RE-EXAMINING VELIKOVSKY

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Immanuel Velikovsky's Worlds in Collision and other books inspired founders of the Electric Universe Theory with its implication of plasma-based electrical interactions between planets, as recorded in historical records such as the Bible. His theories sparked great controversy by implying close encounters between some of the inner planets (Venus, Earth and Mars) within recorded human history, but were summarily dismissed as fiction by mainstream scientists and continue to be dismissed today. Nonetheless, Electric Universe theorists contend that there may be truth in Velikovsky's conclusions when these "interactions" are considered in light of a "plasma/electric universe." Having also read Velikovsky's works, and Electric Universe Theory, I endeavored to perform a simple set of calculations to ascertain if any of Velikovsky's interactions could have been possible.

1. Introduction

The "Electric Universe" Theory (EUT) owes part of its inspiration to the work of Immanuel Velikovsky (Worlds in Collision [1950]), at least for introducing the concept of catastrophism of an electrical nature potentially inducing what EUT proponents see as plasma-arced "scarring" on some planets and other objects within our solar system, such as Mars. Though discredited by mainstream physicists and astronomers since the publication of his ideas in 1950 (see Wal Thornhill, "The Impact of Pseudo-Science," March 17, 2000 [*http://www.holoscience.com/wp/the-impact-of-pseudo-science/*]):

> *In 1974, the AAAS [American Association for the Advancement of Science] held a session in San Francisco which was supposed to allow Velikovsky a forum to answer his critics. It was, as it transpired, a disgraceful ambush. Now, some quarter century later, the American Association for the Advancement of Science (AAAS) has discussed a similar topic but without Velikovsky's presence. The subject was "unpredictable events of extra-terrestrial origin and their impact on humanity". It was an occasion for the sensationalists to parade their predictions of doomsday by impact from a comet or asteroid. It also became another opportunity for academics to rewrite history and indulge in yet another miserable attack on Velikovsky. As reported in the WhyFiles: "…there are some neo-catastrophists, located mainly in Britain, who have an almost Velikovskian pseudo-scientific take on this matter and have argued that such impacts are more frequent … Velikovsky, of course, is the guy who gave asteroid impacts such a bad name back in 1950."*

Velikovsky nonetheless ushered in an era where catastrophic events, rather than just immeasurable eons of uniformitarianism, became acknowledged as a potential contributor to the current state of our solar system (and maybe beyond). While EUT proponents acknowledge that "[i]t seems unlikely that Velikovsky's historical reconstruction of planetary catastrophes is correct," they also contend that

> *None of this denies Velikovsky priority in identifying the major destructive influence in the Earth's past as the near approaches of the planets Mars and Venus. His reconstruction of awesome celestial events in the dimly remembered past follow the laws of physics and the rules of evidence. His model is a good one when measured by its prediction score against that of conventional models. Conventional models are woefully deficient to pronounce upon impacts and their effects. To begin with, planetologists have admitted they are unable to experimentally reproduce the features of so-called impact craters. So, what are the craters? If they are not a result of impacts, what possible use are they in predicting future impacts? Is the science of impacts a pseudo-science?*

I agree that the EUT proponents' contentions regarding electrically plasma-arced scarring of certain planetary features such as those on Mars seem plausible. However, it takes quite a leap of faith to believe that, within human memory, a planetoid (or comet) the size of Venus careened through the solar system over a distance of at least ~ 4.5 Astronomical Units (~ 400 million miles, the distance of closest approach between the orbits of Venus and Jupiter [see Table 1]), encountering both the planets Mars and Earth before settling into its current orbit as the planet Venus. Certainly the perturbations induced by such an "astronomical" event would still have left all three planets "ringing" today. This is not to say that perhaps Mars and Earth (and perhaps even Venus) did not experience "close encounters" with some "rogue" planetoid or comet within human history that inspired the human memory cited by Velikovsky and caused the evidential scarring (e.g., see Allan and Delair, When the Earth Nearly Died [1997]). But to ascribe this to what is now the planet Venus seems too much to believe.

