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Contents

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A Different Way

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Abstract: Einstein's strategy regarding local action will be analysed and a loophole will be demonstrated. A different method will be proposed and this alternative will be applied to the theory of relativity, aiming to clear some of the discrepancies within science. [New York Science Journal. 2008;1(4):1-3]. (ISSN: 1554-0200).

Key words: local action; contradiction; paradox; principle; thesis; antithesis

Introduction: There is quite some controversy between quantum mechanics and the theory of relativity and the question remains open whether and if so where the mind slipped. A good starting point for clearing this muddle is to analyse how Albert Einstein chased quantum mechanics up a tree. The strategy he used can be found in his article "Quantum Mechanics and Reality" [1]:

The following idea characterises the relative independence of objects far apart in space (A and B): external influence on A has no direct influence on B; this is known as the Principle of Local Action, which is used consistently only in field theory. If this axiom were to be completely abolished, the idea of the existence of quasienclosed systems, and thereby the postulation of laws which can be checked empirically in the accepted sense, would become impossible.

It is important to realise that in science the word principle (from *primus* "first" + *capere* "to take" [2]) has lost its original significance ("Scientific sense of "general law of nature" is recorded from 1802." [3]). According to its primary meaning a principle is the ultimate origin, source or cause of something [2]. This origin or source takes first place and everything that stems from this root comes afterwards and can be seen as being true. Hence there is a difference between "a principle" and "being true". This paper will only use this primary significance of the word principle.

Einstein defines local action by denying (from *de-* intensifier + *negare* "to say "no", refuse" [2]) the opposite: "external influence on A has no direct influence on B". This strategy is based on the assumption that local action is a principle because one can reason that if the opposite of local action would also be true (i.e. external influence on A has direct influence on B) then this opposite would speak against a principle and therefore contradict (from *contra* "against" + *dicere* "to speak" [2]) this principle. Hence local action as a principle implies: "external influence on A has no direct influence on B".

Einstein's strategy of defining local action by denying the opposite fails if local action turns out to be true without being a principle. In this case it would be possible for the opposite of local action to also be true as long as this opposite avoids contradicting any principle. One can then consider local action and its opposite as complements in the same way that particles and antiparticles complement each other without any contradiction. In other words, defining a proposition in a complete system can be achieved by denying the opposite because the denial of the opposite and the opposite of the opposite are both equal. This method, though, becomes invalid within an incomplete system because the complete denial of the opposite also includes that which lies outside this incomplete system. Hence complete denial within an incomplete system remains undefined (from *un-* "not" + *de-* "completely" + *finire* "to bound, limit" [3]) and here there remains a difference between the denial of the opposite and the opposite of the opposite. Incompleteness of a system can be caused due to failure of including its source (principle).

A more open and logical method would be as follows: translate the idea that characterises the relative independence of objects into a proposition or thesis. Let this thesis define local action by what it includes (from *in* "in" + *claudere* "to shut, close" [2]), whether local action is a principle will be left open. This way there would still be room for a counter proposition or antithesis to arise. If both thesis and antithesis would turn out to be true, then thesis and antithesis can be considered as complements. This method therefore demands restating local action by proposing what it actually includes instead of proposing what it does not include. Accordingly, the first sentence of Einstein's fragment would have to be restated as follows:

The following idea characterises objects far apart in space (A and B): external influence on A has *indirect* influence on B; this is known as the *thesis* of Local Action, which is used consistently in field theory. *(External influence on A has direct influence on B is known as the antithesis of Local Action.)*

If one is willing to take this step backwards and let go of the idea of relative independence being a principle one avoids the abolishment of local action. The last part of Einstein's fragment can now be stated as follows:

If this *thesis* were to be *complemented with its antithesis*, the idea of the existence of quasienclosed systems, and thereby the postulation of laws which can be checked empirically in the accepted sense, would become *incomplete*.

If the universe (and mind) is open enough and non-discriminating, there would be room for both thesis and antithesis to be true. Together they could synthesize (from *syn-* "together" + *tithenai* "to place" [2]) into a paradox (from *para-* "beyond" + *doxa* "opinion" [2]) taking the scientist beyond the self-evident opinion of relative independence.

Discussion: In 1957 Geoffrey Builder published an article in which he criticised Einstein's interpretation of the theory of relativity concerning the mechanism of time dilation. Builder's critique arises because Einstein's explanation incorporates a homogeneous gravitational field that appears and disappears instantaneously:

"A homogenous gravitational field appears, that is directed towards the positive x-axis. Clock U1 is accelerated in the direction of the positive x-axis until it has reached the velocity v, then the gravitational field disappears again. An external force, acting upon U2 in the negative direction of the x-axis prevents U2 from being set in motion by the gravitational field."[4]

Builder comments on this as follows:

"The concept of such a field is completely incompatible with the limited value c for all velocities [...], so that the specified field would have to be created simultaneously at all points in S' and be destroyed simultaneously at all points in S0. Thus the principle of equivalence can contribute nothing of physical significance to the analysis."[5]

One can see how Builder uses the same strategy towards relativity as Einstein did towards quantum mechanics. Builder's rejection of Einstein's clarification is based on regarding these "spooky" gravitational fields as a contradiction instead of a possible complement of local action, creating a paradox. The thesis of local action is considered to be a principle and therefore automatically contradicts any sign of its antithesis i.e. direct influence created by an "unlocal" gravitational field. Builder is unaware of the possibility that the thesis of local action might be true without being a principle and his critique on Einstein's perception of relativity might therefore be based on an invalid premise.

Conclusion: The rigorous sideways strategy of proposing a thesis by denying its antithesis (clearly translated into words by Albert Einstein in his article "Quantum Mechanics and Reality") contains a loophole if the thesis turns out to be true without being a principle. To close this loophole the thesis needs to define what it includes, instead of saying “NO” to its opposite. This method avoids forcing a self-evident proposition into a principle (or fundament) and leaves room for a counter proposition to arise. This non-fundamentalising way might merit further exploration.

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References:

1. Einstein, A. Quantum Mechanics and Reality ("Quanten-Mechanik und Wirklichkeit"), *Dialectica* 2:320-324, 1948.
2. Webster’s New World Dictionary of the American Language, College Edition, 1966.
3. Online Etymology Dictionary, Douglas Harper, 2001.
4. Einstein, A. "Dialog über Einwände gegen die Relativitätstheorie", Die Naturwissenschaften 48, pp. 697-702, 29 November 1918 (English translation: dialog about objections against the theory of relativity)
5. Builder, G. The Resolution of the Clock Paradox. Published in Austral.J.Phys.10:246, 1957.

Development of an Ion Emitter with Hollow Cold Cathode

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Abstract: Ion physics forms the basis for numerous modern technologies and research directions such as microelectronics, material research, analytics or high-energy physics.
The reason for the broad range applications of ion physics lies in the ions characteristics:
-The ions possess a mass, which makes a direct energy transfer possible to the solid atoms (flexible energy transmission);
-The velocity of the ions can be multiplied by multiple ionisations in usual electrostatic accelerator installations.
-The ions interact also with the electrons of the target material; this reciprocal effect is speed dependent and particularly effective, if the particle speeds are comparable;
-The ions transporting characteristics with itself, which correspond to their chemical elements, from which were produced;
-The ions can overcome the Coulomb barrier at high speeds with the impact with the target atoms and cause a nuclear fusion, whereby it comes afterwards to a nuclear explosion and to sending of elementary particles;
-The ions can be bundled to particle beams with high energy and impulse density and be used thus as tool for metalworking.
Although ion physics is a basic science in the most diverse fields, it exists mostly not as independent Discipline, but as application method within other science ranges.
The development in this area carried of some specialists, who are active in different specialist areas.
The most important sub ranges of ion physics are the ion production, the ion beam forming and the ion beam guidance.
These aspects are gathered in the Monograph from I.G. Brown (Aitken, 1989). In addition a number of other recapitulate works over ion sources was published

For the sub ranges of ion physics it is characteristic that progress in this area is obtained by skill and experience by specialists and the results in the connection a physical reason experiences. This applies in particular to the ion source development (Domonkos, 1999; Pessoa et al. 2006). With the beam forming and guidance come more computer simulation into the play, in order to before-compute favourable geometrical arrangements.
Because of the procedures complexity in the combustion chamber of an ion source and the sensitive dependence of the ion source points on the kind, geometry and fuel parameters of the ion source often the task exists to optimize parameters, to the beam forming empirically in ion physics, which we want to examine with a cold cathode discharges.
The aim of the present studies was to obtain experimental observations about the main features of hollow cold cathode discharge in order to evaluate its capability of generating compounds in the plasma medium, by reaction between sputtered species from the cathode and radicals from the gas discharge.
[New York Science Journal. 2008;1(4):4-13]. (ISSN: 1554-0200).

