

GRAVITATIONAL SYMMETRY INSIDE THE SOLAR SYSTEM
EXPERIMENTAL FACTS AND PREDICTIONS

Aleksandr Timofeev

Abstract. The empirical law connecting values of planetary masses in the Solar system is demonstrated and analyzed. A characteristic property of this law is the existence of groups consisting of four planets. The law predicts the existence and properties of three unknown planets inside the Solar system. This law can serve the useful tool for research in extra-solar planetary systems.

1. Empirical gravitational regularities of a symmetry in the Solar System

1.1. Magic ratios of linear combinations of planetary masses .Here are the most reliable values of the Solar System [1] planetary masses that can be experimentally obtained by celestial mechanics:

Table I

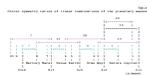
Planetary masses and Ratios of linear combinations of masses

Planet	Symbol used for each planet	Mass value Earth=1	Ratio considered	Exact value of the ratio	Rounded ratio
Jupiter	MJU or 1	317.735	(MJU+MSA) / (MUR+MNE)	= 12.9959	~ 13
Saturn	MSA or 2	95.147	MJU/ (MUR+MNE)	= 10.0010	~ 10
Neptune	MNE or 3	17.23	MSA/ (MUR+MNE)	= 2.9948	~ 3
Uranus	MUR or 4	14.54	(MJU+MSA) / MNE	= 23.9630	~ 24
Earth	MTE or 5	1.000	MUR/ (MTE+MVE)	= 8.0110	~ 8
Venus	MVE or 6	0.815	(MNE+MUR) / MVE	= 38.9816	~ 39
Mars	MMA or 7	0.108	(MTE+MVE) / MME	= 33.0000	~ 33
Mercury	MME or 8	0.055	MVE/ (MMA+MME)	= 5.0000	~ 5

The difference between computed values of ratios and the closest integer can possibly be explained by an effect similar (Francis Aston 1920) to mass modification caused by dense packing in atom nuclei. The planetary masses are measured with some errors also.

1.2. Chiral symmetry ratios of linear combinations of the planetary masses

When organised graphically, the ratios [2] of linear combinations of the planetary masses considered, reveal a chain of gravitational correlations between triples of planets possessing chiral symmetry:



The following symbols are used in the above graph:

MU = MJU < 2 < 3 < 4; ME = MNE < 5 < 6 < 7;
 MS = MSA < 8 < 9 < 10; MM = MMA < 11 < 12 < 13;
 MN < 14; MN < 15; MN < 16; MN < 17; MN < 18;
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 MN < 10

Note: Here it is necessary to understand the exclusive importance of the Fibonacci series for gravitational regularities inside the Solar system in the common case:

If you look at direct gravitational connections then you will see the following numbers: 3, 5, 8, 13.
For the third hypothetical quad there should now be the following numbers accordingly: 21 and 34.

1.3. Formula for pairs of conjugate gravitational correlations.

We shall name "pairs of conjugate gravitational correlations" the following pairs of values that can be identified on the previous graph:

33,5 39,8 24,3 10,13

We shall now consider relating the sums of these pairs of conjugate gravitational correlations with the squares of natural numbers:

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From these relations, a common formula for the sums of the pairs of conjugate (direct and reverse) gravitational correlations can be established:

$$(\text{value of reverse correlation}) + (\text{value of direct correlation}) = n^2 (+/-) 2$$

To some extent, this formula is an analog of Balmer's formula for the spectral series of the Hydrogen atom. The analysis of the chained series of conjugate gravitational correlations clearly reveals a periodic alternance of the sign before number 2.

1.4. Gravitational correlations for groups of four planets.

For a long time astronomers have been aware of dynamic relations in celestial bodies in groups of four, in the stable gravitational system with which the Solar System presents us. On this specific criterion and on some other dynamic criterions stemming from celestial mechanics, we can select two groups of four planets in the Solar System. The planets of the Terrestrial group are: Earth, Venus, Mars and Mercury. The planets of the Jovian group are: Jupiter, Saturn, Neptune and Uranus. The empirical facts discovered here indirectly confirm the existence of further relations.