2. Analysis

Rather than dismiss this outright, I decided to perform some very simple, hopefully conservative, physics calculations to determine if such encounters could have happened within human memory. (Velikovsky proposed that Venus was ejected from Jupiter and had a close encounter with Earth roughly 3500 years ago [see "Immanuel Velikovsky" (*http://en.wikipedia.org/wiki/Immanuel_Velikovsky*)]). While Velikovsky proposed multiple encounters between Earth and Venus, I will assume just one for my analysis. Table 1 lists the planetary properties that will be relevant for my calculations (retaining Pluto as a "planet").

If Venus were ejected from Jupiter as Velikovsky contends, it would have had to achieve at least the Jupiter Escape Speed of ~ 60 km/s (see "Escape Velocity" [*http://en.wikipedia.org/wiki/*

Escape_velocity#List_of_escape_velocities]). An object escaping Jupiter will have a speed, depending upon its direction of escape, relative to the Sun of 60±13 km/s, since the latter is Jupiter's orbital speed. If Venus were expelled from Jupiter (which seems unlikely given the factor of four difference in their densities [see Table 1], but perhaps it was a very large moon that somehow was ejected), its slowest initial speed relative to the Sun would have been 47 km/s.

Ignoring any increase in speed as Venus accelerated inward toward the Sun, upon encountering Mars (presumably close enough to induced electrically plasma-arced scarring but not to have physically disrupted planetary integrity via tidal forces, i.e., no closer than the Roche limit of ~ 33,500 km, or about 2.5 times Venus' diameter), conservation of momentum would have required that

$$M_vS_{v1} - M_mS_{m1} = M_vS_{v2} - M_mS_{m2}$$

where M = mass and S = speed; for the subscripts, v = Venus, m = Mars, 1 = pre-encounter, 2 = post-encounter.

Note that I assume no change in mass for either planet during the encounter, only changes in their speeds. Further, I assume they pass each other going in parallel but opposite directions, to minimize the final speeds after the encounter (a slowing process). With the M values from Table 1, S_{v1} = 47 km/s (assuming the minimum ejection speed) and S_{m2} = 24 km/s (Mars' current orbital speed), the following relation evolves:

$$S_{v2} = 47 + (0.641/4.83)(24 - S_{m1})$$

Assuming Venus next encountered Earth (again, presumably no closer than the Roche limit of ~ 32,800 km, or ~ 2.5 times Earth's diameter), the same conservation of momentum would have required that (now with subscripts e = Earth and 3 = Venus' post-encounter with Earth)

$$M_vS_{v2} - M_eS_{e1} = M_vS_{v3} - M_eS_{e2}$$

again assuming no change in mass, no acceleration of Venus due to the Sun and an anti-parallel encounter. With the M values from above, S_{v3} = 35 km/s (Venus' current orbital speed) and S_{e2} = 30 km/s (Earth's current orbital speed), the following relation evolves:

$$S_{e1} = 30 + (5.2/5.52)[12 + (0.641/4.83)(24 - S_{m1})]$$

Unfortunately, we do not know S_{m1}, the initial speed of Mars, i.e., prior to its encounter with Venus. However, if we assume the original ("pre-Venus-encounter") speeds of Earth and Mars were in the same proportion as their current, we can derive

$$S_{m1} = (24/30)S_{e1}$$

Substituting this in the previous equation yields S_{e1} = 40 km/s, or ~ 33% faster than today. (The corresponding "pre-Venus-encounter" speed for Mars would have been 32 km/s, or also ~ 33% faster than today.) Thus, if Venus encountered Earth within human memory, there would be evidence of a pre-encounter "year" that was ~ 33% shorter than current, i.e., ~ 245 days.

