ON PATTEN'S REVIEW OF VELIKOVSKY'S VENUS THEORY

Laurence C.W. Dixon
Emeritus Professor
Numerical Optimization Centre, University of Hertfordhire

April 1999

1 Introduction

In [1] Patten reviewed Velikovsky's Venus and Mars theories and concluded that the Venus theory was not possible but that the Mars theory could be true. His analysis of the Venus theory was largely based on energy and angular momentum considerations. In the paper (on page 51) he states "The modern Venusian energy comes from multiplying its mass by its distance to the Sun (0.72333) multiplied by $0.5\times2\pi^2$." In the correct expression it is necessary to divide by the distance to the Sun, not multiply. This simple mistake repeated in all his calculations invalidates his "analysis" which claimed to show that the Jupiter-Venus scenes so central to Velikovsky's theory are impossible due to gravitational considerations.

I was interested to see what would happen if the analysis was repeated using the correct expressions, and this is given below in section 3. In section 2 a derivation of the expressions for the energy and angular momentum of gravitational orbits is given, to justify my statement.

In *World in Collision*, Velikovsky advocated that Venus, after being expelled from Jupiter began to make close flybys of the Earth. He dated these flybys in the second millennium B.C. Subsequently Venus interacted with Mars finishing in its present orbit, whilst Mars then began to interact with the Earth. In this paper we will assume these Earth-Mars interactions continued until Mars interacted with another body that was later expelled from the solar system or exploded leaving Mars in its present orbit.

A number of Velikovsky's supporters in 1972 published 10 issues of the journal *Pensee.* In Volume 1 p. 43 Rose and Vaughan suggested the following

orbits for the three lengthy periods (where e is the eccentricity and a the distance from Sun in astronomical units):
Period 1: Between Venus' expulsion from Jupiter and interaction with Earth.

Period 2: Between Venus' encounters with Earth and Mars.

Period 3: Between Mars' encounters with Venus and Earth

Period 1: Venus ($a = 3.0$, $e = 0.8$), Earth (0.81, 0.067), Mars (0.55, 0.050)

Period 2: Venus (1.0, 0.5), Earth (1.1, 0.167), Mars (0.55, 0.050)

Period 3: Venus (0.72, 0.007), Earth (1.1, 0.167), Mars (1.0, 0.4)

No explanation however is given on how the above numbers were obtained.

In Volume 3 on pages 22-24, in a paper entitled *The orbits of Venus*, Ransom and Hoffee presented a more detailed discussion of the same orbits, and claimed that these orbits are not inconsistent with the laws of physics.

In Volume 8 p. 27, Rose and Vaughan in *Velikovsky and the Sequence of Planetary Orbits* presented the mathematical justification of their orbits. They state "Keplerian orbits can be proposed that not only cross each other, so that collisions on near collisions will tend to occur, but also mantain total angular momentum and do not increase total orbital energy". They do however note that there is a large discrepancy between the initial and final values of the energy and do suggest that the inclusion of a final interaction between Mars and an asteroid would balance this.

The final interaction is also discussed by Rose in [6]. A rather different final interaction is included below to complete the major changes in orbits to the present.

Rose and Vaughan assume that the mass of Venus decreased during the interactions; the lost mass would remove some angular momentum. The amount of mass loss is of course unknown. In our calculations we assume no mass loss. We claim no priority for the ideas in the paper, our calculations follow those of Rose and Vaughan.

The paper was written to show that Patten's claim was false. A main surprise was how easy it was to find a set of feasible orbits. There are certainly much better orbits than those given here.

We do not intend here to cast doubts on the mathematical feasibility of Patten's Mars theories, which require a separate calculation.

2 Energy and angular momentum

The gravitational orbits of the planets will be assumed, for the purpose of this paper, to obey Newton's laws of gravity and to be coplanar. For the planets the orbits can then be expressed in 2 dimensional polar co-ordinates r, θ, where r is the radial distance from the Sun and θ measures the angle round the orbit.

