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Can Lorentz Relativistic Mass Explain the Hubble Tension ?

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Abstract

The Hubble tension several prominent researchers have claimed brought cosmology into a crisis. We show that Hubble tension seems to be explained when one take into account Lorentz relativistic mass. The general relativity theory community rejected Lorentz relativistic mass long time ago without properly investigating what predictions it would lead to if incorporating it. Ignoring Lorentz relativistic will overestimate the Hubble constant with about 4.19 when calibrated to the full distance ladder of 1a Supernovas. This we find from looking at redshifts from 580 SN 1a taken from the Union-2 database. This likely explains why when only calibrating t low z supernovas or the CMB that one then get an Hubble constant of around $68 \text{ km s}^{-1}\text{Mpc}^{-1}$ versus about $73 \text{ km s}^{-1}\text{Mpc}^{-1}$ when using the full distance ladder of supernova 1a's. This large difference in Hubble constants predictions is known as Hubble tension that seems like it can be fully explained if one take into account Lorentz relativistic mass.

That Lorentz relativistic mass seems to explain the Hubble tension should not been isolated but be seen together with recent published research that shows that incorporating Lorentz relativistic mass gives supernova 1a predictions about magnitude versus redshift that are in line with observations without the need of dark energy. Further micro black holes then perfectly fit all properties of the Planck scale something general relativity theory cannot do. It even seems we get a simpler cosmology. All in all, there starts to be much evidence in favor of incorporating Lorentz relativistic mass, something that is totally ignored in Newton and general relativity theory today.

Keywords: Hubble constant, Hubble tension, Lorentz relativistic mass, Supernova 1a, distance ladder.

1 The Hubble tension problem

There exist different observations and methods to find the value of the Hubble constant. In general, one need standardized cosmological candles to do so. Supernova 1a's have special signatures that make them reliable as standardized cosmological candles. They are also bright enough so that we can observe the light from them even over enormous cosmological distances. A long series of studies finding the Hubble constant from SN Ia distance ladder observations gives a Hubble constant value of about $73 \text{ km s}^{-1}\text{Mpc}^{-1}$. For example, a recent study by Reiss et. al [1] and Brout et al. [2] using the full SN Ia distance ladder finds that the Hubble constant value of respectively $H_0 = 73.04 \pm 1.04 \text{ km s}^{-1}\text{Mpc}^{-1}$, and $73.4^{+0.99}_{-1.22} \text{ km s}^{-1}\text{Mpc}^{-1}$. These are studies from large amounts of supernova 1a including both low and high z supernovas.

Some other studies have only looked and low z supernovas and found a much lower value of the Hubble constant. For example, Sedgwick et. al [3] used 88 SN 1a with $0.02 < z < 0.05$ and found a Hubble constant of $H_0 = 67.41 \pm 1.02 \text{ km s}^{-1}\text{Mpc}^{-1}$. That this is a considerably lower Hubble constant than one gets from when using full sample of also high z supernovas we will see is perfectly in line with what one should expect when considering Lorentz relativistic mass that we soon will get back to.

Other methods or calculating the Hubble constant are not relying on distance ladder standardized candles. Recently Mukherjee et al. [4] in 2020 have used gravitational waves independent on the traditional distance ladder mythology and derive a Hubble constant of $H_0 = 67.6 \pm 0.43 \text{ km s}^{-1}\text{Mpc}^{-1}$. Another recent but accurate method to find the Hubble constant is to use data from cosmological microwave background. Using this method, the Planck Collaboration; Aghanim, N. et al. [5] in 2018 estimated the Hubble constant to be $H_0 = 67.66 \pm 0.42 \text{ km s}^{-1}\text{Mpc}^{-1}$ using CMB data from the Planck satellite.