Even if all these approximations and simplifications yield a result that is off by a factor of 10, a pre-encounter Earth "year" only ~ 3.3% shorter (353 days) than current would quickly accumulate into one of our current years in only ~ 30 years. Presumably even our ancestors would have noticed such a difference, as a "century" would have been over three "years" shorter than it is now. Coincidentally, a "year" shorter by ~ 3.3% (~ 12 days) has precedence regarding human reaction. In 1750, the Parliament of Great Britain switched from the Julian to the Gregorian calendar (other countries had previously converted as early as 1583), which had over time amounted to an 11-day difference. Thinking their lives had been shortened, the uneducated populace rioted for the "return of our 11 days." (By the time Russia switched in 1918, the difference had increased to 13 days.) (see "Calendar [New Style] Act 1750" [*http://en.wikipedia.org/wiki/Calendar_(New_Style)_Act_1750*]; and "Gregorian Calendar" [*http://en.wikipedia.org/wiki/Gregorian_calendar*])

3. Conclusion

Based on my admittedly quite crude calculations, it still appears too far-fetched to believe the planet Venus arose out of Jupiter and careened through the inner solar system anytime within human history (if ever at all). However, this does not invalidate the EUT contention that planetary scarring due to electrical plasma-arcing may be responsible for the bizarre surface features seen on Mars and perhaps other celestial objects. But just what particular planetoids or comets might have been responsible for this remains unknown.

TABLE 1. List of Selected Planetary Properties

Planet	Mass (* M_E)	Diameter (km)	Density g/cm^3	Mass (10^{24} kg)	Rotation	Distance (A.U.)	Revolution	Orbital Speed (km/s)
Mercury	0.0553	4880	5.43	0.330	58.81 d	0.387	87.97 d	48
Venus	0.815	12,104	5.2	4.83	243.69 d	0.723	224.70 d	35
Earth	1	12,742	5.52	5.98	23.93 h	1	365.26 d	30
Mars	0.107	6780	3.93	0.641	24.62 h	1.524	686.98 d	24
Jupiter	317.83	139,822	1.33	1,900	9.93 h	5.203	11.86 y	13
Saturn	95.162	116,464	0.687	568	10.50 h	9.539	29.46 y	9.7
Uranus	14.536	50,724	1.32	90.2	17.24 h	19.182	84.01 y	6.8
Neptune	17.147	49,248	1.64	103	16.11 h	30.06	164.79 y	5.4
Pluto	0.0021	2274	2.05	0.0126	6.41 d	39.53	247.68 y	4.7

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VELIKOVSKY & THE ELECTRIC UNIVERSE (1)

- The Electric Universe Theory (EUT) owes part of its inspiration to the work of Immanuel Velikovsky (Worlds in Collision [1950])
  - Introduced catastrophism of an electrical nature, potentially inducing plasma-arced "scarring" on planets and other objects within our solar system, such as Mars.
  - Though discredited by the mainstream, he ushered in an era where catastrophic events, not just immeasurable uniformitarianism, became a potential contributor to the current state of our solar system (and beyond?).

VELIKOVSKY & THE ELECTRIC UNIVERSE (2)

- EUT admits "[i]t seems unlikely that Velikovsky's historical reconstruction of planetary catastrophes is correct," still
  - *None of this denies Velikovsky priority in identifying the major destructive influence in the Earth's past as the near approaches of the planets Mars and Venus. His reconstruction of awesome celestial events in the dimly remembered past follow the laws of physics and the rules of evidence ... Conventional models are woefully deficient to pronounce upon impacts and their effects. To begin with, planetologists have admitted they are unable to experimentally reproduce the features of so-called impact craters … Is the science of impacts a pseudo-science?*

VELIKOVSKY & THE ELECTRIC UNIVERSE (3)

- EUT 's contentions regarding electrically plasma-arced scarring of certain planetary features such as those on Mars seem plausible.
  - However, it takes a leap of faith to believe that, within human memory, a planetoid (or comet) the size of Venus careened through the solar system over a distance of at least ~ 4.5 Astronomical Units (~ 400 million miles, the distance of closest approach between the orbits of Venus and Jupiter), encountering both the planets Mars and Earth before settling into its current orbit as the planet Venus.
    - Certainly the perturbations induced by such an "astronomical" event would still have left all three planets "ringing" today. To ascribe this to what is now the planet Venus seems too much to believe.

