The Subjectivity of Reality

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The lengths of time elapsed up till the present since the occurrence of all past events, as 'measured numbers' of Planck times, and also the 'reduced numbers' derived from the measured numbers by way of the Quantum/Classical Connection, a power-law equation, take values equal to integer and specific fractional powers of π, $\pi/2$ and e. Pairs of related events result in symmetrically related powers of π, $\pi/2$ and e. A geometrical basis is hypothesised for the storage of the measured and reduced numbers.

1.   Introduction

All parameters, when measured as numbers of Planck units, take values equal to integer and specific fractional powers of π, $\pi/2$ and e [1, 2]. The three bases may derive from the geometry of spacetime [3]. The lengths of time elapsed up till the present since the occurrence of past events have been shown to be equal, as numbers of Planck times, to integer, half-integer, quarter-integer, etc powers of π and e, signifying that reality is subjective. Here, more lengths of time elapsed up till the present since some notable events of the past, as 'measured numbers' of Planck times, N_M, are shown to equal integer, half-integer, quarter-integer, etc powers of π, $\pi/2$ and e. However, the thrust of this paper is on the 'reduced numbers', N_R, derived from the measured numbers using the Quantum/Classical Connection:

$$2N_R{}^5 = N_M{}^2 \qquad (1)$$

The Quantum/Classical Connection – a small number/large number correspondence – was found in an analysis of vacuum energy [4]; the origin of the correspondence will be contemplated. The reduced numbers will be shown to equal integer, half-integer, quarter-integer, etc powers of π, $\pi/2$ and e.

Both measured numbers and reduced numbers are expressed as powers n_1, n_2 and n_3 of π, $\pi/2$ and e, respectively. The calculated powers[1], for measured and reduced numbers separately, are plotted one against another, the markers lying on a straight line since n_1, n_2 and n_3 are in constant ratio. The powers are superimposed on a lattice of principal levels and sub-levels corresponding to the locations of integer, half-integer, quarter-integer, etc powers.

The value of Planck time used in the calculations is $5.391247(60) \times 10^{-44}$ s [5].

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[1] Strictly, the exponents

2. Results

2.1 Maxwell and Einstein

Maxwell's seminal paper on electromagnetic theory, 'On Physical Lines of Force', was published in March 1861. Maxwell's work paved the way for Einstein's theories of special relativity (June 1905) and general relativity (November 1915). The powers n_1 and n_3 have been calculated from the reduced numbers derived using (1) from the lengths of time elapsed up till the present (8 March 2021) since the three publication dates and are plotted in Figure 1.
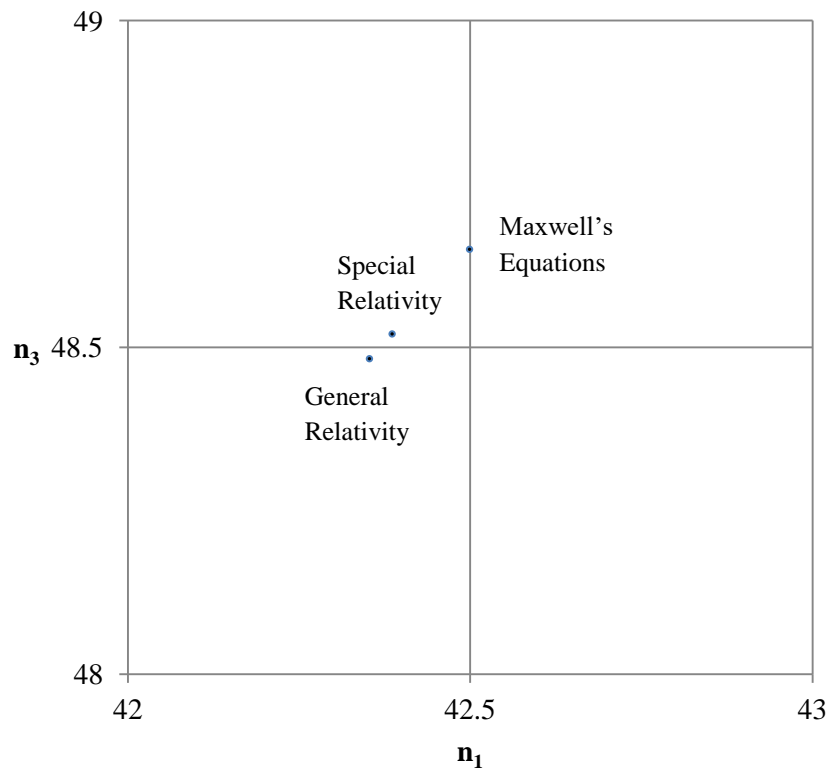

Figure 1: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (8 March 2021) since the publication of three groundbreaking papers, one by Maxwell and two by Einstein.

The power n_1 of π equal to the reduced number derived from the publication date of Maxwell's equations is of value 42.50. The powers n_3 of e equal to the reduced numbers derived from the publication dates of special relativity (48.52) and general relativity (48.48) are arranged symmetrically about the value 48.50. Such symmetrical arrangement is a feature of the model, denoting a broken symmetry of the underlying theory [6].

2.2   Braneworld Models

The ADD and RS braneworld models, both of which were influenced by developments in string theory and address the hierarchy problem, entered the public domain on 11 March 1998 and 4 May 1999, respectively [7, 8]. The powers n_2 and n_3 of $\pi/2$ and e, respectively, equal to the lengths of time elapsed up till the present (13 March 2021) since the events took place, are shown in Figure 2. The two measured numbers (of Planck times) are arranged symmetrically about a quarter-level in Sequence 2.
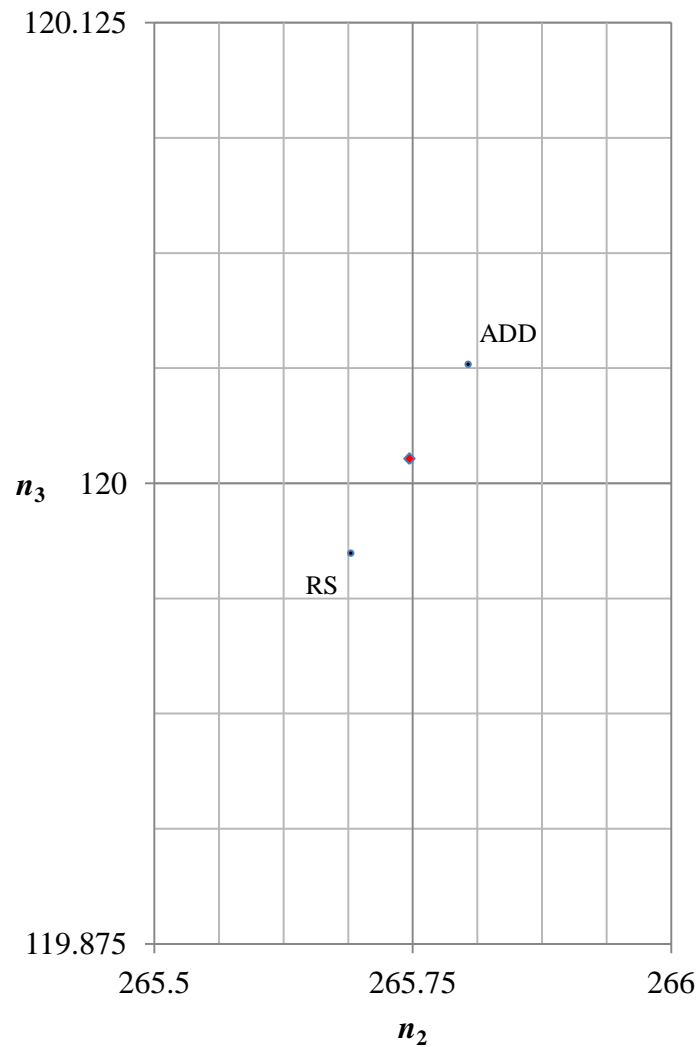

Figure 2: The powers n_2 and n_3 of $\pi/2$ and e, respectively, equal to the lengths of time elapsed up till the present (13 March 2021) since the ADD and RS1 braneworld models were uploaded to the ArXiv. The diamond marks the point of mean n_2 and mean n_3.

The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present since the two events took place, are shown in Figure 3. The reduced numbers are arranged symmetrically about a sub-level in Sequence 1.
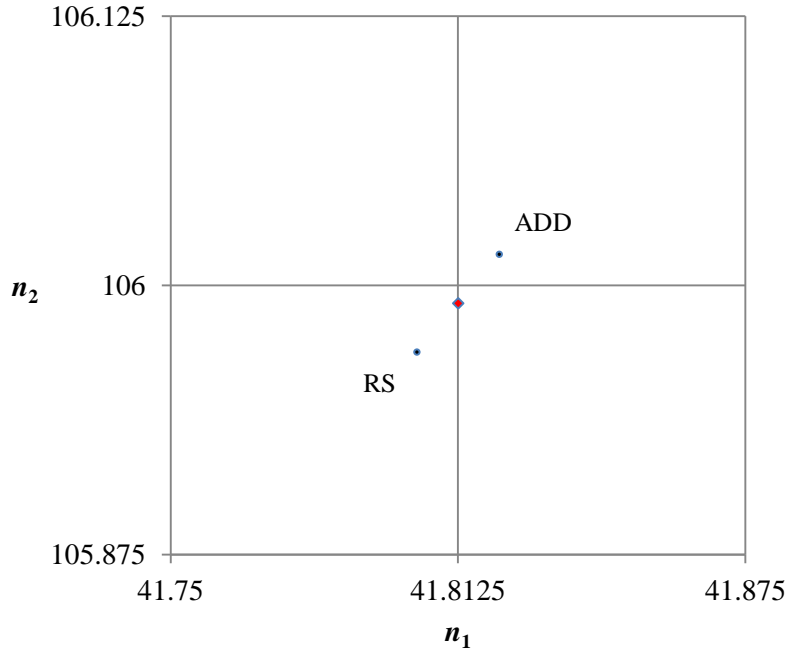
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Figure 3: The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (13 March 2021) since the events of Figure 2. The diamond marks the point of mean n_1 and mean n_2.