Many more Hubble constant measures studies have been performed, these tend to fall around 73 or around 68 depends on if they rely on the full traditional distance ladder or not. An overview of many Hubble constant measurements and much more details about the Hubble tension problem and various solutions that have been suggested to solve it is given by Valentino et. al [6]. They conclude that we are in "a serious desperate crisis in cosmology" despite many solutions have been suggested. The further conclude that none of the suggested

solutions stand out, the authors suggest further work is needed to solve the Hubble constant puzzle. Krishnan et. al [7] has even indicated it could be a break down in the Hubble tension signal a breakdown in FLRW cosmology. In other words, it is an ongoing crisis that should open up also for more possible suggestions for solutions, even solutions questioning the completeness of FLRW cosmology.

In this paper we present a new possible solution to the Hubble constant puzzle that we think look very promising. Of course, no one should take our suggestions for granted, but it should be studied over time by a series of researchers before one make a “final” conclusion.

2 Lorentz relativistic mass short history

One should think that everything already was investigated to relativistic mass. However, by studying the history of it we will better understand why Lorentz relativistic mass never was fully investigated, but prematurely rejected and ignored.

Already in 1899 and 1904 Lorentz [8, 9] suggested relativistic mass as it is known today, namely $m\gamma$, where γ is the Lorentz factor $\gamma = 1/\sqrt{1-v^2/c^2}$. Many university textbooks mention relativistic mass of this form in their section on special relativity theory, without attributing it to the inventor, namely Lorentz. Einstein in the end of his most famous 1905 paper on special relativity theory suggest two relativistic mass formulas:

$$\text{Transverse mass} = m\gamma^2 = \frac{m}{1 - \frac{v^2}{c^2}} \quad (1)$$

and

$$\text{Longitudinal mass} = m\gamma^3 = \frac{m}{\sqrt{1 - \frac{v^2}{c^2}}^3} \quad (2)$$

None of these are used today, Einstein’s longitude relativistic mass formula was identical to that of Lorentz, as Lorentz also suggested one for transverse and one for Longitude, but it is only the transverse relativistic mass of Lorentz that is considered as relativistic mass today.

Max Planck [10] in 1906 suggest relativistic momentum as we know it today; $p = mv\gamma$. For many years relativistic mass was discussed, for example Einstein [11] in 1906 try to suggest experimental methods that can distinguish between the different forms of relativistic masses that have been suggested, but with little or no success.

Wien [12] in 1921 mentions relativistic mass formula by Einstein and not the competing formula by Lorentz. And Wien was not anybody, he had already in 1911 received the Nobel Prize in physics for his work on heat radiation.

In 1927 Jones [13] publish a paper with the title “*The variable mass of the electron*” where he mention what he call “*the well-known Lorentz-Einstein expression or the mass being $m = m_0(1 - \beta^2)^{-1/2}$* ”. Where $\beta = v/c$, so this is indeed the Lorentz 1899 relativistic mass formula, but now also given credit to Einstein, perhaps because he thought it was incorporated in special relativity as one could get the impression of from series of books. More interesting he claims further about this formula

“This expression for the variable mass has been repeatedly verified experimentally. Its validity is accepted.” – Jones 1927, Department of Physics, University of California.

This is as we soon will see very different from the view of the consensus among physicists today. What Jones likely not was aware of was that Einstein himself had actually abandoned relativistic mass even before he derived his general relativity theory [14]. This however became clear first later, but his negativity to relativistic mass is clearly expressed in his letter a letter to Lincoln Barnett, an American journalist, dated 19 June 1948, Einstein wrote,

It is not good to introduce the concept of the mass $M = m/\sqrt{1 - v^2/c^2}$ of a moving body for which no clear definition can be given. It is better to introduce no other mass concept than the “rest mass”, m . Instead of introducing M , it is better to mention the expression for the momentum and energy of a body in motion. – Einstein, 1948

As Einstein is one of the very most prominent researchers in physics, that we all know had lots of wonderful achievements, his view also here has been actively used by critics of relativistic mass. It is unclear when Einstein exactly stopped ignoring relativistic mass. It could have been that more and more researchers actually favor the Lorentz relativistic mass expression above his own. For example Tolmann [15] in 1912 based on derivations and reasoning was clear on that it was the Lorentz relativistic mass formula that made the most sense, see also Vereide [16].

