Alleged Extended Lifetimes of Atmospheric Muons – Does This Really Confirm Relativity?

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One of the long-standing 'proofs' of Einstein's relativity is the alleged time dilation effect that muons created during cosmic ray collisions with particles in our upper atmosphere experience as they plummet downward at nearly the speed of light. Given the assumption that all are created at one high altitude, relativists see only a 'slowing' of their 'clocks' as the means by which their decay can be sufficiently delayed so that an unexpectedly (according to classical physics) large number reach sea level. One of the earliest experiments allegedly demonstrating this was by Frisch and Smith in 1963. Dissident physicists have offered non-relativistic explanations for the relatively high numbers of atmospheric muons reaching sea level, including the possibility that they are created by cosmic ray collisions with particles throughout our atmosphere, not just at a single altitude. The plausibility of this argument is examined here as an alternative explanation to relativistic time dilation as the only acceptable answer offered by mainstream physics today.

1. Introduction

Atmospheric muons are assumed to be created only in the upper atmosphere (at an altitude of ~15 km) when cosmic rays collide with particles. [1] If created only at these altitudes, and given their half-life of only 2.2 μs, half should decay every (2.2E-6 s)(3E+8 m/s) = 660 m if they are traveling at near the speed of light c. This would leave only $1/2^{(15000/660)} \approx 1/2^{23} \approx$ 1E-7 (one ten-millionth) reaching sea level. Experiments such as that by Frisch and Smith in 1963 indicated that the number of muons reaching near sea level is much greater than would be expected from these standard assumptions, prompting them, and successive physicists, to conclude that the muon half-lives were significantly lengthened due to their near-c speeds as postulated by Einstein's relativity theories. [2] In fact, they measured a decrease from an altitude of ~ 2 km down to sea level of only 151 out of 563 muons, or ~ 27%. Even over this relatively short distance, a 2.2-μs half-life would suggest a decrease by $1 - 1/2^{(2000/660)} \approx 1 - 1/2^3 \approx 88\%$. Therefore, they concluded that relativistic time dilation had 'slowed' the internal decay 'clocks,' by an average factor of ~8.4.

As with other 'proofs' of Einstein's relativity, dissident physicists have considered possible non-relativistic explanations for observed results, typically being dismissed by relativists by patching up 'The Standard Model' with fictions such as Dark Matter/Energy, Big Bang Inflation, etc. Specifically related to atmospheric muons is Reference [3]:

> *... [W]hy are we adamant that we know everything about the muon and controlled all the factors which could affect its speed and life span? Relativists propose time dilation as if our knowledge about the life span and the speed of muons is perfect and absolute. Under certain conditions (gravity, energy state, environment, etc.) why not a muon [that can] travel faster or live longer before it decays into the smaller particles.*
>
> *Muon's time dilation is only a calculated/predicted effect from the mathematics of relativity and hence can't be accepted as a proof of relativity. Muon's time dilation is what we would propose in the given scenario if the theory of relativity is correct. Relativists resort to circular logic here, i.e., they believe that relativity is true, so they imagine time dilation as really happening for the muons and then they claim their imagination of time dilation as proof of relativity —- like this they keep going in circles in every scenario that they claim as proof of relativity.*
>
> *Why not [suppose that] the muons produced in the laboratory experience the same time dilation and length contraction if their speed was same as that of the cosmic ray muons? And if they did, why haven't we seen the laboratory muons travel the same 16000 meters as their cosmic counter parts? And if they travelled 16000 meters distance in their life span of 2 microseconds, what would be their speed?*

Since atmospheric muons apparently are created by particle collisions with cosmic rays, why should these collisions be limited only to the upper atmosphere when atmospheric density increases with decreasing altitude? If muons could be created throughout the atmosphere, what might be observed with decreasing altitude? Could observations similar to that by Frisch and Smith be explained by simply assuming muons are created throughout the atmosphere, not just in the upper atmosphere, thereby eliminating the need for 'time dilation' as a panacea?

