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P5-1 Stargate's Ancient Voyagers

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Abstract

In the popular sci-fi series Stargate universe the season finale ends on a huge cliff-hanger, the crew aboard a ship called Destiny are left travelling to another galaxy while sleeping in cryogenic pods. In this paper we work out the time dilation between the ships crew and the crew's family observing from earth and calculate how long their relatives would have to wait to be in the same point in time . We found the observed time to be 5.32 million years and the difference between observed time and proper time to be 2.12 million years.

Introduction

In the season finale of Stargate universe the crews lead engineer Eli explains that if Destiny runs out of power then the ship will go adrift using sub light engine's rather than warp drive. Therefore, they are left travelling to another galaxy and for simplification we assumed they travel from earth to Andromeda. We are also assuming that for the whole trip the ship warp drive fails and travels at sub light speed. The maximum speed Destiny can travel using sub light engines is 0.999c [1], but the show states the ship is heavily damaged and can only operate the engines at 80 percent power, producing a velocity off 0.799c.

Theory and Results

The distance between the two galaxies they travel too isn't mentioned in the show, therefore we assumed it is the distance to Andromeda. Andromeda is estimated to be 2.52 million light years away from the milky way [2]. We then calculated the distance in meters to calculate the proper time (time on Destiny). Proper time is calculated to be 1.01×10^{14} s or 3.2 million years using Equation 1:

$$t = d/v \tag{1}$$

Where d is distance in m and v is velocity from sub light engines in m/s.

The crew on board Destiny would be cryogenic-ally frozen for 3.2 million years if travelling at 0.799c. Therefore, this rules out the relatives on earth being alive for when the crew arrive to Andromeda, unless they are cryogenic-ally frozen but for how long?

Time dilation is a principle in special relativity which states if two objects are in different reference frames (object 1 moving close to the speed of light and object 2 stationary on earth), time will move slower for object 1 relative to object 2. This means object 2 (relatives on earth) will have to be frozen longer than object 1 (the crew). Time dilation is calculated with Equation 2.[3]

$$\Delta t' = \frac{\Delta t}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2}$$

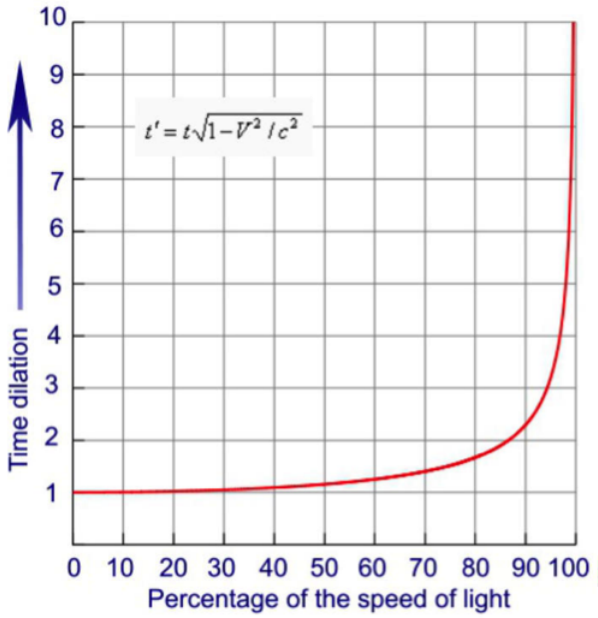

Figure 1: Time dilation as a function of speed of light. [4]

Where Δt is proper time and c is 3×10^8 m/s.

Equation 2 calculates a time dilation of 2.08×10^{14} s or 5.32 million years. Therefore the relatives would be frozen for another 2.12 million years to reach the same point in time as destiny. As destiny's velocity gets closer to the speed of light, the relatives would be frozen for exponentially longer, shown in [Figure 1].

Conclusion

We assumed that the distance between the two galaxies was the distance to Andromeda. This value was used due to higher accuracy from more conclusive data than compared to other galaxies. Assuming cryogenic freezing is possible and reliable for these huge spaces of time, then the relatives would be 2.12 million years older in comparison to the crew on board. The crew would be travelling the void of space for 3.2 million years. It seems we won't be getting season 3 anytime soon.

References

[1] `https://stargate.fandom.com/wiki/Sublight_engine`, Sublight engine [Accessed 6 October 2020]

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[3] P. A. Tipler, G. Mosca, *Physics For Scientists and Engineers, Sixth Edition*, Page R-5, 2007

[4] `http://pages.erau.edu/~andrewsa/sci_fi_projects_spring_2016/Project_1/Altomare_Antonio/HU338Project1-Altomare/TimeDilation-Altomare.html`, How Do You Measure Time [Accessed 7 October 2020]