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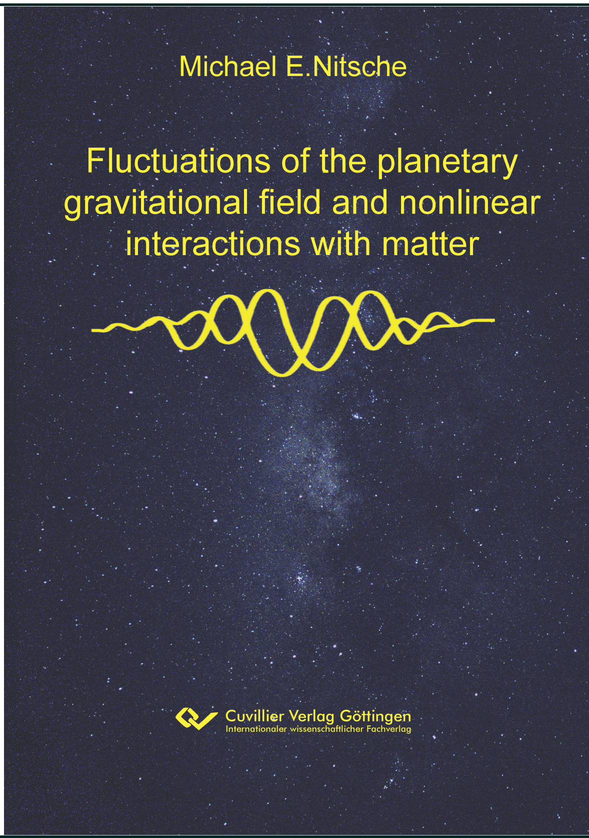
Fluctuations of the planetary gravitational field and nonlinear interactions with matter



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1 The model of nonlinear interactions

1.1 Fluctuations of the planetary gravitational field

Galaxies in space, planetary systems, clouds, geological formations, plants and animals, human societies, our nervous system, quantum physical systems form simple and also complex structures on scales of different size. It is possible that the formation of such structures can be described from a model of more or less strongly coupled oscillating subsystems.
One such oscillating subsystem is the planetary system. The sun and moon are weakly coupled to the ocean system, causing it to oscillate even at low tide. Cause and effect are related in a relatively simple and proportional way. But are there also nonlinear relationships in which cause and effect are not directly proportional?
Developments in computer technology are increasingly making it possible to study complex systems with nonlinear dynamics in nature and society.
One hypothesis underlying such investigations is that nature, as well as society, can be modeled by nonlinearly coupled oscillators at many scales. Starting with quantum fluctuations and ending with the "great cosmic rhythms of our solar system" [9], the complex human organism is influenced in its evolution but also in its individual development. The mathematical model for the influence of fluctuations of the gravitational field on complex systems in nature (triggering of earthquakes) and the human organism has emerged more or less accidentally from different, originally separate investigations.
The purpose of the publication is to draw attention to this oscillating subsystem (the solar system) and to stimulate further research. The computer program developed for this purpose is available for research projects.
There are a number of indications that the relatively weak fluctuations of the planetary gravitational field affect structure formation processes in a nonlinear manner. Frequencies of the fluctuation that remain relatively stable over longer periods of time show a correlation with biological structures.
A correlation function that indicates stabilizing and destabilizing states with a certain probability is suitable for describing these processes. The underlying hypothesis is the oscillation between stable and unstable states throughout evolution. Aspiring to a stable state can only ever be a stage of evolution that maintains that state for more or less time.
Also our very stable planetary system will leave one distant day the Mercury as the first planet.
The gravitational forces themselves are very weak. The first experimental determination of the gravitational constant G was done by Cavendish in 1798. Two masses m (730g) were deflected by two large masses M (158kg) by means of a rotating balance.
Meanwhile, resonances caused by fluctuating gavitation can also be detected on small scales in the laboratory [10].
Now one can ask, how large is the gravitational force change of the planets, compared with terrestrial moving masses. An illustrative idea of this is given by the conversion of the planetary forces to equivalent acting lead balls at a distance of 10 meters from a specimen.

Force changes are illustrated by lead balls rolling on a circle at a distance of 10 m. Table 1 shows the weight and diameter of the lead balls equivalent to the planets.

