Motion of the Sun's nucleus

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Abstract

"Oscillations" of orbital radii length were detected. Radius lengths are taken from astronomical tables. The article contains several types of "oscillations"**.** Hypothesis of this phenomenon is proposed.

Keywords

oscillation; orbital radius; planet; astronomical table.

Introduction

Kepler's second law - the orbit of the planets is an ellipse. The ellipse is symmetrical about the major axis.

1. At symmetrical points of the ellipse, the radii are equal. The movement along the ellipse is multidirectional. When moving from aphelion to perihelion, the radius decreases, and when moving from perihelion to aphelion, it increases. The article compares the length of the radii at symmetric points by calculating the difference in the length of the radii at symmetric points of the radius (hereinafter simply the difference).

2. Perihelion and aphelion do not have symmetrical points. Take the sequence of the difference in radii by years of perihelion and aphelion.
P - is the difference in perihelion radii, $P_2 - P_1, \ldots, P_n - P_{n-1}$
A - is the difference between the aphelion radii, $A_2 - A_1, \ldots, A_n - A_{n-1}$. Plots 4, 5, 9, 15.

The data are taken from NASA astronomical tables [1].

Tables and graphs of orbital radius length difference

	Конвертированные дата и расстояние от перигелия к афелию		Дата и расстояние от перигелия к афелию		Разно сть
	дата	R_1	дата	R_2	$R_2 - R_1$
1					
2					

Table 1

The original data is in the file "horizons_results.txt". In the files файлах "full period_hdr1_[planet name].txt", the source data is presented in table format. The maximum difference for each period is determined and recorded in files "full period_max1_[planet name].txt". The program "Search_for_negative_sequences" calculates the difference in perihelion by years and writes it to the second column of the file, respectively, in the third column writes the difference of aphelion.

Programs and files are located at the link [2].

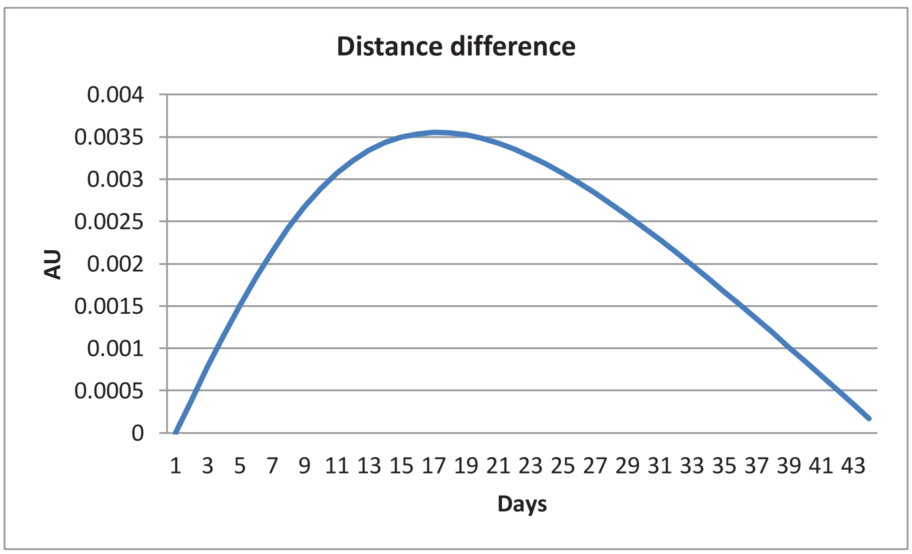
Based on the data obtained, graphs and histograms of the difference in the length of the radii of the orbits of Mercury, Venus, Earth, Mars were constructed.

Mercury

Table 2 and graph 1 show the difference in the length of the radius of the orbit of Mercury for one period.

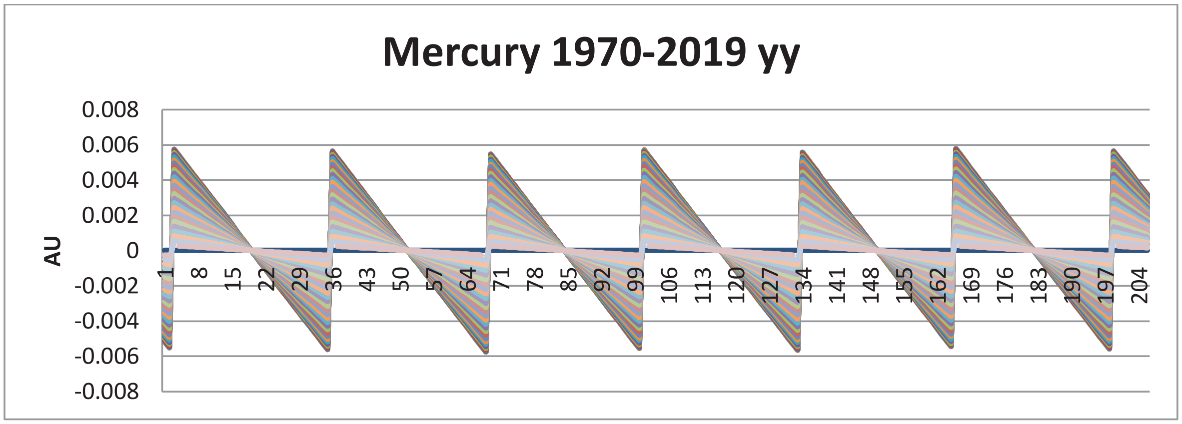
1	2000-Aug-10 00:00	0,30753	2000-Aug-10 00:00	0,30753	0
2	2000-Aug-09 00:00	0,307655	2000-Aug-11 00:00	0,308048	0,000392
43	2000-Jun-28 00:00	0,466466	2000-Sep-22 00:00	0,466636	0,00017

