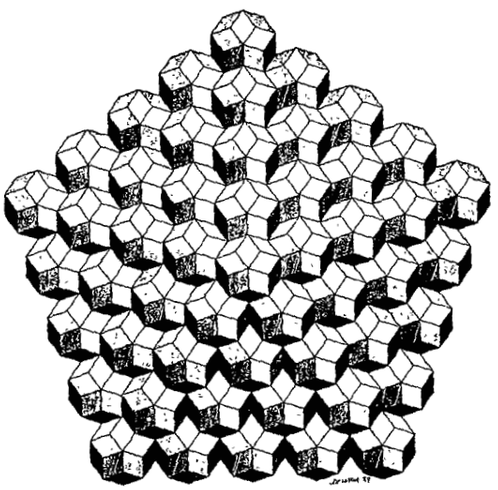
Symmetry of STRUCTURE

an interdisciplinary Symposium

Abstracts

II.



Edited by Gy. Darvas and D. Nagy

Budapest

August 13-19, 1989

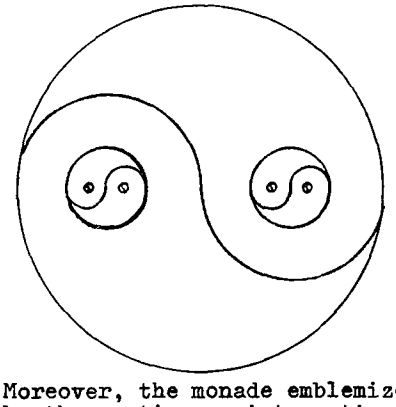
hungary

ON THE STABILITY OF OSCILLATIONS WITH HELICAL AXIS OF SYMMETRY

Magarshak A.S.

Ingeneering Center "Lidar"

Post-Eisteinian physics seems to be excited with non-linear processes and their nature. Therefore, motions and structures with a helical axis of symmetry appear to be central to its interests. It frequently occurs so that having addressed a new problem area, the scholars surprisingly find out that mankind has already dwelt with it at a previous stage of its spiral development, though at another level. Thus, structures and motions with a helical axis of symmetry appear in remarkable symbolism of the ancient Chinese yin-yang monade.



It can be seen that the monade is visualized as a symbol with a helical axis of symmetry emblemizing two vital principles, yin and yang (they can be infinetely interpreted as the male and the female principles; night and day; light and dark; good and evil, etc.), yin being seeded with yang, and yang likewise seeded with yin. Sometimes, the embryos of yin and yang are replaced by two minor momades repeating their greater counterparts. Moreover, the monade emblemized the eternal life process ensured by the continuous interaction and rotation of yin and yang. Broadly speaking, ancient knowledge displays its being specially interested in structures and motions with a helical axis of symmetry. Thus, the concept of "hot" and "cold" processes and medicines was a fundamental acquisition of Oriental medicine. Roughly, "hot" and "cold" correspond to hyperfunctions and hypofunctions in terms of modern medicine. "Hot" drugs and food increase and "cold" ones decrease vital energies of an organ. Very interesting to us is experimental evidence obtained in 1978 by E.Yu.Kushnirenko and I.B.Pogozhev, that "hot" and "cold" drugs differ mainly in their stereochemical parametres. To be more precise, the difference is in that which winding, right or left, prevails in the molecules. Thus, either cognitively or empirically, ancient physicians appear to have been capable of capturing the link between the direction of biological molecule winding having a helical axis of symmetry and its impact on the human organism. Generally, the direction of biological spiralmolecule winding and the stability of the molecules immediately relate to the problem of life as such and its origin. Interestingly

enough, V.V.Alpatov and G.I.Voskresenskaya established in 1962 that ageing lowers the optical activity of the human blood protoplasm telling of a restructuring in the molecules with a helical axis of symmetry.

The stability of structures and motions with a helical axis of symmetry has more than once been approached by various disciplines. At a macro level, astrophysicists are attracted by spiral galaxies, and crystallographers look into crystals with a helical axis of symmetry. At a molecular level, in biophysics, special attention attaches to the spiral molecules of DNA, proteins, glucosides, etc. Finally, a micro level physics is impossible without studies into, and due account of, the spin of elementary particles.

In the Newtonian age, physics described the structures with a helical axis of symmetry as the result of the combination of cyclic and linear structures. This approach makes it possible to describe spiral structures as such, but not the mechanism of their formation and the stability of their moviment. The Einsteinian age in physics brought about the understanding of the need to study into non-linear phenomena and to translate descriptions into the language of non-linear physics. Accordingly, the approach to describing helically symmetrical structures and motions has changed. To divide such motion into a cyclic and a linear component (or into two cyclic components with slightly mismetching periods in case of a spiral wound over a circumference or a torus) was earlier understood as lack of interaction there between or its being negligibly small interpreted as further enhancement introducing no changes into the overall picture. Non-linear physics points to the essentiality of cyclic to translational motion interaction and the need for it to be carefully sutdied.