Keywords: Ion physics, Ionization process, Cold cathode, Ion emitters

INTRODUCTION

Cold cathode discharge is an independent gas discharge, i.e. the transformation of energy in discharge guarantees the constant reproduction of a discharge cycles. The current-voltage-characteristic is negative in the range of the glow discharge. The operating tension decreases with increasing current flow.
If not a current limiting the process of the nuclear chain reaction in the discharge would stop, it would come to the destruction of the arrangement or outside operating devices.
The characteristics of a gas discharge against to current transportation in Solid and liquid exists in the existence of ions and electrons, which are involved in current transport at the same time.
The large mass difference between ions and electrons with same charge, those on behalf different polarity of their charges and their different reciprocal effect mechanisms with the electrodes discharges lead to some peculiarities, which we will soon represent , like the ionization process, potential and field process in a gas discharge, the pressure dependence, the influence of magnetic fields, the extension of the ionization way, the plasma

compression, plasma compression by magnetic field, and the geometrical plasma compression. At the ion accelerators investigations would be accomplished for the reciprocal effect by ions with solid surfaces (Boubetra, 2007).
The ion beam serves thereby as measuring x-ray for ion metric investigations as Rutherford bakes scattering, ion-induced X-raying and Auger electron emission, as suggestion probe with defined suggestion for the observation of optical, acoustic or thermal signals, or as work jet for the layer mixing, alloy formation and defective generation with the ion implantation. The application types of such plant are determined crucial by the characteristics of its ion source.
Interest is the service life of the ion gun in continuous operation, the composition of the ion beam, the amperage, the power requirement, the charge-states of the produced ions etc....
Under this aspect was necessary the occupation with development of new ion source types.

Lately turned out in addition, the need to have a low-energy ion emitter, which could be used for various applications in the laboratory, like layer demolition, layer solidification, atomization, etching or similar surface processing (Boubetra et al., 2007).
In addition it could dedicate oneself to questions by employment of a low-energy ion emitter in combination with the accelerator to the dynamics of the energy and particle transport by the ion bombardment of solids. From this broad application field derived as most important demands on the characteristics of the ion gun:

- Cold Cathode Ion Source
- Small power conversion for the avoidance of complicated cooling devices;
- Small gas charges of the vacuum installation by the ion gun services.
- High current density and probe current density with small extract tensions;
- High service life ;
- Simple handling and optimization;
- Exclusive service with permanent gases, predominantly with noble gases.

MATERIALS AND METHODS

Cold Cathode Ion sources are based on the effect of the field emission (Beckey, 1971), high frequency of a plasma (Valyi, 1977), the glow - or hollow cathode discharge (Mingxiu et al., 1987), or Penning discharge (Penning, 1937).
The field ion source is unsuitable for the production of high ion stream.(Valyi, 1977), it must to produced electrical field intensity of 10^7V/cm within the ionization region, e.g. in order to ionize noble gas atoms. also with macroscopic small distances high service tension is necessary, so that those power conversion takes place essentially at the anode needle; Although the emission current densities are high, the total value of current is small (nA).
In the last years were developed liquid metal ion sources according to this principle (Swanson et al., 1989).
Lately the microwave plasma as ion source is used frequently. It makes possible the ions production with small gas pressure (10^{-5}mbar) with high emission streams.
By suitable magnet traps in the source area it can produce very effectively multi charged ions (so-called ECR sources (Jongen et al., 1989)).
The sources are usable as stationary instruments in the laboratory, but unmanageably for the meant application domains and from safety reasons are unsuitable for routine works.
The glow- and hollow cathode ion sources work at high gas pressure between 0,1 and 1 mbar.
With these gas pressures the gas flow is large by the outlet of the ion source, and the gas charge of the vacuum systems is considerable, a compression phase with separate evacuation distance becomes mostly necessary. By this vacuum-technical expenditure is unsuitable also this type of source for the general, uncomplicated employment in the laboratory.
The Penning sources (Fig. 1) bring with itself favourable conditions.
With this type of source is the cylindrical anode of the gas discharge between two parallel to each other-lying cathodes. Perpendicularly through the cathode metal sheet and parallel to the anode cylinder axles, runs a magnetic guide fields of approx. 0,1T magnetic induction. The ion source burns with gas pressures under 10^{-3}mbar, and related to the discharge stream it supplies a high emission current. The power conversion in the source is around 10W, and the small discharge

current is determined by the ions. Because the electrons will be prevented from the charge transfer in a kind magnetic case and served predominantly only for the ionization of the gas atoms in the source. Disadvantage of the source is the small service life; there due to the atomization of the cathode materials, the function is temporally limited by pollution of the insulators in the source and by atomization of the cathodes. In addition the absolute emission stream is small and can be increased only by gas pressure increase and slightly of the Burning voltage.

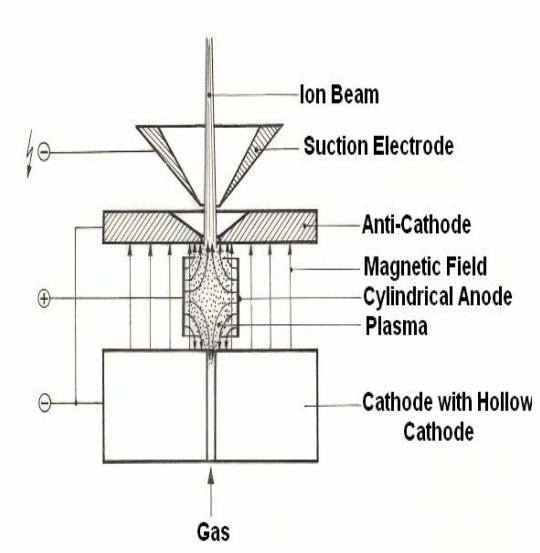


Figure 1. Schematic of a Penning source with axial ion extract:
With the Penning ion source the ions are produced in the plasma area, because the Gas reinforcement is not sufficient for the production of the necessary charge carriers density in the cathode fall area.
The life span of the electrons and concomitantly their ionization probability in the gas volume are very large by the oscillating motion between cathode sheet metals. It is sufficient for the maintenance of the currents conduction.

An interesting suggestion for the development of a cold cathode ion source supplies the Magnetron Sputtering arrangement (Fig. 2).

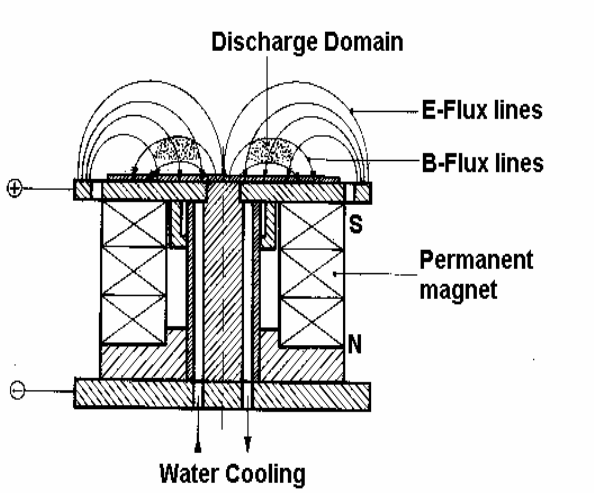


Figure 2. Schema of a Magnetron sputtering assembly. The electrical and magnetic flux lines process is schematically represented.
As accumulation point is marked the place, which is characterized by an intensive luminescent appearance and can be considered as ions source for the substrate atomization (plasma range).

It consists of a magnets pot arrangement with a target as cover plate, which is switched as glow discharge cathode. The environment (recipient) or a cylindrical outer cover around the pot magnet forms the anode, the discharge burns already with low pressures between 5.10^{-3} and 10^{-2}mbar, whereby are possible the discharge stream of more than 1A during a burning voltage of 400V, The conversion power at the cathode requires therefore a water cooling, whereby at the same time takes place a strong atomization of the target material. Characteristic of this sputtering arrangement is a circular glow fringes in the range of the magnetic scattering field between the magnetic poles. From also is the main part of the ion stream originates, which causes the atomization of the target.

PRESSURE DEPENDENCE

With high gas pressure **p** the electrical field force **E** must be high, so that on the mean free path **λ** the electrons receive still sufficiently much energy, in order to be able to ionize gas atoms at the collision. Thus the conditions $\mathbf{e_0.\lambda.E} = \mathbf{e_0.U_i}$ must be fulfilled for similar discharges, where $\mathbf{U_i}$ means the ionization energy. From this follows the Paschen law **E/p=cte**. for independent gas discharges (Valyi, 1977), since **λ ~1/n ~1/p** is in reverse proportional to the particles densities and thus

the gas pressure **p.** if the gas pressure becomes small, then the mean free path of the electrons becomes comparable with the container dimensions. The ionization distance **d** is too short for a sufficient Gases reinforcement. **Z** is the minimum number of the successive impact events of an ionization cascade for the necessary gases reinforcement of a discharge, then **λ.Z** must be smaller than the container dimensions. At a hollow cathode discharges the gas reinforcement takes place within the hollow cathode, and the plasma is enough into the opening inside of the hollow cathode, how fig.3 shows. So that the discharge conditions remain constant in a hollow cathode on change of the gas pressure, all cathode wall distances to the opening of the hollow cathode must change in the same way. i.e. the hollow cathode would have to possess sphere forms of the radius **R = λ.Z.**

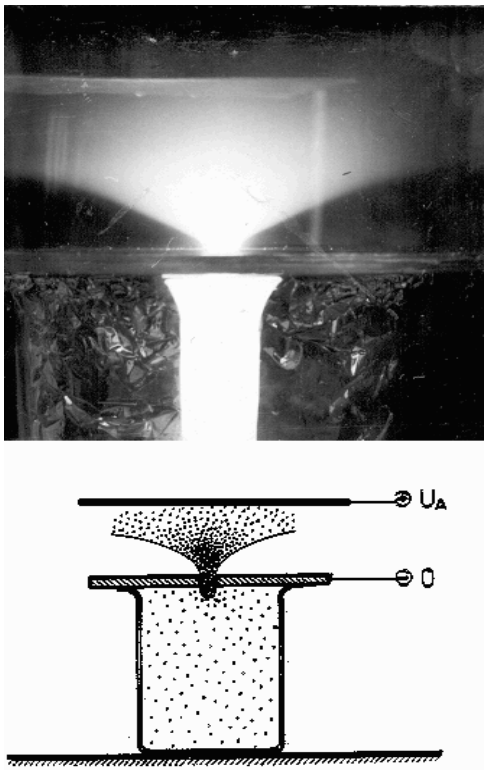


Figure 3. Photography and Schema of a hollow cathode discharge.
A beaker was on the inside deflected up to a slot with aluminium foil.
By a cover made of metal with a drilling in the centre it became the hollow cathode discharge. One recognizes clearly, how the plasma pulls itself in into the hollow cathode and the cathode fall extends itself thereby in the total interior of the hollow cathode.