For the group of planets Earth, Venus, Mars and Mercury $((n^2 + 2); (n^2 - 2))$ the relationship is established in the following manner:

$$(33 + 5) + (39 + 8) = 6^2 + 7^2 = 9^2 + 2^2 = 85$$

For the group of planets Jupiter, Saturn, Neptune and Uranus $((n^2 + 2); (n^2 - 2))$ the relationship is established in the following manner:

$$(10 + 13) + (24 + 3) = 5^2 + 5^2 = 7^2 + 1^2 = 50$$

In each of the groups considered, there is a higher pair $(n^2 - 2)$ and lower pair of planets $(m^2 + 2)$. Therefore, a possibility seems to exist to derive various combinations of these pairs to obtain mixed combinations from these two groups of four planets. In our particular case, only the combination of the two lower pairs $((n^2 + 2); (m^2 + 2))$ Neptune, Uranus, Mars and Mercury, forming a mixed group, allows a correlation to be determined:

$$(33 + 5) + (24 + 3) = 7^2 + 4^2 = 8^2 + 1^2 = 65$$

Some conclusions:

The considered relations can be expressed as the following formula: (sum values of all correlations of the given group) $= k^2 + l^2 = m^2 + n^2$

What is remarkable in these correlations by groups of four planets, is that the sum of the pairs of conjugate gravitational correlations are equal in each case to natural numbers (50, 65, 85) which are the first terms of a sequence of natural numbers, which are the sum of two pairs of squares of natural numbers. Please look Diophantus's theorem of a number theory (III, 19). Here is the beginning of this series:



1.5: Principles of ratio selection

As we examine Table I, we might wonder why these specific ratios were selected among the many combinations that are mathematically possible. Here are the principles that guided the choice of ratios. All these principles should be fulfilled simultaneously.

From a mathematical point of view, the problem gravitational interaction between planets of the Solar System is the nonlinear n-body problem. Principles 1,2,3,4 and 5 are the physical restrictions superimposed on the mathematical formalism of ratios of linear combinations of planetary masses. The given method has analogs in radiophysical, atomic and molecular spectral researches. The considered method is not statistical, it leans on properties of nonlinear stationary systems.

Principle 1. The ratios having the least difference in value from integers are chosen.

Principle 2. The ratios containing only three bodies are chosen (there is one elimination stipulated by Principle 4). Principle 2 leans on the existence of the closed solution of the three-body problem. The three-body problem was solved by Karl Fritiof Sundman [3]. This solution has a very complicated structure that does not give direct tie between coordinates and time, i.e. there is a full analogy to the solution for the two-body problem.

Principle 3. The ratios containing the planets of similar masses are chosen. These ratios are the most essential and reliable from the physical point of view. The Principle 3 integrates in a ratio those planets which have the greatest potential energies of gravitational interaction. The Principle 3 take into account also that the absolute errors in masses of large planets can exceed masses of small planets.

Principle 4. The ratios ensuring existence of a symmetry of a high level are chosen. For the first time in history, the French mathematician and physicist Henry Poincare has paid attention to the symmetry of physical laws [4]. The fundamental physical laws have properties tightly connected with a symmetry [5]. In the given work, the properties of the symmetry of the Solar System are studied.

Principle 5. Only main terms of the ratios are chosen. When the significant ratios satisfying to Principles 1,2,3 and 4 are sorted in ascending order, the following sequence of natural numbers are obtained:

3, 5, 7(*), 8, 10, 13, 24, 33, 39...

Only these terms (except for number 7) are main in gravitational interaction between the planets of the Solar System. These terms represent the main nonlinear process of the Solar System. The remaining ratios are the causal corollary of the main terms, therefore they are excluded from the analysis in the given paper.

2. Revision of the classical statement of the many bodies problem

2.1. Analogies between kinds of chemical and gravitational connections or gravitational chemistry

Let's consider analogies between steady chemical substances and fixed gravitational systems.