2.3 The Heaviest Particles of the Standard Model

The discovery of the top quark was announced on 2 March 1995 and the discovery of the Higgs boson was announced on 4 July 2012. The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the lengths of time elapsed up till the present (15 March 2021) since the two events took place, are shown in Figure 4. Both measured numbers (of Planck times) occupy principal levels. The reduced number for the Higgs boson lies on a sub-level, close to an 'intersection' of half-levels, (41.5, 47.5) in Sequences 1 and 3, as shown in Figure 5.

The discovery of the W boson was announced on 24 February 1983 and the discovery of the Z boson was announced on 1 June 1983. The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (15 March 2021) since the discoveries took place, are plotted in Figure 6. The reduced numbers lie on a principal level in Sequence 1.

It may prove useful to know that I first constructed the two types of graph (measured and reduced numbers) for the top quark and Higgs boson; no other particles were considered at the time. Minutes later, I thought to construct the graphs for the W and Z bosons.
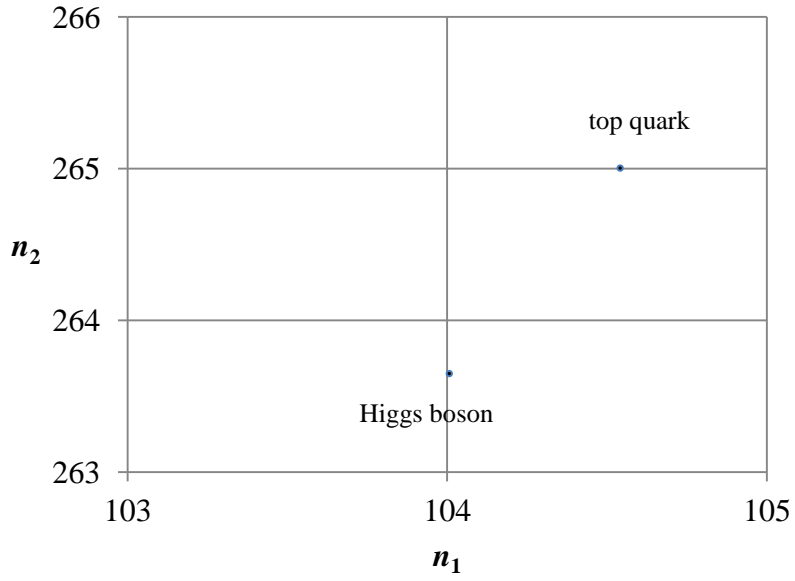
Figure 4: The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the lengths of time elapsed up till the present (15 March 2021) since the discoveries of the top quark and the Higgs boson.
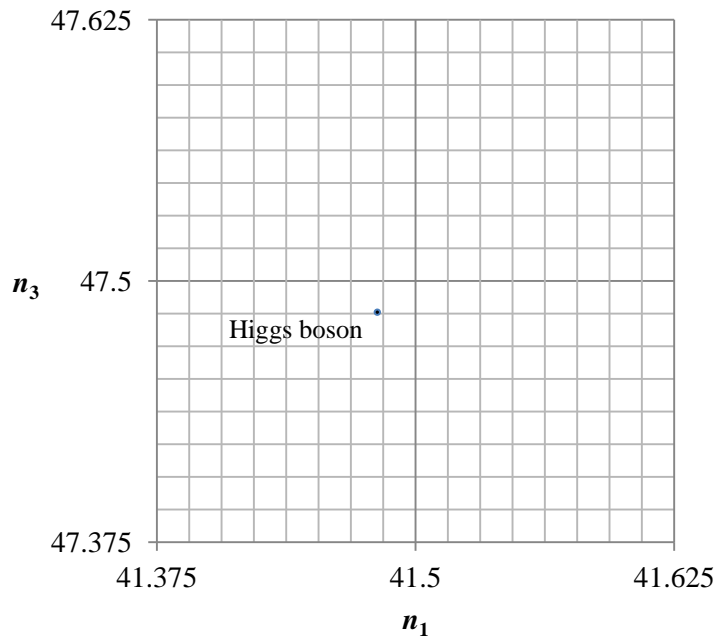

Figure 5: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (15 March 2021) since the discovery of the Higgs boson.
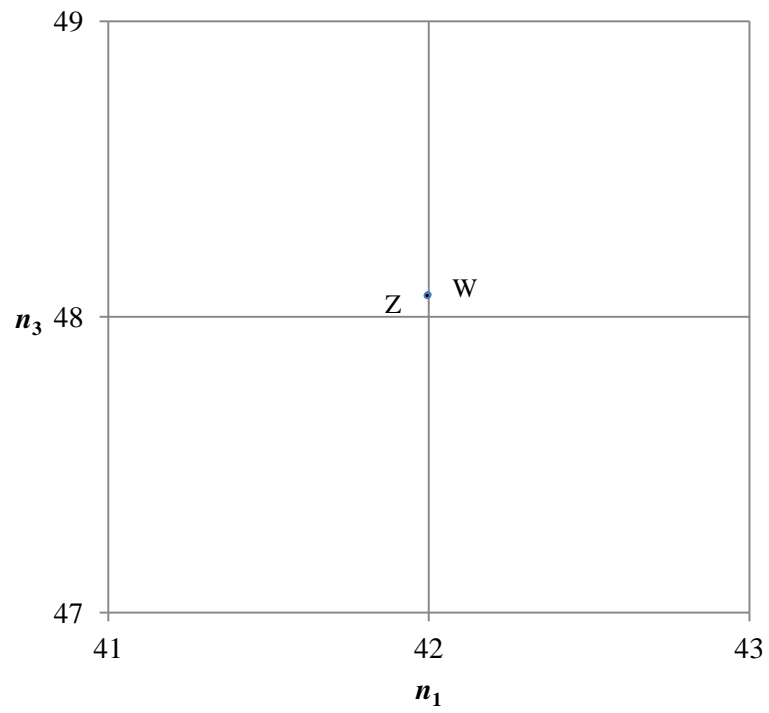
Figure 6: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (15 March 2021) since the discoveries of the W and Z bosons.

2.4   Uranus, Neptune and Pluto

Uranus was discovered on 13 March 1781, the discovery of Neptune was confirmed on 23 September 1846 and Pluto was discovered on 18 February 1930. The powers n_1 and n_3 of π and e, respectively, equal to the lengths of time elapsed up till the present (14 March 2021) since the three events took place, are shown in Figure 7. Each measured number occupies a sub-level.

The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present since the discoveries of the twin planets Uranus and Neptune are shown in Figure 8. The reduced numbers are arranged symmetrically about a quarter-level in Sequence 3.
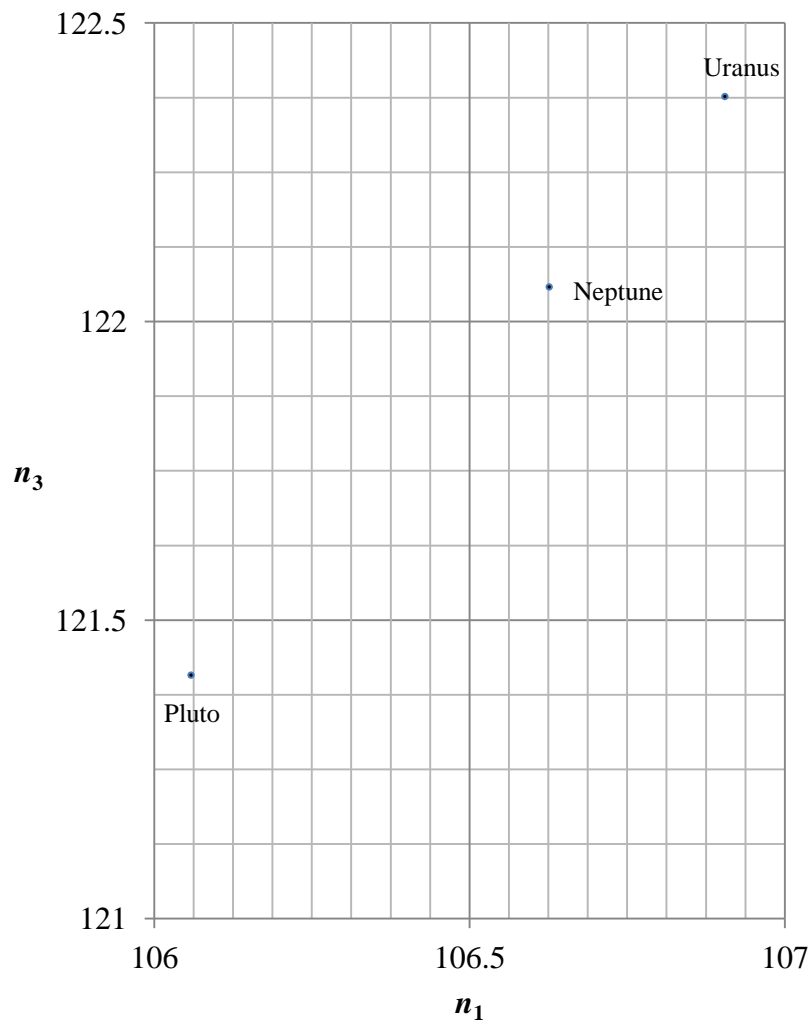