Newton's radial and tangential equations of motion are then:

$$\ddot{r} - r\dot{\theta}^2 = -\mu/r^2 \tag{1}$$

$$r\ddot{\theta} + 2\dot{r}\dot{\theta} = 0 \tag{2}$$

The second implies that $r^2\dot{\theta}$ is constant. This can be seen by differentiating $r^2\dot{\theta}$ and noting that by Eq. (2) the derivative is zero. This constant is defined to be the angular momentum (per unit mass):

$$h = mr^2\dot{\theta} \tag{3}$$

Similarly if we define the total energy (per unit mass) by:

$$E/m = 1/2(\dot{r}^2 + r^2\dot{\theta}^2) - \mu/r \tag{4}$$

then we find that, on differentiating E, its derivative is also zero.
Let us now consider circular orbits, implying $\dot{r} = \ddot{r} = 0$, and let us introduce the period T, so $\dot{\theta} = 2\pi/T$. Then equation (1) becomes

$$\mu = r^3(2\pi)^2/T^2 \tag{5}$$

This must be true for all circular orbits including the nominal orbit of the Earth, so if we fix the length and time scales so $r = T = 1$ for the Earth in its present (normally circular) orbit, i.e we take as units of length and of time respectively the astronomical unit and Earth year, we obtain

$$\mu = (2\pi)^2 = 39.48 \tag{6}$$

and

$$r^3 = T^2 \tag{7}$$

On substituting for $\dot{\theta}$, μ, and T in Eq.(4) we obtain

$$E/m = -1/2(2\pi)^2/r \tag{8}$$

as claimed in the introduction.
To perform the analysis we also need the formula for elliptical orbits. Here we note that there are two points, the perihelion r_1 and the aphelion r_2, where $\dot{r} = 0$. To connect notations note that the semi-major axis is $a = (r_2 - r_1)/2$ and the eccentricity is $e = (r_2 - r_1)/(2a)$. Equating the energy at these two points gives

$$1/2h^2/(m^2 r_1^2) - \mu/r_1 = 1/2h^2/(m^2 r_2^2) - \mu/r_2 \tag{9}$$

$$(h/m)^2 = 2\mu r_1 r_2/(r_1 + r_2) = 2\mu a(1 - e^2) \tag{10}$$

and on substituting this into the energy

$$E/m = -\mu/(r_1 + r_2) = -\mu/2a \tag{11}$$

For a given value of a the angular momentum is greatest when the orbit is circular so $e = 0$. For convenience the values of E and $h_{\max}$ per unit mass are tabulated below for some useful values of a.

a	0.5	0.7	0.8	0.9	1.0	1.1	1.52	3.0
-$E/m = \mu/2a$	39.44	28.17	24.65	21.91	19.72	17.93	12.97	6.58
$h_m/m = \sqrt{2}\mu a$	6.28	7.43	7.94	8.43	8.88	9.31	10.95	15.38

3 The orbital data

We are concerned with 4 present orbits and at least 4 sets of old orbits. The present orbits are those of Venus, Earth, Mars and Jupiter:

	r	m	e	E	h
Venus	0.718/0.728	0.815	0.007	-22.22	4.35
Earth	0.983/1.02	1.012	0.018	-19.94	6.35
Mars	1.40/1.65	0.107	0.082	-1.385	0.83
Jupiter	5.2	317.		-1220.3	4551.

If we now consider a non-circular transition orbit from Jupiter for Venus we can calculate the energy and angular momentum. To be specific we will assume the transition orbit goes from 5.2 to 0.4 a.u.; giving

	r	m	e	E	h
Venus	5.2/0.4	0.815	0.85	-5.73	4.41

These figures are so small compared to those for Jupiter that the expulsion cannot significantly affect Jupiter's orbit.

The final encounter would be that between Mars and an asteroid (or an Apollo or Amor object, or a comet....). This encounter must place Mars in its present orbit. If we assume that before the encounter Mars was in a transition orbit from 0.73 to 1.52, then we obtain

	r	m	e	E	h
Mars	0.73/1.52	0.107	0.35	-1.875	0.66

from which we see that 0.49 units of energy and 0.17 units of angular momentum would be transferred between Mars and the asteroid, as Mars must end in its present orbit.

In all intermediate encounters the total energy of Mars, Venus and Earth must be constant, so

$$\sum mE = -22.22 - 19.94 - 1.87 = -44.03 \tag{12}$$

and

$$\sum mh = 4.35 + 6.35 + 0.66 = 11.36 \tag{13}$$

It is easier to see the implications if we multiply the energy and angular momentum per unit mass given in section 2 by the masses of Earth, Venus and Mars

a	0.5	0.7	0.8	0.9	1.0	1.1	1.52	3.0
-E_{Earth}	39.91	28.50	24.96	22.17	19.96	18.15	13.12	6.66
$-E_{Venus}$	32.14	22.95	20.09	17.86	16.07	14.61	10.57	5.36
$-E_{Mars}$	4.22	3.01	2.64	2.34	2.11	1.92	1.38	0.70
$h_{\max}, E$	6.35	7.52	8.03	8.53	8.99	9.42	11.08	15.56
$h_{\max}, V$	5.11	6.05	6.47	6.87	7.23	7.59	8.92	12.53
$h_{\max}, M$	0.67	0.79	0.85	0.90	0.95	1.00	1.17	1.64

