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Did Busted really make it to the Year 3000?

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Abstract

This paper investigates the plausibility of Busted making it to the year 3000 and if, on arriving, "everyone was underwater", as depicted in the lyrics and music video to their song "Year 3000". The velocity required to achieve sufficient time dilation to transport the band and their neighbour to the Year 3000, from 2002, in the 7 s of travel shown in the music video, was calculated as $2.9979245799...\times10^8$ ms^{-1}. The energy required to achieve this speed was determined to be approximately 4.267×10^{29} J. Finally, literature models of sea-level rise were investigated to determine if Busted's home town, Southend-on-Sea would be underwater in the year 3000. Even extreme predictive models showed it to still be above water; this, in addition to the large velocity and energy requirements question the legitimacy of Busted's ventures.

Introduction

Busted are a three-piece English pop rock band from Southend-on-Sea, Essex [1]. "Year 3000", released in 2002, is the second single from their self-titled debut album [2, 3]. Within the lyrics and music video to this song the band are depicted meeting with their neighbour, Peter, who has built a car based time-machine with a striking similarity to the DeLorean seen in the Back to the Future series [4]. The band are then shown travelling with Peter in the time-machine to the year 3000. Upon arriving in the year 3000 the band discovers that everything is underwater, as seen in the music video and stated by the lyrics: "I've been to the year 3000. Not much has changed but they live underwater."

This paper investigates the plausibility of Busted traveling to the year 3000, and the likelihood of their home town in the year 3000 being underwater.

Theory

Busted and Peter are shown traveling forwards in time to the year 3000 between 0:38 and 0:45 in the song's music video [4]. While the plan featured on Peter's schematic (at 0:33) implies the quartet travel forwards in time by taking a shortcut through higher dimensional space, a squirrel on a tree is shown rapidly aging (at 0:45) [4]. This is suggestive of some form of time dilation; a natural phenomenon where time is experienced at differing rates by two frames of reference depending on factors such as the velocity of the given reference frame [5].

It is assumed the quartet travel at a velocity great enough to slow their experience of time relative to that experienced on Earth, to the extent that when they stop moving they are in the year 3000. Equation 1 is used to calculate this required velocity [5]:

$$T = \frac{T_0}{\sqrt{1 - (v^2/c^2)}},$$

$$\therefore v = \sqrt{c^2 - (c^2 T_0^2 / T^2)}, \qquad (1)$$

where v is velocity, c is the speed of light in a vacuum, and T and T_0 are the time experienced in the reference frame - in this case by the quartet, and the proper time interval - in this case the time on Earth, respectively.

The kinetic energy required to achieve this speed is then calculated through the use of equation 2 [5]:

$$K = \frac{mc^2}{\sqrt{1 - (v^2/c^2)}} - mc^2, \qquad (2)$$

where K is kinetic energy and m is mass.

Calculations

For these calculations to be carried out the following assumptions are made:

- The time travel machine remains on the surface of the earth.
- The time-travel machine travels in vacuum conditions and experiences no heating.
- The time-travel machine does not make contact with anything while traveling.
- The time-travel machine reaches maximum velocity instantaneously and instantaneously returns to a standstill after the travel duration.
- The time-travel machine and occupants are un-damaged on the journey.

Note that all calculations were carried out on Wolfram [6], as the engine carries forward many significant figures during calculations, attaining a higher accuracy than is possible on many equivalent programs; no variables were rounded when completing calculations.

In the music video the quartet are shown to be traveling to the year 3000 over a period of 7 s, hence T_0 is taken as 7 s. The time, T, between the years 2002 and 3000 is:

$$998 \text{ Years} \times 3.154 \times 10^7 = 3.147 \times 10^{10} \text{ s}$$

The value used for the speed of light was 2.99792458×10^8 ms^{-1}, hence:

$$v = \sqrt{(2.998 \times 10^8)^2 - \frac{(2.998 \times 10^8)^2(7)^2}{(3.147 \times 10^{10})^2}}$$
$$\therefore v = 2.9979245799 \ldots \times 10^8 \ ms^{-1}$$

The calculated required velocity, v, is given to 11 significant figures to highlight the discrepancy between this value and the speed of light, c.

Upon the release of "Year 3000" two Busted members were 18 and one was 16, hence the average UK male mass for these age brackets, 77 kg and 61 kg respectively, were used for their contribution to the total mass [7, 8]. Peter is assumed to be 7 years of age, hence the average mass of a 7 year old UK boy, 24 kg, was used for his mass contribution [7]. The car depicted in the music video is a 1970s HC Vauxhall Viva, with a mass of 817 kg [9]. It was assumed that the adaptations to the car by Peter added negligible mass. The energy required to attain this velocity is therefore:

$$m = (77 \times 2) + 61 + 24 + 817 = 1056 \text{ kg}$$

$$K = \frac{1056 \times (2.998 \times 10^8)^2}{\sqrt{1 - \left(\frac{(2.998 \times 10^8)^2}{(2.998 \times 10^8)^2}\right)}} - 1056 \times (2.998 \times 10^8)^2$$

$$\therefore \text{K} \approx 4.267 \times 10^{29} \text{ J}$$

Note that both v and c values have been rounded in the text above; this is for presentation purposes only, a 1:1 ratio did not occur within the calculation.

Discussion

The required velocity was calculated as being close to the speed of light, giving an extremely large kinetic energy of 4.267×10^{29} J. This highlights the similarity between the required velocity and the speed of light; if v is equal to c in equation 2, the kinetic energy becomes infinite. The 2017 international energy outlook report stated that the total energy consumed by all of humanity in 2015 was 575×10^{15} British thermal units, or 6.07×10^{20} J; 9 orders of magnitude lower than the calculated required kinetic energy [10]. The astronomical energetic requirements alone, ignoring the physical implausibility of reaching such speeds, highlight the impossible nature of Busted's venture. However, assuming they did make it to the year 3000, would they be underwater?

In their 2012 study, Goelzer et al. modelled current rates of sea-level rise to attain an estimate for sea-level changes by the year 3000 [11]. The team predicted a maximum sea level rise of 7 m by the year 3000 based on a number of complex parameters, including but not limited to: thermal expansion, glacial, Greenland and Antarctic ice sheet melting [11]. Other more recent estimates have higher projections; DeConto and Pollard predict a maximum sea level rise of 15 m by 2500 [12]. Southend-on-Sea is 31 m above sea level, therefore, assuming Busted were located at their birthplace in the year 3000, current predictions indicate that they would still be above water [13]. Therefore a much more plausible explanation for the events depicted in the music video and lyrics involve Busted driving down the 1.33 mile Southend-on-Sea pier and into the Thames Estuary, where the lack of oxygen may lead to the events described in the song [14].

Conclusion

The velocity required to cause sufficient time-dilation to transport Busted to the year 3000 was determined to be $2.9979245799 \ldots \times 10^8$ ms^{-1}. The energy required to generate this velocity was determined as approximately 4.267×10^{29} J. Both of these values are far too high to realistically achieve. In addition to this, Busted's home town, Southend-on-Sea, was shown to be above sea level in the year 3000. Combined, these factors make it unlikely that Busted were able to reach the Year 3000 in the manner depicted in their music video and lyrics.

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