Figure 7: The powers n_1 and n_3 of π and e, respectively, equal to the lengths of time elapsed up till the present (14 March 2021) since the discoveries of Uranus, Neptune and Pluto.
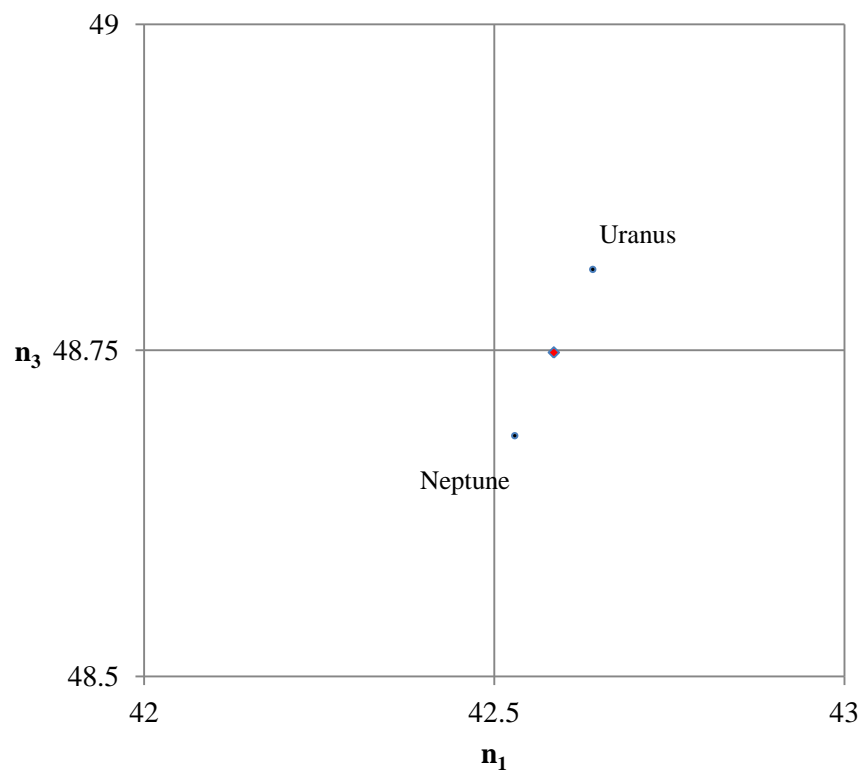
Figure 8: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (14 March 2021) since the discoveries of Uranus and Neptune. The diamond marks the point of mean n_1 and mean n_3.

2.5 Voyager 1

The Voyager 1 spacecraft was launched on 5 September 1977, took the 'family portrait' montage of solar system images on 14 February 1990 and became the furthest spacecraft from the Sun on 17 February 1998. The powers n_2 and n_3 of $\pi/2$ and e respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (5 March 2021) since the above three events took place, are presented in Figure 9, where the reduced numbers may be seen to occupy low-order sub-levels.
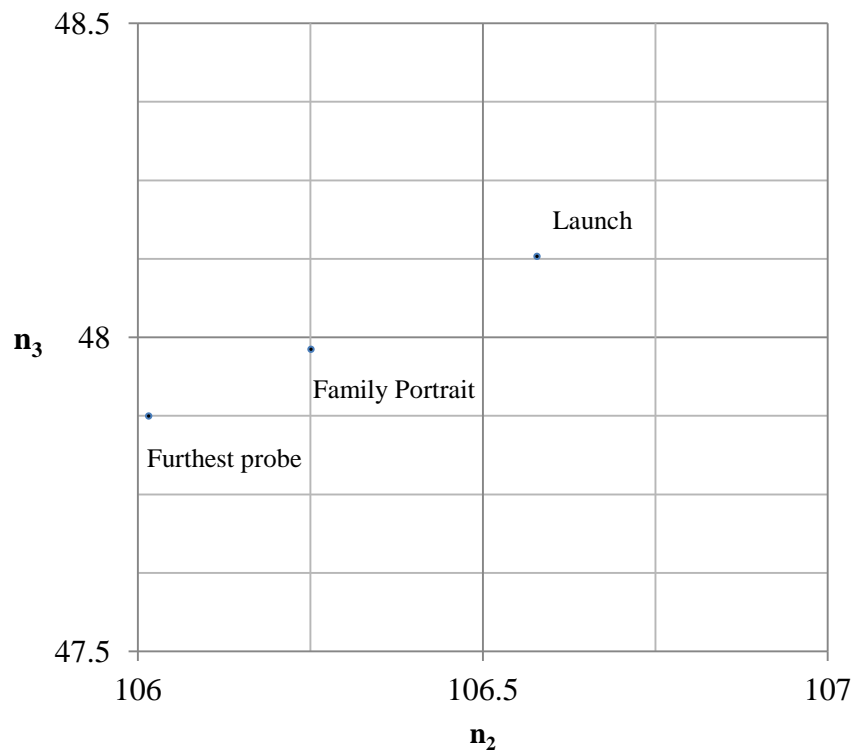

Figure 9: The powers n_2 and n_3 of $\pi/2$ and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (5 March 2021) since three events during the Voyager 1 mission.

2.6 Extreme World Temperatures

The highest (56.7°C) and lowest (-89.2°C) natural temperatures on Earth were recorded on 10 July 1913 and 21 July 1983, respectively. The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present

(1 March 2021) since the two events took place, are shown in Figure 10. The reduced numbers occupy a half-level and a principal level.
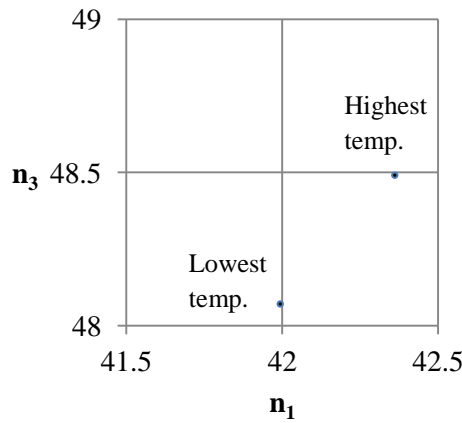

Figure 10: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (1 March 2021) since the highest and lowest natural temperatures on Earth were recorded.

2.7   Civil wars

The English and American civil wars commenced in August 1642 and April 1861, respectively. The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (5 March 2021) since the two events took place, are shown in Figure 11. The reduced numbers occupy a principal level and a half-level.
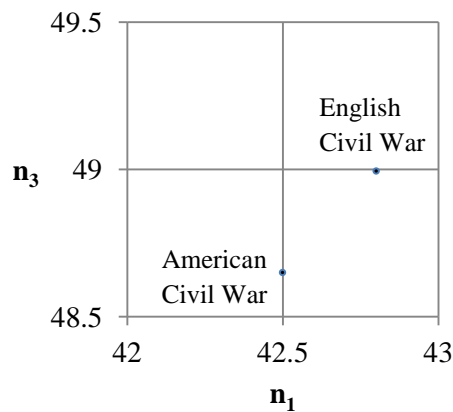

Figure 11 : The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (5 March 2021) since the commencement of the English and American civil wars.

2.8   World War 1

The powers n_1 and n_3 calculated from the reduced numbers derived using (1) from the lengths of time elapsed up till the present (10 March 2021) since the start (28 July 1914) and end (11 November 1918) of World War 1 are plotted in Figure 12. The reduced numbers occupy sub-levels.
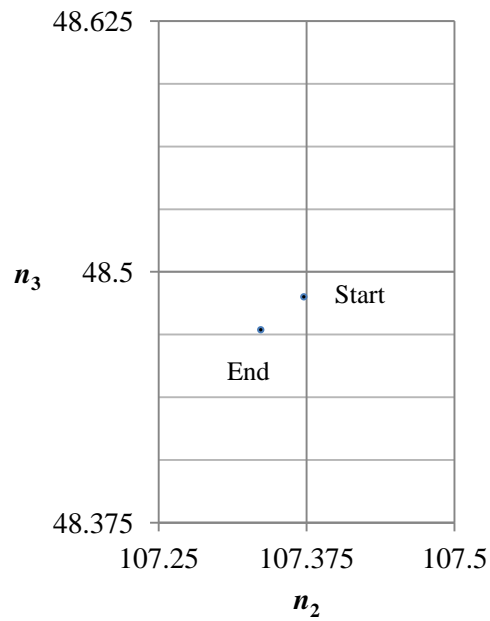

Figure 12: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (10 March 2021) since the start (28 July 1914) and end (15 August 1945) of World War 1.

