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A4_7 Okay, but what's the Speed of Dark?

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Abstract

In this paper, we investigate how long Count Dracula, from the show *'Young Dracula'*, would have to travel at half the speed of light, $0.5c$, for him to reach 600 years old, his age on the show, relative to a stationary observer on Earth. Using the equation for time dilation, we find that he would need to travel for 520 years. Using the kinetic energy equation, we also find that he would require 6.04×10^9 J of energy to travel at this velocity.

Introduction

Young Dracula was a popular children's TV show based on a family of vampires, which was featured on CBBC, with a run time of 8 years, from 2006 - 2014 [1]. Count Dracula, the father, is one of the main characters in this show, and we are told that he is 600 years old. Assuming that he is an ordinary human, how long would Count Dracula have to travel at half the speed of light for 600 years to pass on Earth, making him 600 years old relative to a stationary observer?

Count Dracula's Travel Time

Since Count Dracula will be travelling at half the speed of light, $0.5c$, we need to take time dilation into account. This is where there is a difference in time measured by two clocks due to relativistic speeds. Therefore, we will use the time dilation equation to calculate Count Dracula's travel time. This equation is given by:

$$t = t_0 \frac{1}{\sqrt{1 - v^2/c^2}} \tag{1}$$

where t is the time measured by a stationary observer on Earth, t_0 is the time measured by Count Dracula, v is Count Dracula's speed, and c is the speed of light. We therefore need to rearrange this equation for t_0, making it:

$$t_0 = t\sqrt{1 - v^2/c^2} \tag{2}$$

Before substituting the values into Equation 2, we converted 600 years into seconds, which is roughly 1.89×10^{10} s.

Using the value for time in seconds and the velocity of $0.5c$ stated earlier, we we obtain a time value of 1.64×10^{10} s in Count Dracula's reference frame.

This value is equivalent to approximately 520 years, which means that, even in Count Dracula's reference frame, he is travelling for an unrealistically long period of time. If we assume that the average human life expectancy is 73.4 years [2], he would therefore be travelling for 7.1 human lifetimes.

Energy Usage at Relativistic Speeds

When travelling at such high velocities, Count Dracula's energy usage should also be taken into account. With his velocity being $0.5c$, Count Dracula's energy usage would be very high.

Assuming all of his energy is kinetic energy, we used Equation 3 below to calculate Count Dracula's total energy output:

$$E = \frac{1}{2}mv^2 \tag{3}$$

In this case, m is Count Dracula's mass and v is his velocity. Taking his mass to be the average mass of a human man over the age of 80, 80.51 kg [3], the energy required to travel at a velocity of $0.5c$ is 6.04×10^9 J.

The average human produces 1.07×10^7 J of energy per day [4]. This means that it would take Count Dracula roughly 564.5 days to reach the calculated energy, assuming all of his energy is converted into kinetic energy.

Discussion

Realistically, Count Dracula would never be able to travel at relativistic velocities to reduce the time taken for 600 Earth years to pass from his frame of reference. In addition to this, travelling at $0.5c$ would only reduce his travel time by 80 years relative to a stationary observer. Therefore, Count Dracula would still have to be a vampire to live all 520 years during which he is travelling at half the speed of light.

To bring his travel time down, Count Dracula would have to travel much closer to the speed of light. At $0.999c$, he would have to travel for a total of 27 years in his reference frame for 600 years to pass for a stationary observer on Earth. This is not physically possible for a human due to how close it is to the speed of light.

Conclusion

Overall, it is not physically possible for Count Dracula to travel at relativistic velocities for him to reach 600 years old within a human lifetime. This is because he would need to travel at $0.999c$, which is very unrealistic for a human of an average size. Therefore, it would be more realistic for Count Dracula to be a vampire than for him to travel at such high speeds.

References

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