2. Creation of Muons as a Function of Atmospheric Density

From Reference [4], a plot of atmospheric density vs. altitude shows an exponential-like increase with decreasing altitude, from near-zero density at ~ 35 km to ~ 1.3 kg/m^3 at sea level (0 km), as shown in Figure 1. Where muons supposedly are created (~ 15 km), the atmospheric density is only ~ 0.2 kg/m^3, or < 1/6th of the maximum. Would it not seem logical to assume cosmic rays create muons at altitudes less than 15 km where collisions with particles should be more likely, perhaps all the way down to sea level? Countering this to some extent (evaluated below) is the decrease in cosmic ray intensity with decreasing altitude, from a maximum at ~15 km (~ 70/min according to Reference [5]) to a minimum at sea level (~ 8/min, from the same reference), as shown in Figure 2.

Let us assume that the creation of muons is directly proportional to the ratio of the atmospheric density at altitude y to that density at ~ 15 km = 15,000 m (here we use 15,180 m so that equal intervals of 660 m exist down to sea level, corresponding to the distance over which half of the muons created at altitude y decay) as well as to the ratio of the cosmic ray intensity at altitude y to that intensity also at ~15 km = 15,000 m (again using 15,180 m). Start with one muon created at 15,180 m and calculate the number created and remaining undecayed for every decrease in altitude by 660 m down to sea level. The net number of muons at each altitude decrement is shown in Table 1 and Figure 3.

3. Speculation

The trend shown in Figure 3 indicates the number of muons vs. altitude rises initially with decreasing altitude as the atmospheric density increases fairly steadily while the cosmic ray intensity decreases sharply but is still at its highest levels.