Table 2



Plot 1

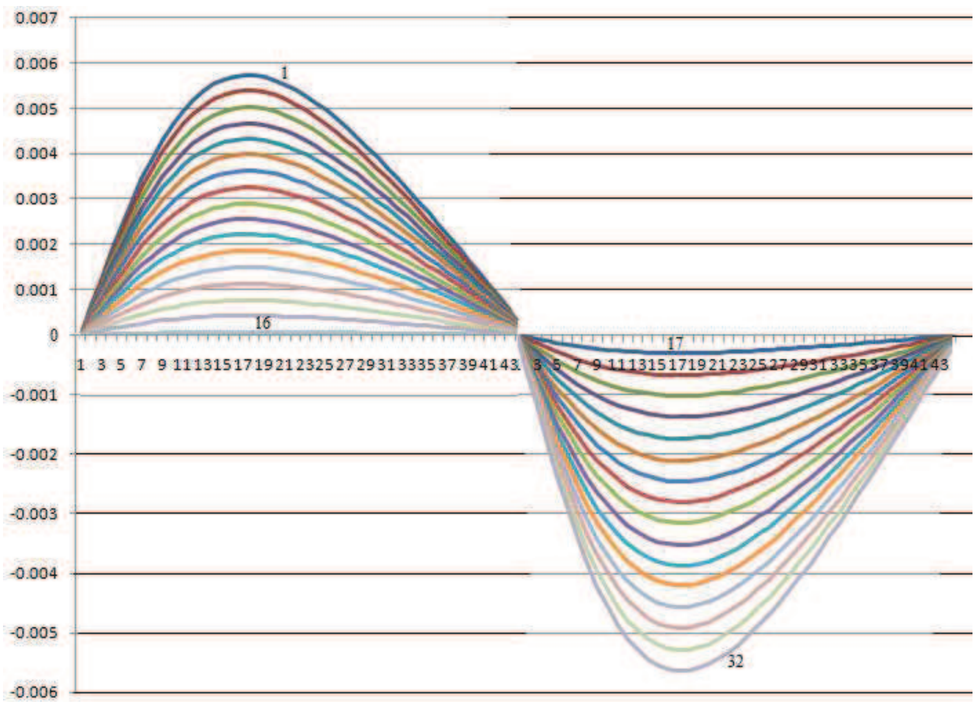
Plot 2 shows the differences over 205 Mercury years.



Plot 2

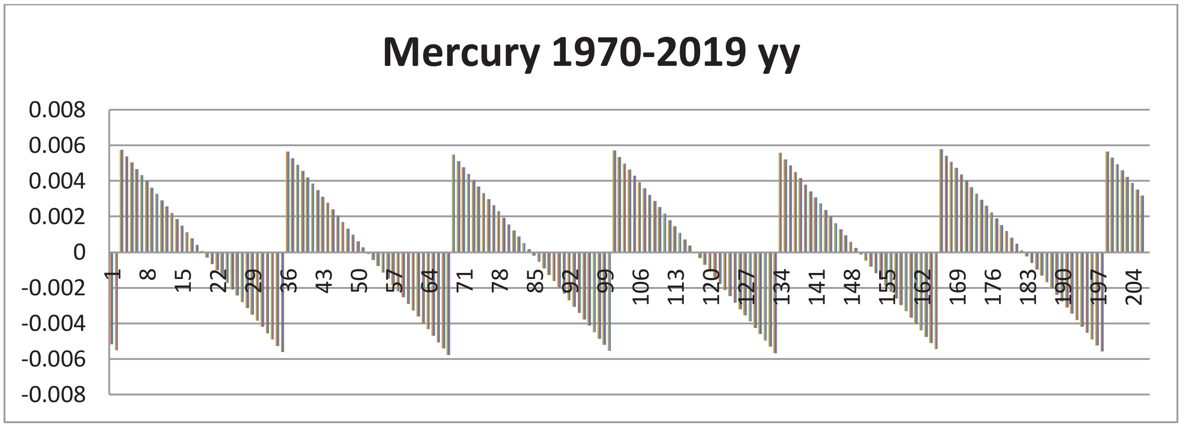
In Plot 2, in addition to annual fluctuations, we see cycles of 32-33 years.

Plot 3 shows one of the cycles in an enlarged format.

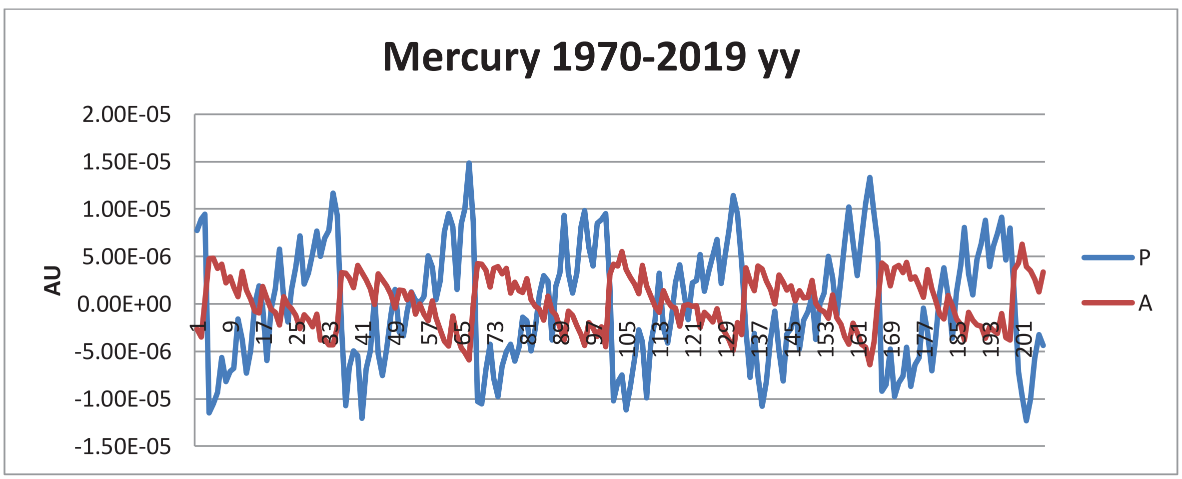


Plot 3

Histogram 1 displays the absolute maximums of the annual differences.