"Planet"	Weight [kg]	Diameter of lead ball [m]
Sun*	$8,892\ 10^9$	114,4
Mercury	1477	0,63
Venus	21779	1,54
Moon*	50969529	20,46
Mars	1237	0,59
Jupiter	313097	3,75
Saturn	27748	1,67
Uranus	1047	0,56
Neptune	506	0,44
Pluto	0,05	0,02
** little meaningful values*		

Table 1; Conversion of the gravitational forces of the planets to equivalent acting lead spheres at a distance of 10 meters.

The structure and development of physical systems is determined by the interaction of different parts of the system with each other and between systems and environment. Four groups of interactions are distinguished: strong, electromagnetic, weak and gravitational. These interactions are not equally effective on the different scales of nature, but they are also not completely decoupled in their effect.

The human organism, especially the nervous system with its high complexity, is certainly exposed to the influences of all interactions, also gravitational ones.
If one restricts oneself in the investigations to only one interaction, then the results will always remain incomplete and take the character of more or less probable statements. It is then left to a future to bring together the separately investigated interactions without ever reaching the "power of Laplace's mind".

The aim of these investigations here is to develop a model based on gravitational interaction, which is suitable to prove an influence of cosmic rhythms of the planetary system on different complex structures and processes in nature and society.

The planetary system of the sun is on the one hand an object of research of astronomy, on the other hand also a factor of influence on the evolution of the earth and its inhabitants. Thus, the Earth's moon acts not only in the formation of romantic and mystical ideas in human consciousness, but also through its stabilizing effect on the Earth's axis. Thus he guarantees the relative stability of the climatic conditions necessary in the biological evolution.
If also for the today's cosmology the general-relativistic gravity theory of Einstein forms the basis, for investigations on the scale of the solar system the Newtonian gravity theory is sufficient.

1.2 Nonlinear interactions

The fundamental Newtonian equation of motion of N mass points has the form:

$$\ddot{r}_i = G\sum_{\substack{j=1 \\ j\neq i}}^{N} M_j \frac{r_j - r_i}{\left|r_j - r_i\right|^3} \qquad (1)$$

r_i, r_j = position vectors of planets i, j with masses Mi and M_j; G = gravitational constant

This equation is the starting point for the derivation of the "Cosmic Fluctuations", however, it is not yet in the form favorable for the present problem of the fluctuations. For this purpose it becomes necessary to consider first ordering points of view, which result from the structure and dynamics of the planetary system.

These are:

A) The stability of the solar system.

The present solar system is about 4.5 billion years old and consequently must have manifested itself as a quasi-stable structure during this time.

Although Newton's equations of motion (1) are nonlinearly coupled, the structure of the planetary system persists over long periods of time.

The Lyapunov constant tL, which indicates the time in which the orbital shapes of the planets are entirely different, Laskar determined to be tL~ 5 million years. For the outer planets starting from Jupiter even larger Lyapunov periods were calculated. This gives fairly tight limits on the orbital elements of the major planets over periods as large as the age of the solar system.

B) Cosmic rhythms are considered over very long periods of evolution.

Therefore, it is mainly the cosmic rhythms (frequencies) that are stable over longer periods that will be able to exert an influence. So it is not so much the absolute forces of the major planets, but rather their periodic changes which are considered. A stable alternating part is filtered out.

C) The planets of the solar system move all on nearly in one plane circular orbits around the sun. They represent natural oscillators whose couplings generate the superposition frequencies of the cosmic fluctuations.

A cosmic cycle begins with the conjunction (seen from the earth) of two planets i, j and ends after the opposition with the next conjunction. From the ordering aspects A, B and C a model of the cosmic fluctuation can be set up.

Heliocentrically considered, circular frequencies ?i,j can be given for the cosmic cycles, which are relatively stable and change only little with the time.

$$\omega_{i,j} = \frac{2\pi}{T_{i,j}} \qquad (2)$$

$T_{i,j}$ = time duration from conjunction to conjunction of the planets i, j.

Without considering the direction of the resulting planetary forces (only directionally invariant processes are studied), one can apply for the changes of the planetary forces (in first approximation). From the geocentric point of view the cosmic cycles are not quite so stable, therefore it is easier to use the angle $\alpha_{i,j}$, under which the planets i, j appear from the earth, in (3) instead of $\omega_{i,j}(t)$.