The experiment shows that actually for same discharge parameters with pressure decreases a sphere form volumes is necessary, its size goes up inversely proportional to the pressure (see Fig.4).
The exact evaluation of the experiment results in however that even with very large volume stills another pressure of 5.10^3 mbar is necessary. The explanation for the fact consists that the gas reinforcement runs off particularly within a critical range in the proximity of the plasma boundary layer.

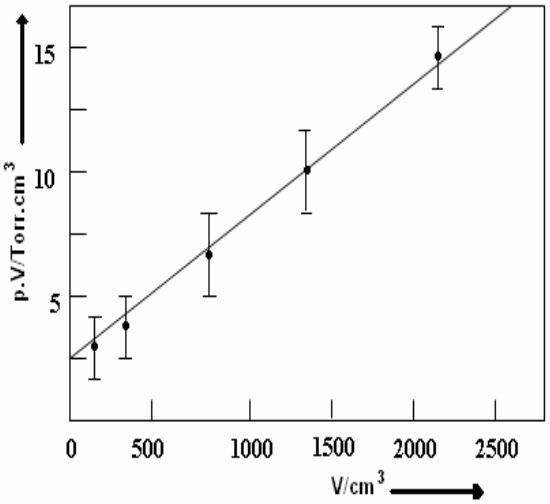


Figure 4. Pressure dependence of the volume of a hollow cathode for same discharge conditions. As characteristic size the pressure was determined, with which discharge under same electrical conditions expired. Therefore small discharge pressures require large volumes of the hollow cathode.

Outside of this critical distance takes place any more gas reinforcement, because then the electrical field force becomes too small, because of the quadratic distance laws just from the source point (opening of the hollow cathode). The situation is here comparable with a counter, where the substantial contributions are reached for Gas reinforcement because of the high gas pressure within the range of the counting wire (anode). In addition the ions lose energy by gas dispersion, which is not completely replaced by the weak electrical field close of the cathode surface. Thus also the electron yield sinks at the cathode. Both effects require therefore a minimum gas pressure for a glow discharge. If the mean free path of the electrons and their energy gain on this distance

is smaller than the ionization energy for the gas atoms, it comes to no training of discharges (ranges of high gas pressures or low field strengths). It comes to the training of ionization streams, however without ignition of a gas discharge, if the anode- cathode distances lie in the order of magnitude of the mean free path of the electron. Loads flow, however their current contribution is small, because the gas Reinforcement is missing (obstructed discharge). This effect can e.g. also obtain, if one makes the mean free path comparable with the electron distances by dilution of the gas (obstructed discharge in low pressure: High vacuum range). To a disruptive discharge it can come then only by adsorption or field emission processes due to high electrical field strengths at the electrodes.

THE EXTENSION OF THE IONIZATION WAY

The magnetic guide field plays a crucial role in numerous ion sources. With electron collision ion sources for the mass spectrometry (Ewald et al., 1953) a magnetic field parallel to the flux electrical lines provides for a bundling of the electron-beam, and thus for a high yield, a spatially fixed developing place of the ions.

With the Freeman ion source (Aitken, 1982) the glow cathode is arranged axially in a cylindrical anode, and an axial magnetic field ensures for the fact that the electrons do not arrive directly at the anode, but describe the way between cathode and anode in cycloid courses.

With the Calcutron-Ion source (Aitken, 1982) the electrons are emitted by a laterally appropriate cathode and sucked through an opening into the anode region. A magnetic guide field holds together the electron-beam; at the opposite side is a second heater that it works electrically as reflector,

and contains a reserve cathode , which with cathode break will be switched. One reaches an increase of the electron density in the ionization volume by the reflection of the electron-beam. The effect principle is similar to the Heil ion source (Heil, 1973). All mentioned ion gun types are glow cathode sources.

Special an efficient cold cathode source is the Penning-source. It consists of two each opposite sheet metals cathode, between which is a cylindrical anode (Fig.1). Parallel to the cylinder axle of the anode runs a magnetic field with a magnetic induction of approx. 0,1T. An ion extracts an electron by impact on one of the two cathodes, thus this is sucked by the electrical field hitting perpendicularly to the cathode toward the magnetic lines.

The further the electron departs from the cathode, the more strongly it undergoes a transverse attraction force through the anode, however again decreases, if the electron is almost free-field of the cylindrical anode areas. Thereby is the caused drift movements by the magnetic field converted into a circular movement. The radius of this circular path is everywhere large, where the transverse speed is large. While the electron in axial direction describes an oscillating motion, it experiences an almost homogeneous acceleration in transverse direction, i.e. the speed and the elliptical radius grow. At the same time, the focus of the rotary movement shifts, because the circulation path speed is not constant. The electrons go through perpendicularly to the magnetic field lines in cycloid courses, their radius and drift movement grow according to the transversal accelerations. Therefore electrons, which move near the anode ring, possess a smaller duration of stopover than axially led electrons; lastly they haven a large duration of stopover and pendulum frequency, because they move along the anode cylinder axle. From this range on use of a Penning discharge as ion source also the ions are sucked.

From $\vec{f} = q \cdot \left(\vec{v} \times \vec{B}\right)$, the course radius of one electron is approx. 1mm with transverse energy of 10^4eV, if the magnetic field amounts to 0,1T. Due to geometry in a Penning ion source are converted about 10% of the acceleration energy into transverse energy. An electron can do unimpaired more than 100 oscillating motion would drive out, without reaching the anode, if it developed sufficiently axially in the cylinder-symmetrical arrangement. Such pendulum factors are practically also reached. This principle of the maintenance of the gas discharge by extension of the ionization way is used with the ion getter pumps. They work as atomizer pumps into the pressure range of 10^{-8}mbar inside.

The high electron density in the magnetically led electron-beam can be maintained only by the fact that a part of the negative electron charge is compensated by ion charges. Otherwise could space charge effects bring the entire oscillating motion to succumbing and transform the arrangement into a stationary circling electron gas. Actually neutral gas atoms, which cross the way of the electrons, are lively or ionized, whereby new electrons develop and for ions, which contribute to the dismantling of the electron space charge. Since the ions have one about 10^4 times larger mass than the electrons, their course radius is already 1cm with energy of 100eV. They are affected thus only slightly by the magnetic field and held by electron space charge and by axial electrical field in the cylinder axle and accelerated only longitudinal to one of the cathodes. With the impact one of the cathodes they are ruled out for current transport. The discharge current, which drifts to the anode, is comparable to the ion current. The middle drift of the electrons to the anode is obstructed by the longitudinal magnetic field. Since the plasma is separate from the anode normally potential-moderately only by the anode fall, thus almost anode potential possesses, arises the question whether under the influence of an axial magnetic field the potential of the plasma is substantially changed opposite the anode. The Penning discharge represents an extreme case of anisotropic suppleness of the electrons in the plasma. Therefore the Energy spectra by the ion current of a Penning ion source in a measure-spectrometric arrangement were compared with those a glow cathode ion source, in order to determine the potential of the plasma.