Histogram 1

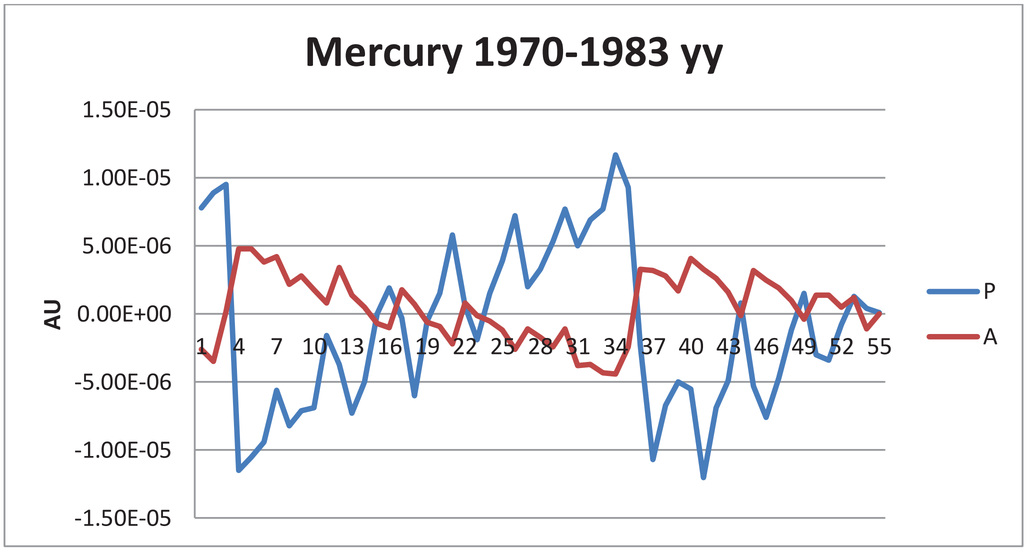


P - perihelion A - aphelion

Plot 4

Plot 4 shows the same multi-year cycles of 32-33 years.

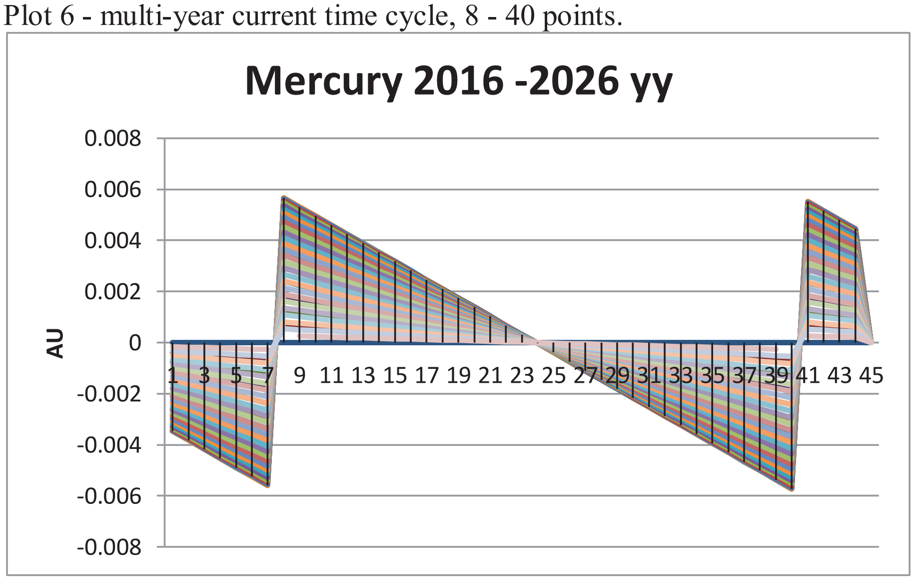
Plot 5 is obtained from the astronomical tables of the Paris Observatory [3]. Plot 5 has one multi-year cycle of 33 years, 3 - 36 points.