2.9   World War 2

The powers n_1 and n_3 calculated from the reduced numbers derived using (1) from the lengths of time elapsed up till the present (10 March 2021) since the start (1 September 1939) and end (15 August 1945) of World War 2 are plotted in Figure 13. The reduced numbers are arranged symmetrically about a quarter-level in Sequence 1.
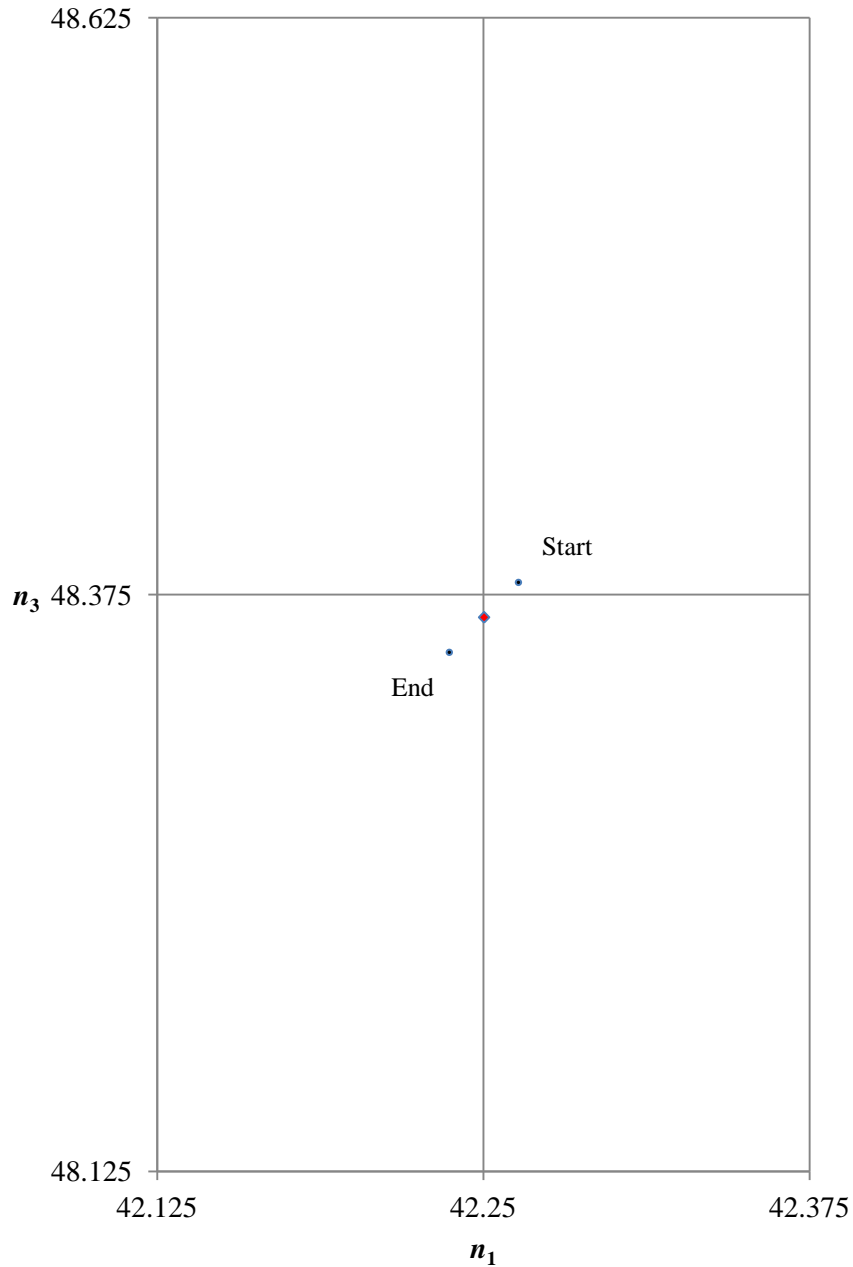

Figure 13: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (10 March 2021) since the start (1 September 1939) and end (15 August 1945) of World War 2. The diamond marks the point of mean n_1 and mean n_3.

2.10   Berlin Wall

The wall went up on 13 August 1961 and was dismantled on 9 November 1989. The powers n_1 and n_3 of π and e, respectively, equal to the lengths of time elapsed up till the present (6 March 2021) since the two events took place (the measured numbers), and the reduced numbers derived using (1), are presented in Figures 14 and 15. For the dismantling of the wall the reduced number occupies a principal level (of integer n_3).
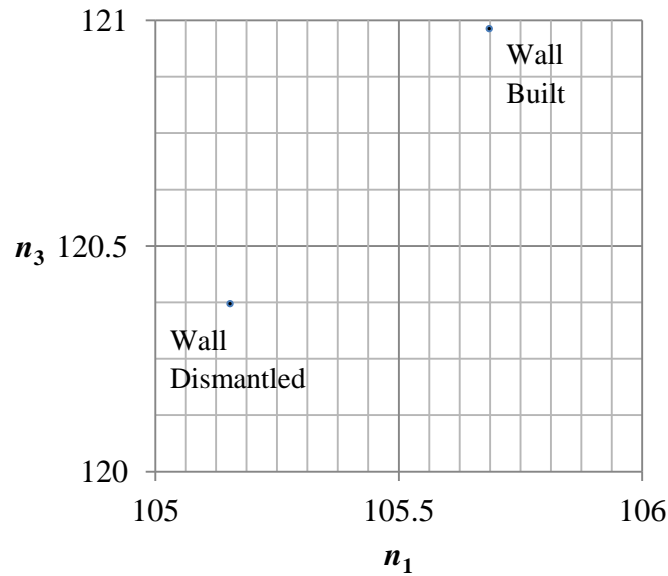

Figure 14: The powers n_1 and n_3 of π and e, respectively, equal to the lengths of time elapsed up till the present (6 March 2021) since the building and dismantling of the Berlin Wall.
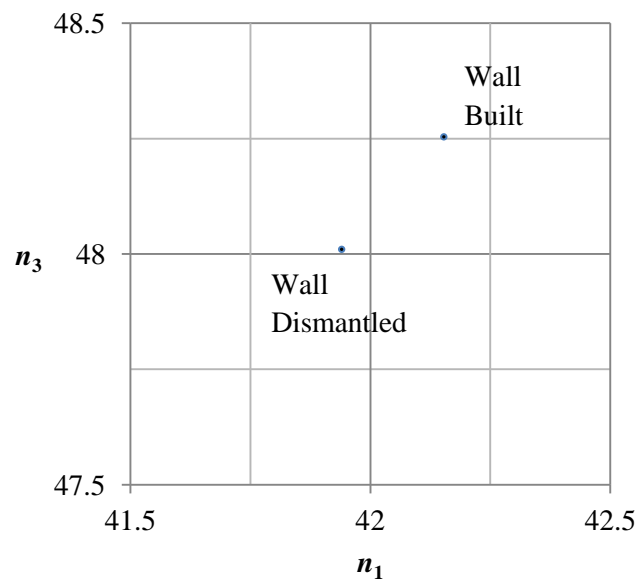

Figure 15: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (6 March 2021) since the events of Figure 14.

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2.11 Nuclear accidents

A broken symmetry has been manifested by calculating the powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (10 March 2021) since the Three Mile Island (28 March 1979) and Chernobyl (26 April 1986) nuclear accidents occurred. The two reduced numbers, characterised by $n_1 = 42.03$ and $n_1 = 41.97$, are arranged symmetrically about a principal level, as shown in Figure 16.
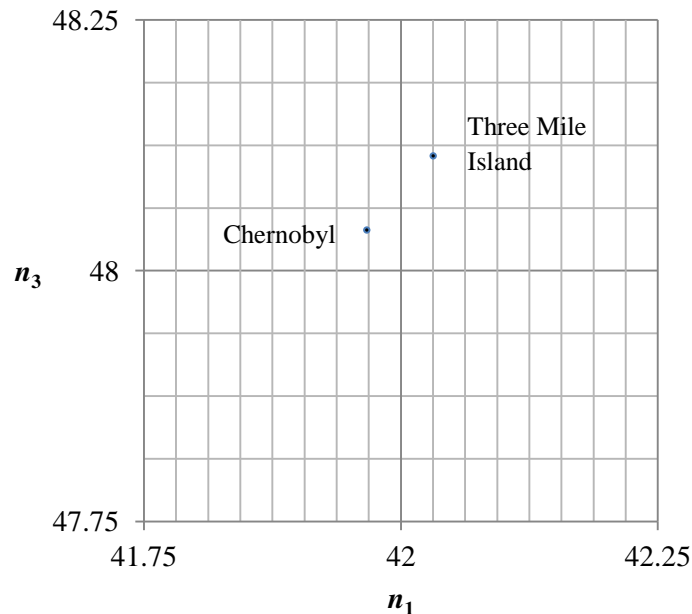

Figure 16: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (10 March 2021) since the Three Mile Island and Chernobyl nuclear accidents.

2.12 Football

Association football, with its many events, has proved to be a useful source of data for this project.

