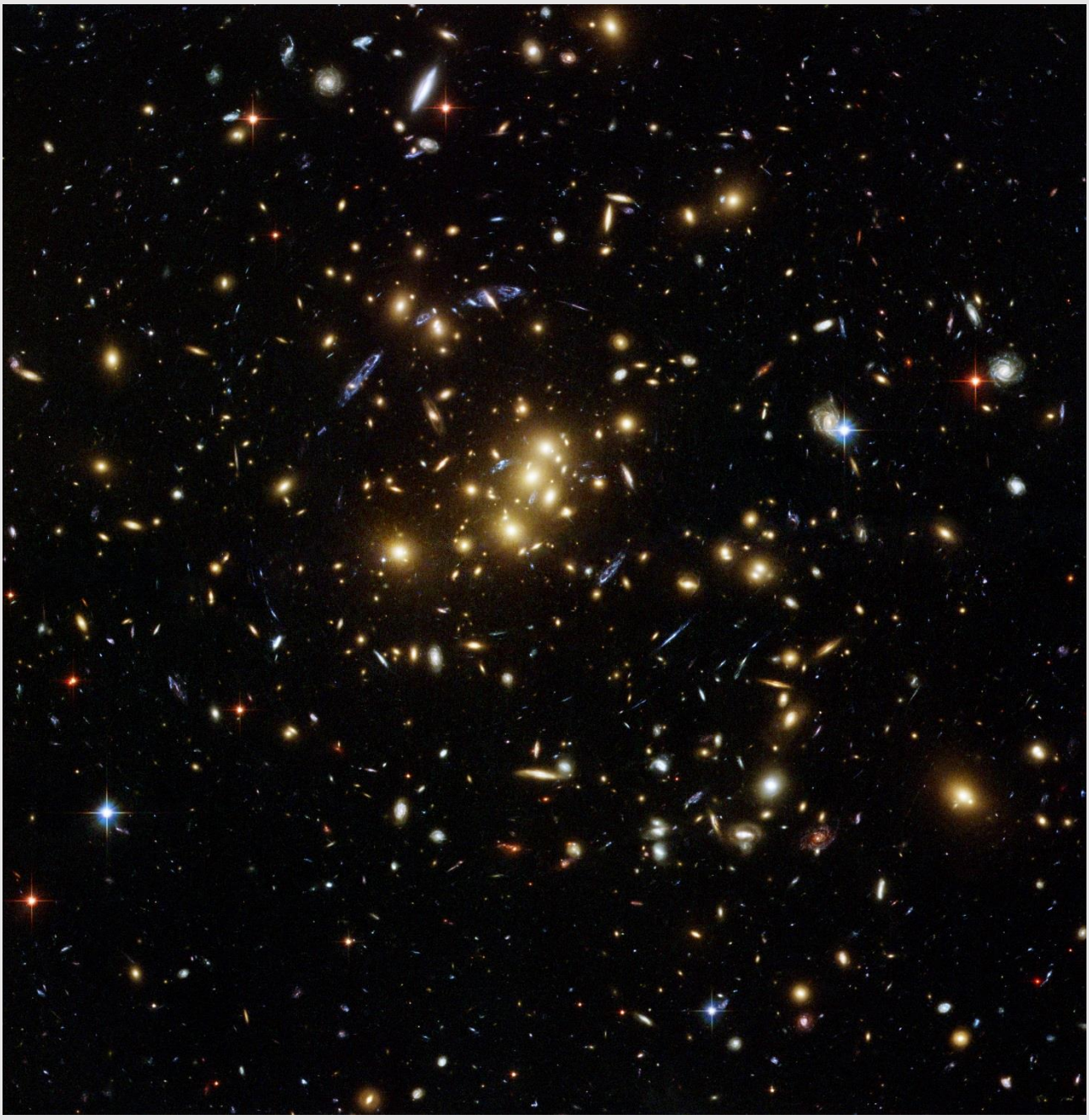
Equipped with above given information, now we no more find Bullet Cluster as a unique mysterious case where a complete transparent collision of galaxies, excluding gas component, has already taken place and where the gas component is now emitting high

intensity x-rays whereas temperature of that gas is as high as 70 million K. Now our simple interpretation of Bullet Cluster is that collision has not already taken place. These two sub-clusters are still at their original sides i.e. larger on left and smaller on right and still exist in original perfect shape and also there is no sign of gravitational deformation of individual galaxies or sub-clusters as a whole. These two sub-clusters are now heading towards one another and what we are observing now is a phase which is prior to the actual collision. Due to approaching of two sub-clusters, the hot gas of clusters has been compressed between these two sub-clusters and thus gas temperature has risen to almost 70 million degree kelvin and also that's why this portion is emitting high intensity x-rays.