Or it could have been simply that Einstein not could see relativistic mass fit into his soon to come gravity theory, we will never know for sure. Einstein likely abandoned relativistic mass somewhere after the invention of Minkowski [17] space-time geometry in 1908. He clearly did not incorporate relativistic mass into his general relativity theory. A series of today’s experts on general relativity has gone out against the use of relativistic mass, both in special and general relativity theory, for example Adler [18] has stated:

Anyone who has tried to teach special relativity using the four-vector space-time approach knows relativistic mass and four-vectors make for an ill-conceived marriage. In fact, most of the recent criticism of relativistic mass is presented in the context of the four-vector formulation of special relativity.
– Adler, 1987

We have [19, 20] recently shown that one can look at space-time as three dimensional space-time, where there is three time dimensions as well as three space-dimensions, but where space and time are even closer connected than in Einstein's theory. In our theory space and time are two sided of the same coin, one cannot move in one without moving in the other. So, then we can model this as three dimensional space-time even if three space and three time dimensions, they are just two sides of the same dimension. Then then potential issues related to relativistic mass and the four-vector formulation seems to be gone. We do not ask anyone to take this for granted, but to keep an open mind that there are other alternatives recently discussed in the literature that could be worth study carefully before making up one's mind based on prejudice, such as that Lorentz relativistic mass is inconsistent with the four-vector approach. The suggestion of three-time dimensions is far from new (see [21–23]), but we will claim there have been recent progress in this view of physics.

A series of other prominent physicists has gone out against incorporating relativistic mass, for example Okun [24], Taylor and Wheeler [25] and Hecht [26]. Other prominent researchers like Rindler [27, 28] that was a known expert and supporter of special and general relativity was much more positive to relativistic mass. The same is true with Jammer [29] in his book about the concept of mass. Still non of the negative or few positive researchers did many attempts to fully investigate what incorporating Lorentz relativistic mass could lead to in terms of predictions compared to not doing so.

The extreme negativity towards relativistic mass from most experts we think must be the cause of this lack of interest in relativistic mass the last 80 to 100 years or so. In our view the way Lorentz relativistic mass was ignored and rejected has been done in a way that goes a bit against the scientific method. One should not be based on prejudice or loose meanings reject an idea, in particular when suggested by such a prominent physicist as Lorentz himself. One should first do considerably investigation of what it leads to when incorporating it and then compare the totality of incorporating it with not incorporating it. If it seems inconsistent on a few points, but after more careful investigation seems to lead to many more logical predictions, then one should ask why is it in conflict for example with the four-vector approach? Could it be our idea of four-dimensional space-time that needs to be re-considered? Well to go in depth about space and time dimensions and its geometries is outside the scope of this paper, but here we will show by incorporating Lorentz relativistic mass in cosmology it seems like the Hubble tension is easily explained.

3 Hubble constant and Lorentz Relativistic mass

The Hubble constant can in standard cosmology be presented as

$$H_0 = \frac{zc}{d} \quad (3)$$

where z is the measured redshift and c is the speed of light in vacuum, and d is the distance to the object sending out the photons. The critical mass in the Friedmann [30] critical universe is given by

$$M_c = \frac{c^3}{2GH_0} \quad (4)$$

This is an equivalent mass, so it dose not distinguish between what is energy and what is mass, something we naturally can do as we know we have $\frac{E}{c^2} = M$.