The top European football competition (European Cup and UEFA Champions League) has been won by Manchester United on three occasions: 29 May 1968, 26 May 1999 and 21 May 2008. Powers n_1 and n_3 of π and e, respectively, equal to the lengths of time elapsed up till the present (10 March 2021) since the events took place (the measured numbers), and powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the reduced numbers derived using (1), are presented in Figures 17 and 18. The measured and reduced numbers clearly occupy principal levels and sub-levels. Interestingly, both measured and reduced numbers calculated for the memorable event of 1999, which had a spectacular ending, occupy or lie immediately adjacent to principal levels.
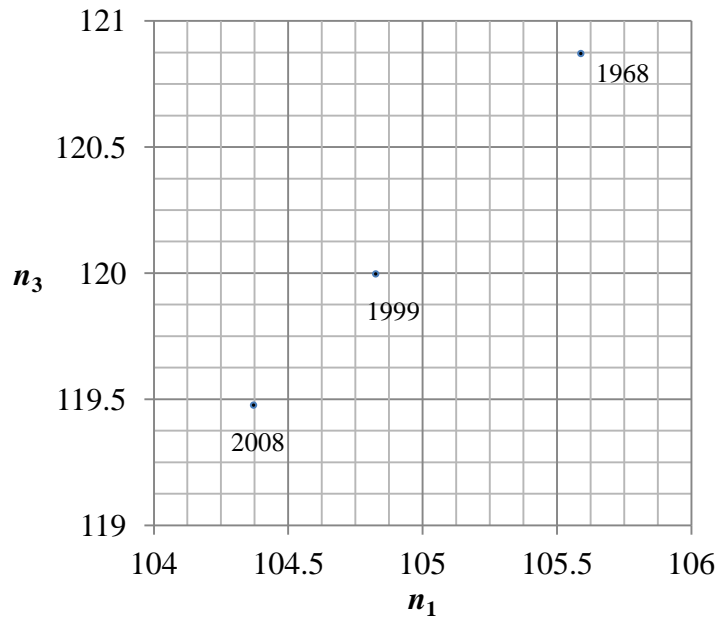
Figure 17: The powers n_1 and n_3 of π and e, respectively, equal to the lengths of time elapsed up till the present (10 March 2021) since Manchester United won the European Cup or UEFA Champions League
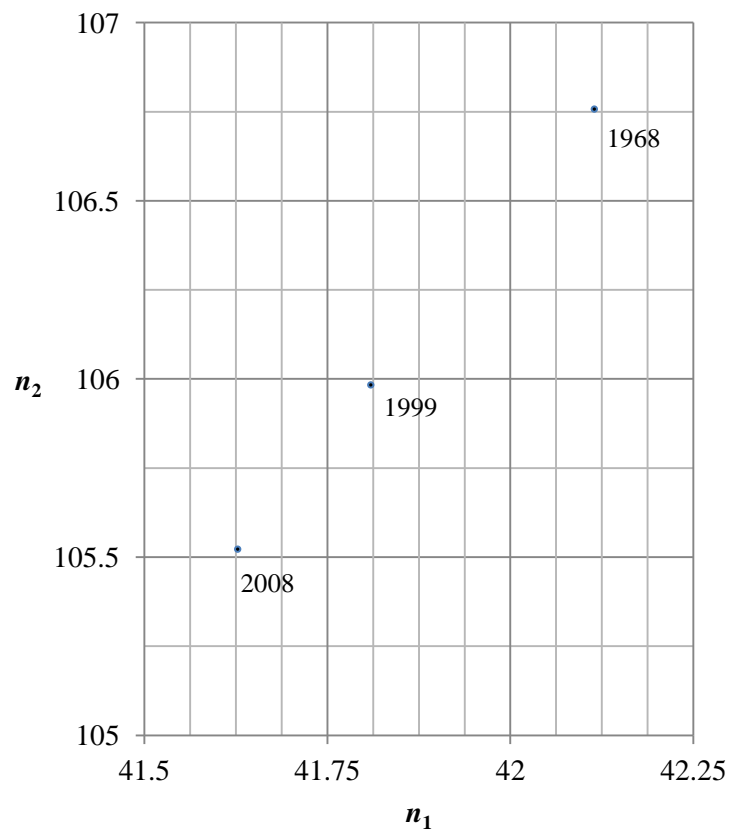

Figure 18: The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (10 March 2021) since the events of Figure 17.

Liverpool FC won the European Cup/Champions League for a sixth time on 1 June 2019 and in the following season won the Premier League, being confirmed as champions on 25 June 2020. The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the lengths of time elapsed up till the present (15 March 2021) since the two events took place are plotted in Figure 19. The corresponding reduced numbers are plotted in Figure 20. The measured numbers are arranged symmetrically about a principal level in Sequence 2. The reduced numbers are arranged symmetrically about a quarter-level in Sequence 1.

Figure 19: The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the lengths of time elapsed up till the present (15 March 2021) since Liverpool FC won the Champions League (2019) and the Premier League (2020). The circle surrounds a 'compromised' location. The diamond marks the point of mean n_1 and mean n_2.
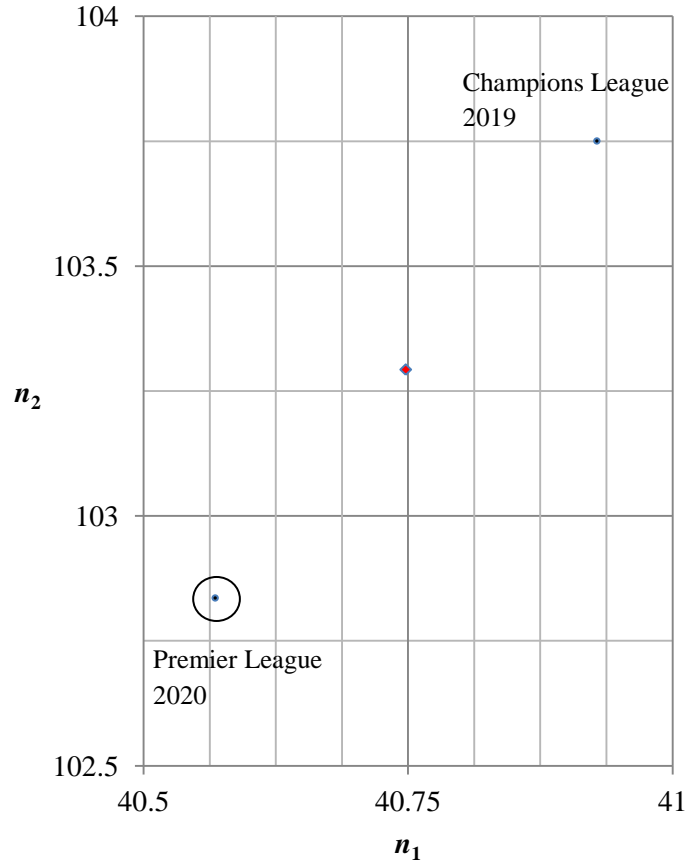
Figure 20: The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (15 March 2021) since the events of Figure 19. The circle surrounds a 'compromised' location. The diamond marks the point of mean n_1 and mean n_2.

Two points arise. First, the circles on the two graphs indicate 'compromised' locations on high-order sub-levels adjacent to the sub-levels drawn. The second point concerns the other major competitions Liverpool FC won during this highly successful period. Being only a peripheral follower of football, when constructing the graphs shown here I had overlooked the successes in the UEFA Super Cup (14 August 2019) and the FIFA Club World Cup (21 December 2019). On calculating the 'measured numbers' (elapsed times since the event) for these two events I found that they lay on high-order sub-levels. All four measured numbers are plotted in Figure 21. Why do the elapsed times since the occurrence of the first two events I examined lie in precise symmetrical arrangement about a principal level, and why do the reduced numbers for the first two events lie in symmetrical arrangement about a low-order sub-level? Possible reasons include the following: they were the *first two* events I examined; I was *well aware* of the first two events I examined, but not of the other events; I regard the first two events I examined as *pre-eminent*; I regarded the two events as *partners* as they occurred after a relatively lean spell for the club.
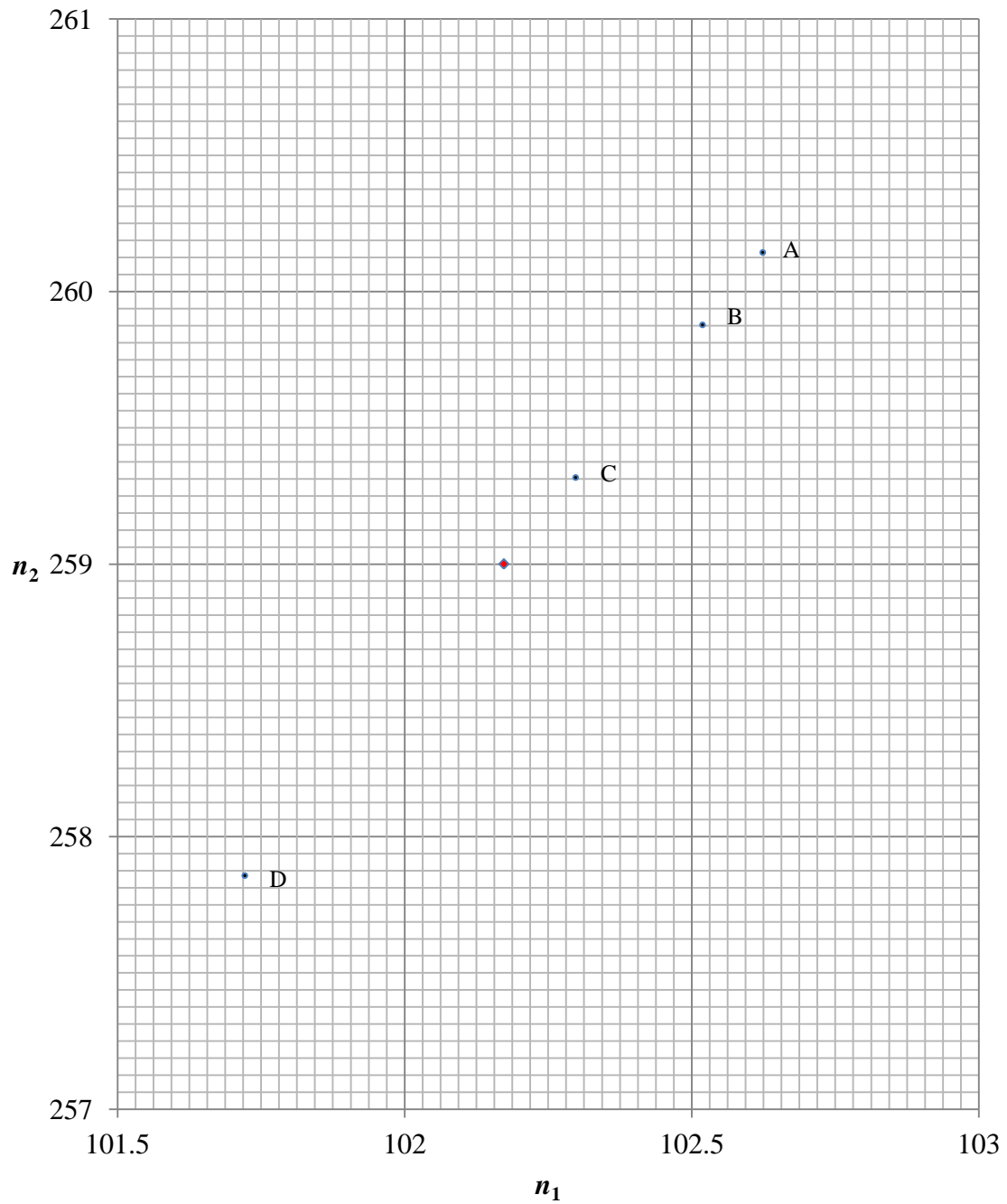
Figure 21: The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the lengths of time elapsed up till the present (15 March 2021) since Liverpool FC won:

A   Champions League (2019)

B   Super Cup (2019)

C   Club World Cup (2019)

D   Premier League (2020)

The diamond marks the point of mean n_1 and mean n_2 for A and D.