ANALYSIS (1)

- Velikovsky proposed that Venus was ejected from Jupiter and had a close encounter with Earth roughly 3500 years ago
  - Rather than dismiss this outright, I perform very simple, hopefully conservative, calculations to determine if such encounters could have happened within human memory.
  - Velikovsky proposed multiple encounters between Earth and Venus, but I assume just one.

ANALYSIS (2)

- If Venus were ejected from Jupiter, it would have had to achieve at least an escape speed of ~ 60 km/s.
  - An object escaping Jupiter will have a speed, depending upon its direction of escape, relative to the Sun of 60 ± **13** km/s, thus Venus' slowest initial speed would have been 47 km/s.

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	(* M_E)	(km)	g/cm^3	(10^{24} kg)		(A.U.)		(km/s)
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- Ignoring any increase in speed as Venus accelerated inward toward the Sun, upon encountering Mars (presumably close enough to induced electrically plasma-arced scarring but not to have physically disrupted planetary integrity via tidal forces), conservation of momentum would require that
  - $M_vS_{v1} - M_mS_{m1} = M_vS_{v2} - M_mS_{m2}$
    - where M = mass and S = speed; for the subscripts, v = Venus, m = Mars, 1 = pre-encounter, 2 = post-encounter.
  - With the M values from the table, S_{v1} = 47 km/s and S_{m2} = 24 km/s (Mars' current orbital speed), the following evolves:
    - $S_{v2} = 47 + (0.641/4.83)(24 - S_{m1})$

ANALYSIS (4)

- Assuming Venus next encountered Earth (again, presumably no closer than the Roche limit), the same conservation of momentum would have required that (now with subscripts e = Earth and 3 = Venus' post-encounter with Earth)
  - $M_vS_{v2} - M_eS_{e1} = M_vS_{v3} - M_eS_{e2}$
- With the M for Venus and Earth, S_{v3} = 35 km/s and S_{e2} = 30 km/s (Venus' and Earth's current orbital speeds), the following evolves:
  - $S_{e1} = 30 + (5.2/5.52)[12 + (0.641/4.83)(24 - S_{m1})]$

ANALYSIS (5)

- We do not know S_{m1}, the initial speed of Mars prior to its encounter with Venus. If we assume the original ("pre-Venus-encounter") speeds of Earth and Mars were in the same proportion as their current, then $S_{m1} = (24/30)S_{e1}$
  - Substituting this in the previous equation yields S_{e1} = 40 km/s, or ~ 33% faster than today.
    - Had Venus encountered Earth within human memory, there would be evidence of a pre-encounter "year" that was ~ 33% shorter than current, i.e., ~ 245 days.
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      - Presumably even our ancestors would have noticed such a difference, as a "century" would have been over three "years" shorter than it is now.

COINCIDENCE?

- A "year" shorter by ~ 3.3% (~ 12 days) has precedence regarding human reaction.
  - In 1750, Great Britain switched from the Julian to Gregorian calendar (other countries had previously converted as early as 1583), which had over time amounted to an 11-day difference. Thinking their lives had been shortened, the uneducated populace rioted for the "return of our 11 days."
    - By the time Russia switched in 1918, the difference had increased to 13 days.

CONCLUSION

- Based on my quite crude calculations, it still appears too far-fetched to believe the planet Venus arose out of Jupiter and careened through the inner solar system anytime within human history (if ever at all).
  - This does not invalidate the EUT contention that planetary scarring due to electrical plasma-arcing caused the bizarre surface features seen on Mars and perhaps other celestial objects.
    - But just what particular planetoids or comets might have been responsible for this remains unknown