

# Sun-Earth coupling with the three natural laws<sup>\*</sup>

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**Abstract:** From the opinion of this article, the way to understand the climatic variation is by large scale physical effects in the solar terrestrial space, and it is also the key to forecasting problems of complex systems. Three large scale geomagnetic rules are suggested by diagrams: (1) the crab paws law; (2) the magic bottle law; (3) the soft gear law, with which the mechanism of the long term geophysical effects on Earth's storms is discussed then.

**Key words:** large scale geophysical effect; storm geomagnetosphere; long term effect; climatic variation

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In the end of the last century, the environmental science, especially the predictability of climatic variation, was concerned by the international scholars. Since the beginning of this century, the reversion between the geomagnetic poles and the missing of geomagnetic field have become the popular topic of astrophysics.

In the terrestrial environment, there are some physical phenomena which are very seldom and unusual. Some of them are very strong and cause natural disasters and dangers to people. Generally speaking, the longer the disaster pregnant period is, the longer and more severe the harm is. In the beginning of last century, A. Einstein proposed the geomagnetic field, i. e. the magnetized origin, is one of main problem in physics. From that time scientists have been interested in research of the large scale physical effects. The pioneer idea of Isaac Newton is applied here thought: The purpose of natural philosophy is discovery of function and structure of nature, and try

the best to eventuate the catholic rule and general law—using observing and testing to building these rules to derive the causal relationship of the Nature<sup>[1]</sup>.

Here considering how to cause Earth's storms in large scale environment of solar-terrestrial space, we suggest three laws.

## 1 Three geomagnetic laws of Sun-Earth coupling

Except gravitational field, of course, the vortex magnetic field is the strongest considering the long-range field in solar-terrestrial space where about the coupling of sun and earth there are three laws of the geomagnetism.

**1.1 Crab claw poles law** The dipole geomagnetic lines, which were compressed and reduced by the solar wind before will form a large scale cold vortex when it is recovering. As fig. 1.

When the geomagnetic field is released from the compression of the solar wind, the magnetic lines rebound and the upper magnetofluid expands adiabati-

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cally and the temperature  $T$  of the magnetic medium that will change in terms of  $\left(\frac{\partial T}{\partial B}\right)_S$ . By thermodynamics the relation can be given out as<sup>[2]</sup>

$$\left(\frac{\partial T}{\partial B}\right)_S = -\frac{T}{C_B} \left(\frac{\partial M}{\partial T}\right)_B \quad (1)$$

With the Curie law  $\frac{M}{B} = \frac{M_0^2}{3KT}$ , we can prove

$$\Delta T = \frac{M_0^2 B}{3C_B R T} \Delta B \quad (2)$$

From which both  $\Delta B$  and  $\Delta T$  are negative for demagnetization. Here  $M = M_0 B/B$ , which is the equilibrium state magnetization. This law has been verified by meterscale test in lab, and in large scale area it is always accompanied with relaxation cooling<sup>[3]</sup>.

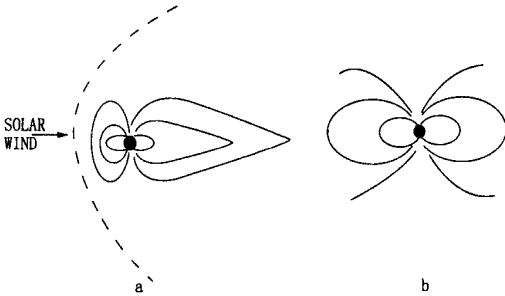


Fig. 1 The law of Geomagnetic crab paws structure in solar wind.

- a) adiabatic compression to store energy;
- b) adiabatic expansion of demagnetization cooling

**1.2 Geomagnetosphere Magic Bottle law** Impacted by the solar wind, the earth's dipole magnetic lines are drawn to form a magnetic bottle which captures and store energetic particles. If the geomagnetic neck produces the antredy, the energetic particles will break out from the bottle<sup>[3]</sup>. As fig. 2.

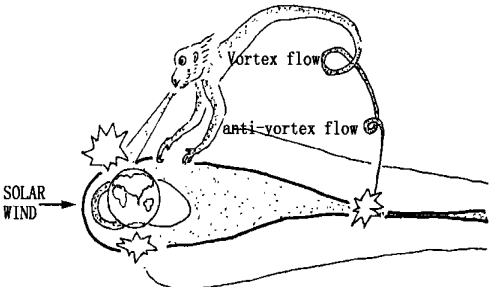


Fig. 2 The law of the magic bottle structure of Geomagnetic line in solar wind

Since stöörmer explained aurora in 1907 by charged particle movement, the description of the forming of the geomagnetosphere has been clear<sup>[4]</sup>. In 1958 the data, by scientific experimental satellite of USA, proved that there is a Van Allen belt in space<sup>[5]</sup>. Under effect of solar wind, the geomagnetic lines of the belt behind the sun were drawn longer, while those facing the sun were compressed, forming a cucurbit magic bottle. It is very frangible and unstable<sup>[6]</sup> of the geomagnetic tail and the energetic particles can easily break out.

**1.3 Soft gears law** Under the solar wind's thrust the gearing between Heliomagnetosphere and Geomagnetosphere obeys the soft gear law, and forms the earth's storm geomagnetosphere by impacting, in accordance with Pythagorean theorem. As fig. 3.