$\mathbf{F}_{i,j} \propto \mathbf{f}_{i,j}(t) + \mathbf{k}_{i,j}(t) \cos(\boldsymbol{\omega}_{i,j})$ (3)*

t = Zeit

$\mathbf{F}_{i,j} = \mathbf{F}_i + \mathbf{F}_j$

$\mathbf{F}_{i,j}^2 = \mathbf{F}_i^2 + \mathbf{F}_j^2 + 2\,|\mathbf{F}_i||\mathbf{F}_j|\cos(\boldsymbol{\omega}_{i,j})$ (4)

$\mathbf{F}_{i,j} \propto \mathbf{f}_{i,j}(t) + \mathbf{k}_{i,j}(t) \cos(\boldsymbol{\omega}_{i,j})$ (5)

* The relation (3) follows from the vectorial addition of the forces *F_i and F_j.*

The quantities $f_{i,j}(t)$ and $k_{i,j}(t)$ contain the slowly and less regularly changing components resulting from distance changes of the planets.

For the further investigations, only the faster and more "regular" changing cosine component in (4) is considered for the cosmic fluctuations. For a conjunction ($\alpha_{i,j} = 0°$) $\mathbf{F}_{i,j}$ is maximal and for the opposition ($\alpha_{i,j} = 180°$) minimal.

The weak gravitational field variations, in particular their cosine component, can be considered as a kind of excitation field strength on matter. The quantities $f_{i,j}(t)$ und $k_{i,j}(t)$ are set approximately constant, since they change weakly and less regularly with time.

$\mathbf{F}_{i,j} = \mathbf{f}_{i,j}(t) + \mathbf{k}_{i,j}(t) \cos(\boldsymbol{\alpha}_{i,j})$ (6)

The interactions of these "waves" (5) with matter and its different structures will be nonlinear. It must be noted that these are not the gravitational waves derived from a linearization of Einstein's General Relativity. In analogy to other nonlinear interactions with matter (e.g. nonlinear optics), with

$$\gamma_1 = \frac{k_1}{k_0};\gamma_2 = \left(\frac{k_2}{k_0}\right)^2;........ \quad (7)$$

A general correlation function $H_{i,j}$ for the influence of two planets i, j can be set up.

$$H_{i,j}(\alpha) = \gamma_1 F_{i,j} + \gamma_2 F_{i,j}^2 + \gamma_3 F_{i,j}^3 + \ldots \quad (8)$$

Better suited is the transformation of (8) into a Fourier series.

$$H_{i,j}(\alpha) = a_0 + a_1\cos(\alpha) + a_2\cos(2\alpha) + a_3\cos(3\alpha) + ... \quad (9)$$

with $\alpha = \alpha_{i,j}$

The form (9) of the correlation function shows the emergence of "higher harmonics" at the interaction of the cosmic fluctuations with matter.

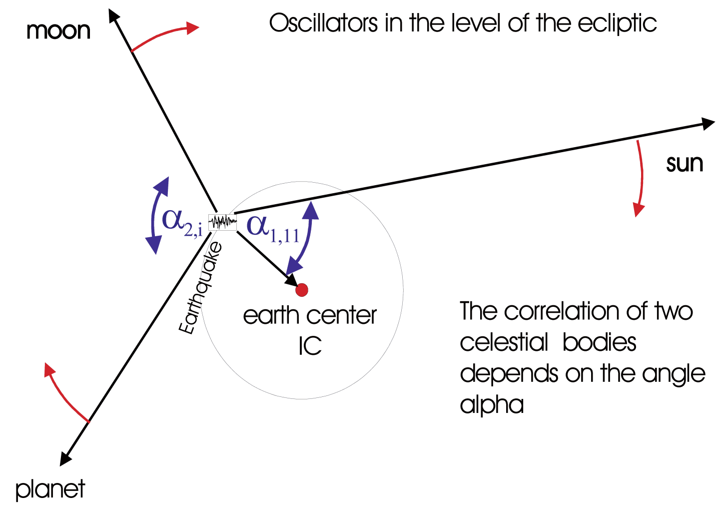

Fig. 1; Angle $\alpha_{2,i}$ iis the distance between the moon and planet i. angle $a_{1,11}$ gives the angular difference between the sun and the center of the earth.