The shape of bullet at the tail of right smaller sub-cluster is due to compression being faced from the other side. The compressed gas of both sides is interacting electromagnetically (this point is mentioned in Wikipedia article) and may be also electrically as large solar flare type structures are visible on both sides of gas. Really there is something unusual going on in this cluster and dark matter supporters even now can point out that after all gravitational lensing had found mass distribution of galaxy area and not that of gas area therefore proof in favor of dark matter stands. Actually due to this reason, initially the case of Bullet Cluster did seem like impenetrable and appeared like a fool proof evidence in support of dark matter regime. However the main argument of Bullet Cluster is based on the claim that this cluster provides a unique setup where dark matter has already been separated from the major component of baryonic matter. Therefore, in case collision has not already taken place then claim of unique setup does not hold and mere fact that gravitational lensing has found out mass distribution of only galaxies and not that of gas area will have no link with the supposed dark matter because then dark matter should be existing on both the areas.

II.IV.II Dark Matter Ring

'Dark Matter Ring' was reported in a 2007 paper titled "Discovery of a Ring like Dark Matter Structure in the core of the Galaxy Cluster CL0024+17"[89]. The researchers analyzed following rich cluster of galaxies (CL0024+17) which is located at about (official) 4 billion light years distance.

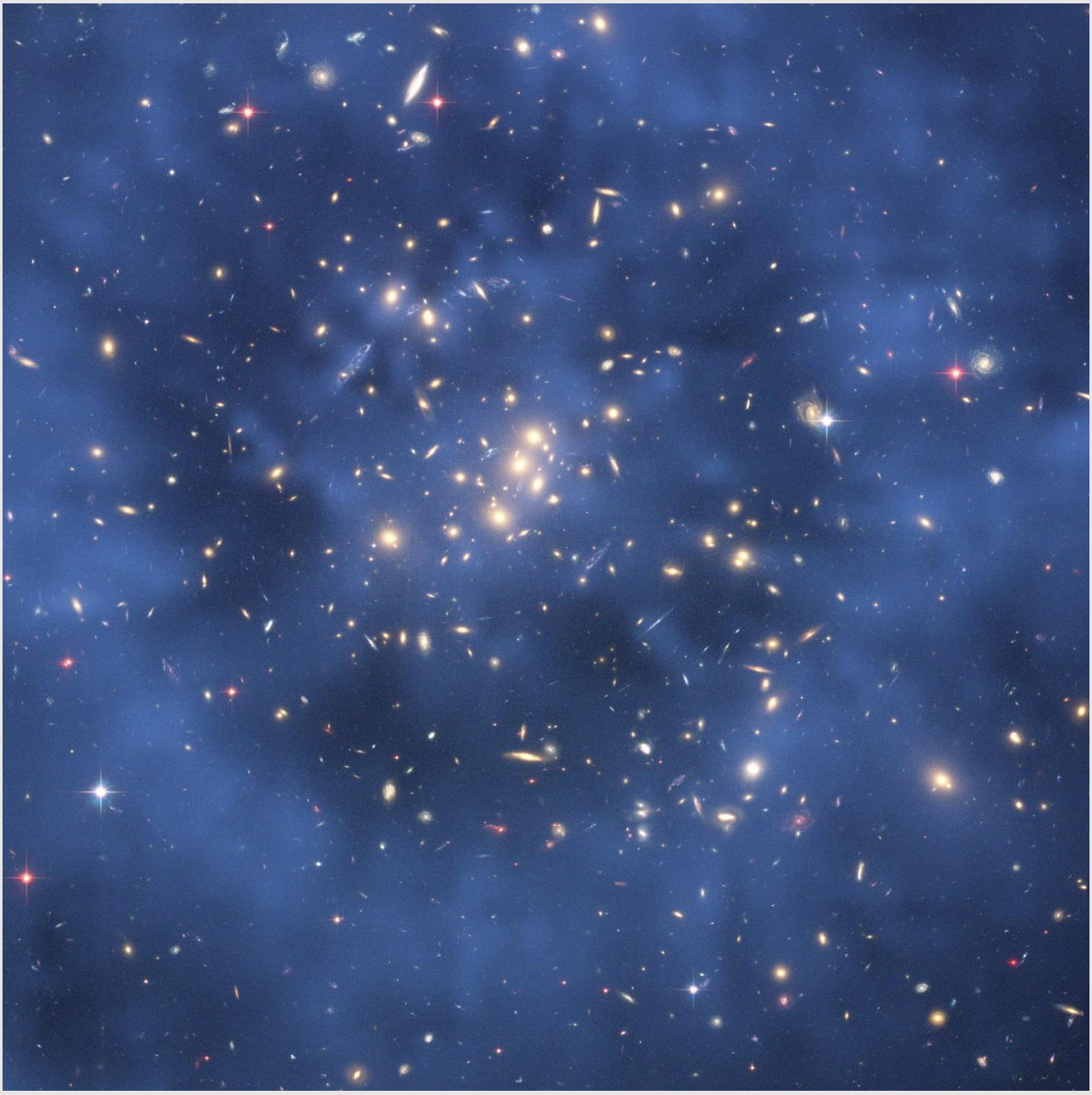


Cluster CL0024+17. Image credit: NASA/ESA

This image is full of strong and weak gravitational lensing cases i.e. there are many instances of distorted images of background galaxies including some prominent multiple distorted images of a single blue galaxy and some other multiple distorted image systems also exist. For the authors of this paper, existence of dark matter is like already established fact so they straight away calculated or determined the map of dark matter for

this cluster system by way of ‘mass reconstruction’ using gravitational lensing of background galaxies. So therefore, we raise our first objection that we have seen in section II.III.II of this book that gravitational lensing for the official distances will automatically leave room for dark matter and discrepancy will be considerably reduced by considering the actual distances of galaxies and clusters. Secondly since there are lot of other factors involved, so gravitational lensing, employed solely on the basis of gravity equations, cannot be used as a definite method to work out mass profile of the galaxy or cluster system.