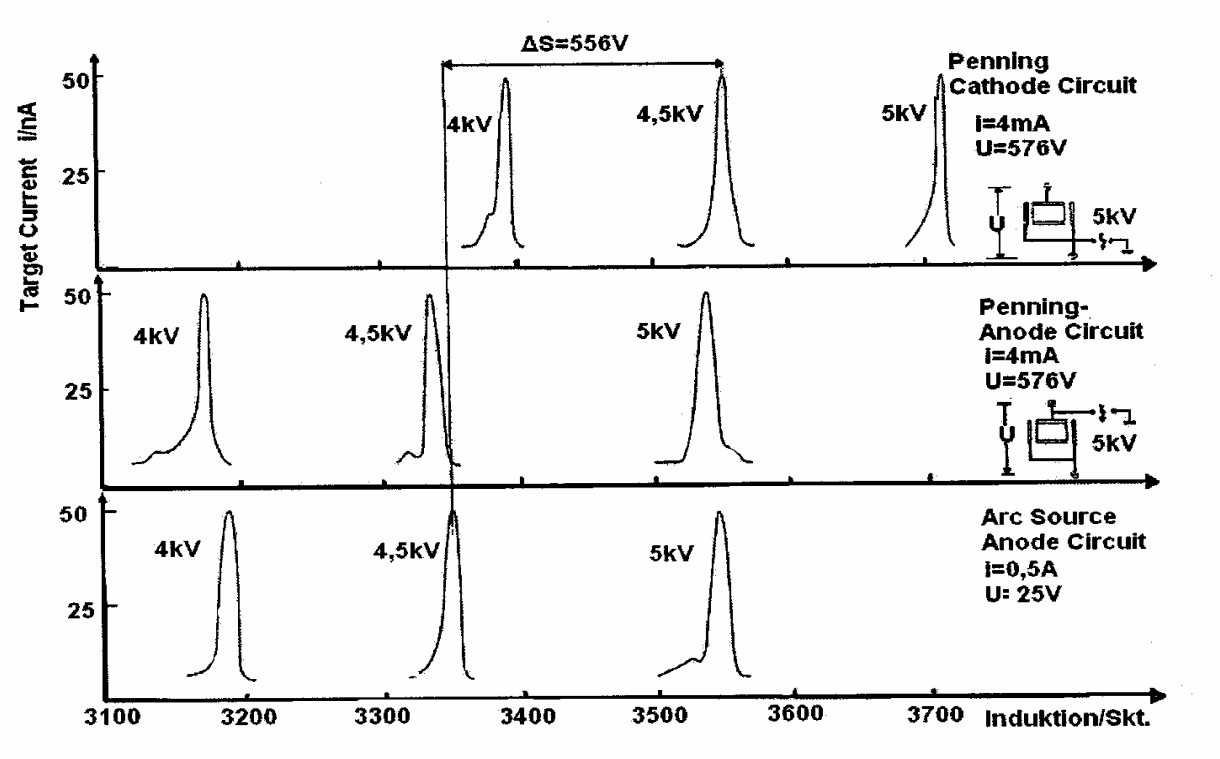


Figure 5. Energie spectra of the ion current of a Penning ion source.
In a measure-spectrometric arrangement with 5 KV Argon ions from the ion source were sucked off and analyzed with a magnet.
The mass line of the Argon isotopes situation with the same magnetizing force as those, which were produced with a glow cathode sheet ion source with a sheet tension by 25V.
If the accelerating voltage increases to the cathode, then the magnetizing force according to the ion energy higher around the fuel tension of the Penning ion source.

In the Fig.5 the results are gathered.
If one applies the accelerating voltage to the anode of Penning discharge, then appears the Argon mass line in the same place, which is found also with a glow cathode ion source. If one applies against it the accelerating voltage to the cathode, then the discharge tension adds itself for accelerating voltage. Hence it follows that the ions come from a range, which possesses practically anode potential. However due to geometry of the ion source this can be only the plasma thread of discharge. Thus the plasma has almost anode potential under the conditions of the obstructed movement of the electrons toward anode.
The mobility of the electrons is comparable by the magnetic field in transverse direction or still higher than those of the ions in longitudinal direction.
The decrease of potential between anode and plasma is still small in relation to the cathode fall.

INFLUENCE OF MAGNETIC FIELDS ON MOVED ELECTRICAL CHARGES

If a charged particle of the charge Q with a speed v flies to a magnetic field of the induction B perpendicularly to the flux line, then it experiences a Lorentz force.

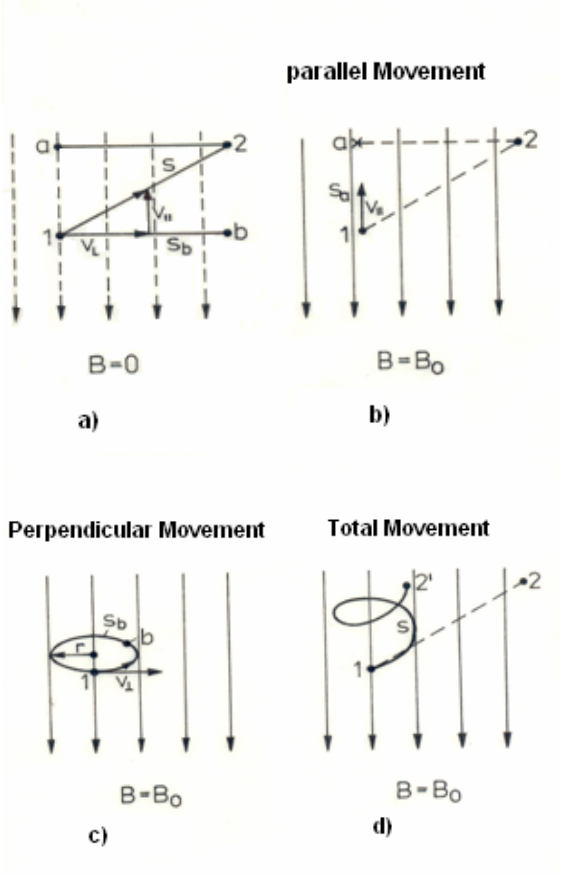


Figure 6. the magnetic field influence on the electrons trajectories in an electrical discharge
While the parallel speed component to the magnetic flux lines has the same course of electrons motion, to the consequence as without magnetic field, the perpendicular speed component leads to a circular motion.

Thus the geometrical distance (1,2) is reduced to the shorter distance (1.2 '), although the way remains in its total length. By creation of a magnetic field an electron can put larger ways back in a smaller volume.

$$\vec{F} = Q.\left(\vec{v} \times \vec{B}\right) \qquad (4)$$

By the inertia of the mass particle m, the acceleration remain however finite and the inertia force (arranged radially outward) equilibrate with the Lorentz force , from which for the curvature radius of the circular paths follows:

$$r = \frac{m.v^2}{Q.v.B} \qquad (5)$$

if the particle flies diagonally to the flux lines of the magnetic field, then one can divide its speed for the description of the trajectory into one parallel ($v_{//}$) and one perpendicular ($v_{\perp}$) component.
The particle moves itself accordingly to ($v_{//}$) along the flux lines and synchronously to it describes unhindered circular path according to the component ($v_{\perp}$).
The superposition of both movements results in a screw course, how is in Fig. 6a to d schematically represented.
To it is remarkable that the points originally separated by the straight distance $\left(\overline{1,2}\right)$ are separate by a shorter space straight line $\left(\overline{1,2'}\right)$, the screw-shaped way however is just as long as the original distance $\left(\overline{1,2}\right)$.
If the movement of the particle would consist alone of $v_{\perp}$, then it would move on a circular path and would not come from the place. One

can use this effect meaningfully to the construction of ion sources. In the following are discussed some possibilities in principle of the use of magnetic fields for gas discharges.

Another example of the stabilization of the developing place of a gas discharge is the shining distribution at a permanent magnet, if it is used as cathode.

Fig.7 shows the observable shining distribution.

With low gas pressures reduces itself the shining seam, which first surrounds the whole magnet , to a shining seam within the crossing range of the electrical and magnetic fields.

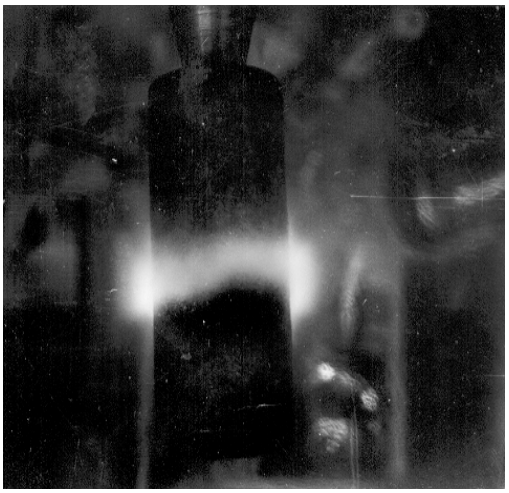
The shining seam is appropriate thus in the magnet centre between the north and the south pole, where the magnetic leakage flux runs tangential to the magnet cylinder surface ,

Before however some construction variants of a ExB-hollow cathode are presented, possibilities of the plasma compression are to be discussed (Boubetra, 2007; Domonkos, 1999; Pessoa et al., 2006), because for an ion source it depends not only on the kind of the cathode, but on the plasma density and the extract from the plasma range.

construction of cathode geometry, which supplies a spatially stable developing place for an plasma discharge, which in an appropriate way the ions can to be extracted.

This principle of the crossed electrical and magnetic fields should form the basis of the

which however the electrical field lines stand perpendicularly to the leading magnet surface.



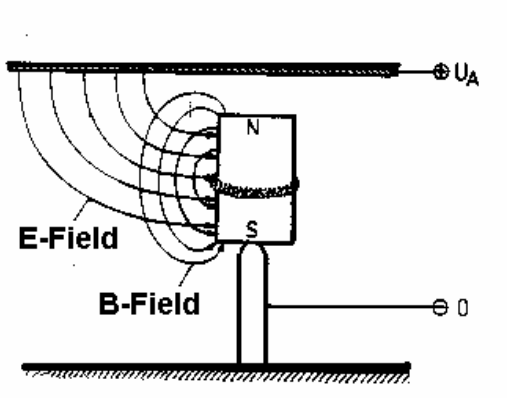


Figure 7. Photography and Schema of the shining distribution around a permanent magnet as cathode of a glow discharge.
With low gas pressures remains a circular discharge around the permanent magnet in the centre. At this place stands electrical and magnetic lines of flux to each other perpendicularly.

PlASMA COMPRESSION

The middle impacts number δ of gas atoms on a wall with a gas pressure P amounts to

$$\delta = \frac{p}{\sqrt{2\,mKT}} \qquad (6)$$

Where m is the mass of the atom; K the Boltzman constant and T the absolute temperature.

if all atoms would be ionized, the current density would amount to $j = e_0 \cdot \delta$.

Fig.8 shows the relation which can be expected, and it is to be recognized clearly that the ionization degrees in a cold cathode ion source amounts to only little per cent.