Solved with respect to H_0 the equation above gives

$$H_0 = \frac{c^3}{2GM_c} \quad (5)$$

replacing H_0 on the left side of equation 3 and solved with respect to z gives

$$z = \frac{1}{\frac{2GM_c}{c^2d}} \quad (6)$$

Pay attention to that this looks like simply one divided by twice the normal gravitational redshift formula $\delta = \frac{GM}{c^2R}$. We think this is more than a coincident something we soon will get back to. Equation 6 we can re-arrange by multiplying by c and dividing by d on both sides this gives

$$\begin{aligned} \frac{zc}{d} &= \frac{1}{\frac{2GM_c}{c^3}} \\ H_0 &= \frac{1}{\frac{2GM_c}{c^3}} \end{aligned} \quad (7)$$

In a model linked to the relativistic mass Haug [31] has recently shows that one get the following formula for cosmological redshift, this gives

$$z = \frac{1}{\frac{GM_u}{c^2 d}} \quad (8)$$

where M_u is the mass in the observable universe, not only inside a critical universe. This mass is given by $M_u = \frac{c^3}{GH_0}$, so it is exactly twice the critical mass in the Friedmann model, so at this point the two models give the same prediction, but different interpretation, but equation 7 and 6 gives exactly the same output. The cosmological redshift in the latest equation clearly looks like simply one divided by a traditional gravitational redshift formula one gets from general relativity, for weak field, but in the Haug quantum gravity model it is also consistent for a strong gravitational field, see [31].

Next we assume the universe mass should be relativistic relative to the object emitting light, for example a supernova that we are getting light from and uses as an indirect observer that we get photons from. This means the universe mass should be relativistic based on Lorentz relativistic mass concepts, this gives

$$z = \frac{1}{\frac{GM_u \gamma}{c^2 d_r}} = \frac{1}{\frac{2GM_u \gamma}{c^2 d}} \quad (9)$$

where we suggest $\gamma = 1/\sqrt{1 - v_{pec}^2/c^2}$, that is v_{pec} that is found from solving relativistic doppler shift with respect to v , that is we have

$$z = \frac{\sqrt{1 - \frac{v}{c}}}{\sqrt{1 + \frac{v}{c}}} \quad (10)$$

and solved with respect to v we get the well known formula

$$v_{pec} = v = c \frac{(1+z)^2 - 1}{(1+z)^2 + 1} \quad (11)$$

We now replace this into equation 9 and gets

$$z = \frac{1}{\frac{GM_u}{c^2 d \sqrt{1 - \frac{v_{pec}^2}{c^2}}}} \quad (12)$$

$$(13)$$

Next we multiply both sided with c and divide both sided with d this gives

$$\begin{aligned} \frac{zc}{d} &= \frac{c}{\frac{GM_u d}{c^2 d \sqrt{1 - \frac{v_{pec}^2}{c^2}}}} \\ H_{0,r} &= \frac{1}{\frac{GM_u}{c^3 \sqrt{1 - \frac{v_{pec}^2}{c^2}}}} = H_0 \sqrt{1 - \frac{v_{pec}^2}{c^2}} = H_0/\gamma \end{aligned} \quad (14)$$

That is the Hubble constant taking into account relativistic mass, so we use notation $H_{0,r}$ for it. It is equal to the Hubble constant not taking into account relativistic mass divided by γ .

That means we will overestimate the Hubble constant when not taking into account Lorentz relativistic mass. The error in the estimate will be

$$\Delta_H = H_0 - H_{0,r} = H_0 - H_0/\gamma = H_0 - H_0 \sqrt{1 - \frac{((1+z)^2 - 1)^2}{(1+z)^2 + 1}} \quad (15)$$

This error will be bigger for high z distance standardized candles, like supernovas than for low z objects.

From a deeper and new quantum gravity theory we have recently shown that embedded in even standard gravity is what we call collision-time mass. Where the rest-mass is given by $M_g = t_p \frac{l_p}{\lambda}$, where t_p is the Planck time, and $\frac{l_p}{\lambda}$ is the number of Planck events over the Planck time for the gravitational mass. For a mass smaller than the Planck mass this is smaller than one and then should be interpreted as a probability, for a larger mass this is an integer plus a small fraction. It is then a probability aggregate, where the integer part is number of certain events, and if in additional a fraction this is the probability for one more event. It will take many pages to explain this in detail, but that we have already done in other recent papers see, [20, 32, 33]. What is interesting here is that in this view the Hubble constant is nothing more than one divided by this collision-time mass. The Hubble tension is therefore simply

$$H_0 - H_0 \sqrt{1 - \frac{v_{pec}^2}{c^2}} = \frac{1}{\bar{M}_u} - \frac{1}{\bar{M}_u \gamma} \quad (16)$$