Anyhow, we see that the researches of this paper successfully determined a ring like dark matter substructure. Then they linked this ring like ‘dark matter substructure’ with an earlier finding (2002) about this same cluster according to which this cluster CL0024+17 had undergone collision along line of sight from earth and that it was same Bullet Cluster type of transparent collision with the main difference that CL0024+17 had a (transparent) collision along the line of sight from earth and thus we now see aftermath of this collision at the head on position. The collision scenario is also duly supported by the velocity dispersion profile of this system. Then researchers inform us that their computer simulations show that such ring like ‘density ripples’ can be formed through a collision-less expanding and decelerating of particles that originally comprised the pre-collision cores. Thus authors of this paper are sure that nature has devised a particular laboratory experiment which has confirmed their computer simulation and thus ring like structure which they found around the core of CL0024+17 is the real location of dark matter and thus first time real location of the dark matter has been identified in any cluster. Therefore they superimpose the ring like structure on actual image of CL0024+17 and tell us that actual dark matter has been traced within the ring area of the following cluster:



The gravity map (clouds) is superimposed on a Hubble image of the cluster CL0024+17. Image credit: NASA/ESA

No doubt the researchers have completed a very complicated task of making a gravity map on the basis of hundreds of distorted images of background galaxies but what has been determined is the “deviation from (official) theory”. Quantitative deviation from theory was already known. Now what this paper has achieved is the determination of spatial location for that theoretical deviation. Its meaning is that if dark matter really exists then it exists in this mapped location i.e. cloud like ring. Therefore, dark matter ring is not like an

empirical verification of the existence of dark matter. Dark Matter regime has yet to find observational or empirical proof of dark matter. Here they have shown a superimposed location of dark matter. Actual location of actual image is devoid of these superimposed clouds. Dark Matter Ring has however successfully shown the picture of (official) theory and just how it differs from the actual picture of reality. By only painting the picture of dark matter on a real picture, it cannot be said that real dark matter has been found in the real picture.

Yes researchers also had executed simulations through which ring structure was found compatible with the collision history of cluster CL0024+17. Here it will not be rightful to point out that such a ring structure did not show up in similar 'collision' of Bullet Cluster because for that case, collision has not yet started. The authors of the Dark Matter Ring paper also stress that CL0024+17's collision has entered to far next phases for which computer simulations show ring like density ripples. Therefore, we accept the validity of simulations and also accept that such ring like gravity distribution is applicable to only those clusters where transparent collision has already occurred long ago.

Important thing to be considered is that simulations do not say that the ring like density ripple has to be made up of 'dark matter'. Density ripple is just density ripple and only indicates more density of mass in ring like structure which is located outside of the core area which is also dense. Now we notice that there is already a ring of real matter just under the inner boundary of so-called dark matter ring and even the dark matter ring is already filled with considerable number of galaxies. Real matter is already arranged in ring like structure – only thing is that it is less than the required quantity of mass.

And the fact is that superimposed ring structure has been determined for the official distance of cluster CL0024+17 i.e. 4 billion light years. The actual cluster with actual galaxies is located far beyond the official distance as we have noted in section II.I.II of this book and that's why quantity of available real mass is looking on lower side. If we take our super imposition to a distance which is actually 4 billion light years away from the actual location of cluster, then image of actual cluster will fit on the superimposition and it will appear that gravity map has worked out correct quantity and distribution of real matter. NASA website claims that the ring's discovery is among the strongest evidence yet that

dark matter exists. This claim is not hereby accepted because first of all ring has only calculated the distribution of total matter for this specific system. Secondly the total mass is not more than actual available mass – the available mass is only appearing on lower side because we are looking the cluster from way too larger distance under the false impression that we are looking it from only 4 billion light years distance.

II.V. Components of the Big Bang Cosmology as 'Proof' of Dark Matter

Dynamics of the clusters of galaxies, galactic rotation curves and up to gravitational lensing – these phenomena were linked with the hypothesis of dark matter by way of 'inference from observations' and that was, at least, right scientific approach; the only flawed things were wrong interpretation or the application of incorrect part of the available theory etc. Bullet Cluster problem was simple misinterpretation of what is observable. Dark matter ring relates to gravitational lensing. Although all the above mentioned phenomena were wrongfully linked with the idea of dark matter but at least they were linked in a scientific way i.e. drawing inferences from observations.

However, by using various components of the Big Bang Cosmology as 'proof' of dark matter, the only previous scientific element also has been compromised. Rather than the scientific method of drawing inferences out of observations – now we enter into a regime which is characterized by 'authenticating one hypothesis on the basis of other hypotheses'. Basically two elements of the Big Bang Cosmology i.e. (i) fluctuations in temperature of CMB and; (ii) Structures formation after Big Bang are often discussed in literature as a kind of 'proof' of the existence of dark matter. Therefore, let us check both of them one by one.