In this connection much has been done to show the stability and structures and motions with a helical axis of symmetry, and the conditions in which stability is achieved. We have investigated a case of combined cyclic and translational motions whose interaction rather substantially influences the physics of the process despite its very small value. The cyclic motion was represented by a high frequency periodical process, and oscillations of a much lower frequency were taken as a translational motion. The working model was a low-frequency HF pumped pendulum. Interaction between low-frequency oscillations of the pendulum and the high-frequency field took place in a narrow zone around the pendulum's zero position. Given certain initial phase requirements and an adequate system's Q level, it acquires stationary oscillations with a frequency close to the free-running one. Depending on the initial conditions, the above pendulum oscillates with varying stationary amplitudes (to be more precise, stationary oscillation zones). The occurrence of the pendulum's stationary oscillation zones is the product of minor interaction between the components forming the system of a HF field and a LF oscillating pendulum. Their most characteristic feature is their stationary pattern associated with the stability of helically symmetrically structures, the cyclic motion being associated with

a HF field, whereas translational motion, with LF oscillations of the pendulum.

Because the essential feature of natural oscillations is their stability, the above suggested physical model can lay claims on reaviling and explaining interrelations between helically symmetrical motions in nature. For example, let us consider the motion of the Earth-Moon system around the Sun. Both the Earth and the Moon move along a spiral orbit. The motion is stable over a period of billions of years. If we have a synchronized pattern for cyclic and orbital motions, the period of rotation of the Earth-Moon system around the Sun is to be connected with the cyclic period of the Earth-Moon system. The latter is known to become currently longer, thus suggesting an increasingly longer solar year or a slower rotation of the Sun on its axis, because the components in the oscillating Earth-Moon system interacts by way of the Sun's magnetic field and the solar wind. One more object allowing for a similar approach can be spiral biological molecules, which are known to be continuously oscillating Such oscillations can reveal synchronization of longitudinal and torsional vibrations. The oscillations of the unwinding spiral are interpreted by us as a HF oscillation component, and the lengthening of the structure of a molecule as a LF component. Because biological molecules are stable in both time and a wide range of external conditions, to explain this we can resort to the foregoing mechanism of stationary vibrations.

Moreover, in biology there is a whole group of oscillatory processes which fails a satisfactory description within quasilinear physics. Helically symmetrical are not the motions involved, but rather their phase images. The motions proper have a biased mirror plane of symmetry. The rest, we believe, can be considered as interaction of two vibrations--a HF oscillatory process and a LF one, which for the sake of simplicity we call translational motion. It is not impossible that the interaction of high-frequency vibrations of the wings of insects with their translational motion explains for the difference between their calculated and real flight parameters.

One more object to study via this approach is the peculiar pattern of dolphin swimming. As is known, when the dolphin swims its body in the water performs wave-like movements, but what is more remarkable, these movements are accompanied by wave-like constructions running along the body. Possibly, low-frequency vibrations of the body ensuring its translational motion and high-frequency vibrations of its skin occur in a synchronized pattern to reduce friction in the water and offer a speed yield. It is not so much the interaction mechanism of such multi-frequency motions, but the stability of such systems, if any, can be of interest for the simulation of historical and sociological processes. Thus, it is possible to analyse the motion of human thought and to show that "dissidence" is necessary for its successful development. It is rather apparent that the greatest contribution to science's headway (which is here associated with a low-frequency process) is mainly

provided by young people whose views often go astray, that is deviate from the accepted point of view (these oscillations are associated here with high-frequency oscillations), and when such high-frequency oscillation of a person's views interacts with the translational low-frequency motion of scientific progress, the result is the most natural and global contribution to the process of scientific development.

Now back to the ancient Chinese monade in which the yin and yang seeds are replaced by smaller monades. In addition to thoughts about the recurrent and unending knowledge, it now hopefully becomes suggestive of many other things. Thus, if we take smaller rotating monade as a symbol of a HF oscillation helically symmetrical process, and a greater monade as a symbol of a low-frequency oscillation process, also helically symmetrical, the pattern as a whole would become the symbol of interaction and stability of such a system as an entity. One more thing, which only naturally comes to ming; depending on a level oscillations which are believed to be low-frequency for any given scale, can be a high-frequency field for yet lower vibrations in a system of a lesser scale, etc. A view on the structure of world natural processes, based thereon, would give an uncontinuous successio of periodical oscillations would one upon another and forming a series of interactions.

R E F E R E N C E S

1. F.V.Bunkin et al. Zh.Teor. Fiziki, v.58, issue II, 1988

2. J.Marri. The Nonlinear differential equations in biology, M.:Mir, 1983

3. V.V.Alpatov and T.I.Voskresenskaya, Proc. of v. VI, 1962

4. V.A.Kizel'. Optical activity and Dissymetry of Living Systems, Upsekhi Fiz. Nauk, M.1980