Where $\bar{M}_u = \frac{G}{c^3} M_u = 2 \frac{G}{c^3} M_c$, this again is the same as $M_u = t_p \frac{l_p}{\bar{\lambda}_u} = 2 t_p \frac{l_p}{\bar{\lambda}_c}$, where $\bar{\lambda}_u$ and $\bar{\lambda}_c$ are the reduced Compton wavelength in a universe model taking into account Lorentz relativistic mass, and the other in the critical Friedmann universe. These can both be deducted as described in our paper [40].

The Lorentz relativistic mass adjustment varies with red-shift and increases with higher redshift. The question is if this idea can explain the measured Hubble tension? The only way to find out is to check against observed as we will do in the next section.

4 Checking against supernova data

We use the Union-2 supernova 1A database with redshift from 580 supernovas. We assume the Hubble constant has been measured to 73 from these, but this is not considering Lorentz relativistic mass. So, we can now calculate an adjusted Hubble constant for each redshift point.

For the total of 580 supernovas we get a predicted Hubble tension adjustment of 4.19 km s⁻¹Mpc⁻¹. This is found as

$$\Delta_H = \frac{\sum_{i=1}^{n=580} \left(H_0 - H_0 \sqrt{1 - \frac{v_{pec,i}^2}{c^2}} \right)}{n} = \frac{\sum_{i=1}^{n=580} \left(1 - 1 \sqrt{1 - \frac{((1+z_i)^2 - 1)^2}{(1+z_i)^2 + 1}} \right)}{n} \approx 4.19 \text{ km s}^{-1} \text{Mpc}^{-1}$$

This means for example if one from this database has estimated the Hubble constant to be $H_0 = 73 \text{ km s}^{-1} \text{Mpc}^{-1}$ not taking into account Lorentz relativistic mass, then in reality it should only be $H_0 = 73 - \Delta_H = 68.81 \text{ km s}^{-1} \text{Mpc}^{-1}$ after adjusted for Lorentz relativistic mass.

Next, we look filter out all 1a supernovas in the Union-2 database with $z < 0.05$. There are 140 such supernovas. The Lorentz relativistic mass adjustment for the Hubble constant is then only

$$\Delta_H = \frac{\sum_{i=1}^{n=140} \left(H_0 - H_0 \sqrt{1 - \frac{v_{pec,i}^2}{c^2}} \right)}{n} = \frac{\sum_{i=1}^{n=140} \left(1 - 1 \sqrt{1 - \frac{((1+z_i)^2 - 1)^2}{(1+z_i)^2 + 1}} \right)}{n} \approx 0.03 \text{ km s}^{-1} \text{Mpc}^{-1}$$

This means if one estimates the Hubble constant only from very low redshift supernovas then we should expect there to be almost no adjustment here for Lorentz relativistic mass, so such a Hubble constant estimate should be close to what one get from the CMB background, as it is, both are around 68. This is exactly what has been found recently, there is no Hubble tension between estimates from only low z supernovas and measurements from the CMB observation.

We therefore both have a simple explanation why studies of only low z supernovas have a much lower Hubble constant than when extracted from databases also containing significant number of high z supernovas. Our method also explains why other methods like CMB also give much lower values for the Hubble constant than the full distance ladder including high z supernovas. Correcting high z supernovas for Lorentz relativistic mass also gives a Hubble constant value of around 68 km s⁻¹Mpc⁻¹ here. The Hubble tension is fully explained. The Hubble tension is likely simply due to ignoring Lorentz relativistic mass.