II.V.I Fluctuations in Temperature of CMB

European Space Agency (ESA) website[90] informs us following:

> Map of the cosmic microwave background (CMB) temperature as observed by ESA's Planck satellite. While fluctuations in the CMB are present and were observed by Planck down to very small angular scales, these images have been filtered to show mostly the signal detected on fairly large scales in the sky,

around 5 degrees and larger – as a comparison, the full Moon spans about half a degree.

On these large scales, a number of anomalies are observed in the CMB temperature – these are features that are difficult to explain within the standard model of cosmology, which relies on the assumption that the Universe, on large scales, has the same properties when observed in all directions.

For now, we just leave aside that there are temperature fluctuations in CMB whose scale is as large in sky as 5 degrees and larger and that by comparison, the full Moon spans just about half a degree.

The time when CMB was first detected in 1960s the details of minute temperature variations in CMB across whole of skies were not known. Scientists immediately or hurriedly accepted it as a proof of Big Bang by saying that such uniform background radiation must have a single source i.e. the whole of (compact) early universe. But since temperature was not uniform across whole of skies, simply CMB was coming from regular galaxies located at distance beyond the visible galaxies whose ordinary light was redshifted enough to become invisible and assumed the shape of microwave CMB; the point which I already have explained in my first book (2018) about Big Bang Cosmology.

Anyhow, dark matter is not a proven fact – after this book, it is even a falsified concept. So if standard interpretation of CMB depends on dark matter then there is problem with standard interpretation of CMB. And since Big Bang is also not a proven fact, it cannot be used to authenticate the idea of a proper falsified concept of dark matter.

If dark matter does not exist in dynamics of clusters and also does not exist in galactic rotations, then there is no point in insisting that the same (falsified) dark matter is responsible for the tiny fluctuations in temperature of CMB. Fact is that scientists have no proper interpretation of CMB and why there are temperature fluctuations in it. If asked from them, they will tell only fairy tales that during the first quantum moment after big bang, Universe had undergone rapid expansion that resulted in many irregularities in the structure of universe and there is role of dark matter and such other farfetched things. The ESA page, on the other hand, clearly mentions that irregular features of CMB are difficult to explain within the standard model.

II.V.II Structure formation after Big Bang

The argument in favor of dark matter is based on misunderstood rotation behavior of galaxies. It is argued that galaxies with only baryonic matter are unstable. Then they performed computer simulations on various ideas. First they tested hot dark matter which did not work. Finally they found that idea of cold dark matter worked with structure formation and since then the name of their standard model has become Lambda CDM where CDM stands for cold dark matter.

Yes – it is possible that we use Newton's Theorem XXXI and add an invisible component CDM and our simulation may work. But then it is not proved that CDM actually exists. My advice to them is that please now try Theorem XXXIII and do not add CDM and then see the result. Empirical observations say that this setup works in real world.

There are also other streams of arguments which suggest that without CDM, structure formation after Big Bang had to be a long process but large structures did appear earlier in the history of universe therefore it became possible due to definite role of dark matter. The reply to this argument is that universe is far older than your standard time frame and also it is not expanding. If structure formation without CDM took more time, that time might have been taken up. The argument however indicates that Big Bang Theory and related time frames do not work without the notion of dark matter, better to say, a falsified notion of dark matter. Above all, this is merely an attempt to authenticate one hypothesis on the basis of another one; scientists must exclude this approach from their methodology.

III. Modified Newtonian Dynamics (MOND)

After observing rotation of Andromeda (M31), Babcock (1939) concluded that "*perhaps new dynamical considerations are required, which will permit of a smaller relative mass in the outer parts (of galaxy)*".

As long as dynamics are not modified, more than traceable mass was required in the outer parts of galaxy. Off course, for Babcock in year 1939, the natural rotation of galaxy should have been like usual solar system or any other orbit system that all seemed to follow Keplerian drop-off. Nevertheless he was the first to come up with right proposal, though the hint was largely going to be neglected by the scientific community.

Scientists evaluate 'dynamics' only by way of keeping the equation of mathematics in perspective. According to the equation, more mass was required so the solution that prevailed dominantly was the addition of more (but untraceable) mass to the reality. The dominant group thus made reality into a subservient to mathematics.

Off course scientists are humans and they also feel trouble in digesting unrealistic solutions to the problems. There was a definite need for a 'realistic' solution within the scientific community. The problem was that within the equation more mass was required and 'realistic' solution should not add more (untraceable) mass to the reality. More 'realistic' solution was to modify the equation in a fitting way so as to match the reality.

The original proposal of Modified Newtonian Dynamics (Milgrom: 1982) was that for the limit of very low accelerations as are prevalent in galactic rotations, the Newton's second law $F = ma$ should be modified as $F = ma^2/a_0$ within the limit of very low acceleration like: $(a \ll a_0 \sim 1.2 \times 10^{-10}\ m/s^2)$.[91]

Wikipedia article titled "Modified Newtonian Dynamics"[92] gives further information that here a_0 "*is a new fundamental constant which marks the transition between the Newtonian and deep-MOND regimes*".