P - perihelion A - aphelion

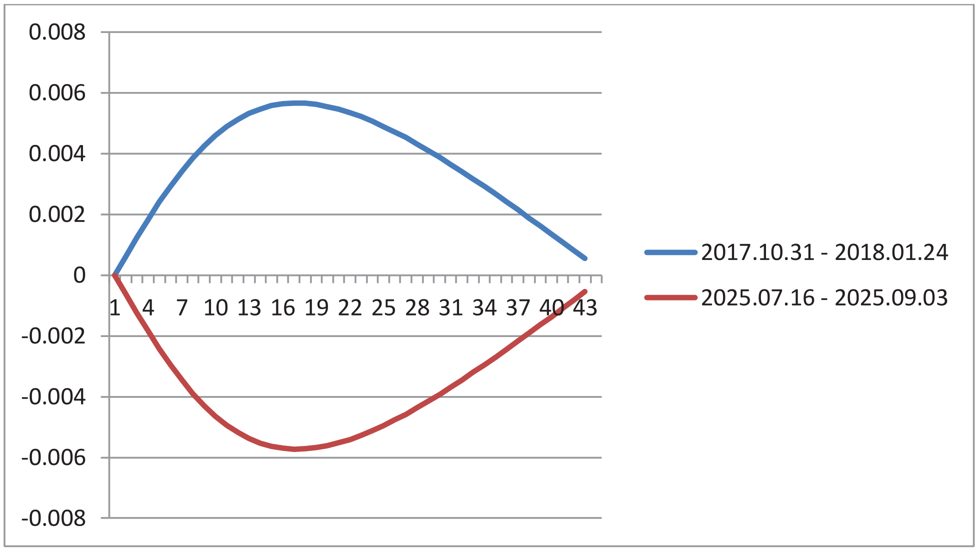
Plot 5

Plot 6 - multi-year current time cycle, 8 - 40 points.



Plot 6

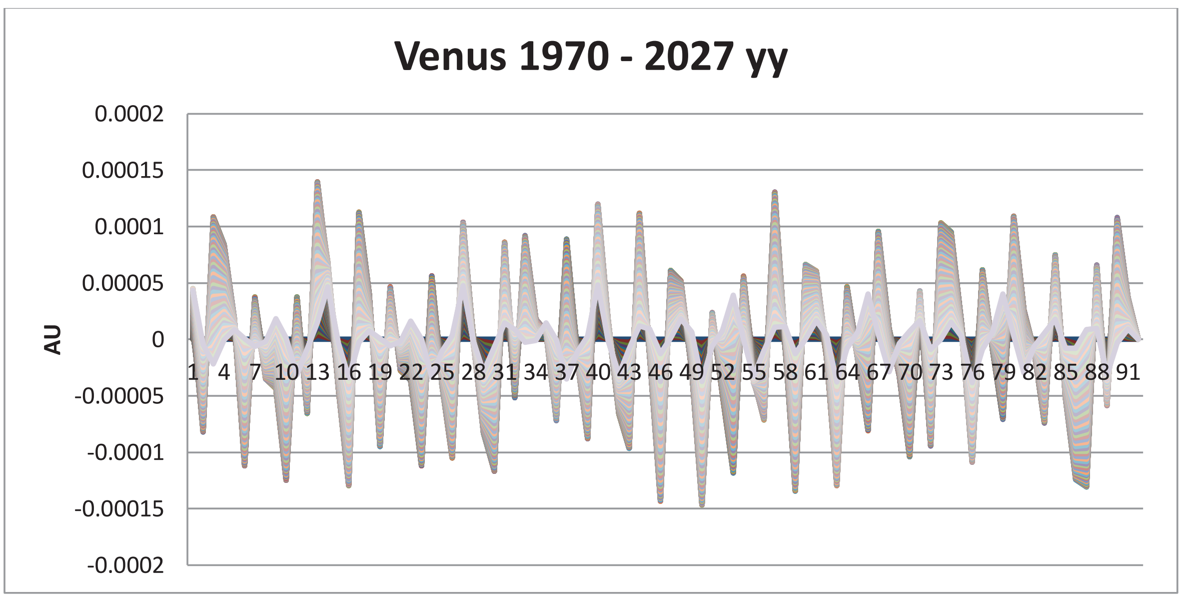
Plot 7 shows the start and end times of the current multi-year cycle.



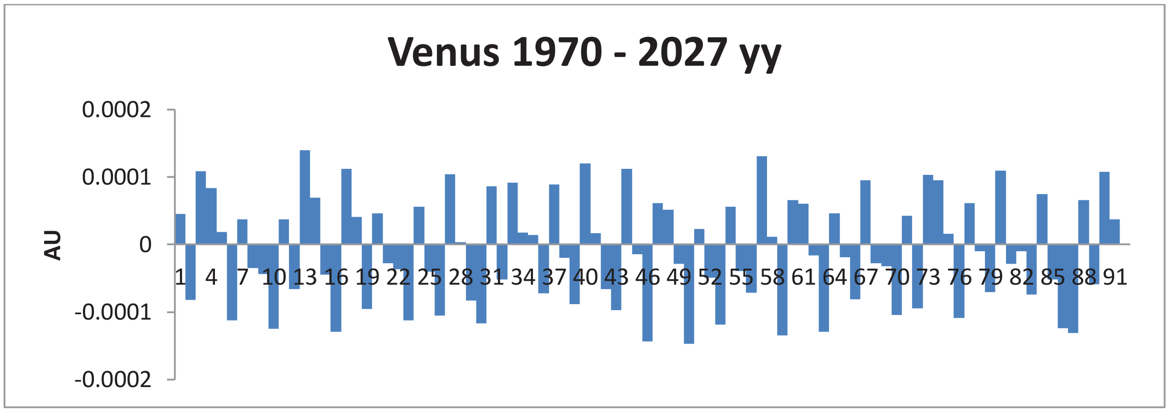
Plot 7

The article [4] shows the annual fluctuations of the radii of other planets.