The varieties of symmetries of crystals of various minerals is a corollary of a varieties of chemical elements and various versions of their spatial packing, which generate a delightful symmetry of an exterior form and symmetry of physical properties of crystals. The varieties of chemical substances is a corollary of a varieties of chemical elements and various combinations of their spatial packing. The stationarity of a structure of steady chemical substances is provided with various kinds of chemical connections. By analogy, the stationarity of structures to gravitational systems should be provided with various kinds of gravitational connections. Here, the authors identify the following kinds of gravitational connections:

- 1 - connection in groups of bodies, each of which does not have a satellite or satellites;
- 2 - connection in groups of bodies, each of which has a satellite or satellites;
- 3 - mixed connections in groups of bodies, part of which has a satellite or satellites and other part that does not have a satellite or satellites;
- 4 - other possible or probable unknown kinds of connections in groups of bodies, for which there is no necessary experimental data or which are not currently identified.

In the given article, only 2 and 3 types of connections are considered for the Jove and Earth group of planets.

2.2. Reduction of symmetry in gravitational many bodies problem

Conventional methods of solution of the many bodies problem and various versions finally come into play. The research in this direction has not found fundamentally new outcomes for very long time. The authors adhere to points of view about the necessity of revision of the classical statement of a many bodies problem.

1. In a classical problem the collisions between bodies are considered. The authors offer a limitation in stationary problems in which there are no collisions. This limitation contains a broad class of systems widely observed (observable) in a nature.
2. In the classical approach all bodies have identical dynamic properties, i.e. they are considered equivalent a priori. The empirical observations of stationary systems contradict this supposition. In the Solar system, for example, we have obvious properties of "multiplicity" - the joining of bodies in groups of four bodies in each. Inside such a group, the division into two groups of two bodies is expressed. Each body in the group of two bodies is distinguished by other dynamic properties. Whether we want to recognize this fact, regardless of orthodox experts in the theory of a gravitation, there should be at least one (unknown now) fundamental gravitational law adequate (answering) for the property of "multiplicity". The group property of "multiplicity" removes degeneration for the values of bodies' masses adhering to different groups of bodies.

The account of the property of "multiplicity" - joining of bodies in groups express a reduction of symmetry for the system as a whole. For each group of bodies in a stationary system (presumably) there should be, at the present unknown, integrals of motion.

2.3. PHYLLOTAXIS AND THE EXPONENTIAL SOLAR SYSTEM REGULARITIES BASE UPON IRRATIONAL PHI

An interesting fact is that, for ALL series that are formed from adding the latest two numbers to the following, and, starting from any two values (larger than zero), the ratio of successive terms will always tend to Phi! Phi is a more universal constant than the Fibonacci series itself. [13]

The golden ratio and the Fibonacci series, the Fibonacci Spiral and sea shell shapes, seeds and flower petal, branching plants, leaves and petal arrangements, leaf and pine cones arrangements: all involve the Fibonacci numbers - why? Just what causes plants to grow with this tendency in accordance with the dictates of the irrational Phi remains a mystery after more than 100 years of study.

In his research "Spira Solaris" [12], John N. Harris wrote: "It has long been recognized that the Phi and the Fibonacci Series are intimately related to the subject of natural growth. The Phi, the Fibonacci, Lucas and related series, far from being confined to plant and animal natural growth alone, occur in numerous diverse contexts over an enormous range that extends from the structure of quasi-crystals out to the very structure of spiral galaxies. And this being so, should there really be any great surprise if Phi should also prove to be an underlying element in the structure of planetary systems?"

J. N. Harris has expressed the exponential law connecting mean periods circulation and mean distances for planets of the Solar system, which relies on the irrational Phi series. The research, considered in the given article, confirms the existence of the Fibonacci series for direct gravitational correlation (see 1.2). Just what causes plants to grow and planets to coordinate their motions and their values of masses in tendency in accordance with the dictates of the irrational Phi remains a mystery until now.

See into [14] " The Keplerian Harmony of the Planets and Their moons " by Lothar Komp.