5 Summary

The result that Lorentz relativistic mass seems to explain the Hubble tension not be studied in isolation. It has recently been shown that taking into account Lorentz relativistic mass also makes it possible to very accurately predict supernova 1a in line with observations without the need for dark energy and several other important aspects that we will list below.

1. Lack of taking into account Lorentz relativistic mass explains why we get a much lower Hubble constant when using only low z supernovas than the full distance ladder of supernovas.
2. Lack of taking into account Lorentz relativistic mass explains why we get a much lower Hubble constant when methods such as CMB and the gravitational wave method than when using the full distance ladder of supernovas. The CMB and gravitational wave methods are likely not affected by Lorentz relativistic mass, but this should be carefully investigated further before one concludes.
3. It has recently been demonstrated that when taking into account Lorentz relativistic mass one get predictions of magnitude versus redshift that fits observations very well for low to high z 1a supernovas, see [34]. In other words, no dark energy is needed. This point we think is indirectly related to the Hubble tension as the Hubble constant value also says something about the rate of expansion in the standard model.

4. Taking into account Lorentz relativistic mass gives much higher predicted redshift when light is sent out very close to a very strong gravitational fields such as from quasars, see [35]. This seems to explain the lack of observed velocity time dilation in quasars, see Hawkings [36, 37].
5. Micro black holes are typically linked to the Planck scale. In a detailed study Haug and Spavieri [38] shows that any micro black hole candidate (all close or equal to the Planck mass) when studied under general relativity all of them only can match maximum a few properties of the Planck scale. With properties of the Planck scale, we think of such as Planck time, Planck mass, Planck length, Planck acceleration, Planck volume and Planck density. While when taking into account Lorentz relativistic mass one gets that the Planck mass size micro black hole perfectly fit every single aspect of the Planck scale.
6. Taking into account Lorentz relativistic mass when deriving a cosmological model one get a very similar but considerably simpler equation than the Friedmann model. This new model can be derived by adding Lorentz relativistic mass to Newton theory [39] or straight from a new quantum gravity model known as collision space-time, see [20]. The model also give us a new quantum cosmology rooted in the Planck scale, see [40, 41].
7. Including Lorentz relativistic mass seems to make wormholes mathematical forbidden, see [42]. No wormholes have been observed despite extensive search also for these. Not only if a theory fit observations should be considered when comparing different models. When considering what theory to prefer one should also consider predictions from a theory that seems unrealistic that never have been observed, if an alternative and simpler model exist. Assume I have a theory predicting there are pink elephants flying between the Earth and the Moon. We can never prove 100% that there are no pink elephants flying between the Earth and the Moon. I can always claim they are hiding deep inside the jungle and extremely unlikely to be spotted, and that they very seldom fly to the moon and are hard to detect. However, if a theory shows pink elephants flying to the moon is an impossibility and no pink elephants flying to the moon has been observed then one should really consider preferring that theory until otherwise falsified or improved.
8. Cole [43] has recently shown that taking into account Lorentz relativistic mass can give a new and interesting interpretation on neutron stars.
9. For decades one have only operated with a Compton wavelength formula for when the electron is initially at rest. That is the original Compton [44] 1923 formula. It is only relativistic in the sense that it naturally considers that the speed of photons is c . Why do we in books and papers for many decades do not find an extension of this formula when also the electron initially is moving. We think again because most researchers have avoided relativistic mass. Only very recently the formula was extended, see [45].

One or several of these points could in theory be proven wrong. Still at this stage one should in our view take into account that there seems to be more and more research pointing in the direction of favoring taking Lorentz relativistic mass back into our theories, or at least keep investigating it more carefully before we decide to conclude about it.