2.13   Coronavirus

The UK has experienced a 'second wave' of coronavirus infections during the last few months. During the period of the wave, the 7-day average of 'cases by specimen date' peaked on 1 January 2021, there having been a lesser peak on 10 November 2020 [9]. The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the lengths of time elapsed up till the present (20 March 2021) since the two events took place, are shown in Figure 22. The two measured numbers are arranged symmetrically about a principal level in Sequence 2, at the intersection (101, 256) in Sequences 1 and 2. The corresponding reduced number for the major peak (1 January 2021) is plotted as powers n_1 and n_3 of π and e in Figure 23; the reduced number lies on a principal level in Sequence 3. The reduced number for the lesser peak occupies a high-order sub-level, not shown.
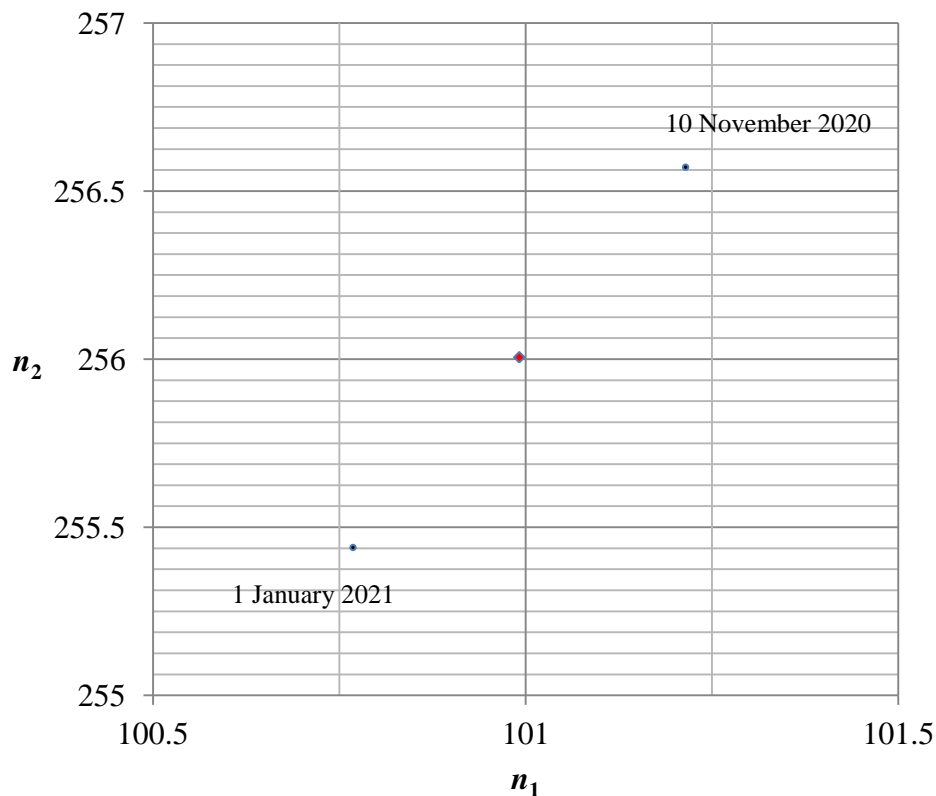

Figure 22: The powers n_1 and n_2 of π and $\pi/2$, respectively, equal to the lengths of time elapsed up till the present (20 March 2021) since the occurrence of the two peaks of UK coronavirus 'cases by specimen date' during the 2020/21 'second wave' of infections. The diamond marks the point of mean n_1 and mean n_2.
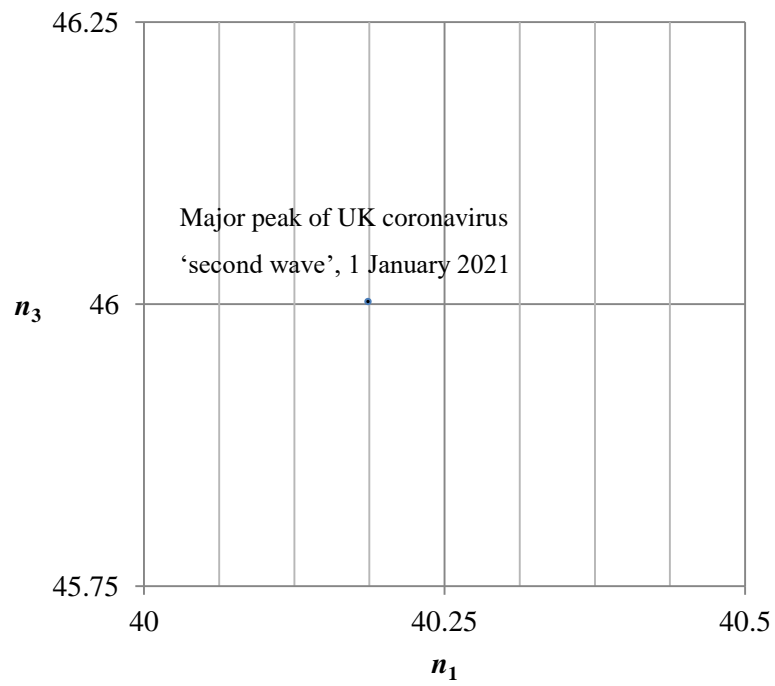
Figure 23: The powers n_1 and n_3 of π and e, respectively, equal to the reduced number derived using (1) from the lengths of time elapsed up till the present (20 March 2021) since the major peak of the UK 'second wave' coronavirus infections.

2.14   World records

In a short diversion from the subject of this paper (the times elapsed since the occurrence of events), the times elapsed during the events themselves will be examined.

In [2], the lengths of time elapsed (as numbers of Planck times) up till the present since all eight current men's Olympic-distance running (without obstacles) world records were set were shown to lie on the principal levels and sub-levels of Sequences 1 and 3. Here, in Figures 24 and 25, the world record times are shown to lie on the principal levels and sub-levels of Sequences 1 and 3.
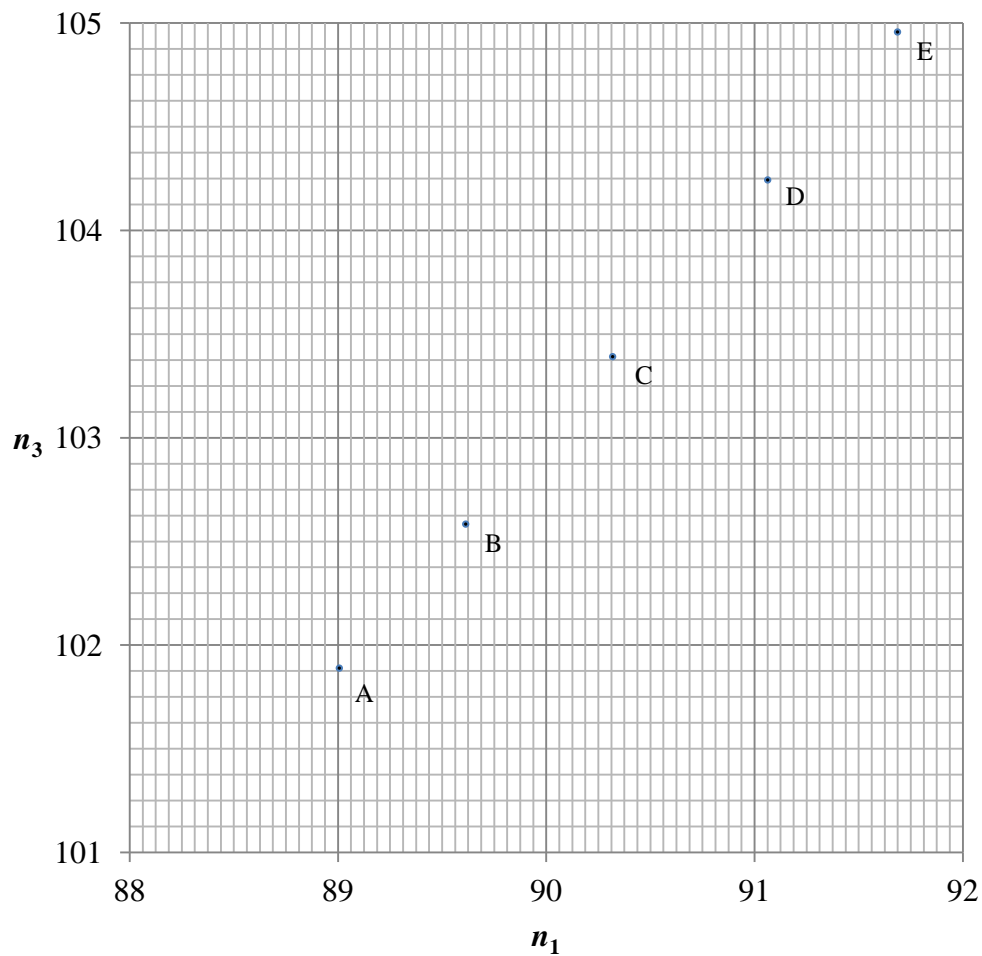

Figure 24: The current men's running world records (as numbers of Planck times) shown as powers n_1 and n_3 of π and e, respectively, on the levels and sub-levels of Sequences 1 and 3.

