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About possible mechanism of inversion cyclic activity and glitches of pulsars

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Resume. On an example of the observably phenomena in solar system the hypothesis expresses, that the similar phenomena can be found out in the future on pulsars. These phenomena occurring on planets, satellites, stars (in particular pulsars) have identical origins and are caused by the forced relative displacements and turns of the shells of these celestial bodies.

Introduction. The mechanism of the forced relative oscillations, wanderings and steps of shells of a celestial body under action of a gravitational attraction of external celestial bodies has allowed to explain and to predict (and then to obtain confirmations from the data of observations) a wide set of the geodynamic and geophysical phenomena on the Earth, on other planets and satellites of solar system, and also on the Sun [1].

The Earth. In particular secular, cyclic and spasmodic changes in motion of the centre of mass of the Earth, in the Earth rotation, in oceanic and atmospheric processes etc. have been explaned. In the given work the possible role of this mechanism in dynamics and behavior of system of shells of pulsars is discussed: the core, a liquid mantle, the crust etc. If the mechanism of translational displacements of shells proves on pulsars (isolated, double, with planetary systems) the dynamic researches of bodies of solar system executed by us allow to make assumption about existence of the following possible phenomena which can be discovered in data of observations over pulsars.

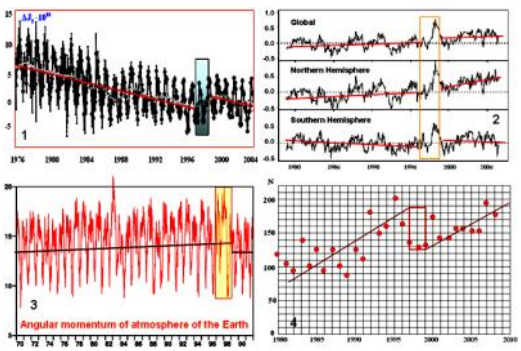

Fig. 1. (1) Steps in secular changes of coefficient of the second zonal harmonic of a geopotential ΔJ_2 during 1976-2004. (2) Steps in variations of global superficial temperature of the Earth and its hemispheres. (3) Step of the angular momentum of an atmosphere in 1997-1998. (4) Spasmodic change of seismic activity of the Earth in 1997-1998 [4].

The Mars.

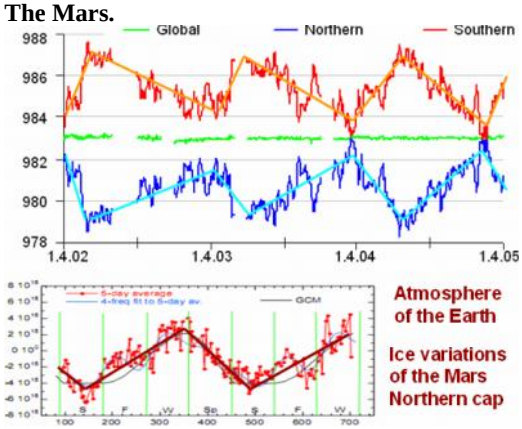

Fig. 2. Mirror and step variations of average atmospheric pressure in northern and southern hemispheres of the Earth (in mb.) and step variations of masses of ice of northern polar cap of Mars (1 unit=10^{15} kg).

On our model the step changes of natural processes are connected to nonlinear character of relative displacement of the core and the mantle of the appropriate planet. Diagrams Fig. 2 testify for the benefit of that displacement of the core of Mars take place actually both in geodynamics of Mars and in its natural processes it is necessary to expect the phenomena similar in the essence terrestrial.

The Sun. Secular changes are observed in many processes occurring on the Sun. As an example the illustration Fig. 3 here is resulted. These changes, alongside with the observably phenomena of inversion of processes in northern and southern hemispheres of the Sun etc. we consider as the

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confirmations for the benefit of action of the mechanism of the forced relative swing and displacement of shells of the Sun, under action of a gravitational attraction of planets.

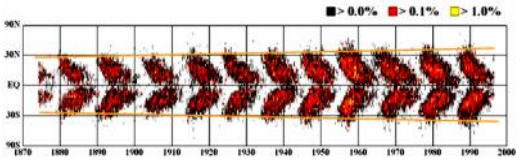

Fig. 3. Sunspot area in equal area latitude strips (%of strip area). The phenomenon of increase of the maximal latitudes of zones of formation of solar spots in period 1870 - 2000.

1. Cyclic forced variations of endogenous activity of pulsars. These variations are caused by a gravitational influence of a displaced bottom shell of a pulsar on its mantle and a crust. Relative oscillations and drift of a core of pulsar result in cyclic and regular changes of the shape of pulsar, in its rotation, in variations of activity of all planetary processes. Relative displacements of shells of pulsar can be caused by gravitational attraction of external celestial bodies (by massive planets, stars companions etc.) which differentially act on the specified shells having various dynamic oblatenesses and, generally speaking, having mutual eccentric positions of the centers of mass [1].