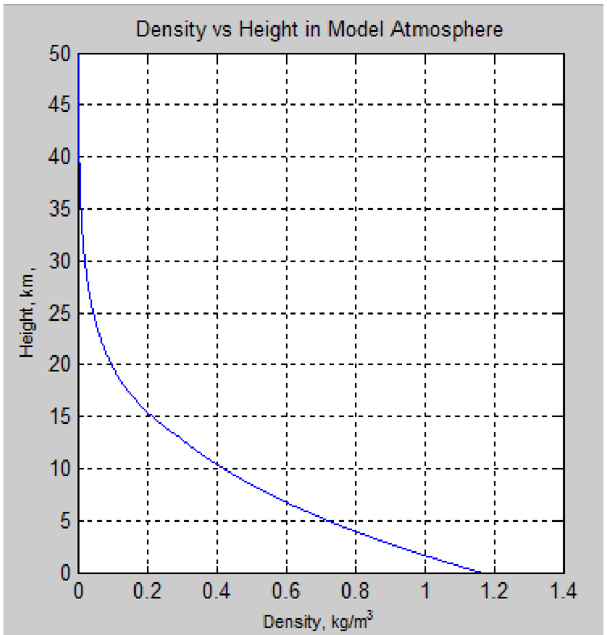

FIGURE 1. Atmospheric Density vs. Altitude

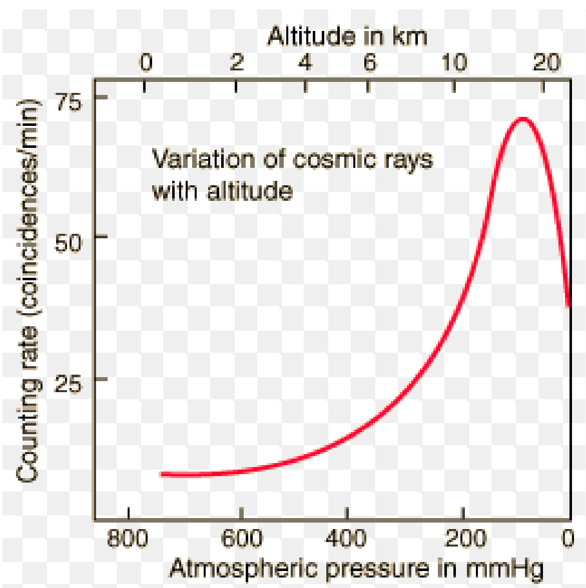

FIGURE 2. Cosmic Ray Intensity vs. Altitude

Subsequently the number of muons decreases with decreasing altitude, leveling off when approaching sea level at ~ 1.4 as the steady increase in atmospheric density is countered by the leveling off of the decrease in cosmic ray intensity and continued decay of previously created muons. The trend over the same range measured by Frisch and Smith (~ 2000 m to sea level) is slightly upward (1.342 to 1.393), an increase by ~ 4% vs. their observed decrease by ~ 27%. However, this does not even remotely approach the presumed non-relativistic decrease of ~88% over that same range that would be expected if all atmospheric muons were created at one altitude (~ 15 km) then decayed with the 2.2-μs half-life as they plummeted downward at near-c speed. Therefore, while the relativists will contend that the Frisch-Smith observations are explained by relativistic time dilation, dissidents like myself might counter that other non-relativistic explanations are also plausible. Given the extreme simplicity of my model here (direct proportionalities to only the ratios of atmospheric density and cosmic ray intensity), it is easy to imagine other secondary effects that could change the slight increase over the Frisch-Smith range that I estimate to align with the decrease they observed without resorting to relativistic time dilation as a panacea.

TABLE 1. Net Number of Muons vs. Altitude

Altitude (m)	Density (kg/m³)	Intensity (1/min)	Muons Created	Muons Undecayed	Net Muons
15180	0.196	71.21	1.000	0.000	1.000
14520	0.217	70.08	1.089	0.500	1.589
13860	0.238	65.91	1.124	0.795	1.919
13200	0.259	62.12	1.153	0.959	2.112
12540	0.280	56.82	1.140	1.056	2.196
11880	0.325	49.64	1.156	1.098	2.254
11220	0.340	48.19	1.174	1.127	2.301
10560	0.375	43.12	1.158	1.150	2.309
9900	0.425	36.59	1.114	1.154	2.269
9240	0.445	33.70	1.074	1.134	2.209
8580	0.480	30.07	1.034	1.104	2.139
7920	0.530	25.72	0.977	1.069	2.046
7260	0.555	23.53	0.936	1.023	1.959
6600	0.615	19.85	0.875	0.979	1.854
5940	0.665	17.28	0.823	0.927	1.750
5280	0.715	15.44	0.791	0.875	1.666
4620	0.765	13.60	0.746	0.833	1.579
3960	0.815	11.76	0.687	0.789	1.476
3300	0.890	10.66	0.680	0.738	1.418
2640	0.965	9.56	0.661	0.709	1.370
1980	1.040	8.82	0.657	0.685	1.342
1320	1.120	8.46	0.679	0.671	1.350
660	1.200	8.09	0.695	0.675	1.370
0	1.280	7.72	0.708	0.685	1.393

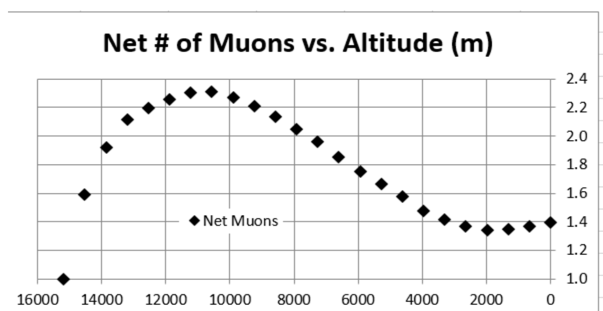

FIGURE 3. Net Number of Muons vs. Altitude (m)

4. References

1. *http://hyperphysics.phy-astr.gsu.edu/hbase/particles/muonatm.html*.
2. *http://en.wikipeida.org/wiki/Time_dilation_of_moving_particles*.
3. *http://debunkingrelativity.com/muons-time-dilation/*.
4. *http://en.wikipedia.org/wiki/File:Comparison_US_Standard_atmosphere_1962.svg*.
5. *http://hyperphysics.phy-astr.gsu.edu/hbase/Astro/cosmic.html*.