In the period immediately after Venus' expulsion from Jupiter, Earth and Mars together then had to share

$$\sum mE = -38.32, \quad \sum mh = 6.94 \tag{14}$$

The above implies that the semi-major axies of Earth and Mars are unexpectedly small. It might be argued that this is incompatible with life on Earth, but clearly life has to be very robust to survive many aspects of this scenario. Mathematically one solution is

Earth	a =0.59	E =-34.3	e =0.24	h =6.4	r =0.44/0.73
Mars	a =0.51	E =-4.0	e =0.43	h =0.56	r =0.29/0.73

We note that these orbits could also lead to interaction with Mercury. The first interaction of Venus with Earth leaves Mars unaltered, so Earth and Venus must then share

$$\sum mE = -40.03, \quad \sum mh = 10.8 \tag{15}$$

One possible solution is

Earth	a =1.03	E =-19.32	h =6.41	e =0.55	r =0.56/1.59
Venus	a =0.77	E =-20.71	h =4.39	e =0.55	r =0.35/1.19
Mars	a =0.51	E =-4.00	h =0.56	e =0.43	r =0.29/0.73

The Venus, Mars encounters will leave Earth's orbit unaltered, place Venus in its present orbit and send Mars into an orbit that crosses the Earth's. This again has a solution

Earth	a =1.03	E =-19.32	h =6.41	e =0.55	r =0.56/1.59
Venus	a =0.723	E =-22.22	h =4.35	e =0.007	r =0.718/0.728
Mars	a =0.847	E =-2.49	h =0.6	e =0.55	r =0.39/1.31

The final interaction between Earth and Mars leaves Venus unaltered, places Earth in its present orbit and moves Mars to the orbit that interacts with the asteroid.

Earth	a =1.012	E =-19.94	h =6.35	e =0.008	r =0.983/1.02
Venus	a =0.723	E =-22.22	h =4.35	e =0.007	r =0.718/0.728
Mars	a =1.125	E =-1.875	h =0.66	e =0.351	r =0.73/1.52

All the above combinations of orbits maintain total mass, total orbital energy and total angular momentum and the changes are therefore gravitationally feasible. It is not a unique solution, there being considerable freedom of choice at many points. Many of the interim orbits given above have quite high eccentricity, but I leave it to others to see if they can get a more plausible solution. Rose and Vaughan would claim that they have.

In this paper it has been demonstrated that the sequence Venus expelled by Jupiter, Venus interacts with Earth, Venus interacts with Mars, Mars interacts with Earth, Mars interacts with another small body, is feasible.

Without knowledge of the final asteroids present position and orbit it is impossible to reverse the integration of the present orbits to obtain any interactions.

4 Conclusions

It has been demonstrated that a set of orbits exist that maintain total orbital energy and total angular momentum for the Jupiter, Venus, Earth, Mars interactions discussed by Velikovsky provided a final interaction between Mars and an asteroid is included. Patten's statement in [1] is therefore refuted.

5 References

1- Patten, D.W., *Reviewing Velikovsky's Venus and Mars Theories*, The Velikovskian 4, 2, 47-76, (1998)
2- Velikovsky, I., *Worlds in collision* Victor Gollancz (1952) .
3- Rose, L. & Vaughan, R.,*Letter* Pensee 1, 43, (1972)
4- Ransom, C.J., & Hoffee, L.H.,*The Orbits of Venus* Pensee 3, 22-24, (1973)
5- Rose, L. & Vaughan, R.,*Velikovsky and the Sequence of Planetary Orbits*, Pensee 8, 27-34, (1974)
6 Rose, L., *A victory for Mars*, The Velikovskian IV, 2, 98-103, (1998)

6 Addendum by E. Spedicato

It should be noted that Patten and Windsor, in their recent monograph *The Mars and Earth wars*, claim that the last event that led to the present orbits happened in the year 701 B.C. and was witnessed by Hesiod, who described it in the *Shield of Herakles.* In the sky Mars interacted not only with Venus (and with Earth of course) but with Herakles, who can be interpreted as a third asteroidal body. Hence Dixon's claim that the final interaction should have involved a fourth body is supported by Hesiod testimony.

This work is related to research on nonstandard planetary systems (project under local University of Bergamo 98 funding).