In simple terms, the accomplishment through this formula is that 'acceleration' a and thus (theoretical) 'rotation' of galaxies has been altered without changing mass m and the same was the task. We see that $a_0$is a 'constant term' whose value will be determined by just noticing which value 'works' in harmony with the observed rotation of galaxy. Essentially, an artificial or engineered agreement between theory and reality has been enforced and the agreement works because it has been made to work.

Argument is not that the 'fact' has been tested that Newton's second law works in a different way at very low acceleration settings. The argument is that since low accelerations have never been tested in laboratory settings so it is fair to assume that there must be a different second law for such low accelerations because otherwise more mass would be required to account for rotation of galaxies. In the previous chapter we were dealing with 'dark matter' and now in this chapter we are noticing a kind of 'dark equation'. Just like dark matter is termed 'dark' because the type and nature of this assumed matter is not known hence for the case of MOND equation where underlying logic, principle or mechanism for the alteration of law of motion is not known so the MOND equation also qualifies for the 'dark' title.

Anyhow, the MOND proposal in the original simple form did not receive ample consideration by the scientific community. Various improvements were made from time to time and it became like another complicated theory. But underlying physical mechanism is never explained – only equation is somehow balanced and harmonized with observations by eliminating the need for untraceable type of extra mass. The cost or the reciprocal effect is that equation itself becomes untraceable from the actual behavior of matter. Yes – the result of the equation is made harmonized with observations but variables, constants and parameters of the equation have no link with the mechanism of reality. For example, the refined form of MOND i.e. relativistic MOND TeVeS contains two additional fields, three free parameters and one free function[93]. This pure engineered solution has successfully explained rotation of hundreds of spiral galaxies and the officially accepted drawback is that this theory fails to reconcile problem of dark matter for cases other than galactic rotations such as dynamics of clusters of galaxies etc.

Yes – new dynamical considerations were required to sort out the problem of galactic rotations. Actually applicability of Kepler's law for the galactic system should have been questioned for this task. Rather than doing this, the actual things deliberated were that do distort Newton's theory to whatever extent but keep your equation within the framework of General Relativity. But this effort of bringing MOND within the framework of GR has only further exposed the incapability of GR to deal with the problem of galactic rotations because it is showing that GR has only engineered solution to the problem. The core of the problem i.e. applicability of Kepler's 3rd law to the rotation of galaxies was not touched at all and a 'working' solution to the problem was manufactured in this way. Scientists were not dealing with dynamics of the physical world – they were developing a relativistic equation which must confirm to all the accepted truths of relativity but with grant of free hand to introduce many free parameters and functions as well as freedom to arbitrarily distort Newton's theory to make the final equation in harmony with observed galactic rotations. They succeeded in this task but any false theory also can be made to succeed in such a way.

Since they have successfully accomplished the task without questioning the applicability of Kepler's 3rd law to the galactic rotations so it should mean that GR acknowledges that Kepler's 3rd law is not at odd with rotations of galaxies and applies to such systems as well. This sounds like the official position of GR but now if we ask from official people, they do unofficially reply that Kepler's 3rd law has no role in this problem. But more mass i.e. dark matter is required in the official explanation only to offset the effect of (applicable) Keplerian drop-off. At the most, the true meaning of MOND is that applicability of Keplerian drop-off is eliminated by just saying that second law of motion acts in a modified form at very low acceleration comparable to that of rotating stars in galaxy. The implication is that they have not questioned the applicability but somehow they have eliminated Keplerian drop-off.

This act of 'elimination' indicates that applicability to the problem was acknowledged. Whereas in the true solution to the problem, as we have gone through in section II.II of this book, and which is based on Theorem XXXIII of Newton's Principia, right from start, the applicability of Keplerian drop-off was not acknowledged for the case of galactic rotations.

Modification of dynamical consideration was required. However the actually required thing was to apply relevant Theorem XXXIII instead of applying irrelevant Theorem XXXI. Since the accurate and applicable theory could already solve the problem, thus any modification of the theory itself was not required. By way of fine tuning – by adding few free parameters and functions etc., even Kepler's third law also can solve the galactic rotation problem without requiring the existence of dark matter. Therefore MOND is not the natural solution to the problem and represents the general scenario of darkness, whether attributable to matter or to the equation.

IV. Conclusion

On ground position is that if we challenge the dark matter interpretation of galactic rotation problem, the representatives or supporters of the official science respond that galactic rotation is not the only one indicator of the existence of dark matter. For example, Mr. Romeel Davé, Astronomer and Astrophysicist from Physics Department, University of Edinburgh, writes following[94]:

> It's also worth noting that today, the evidence for dark matter extends *way* beyond galactic motions. In fact, by today's standards, that is a poor piece of evidence for dark matter, there are many other better and independent pieces of evidence for dark matter. People who try to disprove dark matter by focusing on galactic dynamics always miss this key point. It's rather like saying "Columbus supposedly discovered America, but if I can prove that he actually only discovered the West Indies [which is true], then *America doesn't exist!*" Um, no. Today, we have a lot of other, independent evidence that America exists. We've learned a few things since 1492. Similarly, we've learned a few things since the 60's when Rubin measured her rotation curves.