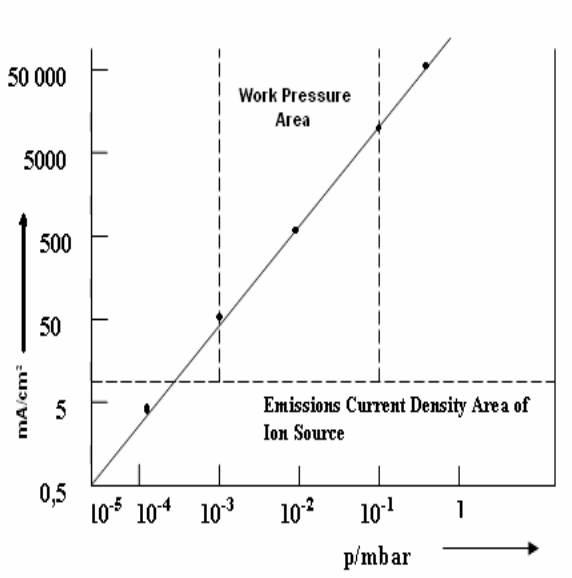


Figure 8.Computed emission current density for ion guns. With a given gas pressure in an ion source a certain number of gas atoms meets the wall of the ion source per second and square centimetre. If one accepts an ionization of all gas atoms, then the represented linear connection between gas pressure and emission stream results substantially smaller than the neutral gas flow from the ion source opening.

The reason for the fact lies above all in the fact that discharge cannot be arbitrarily highly increased, The reason for the fact lies above all in the fact that unloading cannot be arbitrarily highly increased, since otherwise the power losses at the electrons would not to be controlled, if one sinks on the other hand the gas pressure, then the discharge geometry changes, because the mean free path of the discharge particles grows. if it reaches discharge geometry, then the discharge expires. The plasma of a gas discharge is therefore a small disturbance of the essentially neutral gas, which is intending for the impact-kinetic processes of the energy transmission. for the increase of gas discharge ion yields a plasma compression is necessities. One can reach these in two different ways:
By an inhomogeneous magnetic field and by geometrical restricting of discharge.

CONCLUSION

Compared with glow cathode or HF-ion guns the technological expenditure is comparatively small to cold cathode ion source. Their disadvantage is however the high gas pressure discharge and the smaller ion yield. In cold cathode ion source the Gas reinforcement is crucial in the cathode falls range for the size of the discharge current. It determines the gas pressure in the discharge with being certain discharge geometry. In the case of use of a magnetic hollow cathode one can achieve a compression by inhomogeneous magnetic fields within the plasma range or a homogeneous discharge transfer either up to the anode. The plasma follows the Magnet field lines in its density and direction.

REFERENCES

1. Aitken D. The Freeman Ion Source, in I. G. Brown “The Physics and Technology of Ion Sources”. N.Y. 1989.
2. Aitken ,D.: Ion Sources, in “Ion Implantation Techniques” von H. Ryssel and H. Glawisching, Springer Verlag Berlin Heidelberg , N. Y., S.23-70, (1982).
3. Beckey, H. D.: Field Ionization Mass Spectrometry, Akad. Verlag Berlin (1971).
4. Boubetra, Dj., Entwicklung einer Ionenquelle, Dissertation Humboldt University, Berlin (1992).
5. Boubetra Dj. Development of ion source with cold cathode, Journal of engineering and applied sciences 2(6), 985-987, (2007)
6. Boubetra Dj.,Surfaces characterization by ionic bombardment, Journal of Engineering and Applied Sciences 2(8), 1274-1278, (2007).
7. Boubetra Dj., Bouafia M., Ion Implantation damage in GaN Layers investigated by an ellipsometric method, Nature and Science, 5(4),29-33, (2007).
8. Boubetra Dj. Bouafia M., Development of magnetic hollow cold cathode for ion source, journal of American science 3(4), 15-19,(2007).
9. Brown I.G.; The physics and Technology of Ion Sources, J. Wiley & Sons, New York (1989).
10. Domonkos, M.,T., Evaluation of Low-Current Orificed hollow cathodes, PhD thesis, university of Michigan (1999).
11. Ewald ,H., H. Hinterberger: Methoden

und Anwendungen der Massenspektrometrie, Weinheim (1953).
12. Heil H.: Über eine neue Ionenquelle, Z. f. Phys. 120, 212(1973).

13. Jongen ,Y., C. M. Lyneis: Electron Cyclotron Resonance/Ion Sources, in I.G. Brown „ The Physics and Technology of Ion Sources“ S. 207, J.Wiley&Sons New York (1989).
14. Mingxiu, Ma, Li Junping, Zhou Fengsheng: A Hollow Cold Cathode Multipurpose Ion Source, Nucl. Inst. Bd 21, 182-187 (1987).
15. Penning, F.M: “ Ein neues Manometer für niedrige Gasdrucke insbesondere zwischen 10^{-3} und 10^{-5} mm“, Physica Bd 4, 71 1937.
16. Pessoa R.S., G. Murakami, G. Petraconi, H.S. Maciel, I.C. Oliveira, and K.G. Grigorov; Hollow Cathode Magnetron Deposition of AIN thin Films: Crystalline Structure and Morphology; Brazilian Journal of Physics, vol. 36 2A (2006).
17. Swanson ,L. W. and A. E. Bell: Liquid Metal Ion Sources, in I. G. Brown “ The Physics and Technology of Ion Sources”, S. 313, J. Wileey&Sons, New York (1989).
18. Valyi, L.: Atom and Ion Sources, S. 191, Budapest (1977).

Synthesis and characterization of Polyaniline/Poly(p-hydroxyaniline)/Fe_3O_4 magnetic nanocomposite

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Abstract

The several composites have been studied for static dissipationand microwave absorbing materials based on polyaniline with metallic oxides. These composites are conducting polymers have been widely used because of their lower density as well their good environmental stability as in the case of polyaniline (PAN). In the present work , in situ polymerization of aniline was carried out in the presence of Fe_3O_4 nano particles to synthesize polyaniline/Poly(p-hydroxyaniline)/ Fe_3O_4 (PAN/PHAN/Fe_3O_4) composites.The composites,thus synthesized have been characterized by Fourier transfer infrared(FTIR) spectrophotometer and X-ray diffraction . The morphology of these composites was studied by scanning electron microscopy. [New York Science Journal. 2008;1(4):14-18]. (ISSN: 1554-0200).

Keywords: Conductivity, polyaniline ,poly(p-hydroxyaniline), Fe_3O_4 , nanocomposites.

Introduction

Nowdays the conducting polymers offers a great technological application potential in several areas [1-3], can be cited: static films for transparent packaging of electronic components , electromagnetic shielding , rechargeable batteries ,light – emitting diodes , nonlinear optical devices , sensor for medicine and pharmaceutics apparatus , membranes for separation of gas mixture , protection against corrosion ,conducting paint s and glues and others .The most important application of these polymers is like radar(microwave) adsorbing materials[4].These polymers are generally prepared by adding fillers ina polymeric matrix.One very common way, among the several methods fir preparing conducting polymer blends or composites , is by mechanical mixing of the components[5].

Great interest has been focused on polyaniline (PAN) and Poly(p-hydroxyaniline)(PHAN) , within the field of conducting polymers , due to important characteristics that it presents: its conductive form has excellent chemical stability combined with relatively easy ,inexpensive and with high – yield.These blends may combine the desired properties of two components ,the electrical conductivity of polyaniline/poly(p-hydroxyaniline) with the physical and mechanical properties of the polymeric matrix[6-7].

We have been studied some microwave absorption properties of polyaniline / Poly(p-hydroxyaniline)with Fe_3O_4 nanoparticles[8] .

Experiments

Nano particles of Fe_3O_4 were purchased from nanotechnology center of baku state university. The particles have an average of 10 -12 nm. Aniline and 4-aminophenol were purchased from Aldrich chemicals.Aniline was purified by distillation under vacuum.Ammonium persulfate.

The images of nanoparticles were investigated using Philips XL30 scanning electron microscope.The Fourier transfer infrared(FTIR , Bruker)spectroscopy was used to identified the polymer on the Fe_3O_4 nano particles surface.Specta were obtained in the wave number range of 400-4000 cm^{-1}. Spectra of the polyaniline modified Fe_3O_4 nanoparticles were recorded from KBr in 1:10 (wt/wt) ratio.

HCl 1M solution(100 cm^3) was prepared. Add 0.558 gram of aniline to solution,stir for 4 hours .Dissolve 0.006 mol potassium persulfate (KS_2O_8) with 10 ml distilled water. Mix these two solutions to start the polymerization reaction. The solution turned to dark green.Stir for 24 hours to obtain a homogeneous solution of the polymeric matrix . The polymeric matrix is a dispersion of particle of 100-200 nm in diameter. The infrared absorption spectra of the matrix are consistent with the structure of polyaniline .

Stir Fe_3O_4 dispersive solution with sodium dodecyl sulfate / distillaed water with mechanical stirring . A diluted solution of the PAN polymer is then mixed with Fe_3O_4 solution (25% Fe_3O_4) for 10 minutes . The average molar ratio of the components is PAN:Fe_3O_4 = 1:2 . The dispersion is stable with very small amount of precipitation . 0.012 mole (3.5gr) 4-aminophenol dissolve in the 25cm^3 HCl 1M solution. Stir for 2 hours .Then , dissolve 0.01 mol potassium persulfate (KS_2O_8) with 20 ml distilled

water. Mix these two solutions to start the polymerization reaction. The solution turned to dark green.Stir for 24 hours to obtain a homogeneous solution of the polymeric matrix.The viscosity of solution is increased.

