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A3_3 This Time Next Year, We'll be Millionaires!

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Abstract

The path to 'getting rich quick' is one fraught with instability and conjecture. In the British sitcom *Only Fools and Horses*, stock marketer Del Boy Trotter notoriously claims that "This time next year, we'll be millionaires". In this article we utilise the special relativistic phenomenon that is time dilation to calculate the conditions under which this feat would be possible. We found that by investing \$3000 in three companies in the 1980s, travelling at $0.999c$ for 12 ly and instantaneously turning around to undergo a return journey, Del Boy Trotter could have become a millionaire in only a year.

Introduction

In the 1980s television comedy series *Only Fools and Horses*, the protagonist Del Boy Trotter is a market trader who renownedly proclaims that "This time next year, we'll be millionaires". Despite arduous persistence throughout the 22 years that the show ran, Del Boy never fulfilled his economic aspirations.

Senior industry analyst Howard Silverblatt calculated that investing \$1000 in Apple, M&T and Microsoft respectively in the 1980s would have made you \$1,500,000 by 2017 [1]. Interpolating the profits to \$1,000,000 gives a corresponding time frame of approximately 24 yrs. In this paper we humour the idea that Del Boy could have made these investments and boarded a rocket travelling at a specific speed over a certain distance, before instantaneously turning around and returning to Earth at the same speed.

Theory

By constraining the time elapsed on Earth to 24 yrs and the time elapsed for Del boy to 1 yr, we were able to find a turnaround distance of 12 ly with a corresponding speed of $0.999c$.

The Lorentz term is the factor by which time, length and relativistic mass are transformed when converting between inertial (non-accelerating) frames of reference. In this case we are transforming between Del Boy's and Earth's reference frames with the Lorentz factor (conventionally denoted by γ) given by

$$\gamma = \frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}} \quad , \tag{1}$$

where v is the relative velocity between the two reference frames and c is the speed of light. The time relationship between two reference frames is given by

$$t' = \frac{t}{\gamma} \quad , \tag{2}$$

where t' is the dilated time measured in the Del Boy's frame and t is the corresponding time elapsed in the Earth frame [2]. The time taken for Del Boy to reach the turnaround point in the rest frame is given by t. However, in order for observers on Earth to witness the turnaround, light from the event must travel back to Earth. Consequently, the time at which Earth observers would detect that he arrived at the turning point is given by

$$t_{\text{Earth}} = t + t_{\text{light}} = \frac{d}{v} + \frac{d}{c} \quad , \tag{3}$$

where t is the rest time in which the spacecraft arrives at the turnaround point and t_{light} is the time taken for the light to travel back to Earth, allowing for the observation of the spacecraft's arrival. The return journey abides by the same physics, but with distances and velocities in the opposite direction. These outward and return journey times can be summed to give the total time elapsed in each reference frame as shown in Eq.(4) and Eq.(5).

$$t_{\text{total}} = t_{\text{outward}} + t_{\text{return}} \tag{4}$$

$$t'_{\text{total}} = t'_{\text{outward}} + t'_{\text{return}} \tag{5}$$

t_{total} is the time taken to complete the outward (t_{outward}) and return (t_{return}) journeys in the Earth's frame of reference. The same notation is used for Del Boy's frame of reference, with the addition of a $'$ as seen in Eq.(5). Once t_{total} and t'_{total} have been evaluated, the total discrepancy between the time elapsed in Earth's and Del Boy's reference frames can be calculated with the equation

$$t_{\text{discrepancy}} = t_{\text{total}} - t'_{\text{total}} \quad , \tag{6}$$

where $t_{\text{discrepancy}}$ is the aforementioned discrepancy.

Results

Fig.1 shows four events on a 2D space-time diagram labelled A, B, C and D . A is Del Boy's departure from Earth which occurs at 0 yrs for both frames; B is Del Boy's arrival at the turnaround point (12 ly away) which occurs just after half a year in Del Boy's Frame (corresponding to an Earth time of $\sim$ 12 yrs); C is the spacetime coordinate at which observers on Earth see Del Boy

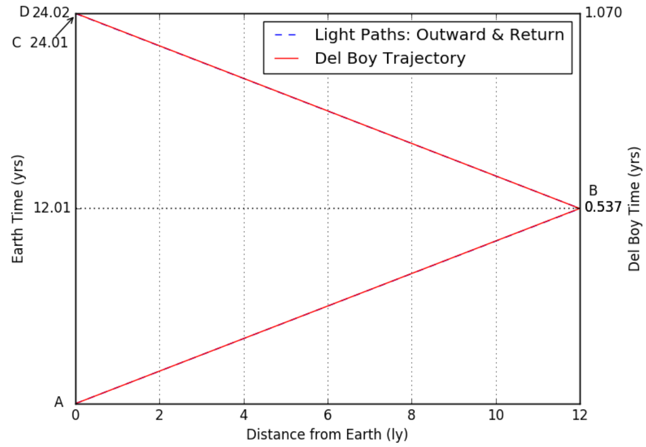

Figure 1: Graph of distance against time with the time measured in Earth's frame on the left y-axis and the time measured in Del Boy's frame on the right. At $0.999c$, Del Boy's paths have almost completely merged with the light paths travelling at c.

arrive at the turning point; D is Del Boy's arrival at Earth which for him occurs after $\sim$ 1 yr, but for Earth occurs $\sim$ 24 yrs after his departure. During those 24 yrs on Earth his $3000 in stocks will have grown to $1,000,000 and he would have arrived as a millionaire [1].

Conclusion

Unfortunately, Del Boy never made true his claims. It would be a different story if he had $3000, the foresight to invest in profitable companies and a rocket in which to travel 12 ly and back at $0.999c$. Paired with the impossibility of surviving the instantaneous turnaround involved, this plot becomes as absurd as the schemes he devised on the show.

References

[1] https://www.cnbc.com/2017/02/23/investing-3000-in-3-stocks-in-1980s-would-have-made-you-a-millionaire.html [Accessed 24 October 2017]

[2] J. P. Luminet, *Time, Topology and the Twin Paradox* Laboratoire Univers et Thories, CNRS-UMR 8102, Observatoire de Paris, F-92195 Meudon cedex, (2009)