Here Mr. Romeel Davé has not regarded galactic rotation problem as a strong piece of evidence in support of the existence of dark matter as there 'many' other better and independent proofs in support of dark matter are available. So my question then is suppose there is no dark matter in galactic rotations then it means that rotations are perfectly normal and arise due to available and traceable mass of the galaxy only. When dark matter does not exist in galaxies then another so-called 'proof' of dark matter i.e. Bullet Cluster becomes equally ineffective. Argument of Bullet Cluster is that dark matter remained associated with galaxies and that's why gravitational lensing could find distribution of mass only for the portion consisting of galaxies and not for baryon dominant component of hot gas which was devoid of dark matter. So if there was no dark matter in galaxies right from the start then there is also no point that within the storyline of the Bullet Cluster, dark matter had remained associated with the portion that contained galaxies. We also note that contrary to the claim of Mr. Romeel Davé, the other so-called 'proofs' are not independent of galactic rotation problem. As another example, if there is no dark

matter in galaxies then there is also no need of dark matter for structure formation as well. And when there is no dark matter in galaxies, structure formation and Bullet Cluster then also there is no dark matter in 'minute' fluctuations in the temperature of CMB. To put it another way, let us accept for the sake of argument, that fluctuations in CMB temperature do indicate the existence of dark matter. Now loaded with this far-fetched proof of dark matter, when we search in real galaxies, we would find no real indication of dark matter.

Actually dark matter, as official science projects it to be, is not really limited to galaxies. Even if we solve galactic rotation problem they are not going to abandon this fake dark matter concept. Official dark matter is a complete package of magic spell of fabricated theories based on incomplete or irrelevant evidences – and the whole extent of the spell was required to be broken apart. That's why this book was not limited only to the galactic rotation problem and has covered all the so-called proofs of dark matter. This book focused on commonsense analysis of the topic after having presented a case for commonsense based analysis in Chapter-I. Then Chapter-II covered entire range of so-called evidences in support of the existence of dark matter and has shown that all of them do no not conclusively establish the existence of dark matter. This book also featured a definite proof that farthest visible galaxies are located at distance scale of many hundred billion light years. Being based on commonsense analysis, this book has not tried or claimed to have determined the exact distance of those galaxies and the only definite thing about this issue is that the actual distances are far greater than the official distances. Task of this book was not to determine or quantify, say rotational velocities or exact angle of deflection through gravitational lensing or the determination of exact quantity of mass. The task was to determine, in definite terms, that whether in principle dark matter exists or not. The definite finding of this book is that, in principle, dark matter does not exist and that scientists are in a definite need to review their methodology, their emphasis on framework and their misleading standard model. In the preface of this book I have written that the end of this book will be a goodbye to ad hoc regimes of dark matter and MOND both. This would be true for the assumption of simpler reality that we are dealing with science which works on solidity based on evidence. There is an actual complex reality also which works by way of unduly protecting the established paradigm. This book alone may not be able to

overcome the forces of paradigm though definitely it will initiate the process of the eventual collapse of the established dark paradigm.

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[1] https://en.wikipedia.org/wiki/Vulcan_(hypothetical_planet) – This hypothetical planet was thought to exist between orbit of Mercury and the Sun.
[2] Gainfranco Berton and Dan Hooper "A History of Dark Matter" – Page 11 (https://arxiv.org/pdf/1605.04909.pdf)
[3] Fritz Zwicky "The Redshift of Extragalactic Nebulae" – Page 10 (https://arxiv.org/ftp/arxiv/papers/1711/1711.01693.pdf)
[4] Gainfranco Berton and Dan Hooper "A History of Dark Matter" – Page 14 (https://arxiv.org/pdf/1605.04909.pdf)
[5] Gainfranco Berton and Dan Hooper "A History of Dark Matter" – Page 15 (https://arxiv.org/pdf/1605.04909.pdf)
[6] SIDNEY VAN DEN BERGH "The Early History of Dark Matter" – Page 4 (https://arxiv.org/pdf/astro-ph/9904251.pdf)
[7] http://astronomy.swin.edu.au/cosmos/B/Baryonic+Matter
[8] https://www.edge.org/conversation/john_horgan-in-defense-of-common-sense
[9] https://en.wikipedia.org/wiki/John_Michell
[10] https://bbtrejected.wordpress.com/2018/04/09/unscientific-methodology-of-science-within-the-big-bang-cosmology/
[11] In fact Newton's Principia also starts from 'axioms' or first principles which are his three laws of motion. But he has used those axioms only to derive various theorems and the axioms do not serve as boundary wall rather only provide a starting point for his work. Modern Theoretical Physics has however bounded itself within the scope of basic framework and mathematical derivatives thereof. For them knowledge does not exist outside of this boundary. According to them this book also does not exist. They have made their Theoretical Physics into a cartoon character who has big and long nose. For the character only nose exists and any other thing does not exist.
[12] https://en.wikipedia.org/wiki/Theoretical_physics
[13] https://home.cern/news/series/in-theory/what-theoretical-physicist
[14] https://www.quora.com/profile/Kirsten-Hacker
[15] https://www.quora.com/Do-you-agree-with-Elon-Musk-when-he-said-physics-teaches-you-to-reason-from-first-principles-rather-than-by-analogy/answer/Kirsten-Hacker
[16] https://www.quora.com/What-is-the-difference-between-a-theoretical-physicist-and-an-armchair-physicist/answer/Cencio-Farre
[17] https://www.quora.com/Why-are-theoretical-physicists-not-armchair-thinkers
[18] http://backreaction.blogspot.com/p/about.html
[19] https://www.amazon.com/gp/product/0465094252/ref=dbs_a_def_rwt_bibl_vppi_i0
[20] Bracket added by me.
[21] Recently Professor Susskind also has presented the idea that QM and GR are equal.
[22] Original 1929 paper of Edwin Hubble http://www.pnas.org/content/15/3/168.full as explained by me on this blog post: https://bbtrejected.wordpress.com/2018/02/18/edwin-hubble-did-not-say-in-1929-that-universe-is-expanding-here-is-the-original-1929-paper/
[23] https://en.wikipedia.org/wiki/Edwin_Hubble
[24] https://www.jstor.org/stable/85585?read-now=1&googleloggedin=true&seq=1#metadata_info_tab_contents
[25] Fritz Zwicky "The Redshift of Extragalactic Nebulae" – Page 10 (https://arxiv.org/ftp/arxiv/papers/1711/1711.01693.pdf)
[26] https://lco.global/spacebook/using-angles-describe-positions-and-apparent-sizes-objects/ , https://en.wikipedia.org/wiki/Angular_diameter and diameters of Sun and Moon taken from simple google search.
[27] Britannica article on Coma Cluster says that diameter is 25 million light years. [The main body of the Coma cluster has a diameter of about 25 million light-years]. Wikipedia article seems silent on diameter but google search show up from reference of Wikipedia that diameter of Coma Cluster is 20 million light years.