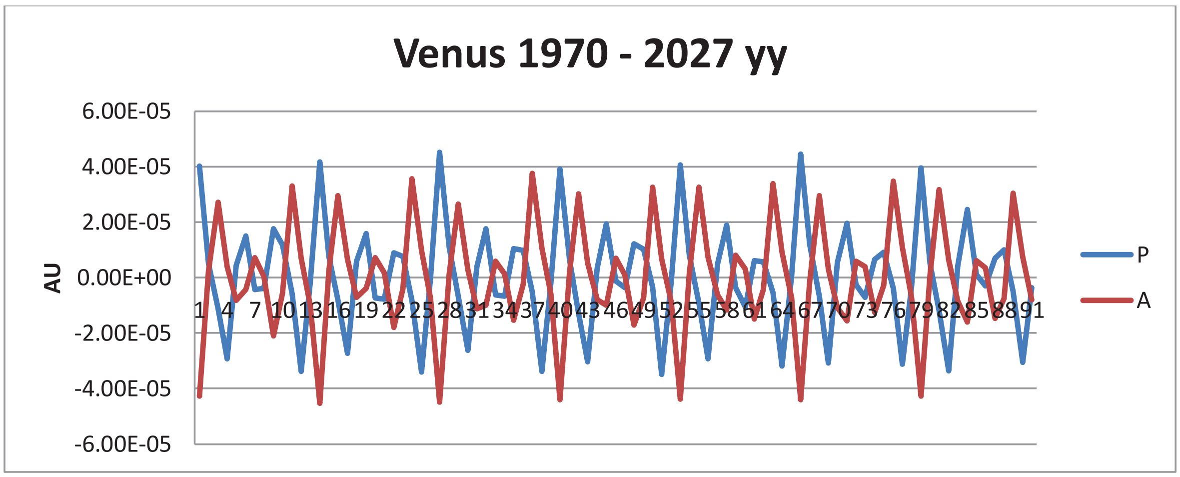
Venus



Plot 8

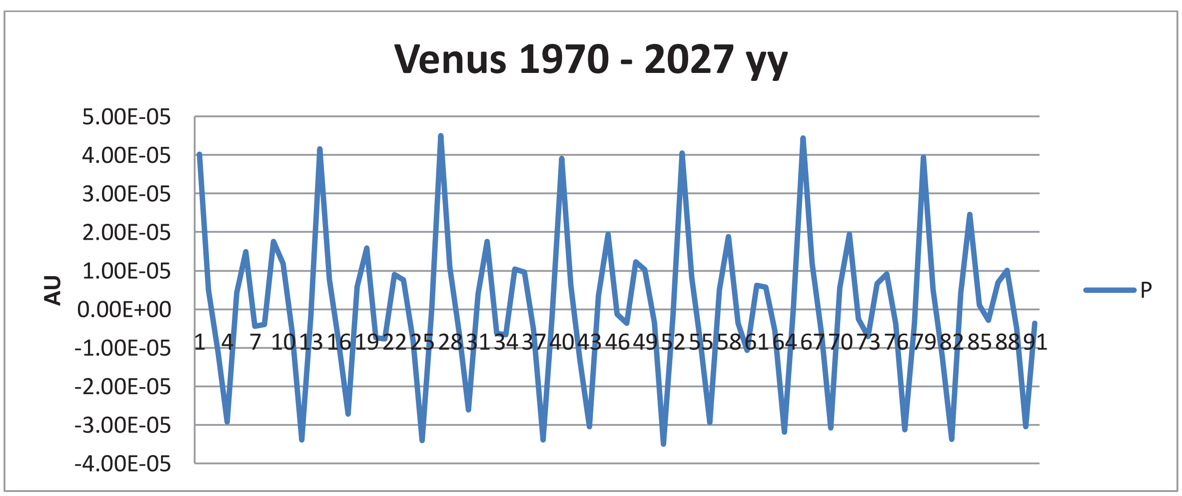


Histogram 2



P - perihelion A - aphelion

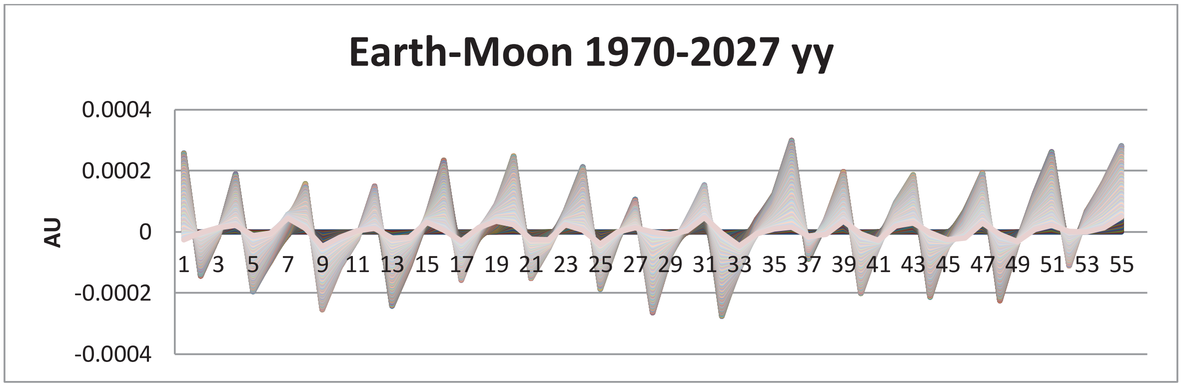
Plot 9



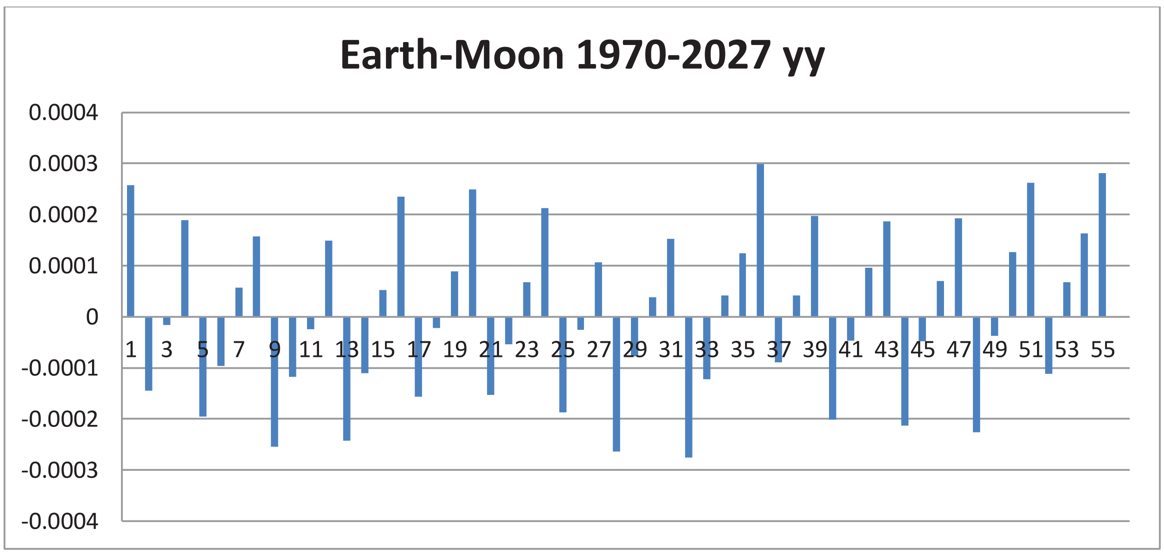
P - perihelion

Plot 10

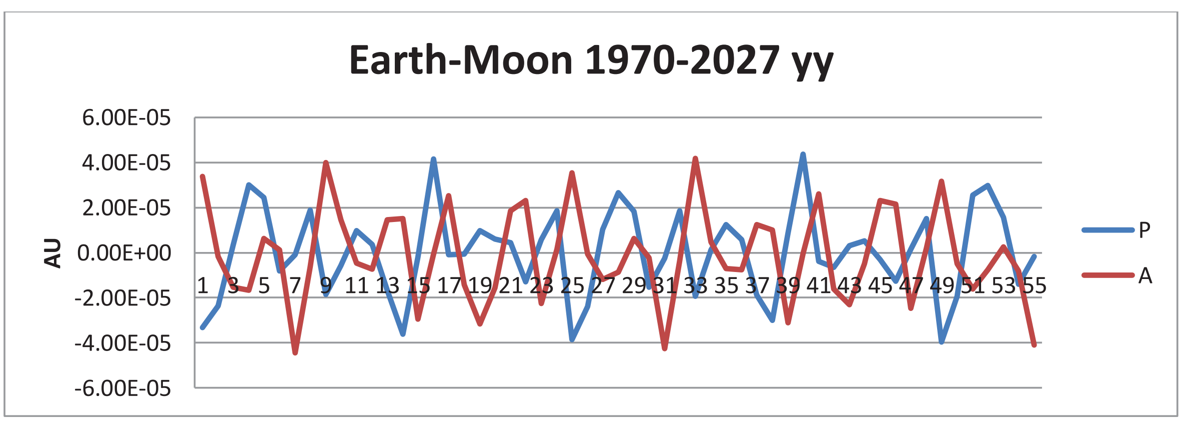
Земля-Луна



Plot 11

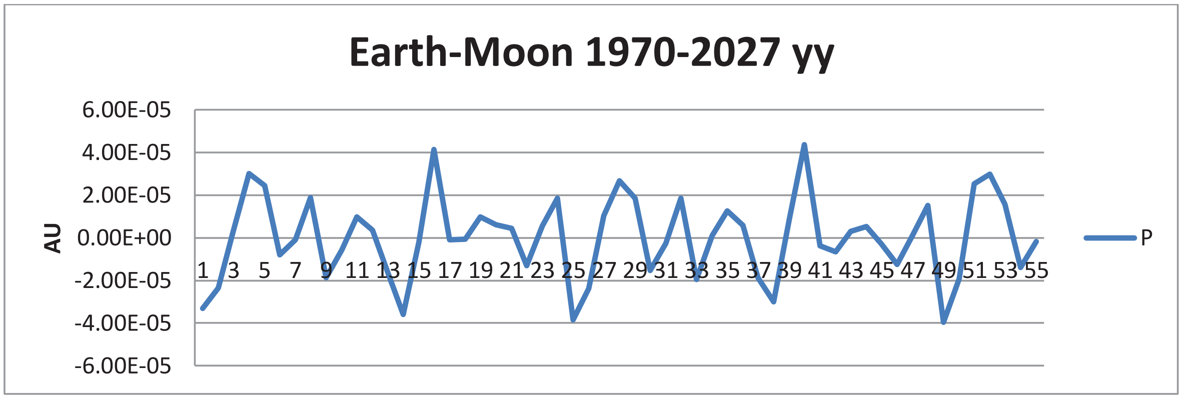


Histogram 3



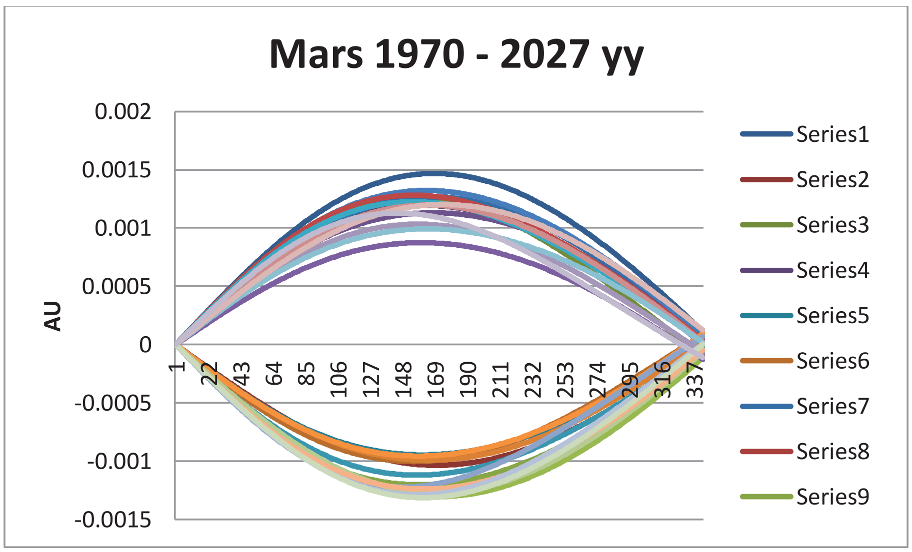