Results and Discussion

SEM of polyaniline/ Poly(p-hydroxyaniline)/ Fe_3O_4 nanocomposite synthesized by chemical oxidative is shown in Figure 1. PAN/ PHAN / Fe_3O_4 nanocomposite is very sensitive to the temperature . Due to the intractionelectron and sample . Scanning electron micrography images were obtains from a diluted solution of the nanocomposite particle . The white spots are Fe_3O_4 nano particles .The SEM image shows the presence of spherical Fe_3O_4 particles in PAN/ PHAN matrix, which are homogenenously distributed throughout the composites ,which is also confirmed from XRD studies[11]. A very high magnification of SEM image shows the presence of spherical Fe_3O_4 particles(cenospheres) in PAN/ PHAN , which are homogeneously distributed throughout the composites ,which is also confirmed from XRD studies .It is for the first time such a beautiful distribution of cenospheres is observed which looks as if the beads are floating over the water surface . These ceospheres show a large variation in their dimensions.Since the partices of Fe_3O_4 are spherical in shape ,the observed porosity in these composites is less than the other PAN/ PHAN composites .

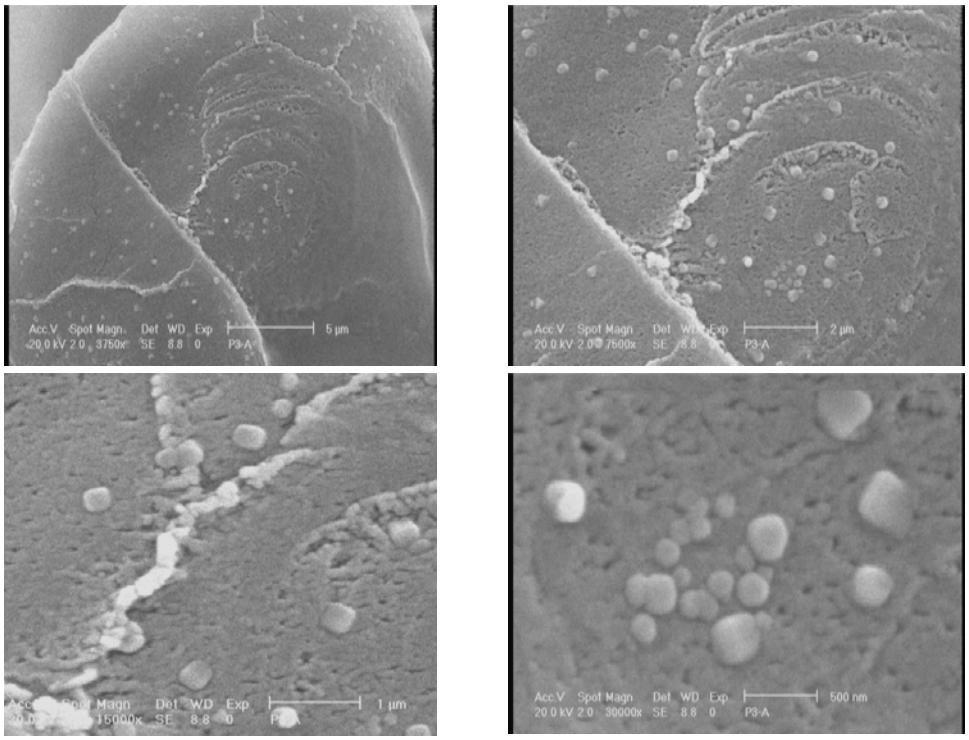

Figure 1. Scanning electron micrograph of PAN: PHAN:Fe_3O_4 nanocomposite

The crystallinity of the formed composites was followed with X-Ray diffraction(XRD) as s function of weight percent inorganic component. Figure 2a shows X-ray diffraction pattern of polyaniline .Diffraction of PAN: PHAN have a broad peak at about $2\Theta = 25.92^\circ$, which is a characteristic peak of PAN: PHAN (Wan et al 1994 , Wan and li 1998) . Studies on XRD patterns of PAN: PHAN are scarce in the literature(Rajendra Prasad and Muunichandriah 2002) .Figure 2b shows the XRD pattern for PAN: PHAN:Fe_3O_4 (25%). The diffraction pattern of PAN: PHAN: Fe_3O_4 nanocomposite shows a peak at about $2\Theta = 26.89^\circ$[12,13].

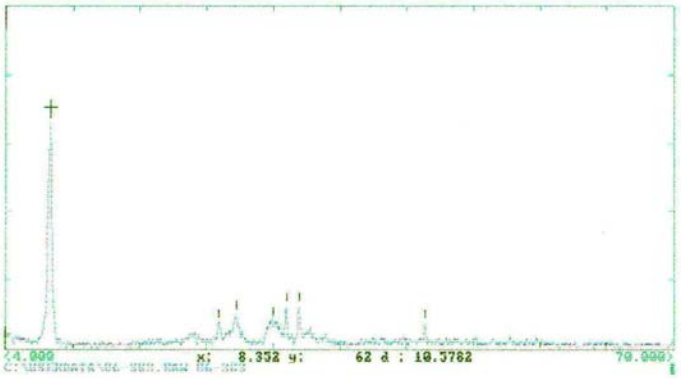

Figure2. XRD spectra of PAN: PHAN: Fe_3O_4 nanocomposite

Figure 3a shows the FT-IR spectrum of pure polyaniline nanopolymer , where the % of transmittance is plotted as a function of wave number (cm^{-1}) . The characteristic FT-IR peak at 1523 and 1485 cm^{-1} are due to the presence of quinoid and benzenoid rings , respectively and are clear indication of these two states in the polymer chain. Also , The peaks at 1176 cm^{-1} are due to the C-N bond stretching vibration ,respectively[14] .

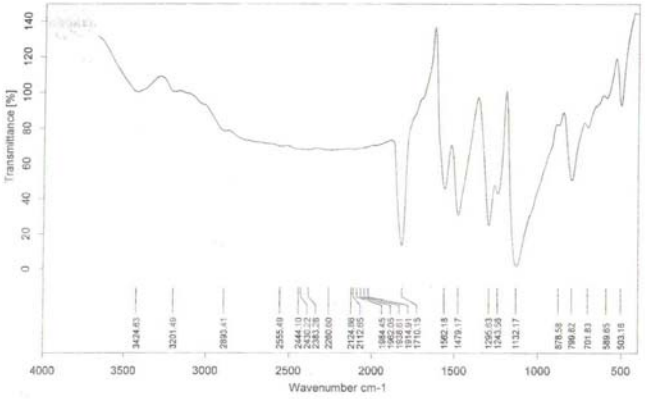

Figure3a. FT-IR spectra of pure polyaniline

Also,figure 3b shows the FT-IR spectrum of polyaniline-poly(4-aminophenol) nanocomposite in presence of Fe_3O_4 as a ferromagnetic material exhibit new absorption peaks distinctly at 1591,1485,1382,1178 and 760 cm^{-1} which are assignable to the presence of various metal oxides in the composite.The broad peaks at 3200-3500 cm^{-1} are O-H Phenolic group in the nanocomposite.

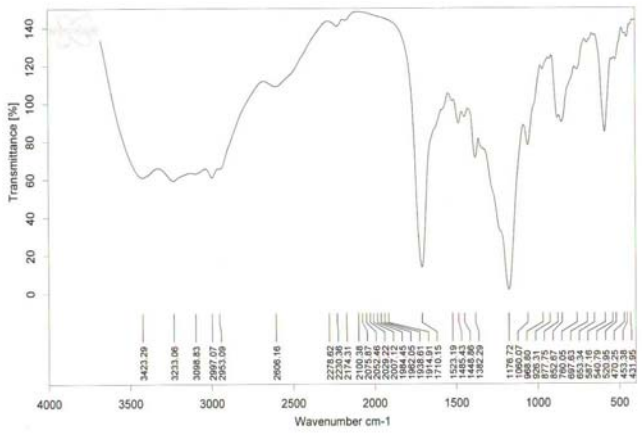

Figure3b. FT-IR spectra of PAN: PHAN: Fe_3O_4 nanocomposite

The effect of Fe_3O_4 particles on the electrical conductivity of PAN/ PHAN / Fe_3O_4 nanocomposites was studied .These data shows the low frequency behaviour of nanocomposite.The absolute conductivity for individual samples increases as a function of frequency except for the nanocomposite with 25 wt% Fe_3O_4 . The electrical conductivity of pure PAN/ PHAN (0 wt% Fe_3O_4) has the order of 10^{-4} S/cm. For the PAN/ PHAN /Fe_3O_4 nanocomposite the conductivity values change the order of magnitude.(10^{-5} S/cm).From FT-IR and XRD studies , the presence of Fe_3O_4 in nanocomposite are confirmed[15].

Conclusions

We have synthesized new polyaniline matrix by in situ polymerization in the presence of Fe_3O_4 nano particles .The PAN/ PHAN / Fe_3O_4 ferromagnetic nanocomposites have been characterized by FT-IR, SEM,and XRD techniques.This nanocomposite show crystalline nature ,whereas the PAN synthezied is amorphous in nature . The SEM photograph of nanocomposite with 25% Fe_3O_4 show the presence of cenospheres. These nanocomposites are suitable materials for high technology industries . The organic component is the hybride material have the dimention of 100-200 nm . One type of the composite is synthesized by preparing a precursor that contains the Fe_3O_4 nano particles.The composites were coated on glass and metal surfaces by the method of layer-by layer coating of self – assembled multi layers.