A   100 m: 9.58 (Usain Bolt, 2009)   **B**   200 m: 19.19 (Usain Bolt, 2009)

C   400 m: 43.03 (Wayde van Niekerk, 2016)   **D**   800 m: 1:40.91 (David Rudisha, 2012)

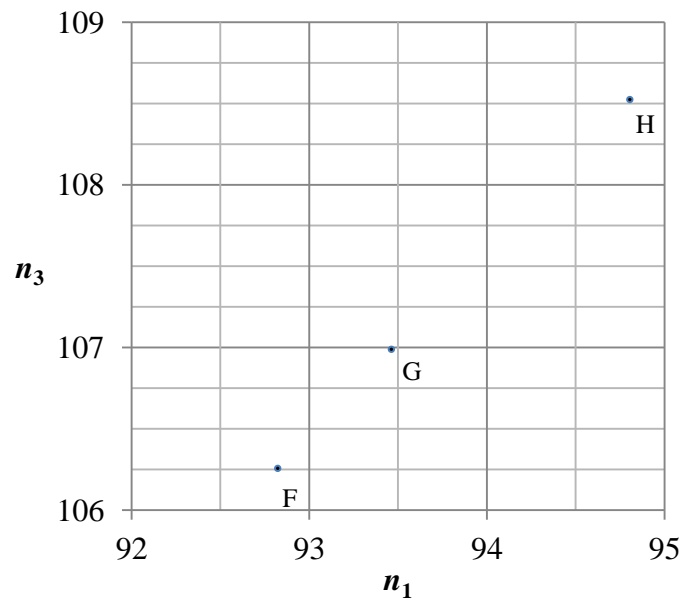**E**   1500 m: 3:26.0 (Hicham El Guerrouj, 1998)

Figure 25 The current men's running world records (as numbers of Planck times) shown as powers n_1 and n_3 of π and e, respectively, on the levels and sub-levels of Sequences 1 and 3.

F   5000 m: 12:35.36 (Joshua Cheptegei, 2020)   **G**   10000 m: 26:11.00 (Joshua Cheptegei, 2020)

H   Marathon: 2:01:39 (Eliud Kipchoge, 2018)

As it seems that all measured and reduced numbers occupy the principal levels and sub-levels of the sequences, measured and reduced numbers have been calculated for the mean speeds (compared with the speed of light, 299792458 ms^{-1} [5] – the Planck speed) during the world record runs, and are shown (as inverse-numbers) in Figures 26 and 27 to be closely aligned with the principal levels and sub-levels of Sequences 1 and 2.
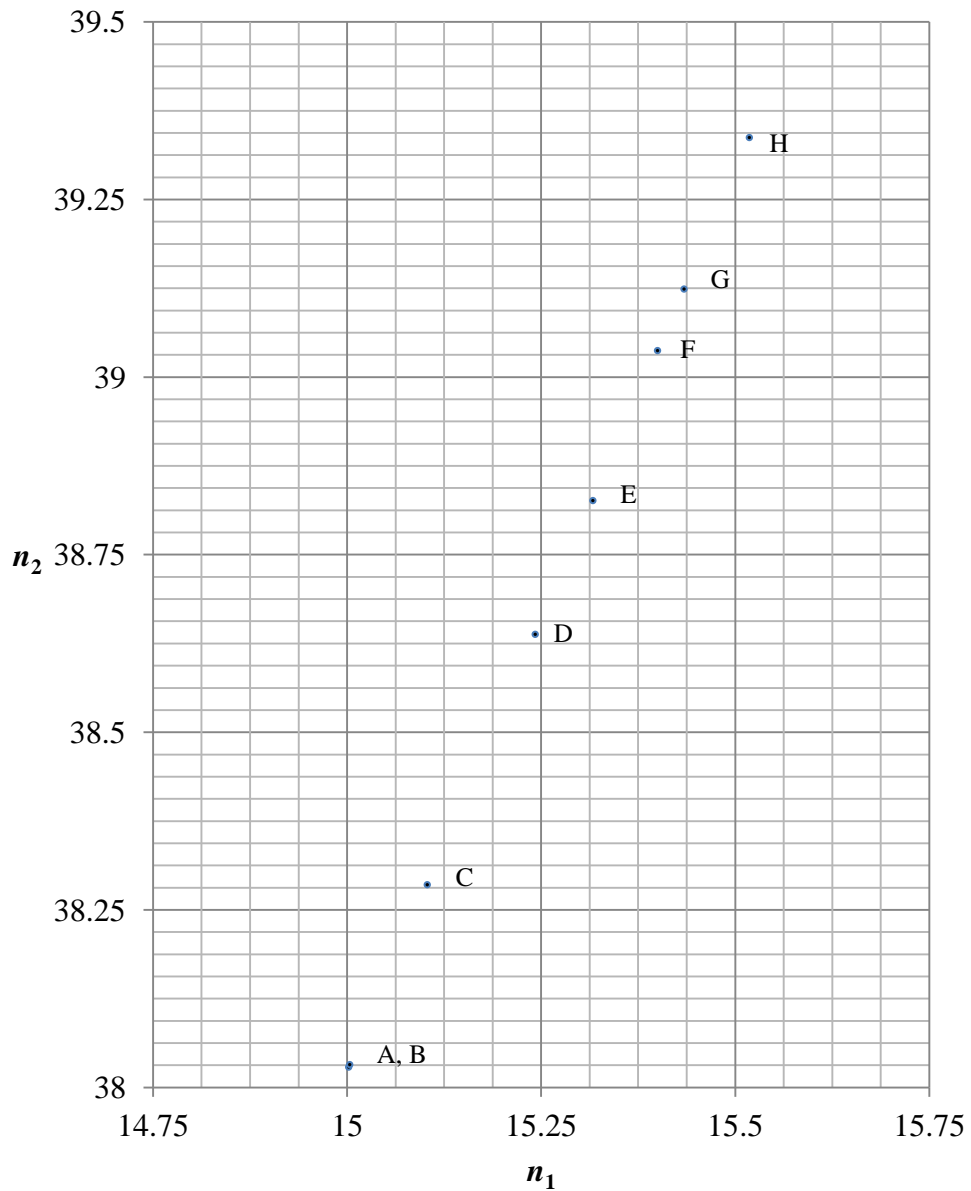
Figure 26: Mean speeds (measured numbers) during the current men's world record runs (as inverse-numbers of Planck speeds), shown as powers n_1 and n_3 of π and e, respectively, on the levels and sub-levels of Sequences 1 and 3.

A 100 m: 10.438 ms^{-1} **B** 200 m: 10.422 ms^{-1} **C** 400 m: 9.296 ms^{-1} **D** 800 m: 7.928 ms^{-1}

E 1500 m: 7.282 ms^{-1} **F** 5000 m: 6.619 ms^{-1} **G** 10000 m: 6.365 ms^{-1} **H** Marathon: 5.781 ms^{-1}
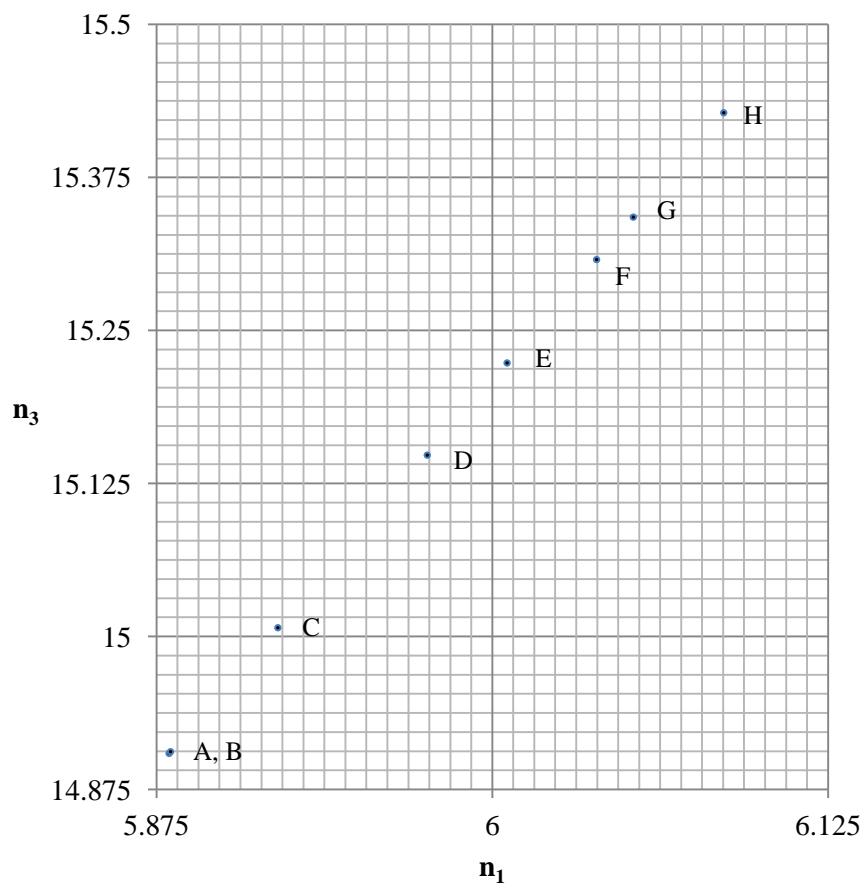
Figure 27: The reduced numbers derived using (1) from the mean speeds (measured numbers) of Figure 26, shown as powers n_1 and n_3 of π and e, respectively, on the levels and sub-levels of Sequences 1 and 3.