[28] "Angular Diameter Distance" section on this Wikipedia page: https://en.wikipedia.org/wiki/Distance_measures_(cosmology)
[29] "Distance Estimates" section of Andromeda article on Wikipedia -- https://en.wikipedia.org/wiki/Andromeda_Galaxy
[30] https://en.wikipedia.org/wiki/Andromeda_Galaxy
[31] https://en.wikipedia.org/wiki/Andromeda_Galaxy
[32] http://sci.esa.int/planck/47695-the-coma-cluster/
[33] Based on comparison of section of sky of deep field image with size of moon on this and many other pages: http://mikkolaine.blogspot.com/2014/01/size-of-deep-sky-objects-compared-to.html

[34] https://en.wikipedia.org/wiki/Andromeda_Galaxy
[35] https://jwst.nasa.gov/galaxies.html
[36] https://earthsky.org/astronomy-essentials/galaxy-universe-location
[37] https://en.wikipedia.org/wiki/GN-z11
[38] https://khuram-on.quora.com/Meaning-of-redshifts-according-to-Edwin-Hubble
[39] Right now, the space telescope is expected to be launched in year 1921. https://jwst.nasa.gov/about.html
[40] https://www.techtimes.com/articles/2714/20140115/forget-hubble-100x-more-powerful-james-webb-telescope-is-getting-prepped.htm
[41] https://jwst.nasa.gov/firstlight.html
[42] I had little conversation (over Internet) with a NASA Information Officer. I told him that official galactic distances are underestimated. I did not explain or prove my point; just told that proof will come with book (i.e. this book). He denied the existence of any such anomaly and also denied that NASA is trying to hide this anomaly. To this I replied that even then I will write in my book that NASA fully knows and only hides this fact because otherwise it will be more embarrassing for NASA. Readers should judge by themselves whether or not NASA knows about it given the simple fact that their formulas do impose upper limit on distance of galaxy.
[43] https://arxiv.org/pdf/astro-ph/0011070v2.pdf
[44] Quora.com profile of Mr. Marco Pereira - https://www.quora.com/profile/Marco-Pereira-1
[45] http://sdss.org/
[46] http://www.worldscientificnews.com/wp-content/uploads/2018/02/WSN-98-2018-127-139.pdf
[47] https://simple.wikipedia.org/wiki/Occam%27s_razor
[48] https://en.wikipedia.org/wiki/Angular_diameter_distance
[49] https://www.quora.com/Is-the-universe-really-flat-or-is-it-just-very-slightly-curved/answer/Erik-Anson
[50] Bracket (scientific) added by me.
[51] https://www.symmetrymagazine.org/about
[52] https://www.symmetrymagazine.org/article/april-2015/our-flat-universe
[53] Edwin Hubble "The Realm of the Nebulae", (1936) P:179
[54] Gainfranco Berton and Dan Hooper "A History of Dark Matter" – Page 19 (https://arxiv.org/pdf/1605.04909.pdf)

[55] SIDNEY VAN DEN BERGH "The Early History of Dark Matter" – Page 4-5 (https://arxiv.org/pdf/astro-ph/9904251.pdf)
[56] Gainfranco Berton and Dan Hooper "A History of Dark Matter" – Page 21 (https://arxiv.org/pdf/1605.04909.pdf)
[57] https://www.windows2universe.org/the_universe/uts/kepler3.html