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References

1. P.F.W. Simon, R. Ulrich, H.W. Spiess , U. Wiesner, Cem.Mater,**13 ,** 3464 ,2001.
2. M.R. Saboktakin., A. Maharramov, M.,A.,Ramazanov, *Nature and Science* ,2007,5(3), 67-71.
3. M.R.Saboktakin,A., Maharramov, M.,A.,Ramazanov,*Journal of American Science*,2007, 3(4),40-45
4. M.R.Saboktakin,A., Maharramov, M.,A.,Ramazanov,*Journal of American Science*,2007, 3(4),30-34
5. B.O'Regan,M.Gratzel, Nature,353,737,1991.
6. A.J.Zarur,J.Y.Ying,Nature,403,65,2000.
7. J.M.Liu and S.C.Yang, J.Chem.Soc.,Chem.Comm.,1529,1991.
8. J.O.Stoffer,T.J.O'Keefe,X.Lin,E.Morris,P.Yu,S.P.Sitaram,US Patent 5,932,083.
9. S.P.Sitaram, P.Yu, T.J.O'Keefe and J.O.Stoffer ,Polym.Mater.Sci.Eng.,75,354,1996.
10. L.Sun,H.Liu,R.Clark,S.C.Yang,Syn.Met,85,67,1997.

11. J.M.Liu,L.Sun,J.H.Hwang and S.C.Tang,H.L.Wang,Mat.Res. Soc.Symposium Proceeding , 247 ,601,1992.
12. P.A.McCarthy,J.HuAng,S.C.Yang,H.L.Wang, Langmir,18,259,2002.
13. Z.Tang ,N.Alvarez and Sze Yang , Mat.Res. Soc.Symposium Proceeding , 732,601,2003.
14. S.C.Raghavendra.S.Khasim,M. Revanasiddappa,M.V.N. Ambika Prasad and A.B.KuKarni,Bull.Mater. Sci,26,7,2003.
15. S.P.Armes, J.F. Miller,Synth. Met.22,385,2001.

2/21/2008

Geophysical investigations for groundwater exploration in a crystalline basement, southwest Nigeria

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Abstract: As part of a borehole sitting programme for rural water supply in a crystalline basement terrain 17offset Werner electrical sounding of ground conductivity profiling with a resistivity meter SAT200 Resist 1.0 version software equipment (Terameter) were made in Osun State, Southwest Nigeria.. The Resistivity meter SAT200 Resistivity 1.0 version software provided a rapid reconnaissance tool in identifying high conductivity anomalies thought to be due to deep weathering and/or bedrock fissuring. Geophysical resistivity techniques are based on the response of the earth to the flow of electrical current passed through the ground and the potential difference between them. Resistivity measurements are associated with varying depths relative to the distance between the current and potential electrode in the survey, and can be interpreted quanlitatively and quantitatively in terms of a lithology and/or geohydrologic model of the subsurface. [New York Science Journal. 2008;1(4):19-35]. (ISSN: 1554-0200).

Key words: crystalline; basement; resistivity; sounding; aquifer; investigation; survey; groundwater; exploration; Nigeria

1 Introduction

Water is an essential resource for human development. It is used for various purposes which includes domestic; irrigation, industrial, power generation and recreation. The development of groundwater resources for potable use has increased substantially over the last two decades in developing countries as a result of rapid expansion of cities and subsequent population explosion. Ground water resource lends itself to flexible development and the capital cost of groundwater development when compared to surface water is modest. However, crystalline basement complex rocks typical of the study area in this research are relatively impermeable and have no storage capacity. Consequently, the ground water recourse in such terrains, which are spread in Africa, is limited. Nonetheless large numbers of water wells have been successfully developed in this area. To ensure maximum and perennial yields it is essential that a borehole be located where it can penetrate the greatest possible thickness of both the regolith and the fracture zone, before hitting the fresh bed rock. A ground geophysical survey is often carried out to locate the ground water aquifer accurately. The most commonly used geophysical techniques for groundwater exploration is electrical resistivity. The aim of electrical resistivity is the identification of high conductivity anomalies, normally thought to be due to deep weathering. Such anomalies are often further investigated by sounding in order to provide a more quantitative information on the geo-electrical profile through the weathered zone as an aid in sitting borehole. This paper present the result of an integrated

geophysical survey involving resistivity sounding (both the Werner & schlumberger array) carried out in a basement area of Nigeria. The survey was aimed at locating sites suitable for drilling of abstraction well.

2 Materials and Methods

2.1 Study Area.

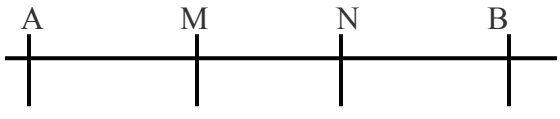
The study area lies within Latitude 7^0 9' N and 7^0 48'N; Longitude 4^0 12'E and 4028'E in Osun State in the Southwestern part of Nigeria. The climate is subequatorial with two peak of rainfall, first peak is in July and the second is in September. The two peaks are marked by heavy rainfalls; the mean annual rainfall is about 1,300mm with relative humidity of about 70%. As the humidity is subequatorial, the temperature is a times severe with an average annual temperature of about 20^0C.

2.2 Geology and Geomorphology

The area lies within the Nigeria Precambrian basement complex. The geology survey map suggests that the basement complex in this area comprises migmatised gneisses and granite. There are occurrences of schist and quartzite, occasionally amphybolite, gabro, diorites; the dominant in the surveyed area is gneisses (Jones and Hockey, 1964; Rahaman 1965). No outcrop of this rock could be seen within the villages. Geomorphologically, the rivers and stream in the study area flow over a slightly undulating valley the drainage could be said to be dendritic in pattern, because the stream within the area is topographically controlled and the homogeneous nature of the underlying rock and their resistance also relate to the drainage.

2.3 Field Measurements

The geo-electric investigation consisted of a combination of V.E.S & L.E.P. The geological structure such as fault, joint, fracture and other water bearing structure in the basement complex occurs either concordantly or discordantly within the host rock. A discordant fracture is localized within the locality that is why electrical profiling and V.E.S method favour the detection of these anomalies. Schlumberger and Werner array configuration were used for V.E.S & L.E.P respectively. The electrical resistivity method are based on the response of the earth to the flow of electrical current, in these method, an electrical current is passed through the ground and two potential electrode allow the recording of the resultant potential difference between them, giving a way to measure the electrical impedance; the arrangement is illustrated below.



Where A & B are the current electrode, M & N are the potential electrode. The space is equidistance and this differentiates it with V.E.S.

AB & MN obey ohm's law.

$\Delta V = IR$…….. (1)

ΔV =Potential difference between any two points measured in volts

I = Current flowing

R = Resistance

is ϱ; the resistance R is expressed thus.

$R \propto L/A$ …….. (2)

$R = \varrho L/A$ …… (3)

Substituting R in equation (3) in (1).

$\Delta V = I/R$

$R = \Delta V \backslash I$

:. R in equation (3)

$\Delta V/I = \varrho L/A$ …… (4)

$\therefore \varrho = \underline{VA}$ …….. (5)

Measurement of voltage and current for different electrode geometry are then used to infer the sub-surfaces distribution of conductivity. Data acquired are presented in the form of resistant plotted against electrode spacing. The curve resulting from the data upon interpretation give thickness and resistivity of various layers.

Instrument used includes the topographical map to locate the villages, while the geological map was used in knowing the geology and structure of the area. Hand held high precision GPS receiver was used in determining the geographical co-ordinate of the V.E.S points. A resistivity survey system SAT terameter model SAT200, cables, electrodes and tape for linear measurement were used. Cutlass was used in cutting lines for the spread of the cable. Hammer was used in driving down the electrode into the earth surface.

Eighteen (18) vertical electrical sounding (V.E.S) locations were occupied, utilizing the Schlumberger electrode configuration. Electrode spacing (AB/2) was varied from 1.0m to

150.0m.Werner array was used for lateral profiling in other to locate the best possible point for sinking a productive hole.

The VES curves were qualitatively interpreted from curve matching and computer iteration technique using computer programme. The curve matching involved segment-by-segment matching of the field curves with 2 layer model curves and their corresponding auxiliary curves.

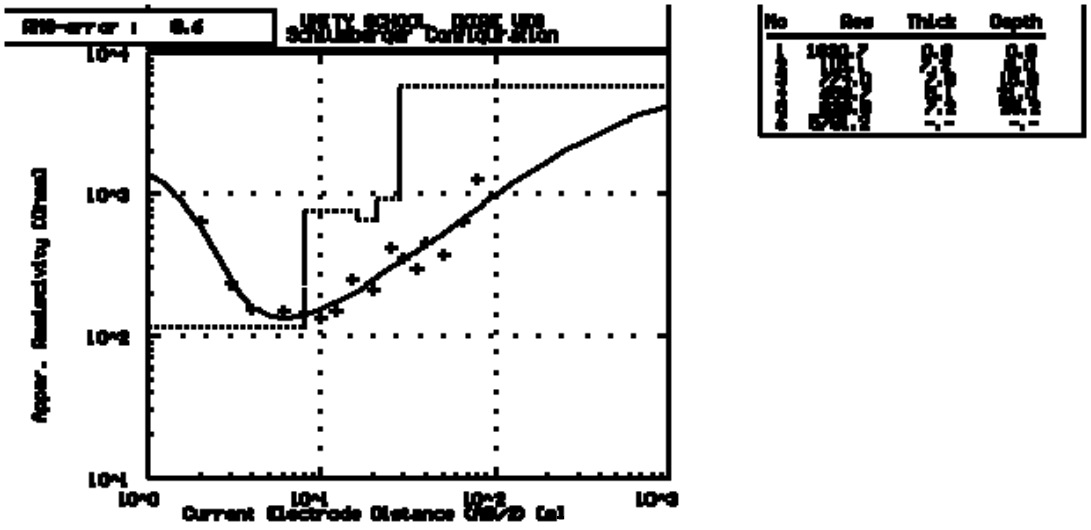
3 Result and Data Interpretation.