2.15   Douglas Adams

Amusingly, the powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (24 March 2021) since the birth and death of the author Douglas Adams (11 March 1952 – 11 May 2001), are arranged about a particular principal level in Sequence 1, as shown in Figure 28.
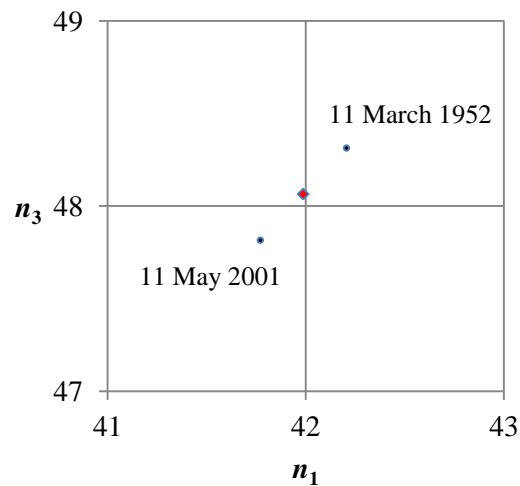

Figure 28: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (24 March 2021) since the birth and death of Douglas Adams. The diamond marks the point of mean n_1 and mean n_3.

Delving into the detail (Figures 29 and 30), one finds that the reduced numbers (Figure 30) are not (yet) precisely arranged symmetrically about Level 42.
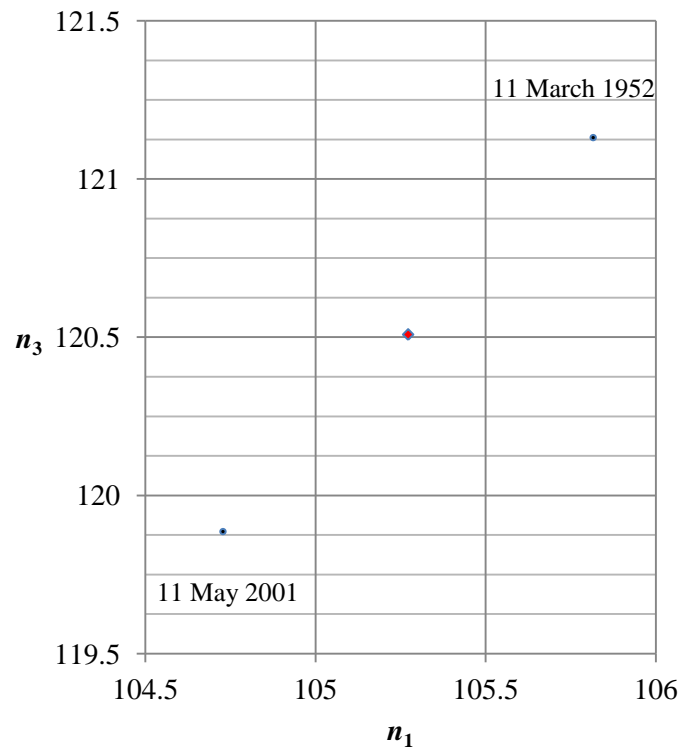
Figure 29: The powers n_1 and n_3 of π and e, respectively, equal to the lengths of time elapsed up till the present (24 March 2021) since the birth and death of Douglas Adams. The diamond marks the point of mean n_1 and mean n_3.

Figure 30: The powers n_1 and n_3 of π and e, respectively, equal to the reduced numbers derived using (1) from the lengths of time elapsed up till the present (24 March 2021) since the birth and death of Douglas Adams. The diamond marks the point of mean n_1 and mean n_3.
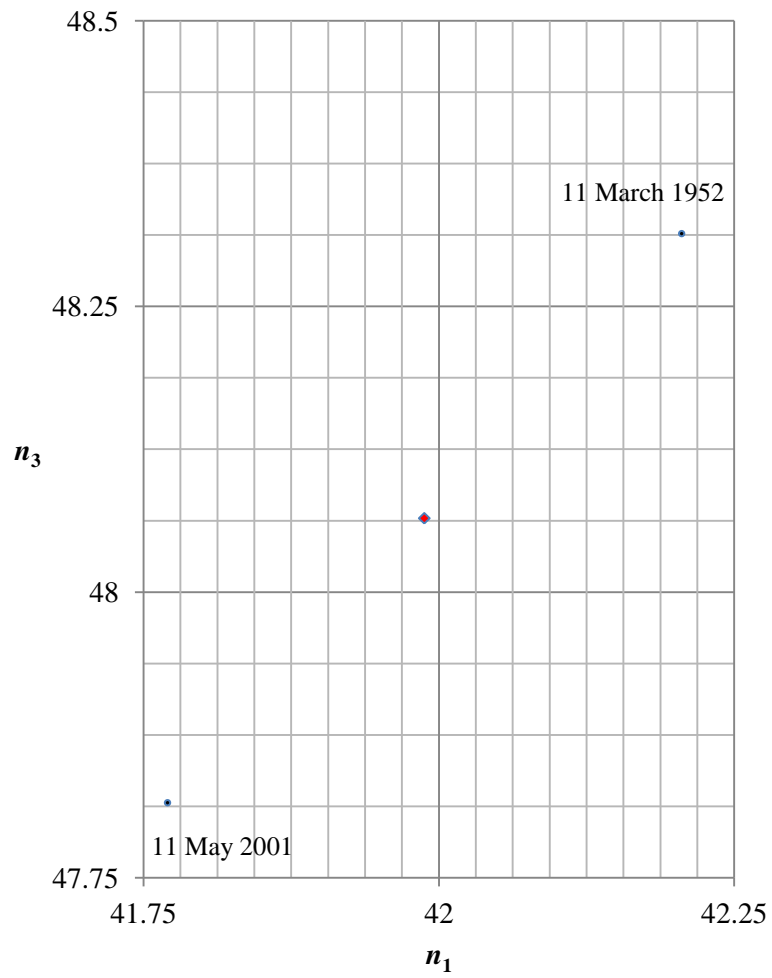
3.   Discussion

On measurement, a parameter will take up a value that, as a 'measured number' of Planck units, N_M, is equal to discrete powers of π, $\pi/2$ and e. The exponents of the three bases will be of integer, half-integer, quarter-integer, etc value. A 'reduced number', N_R, may be calculated and will be found to be equal to similarly discrete powers of π, $\pi/2$ and e. The measured and reduced numbers, N_M and N_R, calculated for *conspicuous* objects and events are the most likely to equal integer and 'low-order' fractional powers of π, $\pi/2$ and e. The measured and reduced numbers constitute knowledge and must be consistent with everything else that is known by the observer. All measurement outcomes, including the age of the universe [1], are subjective.

One imagines the measured number N_M is stored on the spheres S^2 and S^5 within dual higher-dimensional spacetimes. If at Planck scale each sphere can store a single unit of information (bit) then, generally, the radii of the S^2 and S^5 will be in the ratio $N_M : N_M^{2/5}$. The measured number N_M is stored at two scales: N_M and $N_R = N_M^{2/5}$, in Planck units. One sees that $N_R^5 = N_M^2$. The Quantum/Classical Connection of (1), $2N_R^5 = N_M^2$, contains the factor 2, which perhaps originates in the 2-state quantum unit of information (qubit). The scales N_M and N_R are characteristic of locations within the extra dimensions of (intersecting) branes that wrap complete and fractional cycles of the internal spaces. Principal levels within Sequences 1, 2 and 3, corresponding to the locations of branes that wrap complete cycles of the internal spaces, are the preferred destinations of both the measured and the reduced numbers; 'intersecting' principal levels are the most preferred destinations. Sub-levels correspond to the locations of branes that wrap fractional cycles of the internal spaces.

As shown in this paper, symmetry is an important aspect of the phenomenology and may arise when two related (related in so far as the observer is concerned) measurements are made. Many examples of such symmetrical arrangement have been seen, for example in the masses of hadronic isospin doublets [6] and of the quarks of each generation [10]. Reduced numbers calculated from the radii of binary stars of similar size have also been found to take up symmetrical arrangements within the sequences [11, 12]. Interestingly, the reduced numbers calculated from the radii of the Sun and the solar-analogue Tau Ceti, sometimes called the Sun's twin, take up a symmetrical arrangement; this particular arrangement might be more related to the measurement process than anything else.

4.   References

1. B. F. Riley, Our Observations Create Our Reality, viXra:2012.0047

2. B. F. Riley, Subjective Historical Timelines, viXra:2102.0112

3. B. F. Riley, Standard Model Scales from Warped Extra Dimensions, arXiv:0809.0111

4. B. F. Riley, The Cosmological Constant from a Distant Boundary, viXra:1502.0017

5. 2018 CODATA recommended value

6. B. F. Riley, Particle Mass Levels, viXra:0909.0006

7. L. Randall and R. Sundrum, A Large Mass Hierarchy from a Small Extra Dimension, arXiv:hep-ph/9905221

8. N. Arkani-Hamed, S. Dimopoulos and G. Dvali, The Hierarchy Problem and New Dimensions at a Millimeter, arXiv:hep-ph/9803315

9. https://coronavirus.data.gov.uk/details/cases

10. B. F. Riley, Quark Masses in the Planck Model, viXra:1309.0165

11. B. F. Riley, The Correlation Between Stellar Radii and the Masses of Stable Atomic Nuclei, viXra:1704.0049

12. B. F. Riley, The Act of Measurement I: Astronomical Distances, viXra:2006.0247