[58] https://www.universetoday.com/41021/keplers-third-law/

[59] https://www.quora.com/profile/Erik-Anson
[60] https://www.quora.com/How-does-gravity-work-at-galactic-level-Am-I-wrong-to-feel-that-Kepler-s-3rd-law-is-totally-irrelevant-in-such-complex-system-and-therefore-that-there-is-maybe-nothing-wrong-with-the-way-galaxies-are-orbiting-and
[61] https://www.quora.com/profile/Damien-Giraud-1/questions

[62] https://www.quora.com/profile/Nikolay-Sones
[63] https://www.quora.com/If-we-have-Newtons-shell-theorem-then-why-do-we-need-dark-matter-to-explain-why-galaxies-stay-together
[64] https://en.wikipedia.org/wiki/Dark_matter
[65] https://www.quora.com/What-is-a-duplicate-ratio/answer/Carl-Bryan
[66] https://en.wikipedia.org/wiki/Shell_theorem

[67] https://physics.stackexchange.com/questions/18446/how-does-gravity-work-underground?noredirect=1&lq=1
[68] https://en.wikipedia.org/wiki/Gravity_of_Earth#Depth
[69] https://en.wikipedia.org/wiki/Galaxy_rotation_curve#/media/File:Rotation_curve_of_spiral_galaxy_Messier_33_(Triangulum).png
[70] https://en.wikipedia.org/wiki/NGC_1052-DF2 --- "A more recent study on NGC 1052-DF2 suggests the previously reported distance of the galaxy was greatly exaggerated. Consequently, the galaxy now looks "normal" in every way. Using five independent methods to estimate distances of heavenly bodies, a team of researchers from the Instituto de Astrofísica de Canarias (IAC) found the correct distance of NGC 1052-DF2 to be 42 million light years (13 MPc), not some 64 million light years (19 MPc) from the Earth.[10] The total mass of the galaxy is around one-half of the mass estimated previously, but the mass of its stars is only about one-quarter of the previously estimated mass. This implies a significant part of NGC 1052-DF2 could be made up of dark matter, like any other galaxies."
[71] https://www.quora.com/Why-are-dwarf-galaxies-dark-matter-rich

[72] https://www.quora.com/profile/Stephen-Perrenod

[73] https://www.eso.org/public/images/potw1511a/

[74] https://en.wikipedia.org/wiki/Birkhoff%27s_theorem_(relativity) – This Wikipedia article about Relativistic Shell Theorem says following:
"The theorem was proven in 1923 by G. D. Birkhoff (author of another famous *Birkhoff theorem*, the *pointwise ergodic theorem* which lies at the foundation of ergodic theory). However, Stanley Deser recently pointed out that it was published two years earlier by a little-known Norwegian physicist, Jørg Tofte Jebsen."
[75] https://en.wikipedia.org/wiki/Birkhoff%27s_theorem_(relativity)
"Thus, this part of the theorem is just what we would expect from the fact that general relativity reduces to Newtonian gravitation in the Newtonian limit."

[76] Babcock, H. W. (1939). "The rotation of the Andromeda Nebula".
[77] https://en.wikipedia.org/wiki/Galaxy_rotation_curve

[78] http://adsabs.harvard.edu/full/1975ApJ...201..327R
[79] https://iopscience.iop.org/article/10.1088/0004-637X/739/1/20/meta
[80] Diagram and caption added by me. Slightly lesser details than original are shown in this diagram. Description in following text also has been altered just accordingly.
[81] https://www.quora.com/Whats-an-explanation-of-dark-matter-in-details-with-very-high-accuracy/answer/Erik-Anson
[82] https://www.quora.com/What-will-we-most-likely-fully-understand-first-dark-energy-or-dark-matter-And-why/answer/Erik-Anson
[83] https://arxiv.org/abs/astro-ph/0608407
[84] https://www.nasa.gov/centers/marshall/news/news/releases/2006/06-096.html
[85] https://www.vox.com/science-and-health/2019/4/2/18282606/milky-way-mass-stars-dark-matter
[86] https://ned.ipac.caltech.edu/level5/Forman2/Forman1.html

[87] https://www.quora.com/Is-the-Local-Group-filled-with-hot-gas-like-the-large-galaxy-clusters/answer/Kholy-Elgeneina
[88] Bracket words added by me to match the context.
[89] https://iopscience.iop.org/article/10.1086/517498

[90] https://sci.esa.int/web/planck/-/61397-the-cmb-temperature-on-large-angular-scales
[91] Gainfranco Berton and Dan Hooper "A History of Dark Matter" – Page 50 (https://arxiv.org/pdf/1605.04909.pdf)
[92] https://en.wikipedia.org/wiki/Modified_Newtonian_dynamics
[93] Gainfranco Berton and Dan Hooper "A History of Dark Matter" – Page 52 (https://arxiv.org/pdf/1605.04909.pdf)
[94] https://www.quora.com/How-does-gravity-work-at-galactic-level-Am-I-wrong-to-feel-that-Kepler-s-3rd-law-is-totally-irrelevant-in-such-complex-system-and-therefore-that-there-is-maybe-nothing-wrong-with-the-way-galaxies-are-orbiting-and/answer/Romeel-Davé