1.3 The correlation function

The problem of the correlation function is the determination of the coefficients ak in (9) and the determination of the meaning of H.
It is not thought to measure with H a force or a "deflection". This would certainly cause insurmountable difficulties experimentally, if one wanted to determine the influence of the fluctuations on test specimens with rotating lead balls (approximately according to table 1).
Moreover, the evolution, which has extended over millions of years, is unlikely to be simulated experimentally.
Since the fluctuations of the planetary gravitational field are very weak in their effect, only the following areas come into question for correlations:

a) spatial structure formation processes, which are not or only very slightly determined by other effects.
b) Formation of not completely determined biological patterns.
c) Critical states in high-dimensional dissipative systems.
d) Highly complex systems, far from thermal equilibrium and on the edge of chaos.

Thus, the coefficients ak will be determined from the study of interactions with areas a) to d).
It is obvious to construct a correlation function H interacting with stable (harmonic) and unstable (disharmonic) states in regions a) to d).
Determining the coefficients ak from statistical studies of unstable or chaotic processes, where small perturbations can have an effect, is very costly. Therefore, it seems reasonable to first obtain an approximation for the coefficients ak from theoretical considerations, which can then be adjusted by optimization procedures if necessary.
Since cosmic cycles from conjunction to conjunction are concerned, one can take structural considerations of these oscillations as a starting point. If one takes the circle division (Fig. 2) as a basis, then the following structure points can be found:

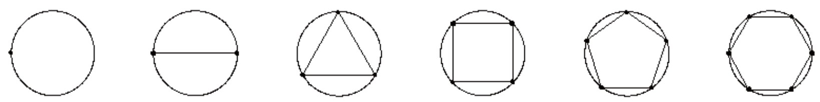

Fig.2; Structures of the circle division. Starting point is the conjunction, followed by the opposition and so on.

<u>1 point:</u> "starting point" (conjunction).

2 points: polar structure; opposites which need a balance. Due to their tension and, if necessary, the impossibility of their balancing, they can nevertheless form a unity over a longer period of time.
Score: strongly disharmonic
3 points: very stable structure; especially in engineering it is a prerequisite for stability in mechanical constructions.
Scoring: very harmonic
4 points: unstable, dynamic structure; in engineering, this structure is often the basis for lever gears.
Score: disharmonic
5 points: quasi-stable pentagram structure; borderline between stability and instability. Complicated patterns and structures can be formed that do not repeat.
Scoring: indifferent
6 points: Honeycomb - structure; near-circular, relatively stable structure in the compound with good area utilization.
Scoring: harmonious

The addition of further points is possible, but the changes in the qualities become smaller as the structure becomes more similar to the circle. These qualitative statements are quantified step by step and plotted in a diagram (Fig. 3).

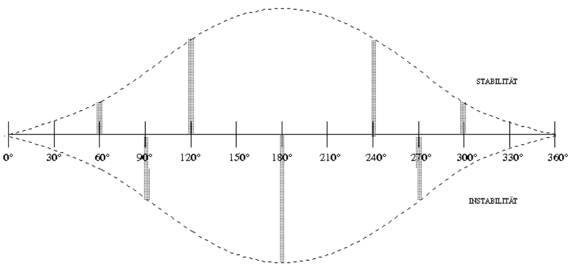

Fig. 3; Quantification of the circular pitch subdivided according to structural aspects. A symmetrical oscillation and decay process is assumed. The image is the basis for a Fourier transform for the 1st approximation of the coefficients a_k.

Since it is a periodic cycle, a Fourier transform can be performed.

The obtained coefficients are the first Fibonacci numbers (alternately mirrored, see 11.). The correlation function takes the following form:

$$Hi, j = \sum_{s=1}^{N \cdot 12 - 1} a_k \cos(s \cdot \alpha); mit(k = s \bmod 12) \quad (10)$$

$$a_k = \{0,1,-2,3,-5,0,3,0,-5,3,-2,1\} \quad (11)$$

The 1st order correlation function is shown in Fig. 4. It represents a first approximation for the study of the influence of cosmic fluctuations on the stable and unstable states of complex systems.