P - perihelion A - aphelion

Plot 12

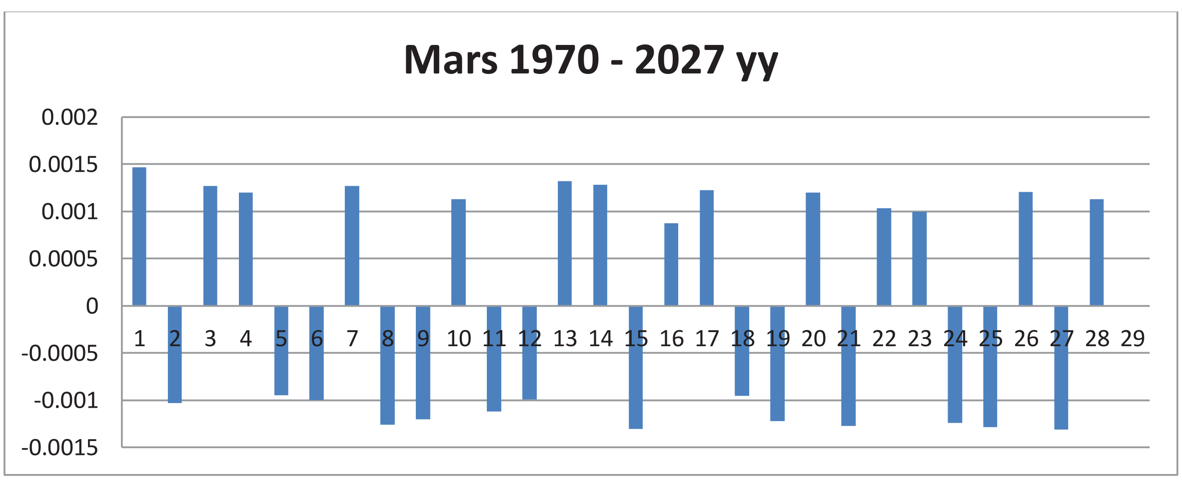


Plot 13

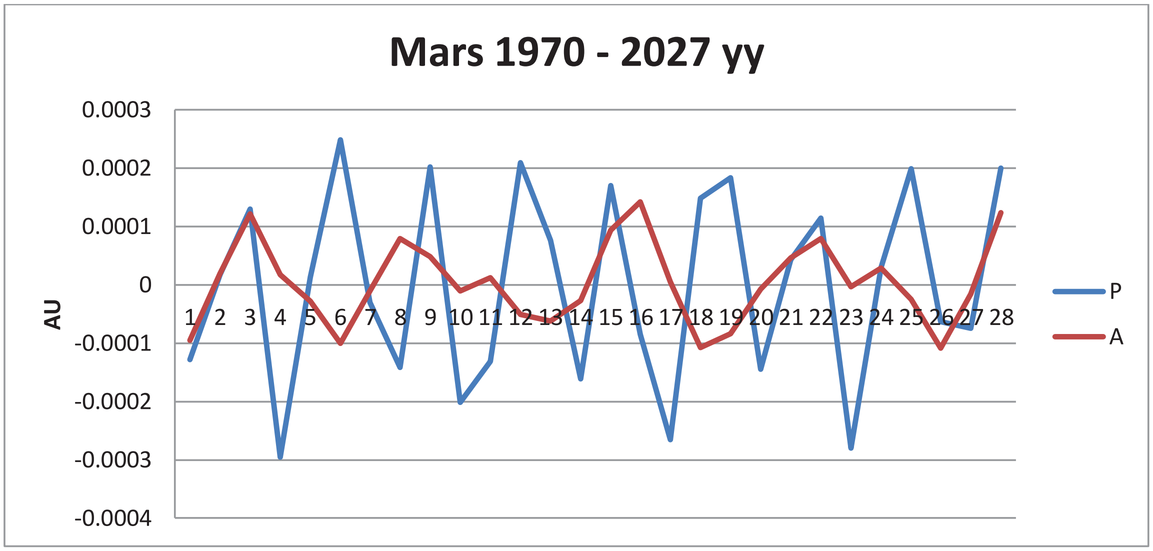
Mars



Plot 14



Histogram 4



P - perihelion A - aphelion

Plot 15

Long-term cycles of Venus, Earth, Mars on plots 8, 11, 14 and, accordingly, on histograms 2,3,4 are not as clearly expressed as in Mercury. Longer data sampling is needed for Mars. Long-term cycles of perihelion and aphelion are more pronounced, plots 4, 5, 9, 10, 12, 13, 15.

Conclusions

The authors of the HORIZONS program write: " *To have an exact value, a quantity must be either strictly constant, or else, exactly periodic.*

The orbits of the planets are only approximately elliptical; their motions are only approximately periodic; not exactly. Therefore, it doesn't make much sense to ask questions about "exact" Keplerian (elliptical) elements.