3. Predictions on trans-pluto planets " The Voyagers 1 and 2 trajectories give negative evidence about possible planets beyond Pluto. " [8] "

The mystery of the tiny acceleration towards the sun in the motion of the Pioneer 10, Pioneer 11 and Ulysses spacecraft remains unexplained. " [7]

" The positional measurements do not bode too well for the existence of Planet X although they do not entirely rule out its existence as it may be a small body. " [6]

Here will be used the new analytical method, considered in chapter 1, for the prediction of the unknown new planets. This method is not based on classical positional measurements. This method concerns the qualitative methods of classical celestial mechanics. It can predict common dynamic properties of unknown planets, but it can not predict exact coordinates (like QM) of these unknown planets.

Prediction 1. The total number of planets in the solar system should be equal 12. There are three groups and in each group there are 4 planets. If we lean on the empirical theory described above in chapter 1 item 1.5, there should be four planets in each group. Now the Pluto group consists of one known planet, Pluto. For this reason there should be three unknown planets which together with Pluto will make full group of four planets. These planets are not members of the Kuiper Belt which are far behind Pluto. These planets have distinguishing masses close to the value of Pluto.

Carefully consider the symmetry of the mass distribution of planets inside group of the Jove. In the pair, Jove - Saturn the heavier planet is closer to the Sun. In the contrary the pair, Uranus - Neptune the heavier planet is further from the Sun.

Closely consider the symmetry of the mass distribution of planets inside group of the Earth. In the pair the Earth - Venus the heavier planet is further from the Sun. In a pair the Mars - Mercury the heavier planet is further from the Sun. Here lies the difference in the Earth group from the Jove group.

To compensate for the mass distribution in the Earth group, analogous to the Jove group, it is necessary that in pairs of planets of the Pluto group, the heavier be closer to the Sun!:

Planet 1	Planet 2	Relative Position to Sun
Jove	Saturn	Jove is closer
Uranus	Neptune	Neptune is further
Earth	Venus	Venus is further
Mars	Mercury	Mercury is further

The line of the symmetry inside the Solar planetary system

Planet 1	Planet 2	Relative Position to Sun
Jove	Saturn	Jove is closer
Uranus	Neptune	Neptune is further
Earth	Venus	Venus is further
Mars	Mercury	Mercury is further

Prediction 2. The mass of the unknown planet, pseudo Earth (the mirror reflection of Earth) is greater than the mass of Pluto. Pseudo Earth has one or more satellites and rotates about its axis faster than Pluto. It is very weak object, and small in size. Prediction 3,4. There are two unknown planets, pseudo Venus and pseudo Mercury. The mass of pseudo Venus is more than the mass of Pluto but less than the mass of pseudo Earth. The mass of pseudo Mercury is less than the mass of Pluto. Similarly to Mercury and the Venus, they do not have satellites, i.e. these two unknown planets are "bald". They also have rather slow axial rotation.

Prediction 5. Similarly to Mercury, Venus and Earth these three planets have resonances.

Note. The additional foundation for these predictions is served with the following prerequisites:

1. There is a law which links periods of axial rotation of planets.
2. There is a law which links potential energies of planets. These laws essentially reduce the number of theoretically possible solutions for dynamic parameters of hypothetical planets.

These unknown planets can be detected in an infra-red telescope.

If we consider the mass distribution of planets in the Solar System with acceptance of the predicted masses of the unknown planets, then the mass distribution of planets becomes surprising symmetrical in pairs.

4. Conclusions

The General Theory of Relativity was created by Henri Poincare, D. Hilbert and A. Einstein, when the base of experimental data for the Solar system was very poor, therefore this theory has many hypothetical suppositions in the

basic concepts and the GTR creators were in main mathematics. It is paradoxical, but this theory does not give useful outcomes for practical needs in the research of circum-solar space. The precise gravitational measurements are extremely accessible within the limits of the Solar system. Now the basis of experimental data for the Solar system is vast, but there has not been an acceptable theory of gravitation until now.

The Nobel Laureate, Irving Langmuir, coined the term "pathological science" for "the science of things that aren't so".

Einstein warned: "Most mistakes in philosophy and logic occur because the human mind is apt to take the symbol for reality".

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