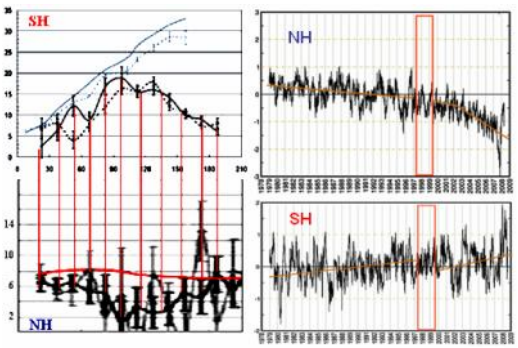

Fig. 4. (Left) Inversion of Ar mass at high southern and northern latitudes of Mars: GCM based, GS based and measured (2 years) (Sprague et al., 2007). (Right) Inversion slow variations of ice areas in northern and southern hemispheres of the Earth in period 1979 – 2009.

2. Variations of a figure of pulsar and its hemispheres. In work [2], for example, it is supposed, that observably slow glitches in velocity of rotation of a pulsar are caused by changes of pulsar figure in its position with respect to an axis of rotation. “It is shown that small glitches in the rotation period of the pulsar B1822-09 can be explained by changes in the shape of the neutron star when the shape becomes inconsistent with the rotation axis, i.e., when the symmetry axis does not coincide with the instantaneous rotation axis.” We add, that the form of a pulsar can essentialy vary at translational displacements of its shells. Not only tension state of a pulsar can be varied, but also its pear-shaped form.

3. Variations of rotation and planetary processes of pulsar with periods multiple to its period of rotation. In rotary motions of the Earth, in motion of its poles, and also in planetary processes variations with the periods of diurnal rotation and to it the multiple periods (the hour periods) are rather precisely shown. The explanation was given to the specified phenomena on the basis of developed geodynamic model about the forced oscillations and relative displacements of the core and mantle of the Earth with the hour periods [1]. Similar short - periodic variations have been observed for natural processes on Mars, the Sun and other bodies of solar system. At presence at a pulsar of the massive partner or planets its core and crust will test high-frequency relative oscillations with the period of rotation of a pulsar and multiple to it. In turn high-frequency oscillations of the core will influence cyclically all processes on a pulsar. In particular, the specified processes definitely should prove in structure and in a structure of pulses of the radiation from a pulsar.

4.The phenomenon of polar inversion of activity of processes on the pulsars occurring in northern and southern hemispheres. To one of the major attributes of action of the mechanism of forced swing and oscillations of shells of a pulsar is a phenomenon of inversion of natural processes in its opposite hemispheres, for example, northern and southern in relation to an axis of rotation. As an example of the similar phenomena and confirmation can be the contrast distinctions in the form pulse of the signals received from polar caps of a pulsar. There are some arguments to assume an existence of the orientated and directed tectonics of crust plates [3]: “In spinning-down neutron stars, crustal " plates " will move toward an equatorial " subduction zone " in which the

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plates are forced into the stellar core below the crust. The opposite plate motion occurs in spinning-up stars. ”

5. Contrast temperature modes of hemispheres of pulsars. Temperature modes of subpolar areas and in general N/S hemispheres of a pulsar can differ appreciably. Average values of temperature of northern and southern hemispheres of a pulsar can be various or vary depending on latitude just as it takes place in atmospheric layers of the Earth. In time specified inversion distribution of temperature also can vary.

6. The ordered positions of crust cracks and other formations on a surface of pulsars. It is possible to expect the phenomenon of the ordered positions of hot spots on a cold surface of a pulsar. By analogy to planets and satellites (Fig. 5) it is possible to assume at some pulsars of the ordered arrangement of hot spots on a cold surface of a pulsar, antipodal positions of some structures, for example, cracks, elevations and depressions of pulsar crust.

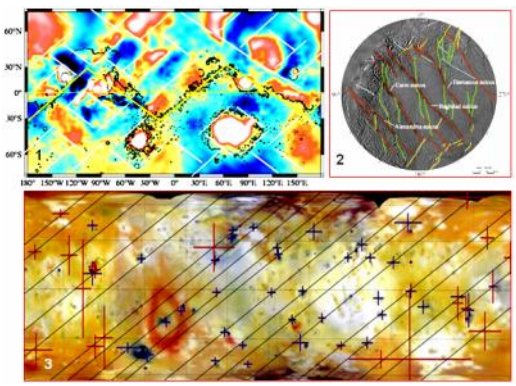

Fig. 5. (1) “The topographical mosaic” of Mars on a coordinate plane "latitude - longitude". (2) “Geological streets” in area of South Pole of Enceladus. (3) Alignment of volcanoes on Io (on a plane "latitude - longitude").

7. Steps in dynamics of a pulsar and in variations of natural processes. Similar spasmodic changes are confidently observed on the Earth, and also on the Sun, Mars and other bodies of solar system. For example it is enough to specify spasmodic changes of geodynamic and geophysical processes on the Earth having a place in 1997-1998 (Fig. 1). Gallops have been observed in variations of the Earth rotation, in variations of a geopotential coefficients, a gravity, a level of ocean, average temperatures, in activity of many natural processes [4]. In rotation of pulsars the similar spasmodic changes - glitches are observed. It is quite natural to assume, that the mentioned above spasmodic changes in dynamics of planets, the Sun and pulsars have one and same nature and are connected to forced spasmodic relative displacements of their shells. In this connection dynamic problems about gravitational excitation of shells of a pulsars by external celestial bodies and research of oscillatory relative motions, wobble and jumps of the core, mantle and crust from each other are rather important.

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