A simple analogy would be to take a pencil and draw a free-hand circle on a piece of paper, going round-and-round a number of times. Then ask, "what is the EXACT radius of that circle?"

It is impossible to give an answer; the curve that you have drawn is not exactly a circle.

One may define an "osculating" radius, for example: the radius of curvature at any given point on the curve. However, this value is exact at that given point only. The value will change for a different place on the curve; or, if averaged over some portion of the curve; or, if averaged over some other portion of the curve.

Which result gives the "exact" answer? None; there is no "exact" radius for the curve.

It's a whole different situation with the JPL ephemerides. We do not use things such as periods, eccentricities, etc. Instead, we integrate the equations of motion in Cartesian coordinates (x,y,z), and we adjust the initial conditions in order to fit modern, highly accurate measurements of planetary positions. As a result, we are able to produce ephemerides which are far more accurate than those based upon elliptical elements.

In the analogy above, it could be possible to measure each point of the hand-drawn curve very accurately; however, one still could not give a unique value for the curve's radius."

As you can see, the authors of the HORIZONS program talk about the presence of "oscillations" of the radii. However, nothing is said about the form and nature of the oscillations. The question arises. Cycles have a computational or natural cause?

Let us estimate the value of the oscillation of the orbital radius

Планета	Радиус радиус планеты а.е.	Максимальная разность радиуса орбиты а.е.	Максимальная разность радиуса в перигелии а.е.
Меркурий	1.63e-5	5.663e-3	1.48e-5
Венера	4.05e-5	1.4e-4	4.51e-5
Земля	4.26e-5	2.9879e-4	4.37e-5
Марс	2.37e-5	1.467918e-3	2.96e-4

Table 3

The difference in the radius of the orbit is one two orders of magnitude greater than the radius of the planet. Radius oscillations at perihelion show that hypothesis number one cannot be the root cause of radius oscillations.

It is known that the core and surface of the Sun rotate at different speeds. The solar core rotates almost 4 times faster than the surface of a star. There is a possibility of cyclic movement of the center of mass of the Sun, which causes a shift in the coordinates of the planets. The radii remain unchanged. Average diameter of the Sun $1.392 \cdot 10^9$ м = 0.009305 AU. The diameter of the motion curve of the core of the Sun is about 100 times smaller than the diameter of the Sun, 0.009305/0.0000999 = 93.14.
The rapid change in the sign of the multi-year cycle on graphs 2, 8, 11 can be mathematically described by the existence of an intermediate axis during the rotation of the Sun's core, the Dzhanibekov effect.

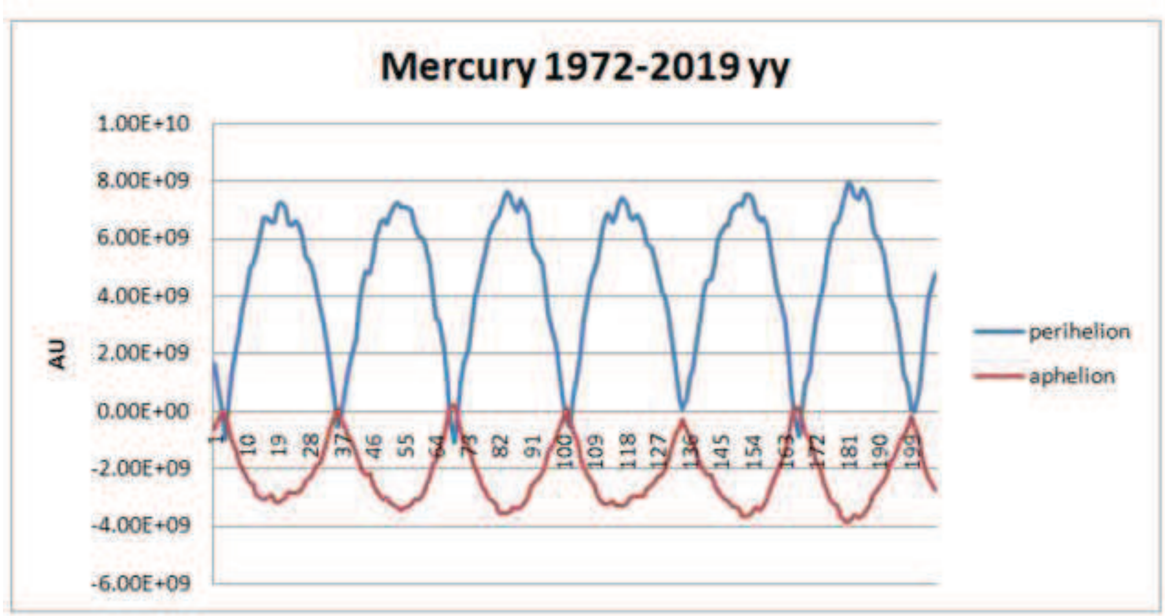
References

1. NASA HORIZONS https://ssd.jpl.nasa.gov/horizons.cgi
2. V. Strohm, programs and data, https://drive.google.com/file/d/1qIz9BaLeQQPaOx8d2dJyV4jHgWPJ-hF9/view?usp=sharing
3. THE IMCCE VIRTUAL OBSERVATORY SOLAR SYSTEM PORTAL, http://vo.imcce.fr/webservices/miriade/?forms

V. Strohm, preprint, Some samples of building a system of objects of a given kind, https://www.academia.edu/43336620/Some_samples_of_building_a_system_of_objects_of_a_given_kind , https://vixra.org/abs/2006.0118

Addition

On graph 16, the same 206 years of Mercury as on graph 2, the same radius, the initial radius of the sample, is subtracted from each radius of the year.



Plot 16