6 Possible issues

Special relativity theory assume that we have Lorentz invariant reference frames globally, or basically flat space-time. Observed gravity phenomena clearly show us this is not the case, why general relativity theory only is consistent with locally Lorentz frames. To incorporate Lorentz relativistic mass in gravity one could mistakenly think one then try to enforce global inertial Lorentz frames on gravity and that it therefore clearly not is valid to do so. This would be a mistake in our view. Recent progress on research on the Planck scale shows that the Planck length and other Planck units can be measured independent on any knowledge off G and even h or c , see [46, 47]. This is far from trivial, as early as 1987 Cohen [48] concluded one could not express gravity through Planck units as one had to know G to calculate the Planck units, in other words that the Planck units only could come out through dimensional analysis. This is the main view of today's physics community, and has been repeated as late as 2016 see [49]. However recent breakthrough in understanding the Planck scale show we indeed can measure the Planck units independent on knowledge of any other constants. This means detection of gravity phenomena are detection of the Planck scale, something that is in full line with a new quantum gravity model [20]. To incorporate Lorentz relativistic mass and gravity is completely in line with this.

Einstein [14] already in 1916 was the first to suggest that the next big step in gravity theory was to develop a quantum gravity theory. Eddington [50] in 1918 was likely the first to suggest that such a quantum gravity theory likely had to be linked to the Planck length.

There could however be a series of smaller adjustments needed to the approach described above. For example the Solar system is moving towards the CMB at about a speed of 0.1% of c according to some studies, see [51], that correspond well with the a measured based relative to the average of galaxies see [52]. Also, the Earth is moving around the Sun at a velocity of about 30 000 km/s (0.01% of c). This mean the Supernova redshifts can be a bit different from different directions and for different times of the years. These effects should however be small and can easily be adjusted for.

It can also not yet be totally excluded if Einstein and Lorentz and others were initially right that there could be differences in relativistic mass for Longitude and transverse direction, even if this is less likely. One however must be extremely carefully here, of from where it is all observed and how it is observed. This is a bit like detect Length contraction directly. Penrose [53] already in 1959 showed that a moving body did not alter shape on a photograph, something that seems to still be consistent with length contraction when one take into account how the measurements have been done, but still we should all be open minded here, that there still could be things not fully understood. One should not close the doors to even speculative ideas before very carefully investigated. We also must have in mind that many big ideas in physics started out quite ad-hock and speculative before they got a solid theoretical and experimental framework around them. For example FitzGerald [54] just ad-hock suggested length contraction to make the ether theory consistent with the Michelson and Morley [55] experiment, this was formalized later by Lorentz and why it often is called Lorentz contraction even in the literature about special relativity theory . Larmor [56] speculatively added time dilation in 1900. Both these concepts are today parts of special relativity theory, but relativistic mass was rejected by the physics community before properly investigated, maybe it is time to consider taking it back into the theory.

7 Conclusion

We have conjectured that ignoring Lorentz relativistic mass in general relativity and in the Λ -CMD model leads to over estimation of the Hubble constant when derived from debases also containing moderate to high z standardized candles such as supernova 1a containing also high z . From 580 supernovas from the Union-2 database we get that the Hubble constant is overestimated with about $4 \text{ km s}^{-1}\text{Mpc}^{-1}$.

For low z supernovas 1a the Lorentz relativistic mass will have minimal any effect. This we have tested out by deriving the Hubble constant correction for ignoring Lorentz relativistic mass in supernova 1as from the Union-2 database using all supernovas with redshift, $z < 0.05$. We find that the Hubble constant correction then only is 0.03. This means deriving the Hubble constant from low z supernovas from the standard methodology (ignoring Lorentz relativistic mass) should be in line with methods not relying on the distance ladder, such the CMB approach of the Planck collaboration.

Our findings should be seen in line with long series of issues in cosmology and gravitational physics that seems to get simpler logic when including Lorentz relativistic mass. Such that one does not seem to need dark energy to correctly predict supernova 1a magnitude versus redshift.

The physics community should naturally not take any of this for granted, but we also encourage the physics community to not come with prejudice. That Lorentz relativistic mass could be inconsistent with some core principles in the standard model should also make one think if it is perhaps these core principles such as four-dimensional Minkowski space-time that need to be looked at closer rather than close the door prematurely to Lorentz relativistic mass and hinder it to be fully investigated and circulated before one compare notes.

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