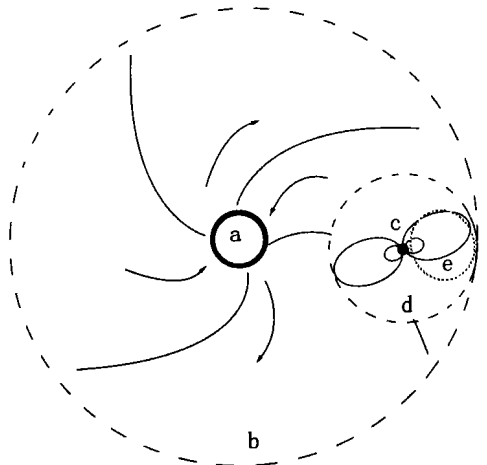


Fig. 3 In solar terrestrial space, the soft gear structure of the magnetosphere.

- a. Photosphere; b. Heliomagnetosphere;
- c. Earth; d. Geomagnetosphere;
- e. Earth's stormosphere.

Both the magnetic fields of the photosphere and the earth are close to the dipole magnetic fields. Between the magnetic axis and autσ rotation axis there is always a small across angle foreach. In vacuity the dipole magnetic fields can extend to infinite space, but which are confined by plasma if any trasform from Heliomagnetosphere to Geomagnetosphere, which are both in quasi stable state. When solar flare emerges, the plasma cloud breaks out and conflicts with geomagnetosphere to form the earth's storm

magnetosphere. The gearing of three balls can match with the mechanics<sup>[7]</sup> of three gear law and gives the gearing angular velocity,

$$\Omega = 2[\eta_1 L(\xi_1) - \eta_2 L(\xi_2) - \eta_3(\xi_3)] \quad (3)$$

Doubling method is proper here. The starting accelerating field by plasma cloud, which breaks out from the solar flare supplies the driving force.

## 2 The Examples for Application

The dipole geomagnetosphere looks like a soft gear. Which is bathing in the quadrupole geomagnetosphere and induces the third tectonosphere with coupling. Driven by solar wind, they evolve catastrophes.

**2.1 Cold vortexes and storm rain** In the second half of 20 century, lots of scientist made a plenty of statistical analyses and all of them knew that the atmospheric disasters are related with the cold vortexes in upper atmosphere, and the sunspot action periodicity of 11 years<sup>[8-9]</sup>. For example, the water-longging drought disaster of American plateau obeys the 22 years period. From the statistical analysis of the disasters history about Yunnan Plateau, 22 year's period is obtained<sup>[10]</sup>.

### 2.2 Flying Vortexes and magnetopole reversing

The photosphere is an ardent plasma cluster. It's inner region more active than is the inner earth. There is 11 years active period for the sunspot's Wolf number. On the photosphere surface about reversal magnetopole there is a 22 years period. The solar flare's periodicity depends on the speed of energy storage<sup>[11]</sup>, The energy release is the power of magnetopole overturning.

On the other hand, from the research of palaeomagnetism, the reversal period of geomagnetic pole is about 250 000 years, but reversion has not happened for about one million years up to now. Today people are worried about what time the magnetic magic bottle will reopen again and how long it will keep-action? Because there is not a source of energy powerful enough in the inner earth<sup>[12-17]</sup>, the driving force can only be supplied by sun-earth coupling<sup>[18,19]</sup>. By means of Faraday's law of the electro-

magnetic effect in the self-induced and the inter-induced transition state, the geomagnetic pole overturning does not last long.

**2.3 Soft gear and megaseism** Now a lot of researchers declare that they have found a "doubling method" to forecast great earthquakes successfully<sup>[20,21]</sup>. However the mechanism of the method has not been clear.

From dynamics<sup>[22]</sup>, for a system moving in a finite space there is a very simple virial law between the kinetic energy  $E_d$  and potential energy  $U$ ,

$$2\bar{E}_d = -\bar{U} \quad (4)$$

From (4), the transition of dynamic force obeys this doubling relation

$$2\nabla\bar{E}_d = -\nabla\bar{U} \quad (5)$$

From electromagnetic theory the theory of geomagnetic storms<sup>[23]</sup> supports the soft gear law, and predicts earthquake breaking with two sequent geomagnetic storm events

$$T_E = 2(T_2 - T_1) \quad (6)$$

Here  $T_E$  is the date of the seismic shaking,  $T_1$  and  $T_2$  are the dates of the events respectively.

## 3 Conclusion and Acknowledgment

This work considers the general law of electromagnetic coupling alone, neglecting the similar gravitational law. The discussion is focused on the method of geometry, omitting mathematical analysis for concision.

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## 太阳·地球耦合三法则\*

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**摘要:** 日地空间的大尺度物理效应是解开气候变迁之谜的钥匙, 也是研究复杂系统预报问题的关键. 在此首先用几何方法求出图形解, 给出大尺度地磁效应三法则: ①蟹爪法则; ②魔瓶法则; ③软齿轮法则. 应用这些法则讨论了长时标地球物理效应对地磁暴现象的作用机理.

**关键词:** 大尺度物理效应; 地磁暴球; 长时标物理效应; 气候变迁

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