The result of the lateral resistivity profiling obtained were used for direct and immediate on the spot localization of sounding point and are therefore of relevance to evaluation and interpretation in this way. The curves obtained are shown in figures 2-19.

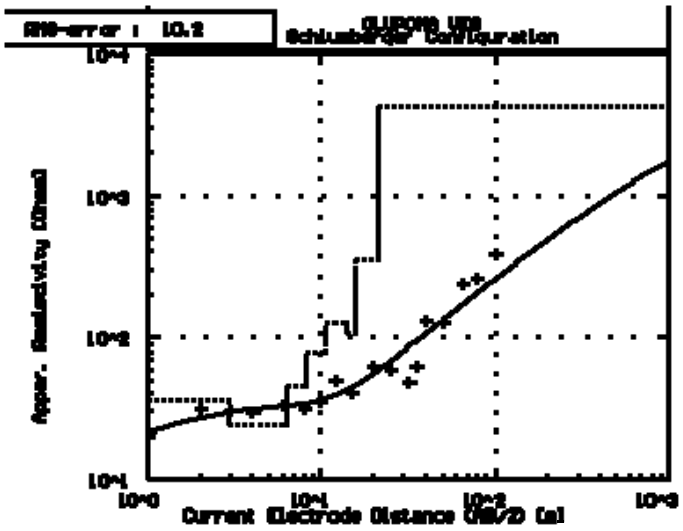
A total 18 VES position were occupied, depth-sounding curves were prepared for each sounding point. Qualitative interpretation was carried out for each sounding curve using curve-matching techniques. These provided approximate layer parameters, which were optimized using computer iterative techniques for qualitative interpretations.

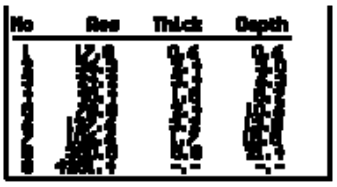
From the investigation of VES result, the curves are characterized as follows;

Unity School Ikire= HKHA,

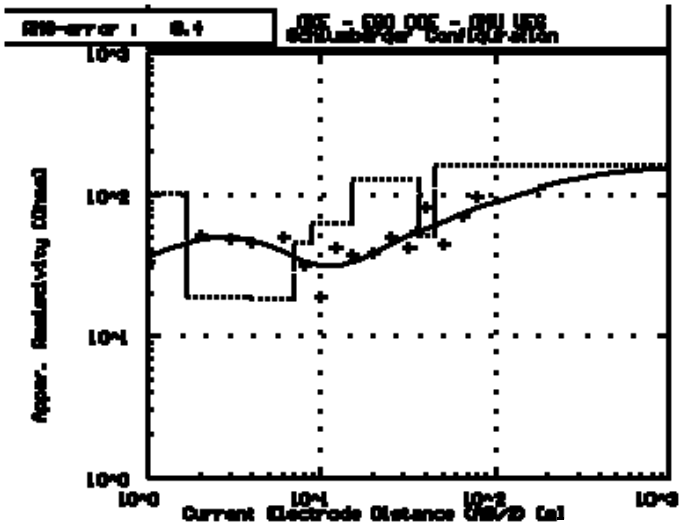


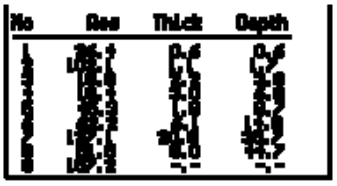
Olupona VES =AAA



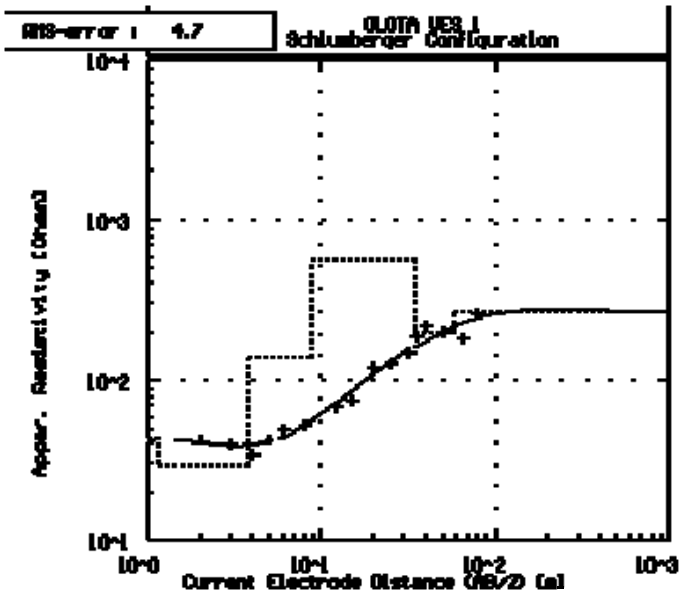


Oke-Eso, Ode-Omu= KQHAAKH



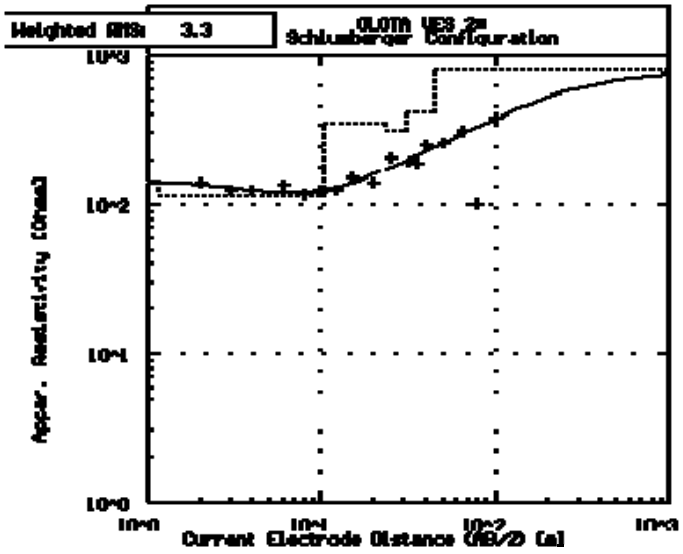


Olota VES1=HAKH



No	Res	Thick	Depth
1	44.2	1.2	1.2
2	28.1	2.7	3.9
3	188.1	6.0	9.9
4	1082.2	28.1	37.9
5	3752.3	44.7	82.7
6	2772.3	-.-	-.-

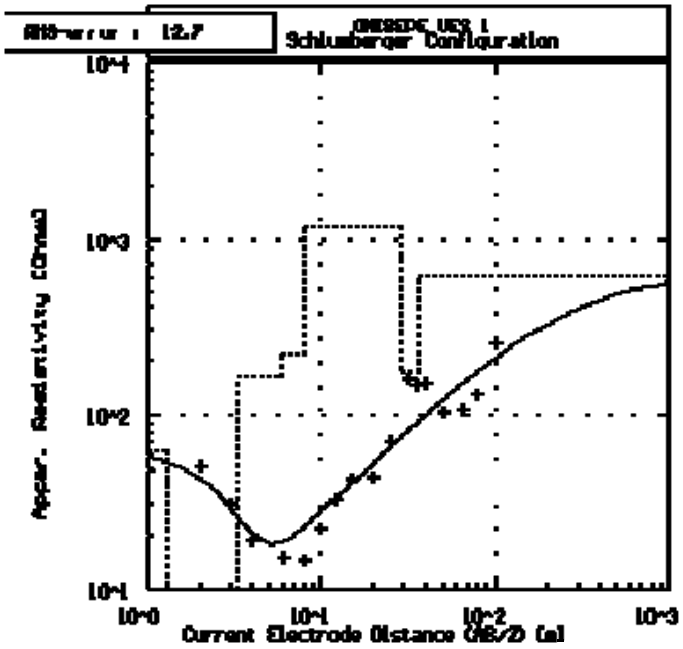
Olota VES 2= HKAA



No	Res	Thick	Depth
1	172.6	1.3	1.3
2	1454.5	4.3	5.6
3	3884.9	13.3	19.0
4	2188.2	23.3	42.3
5	1107.4	12.6	54.9
6	7482.3	-.-	-.-

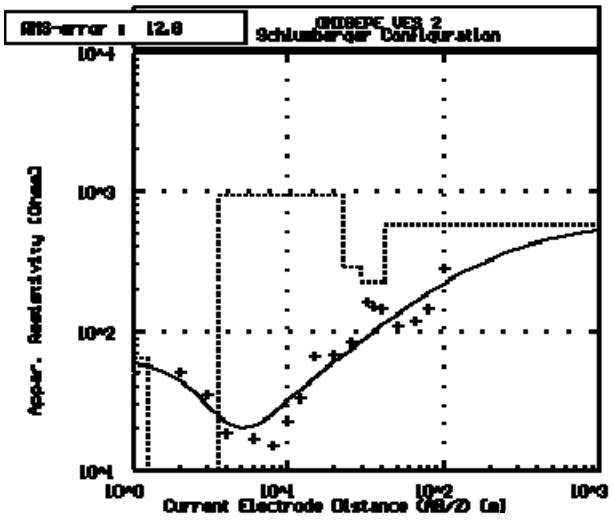
Ogun ward oju court=QHAA

Onibepe VES 1=HAA



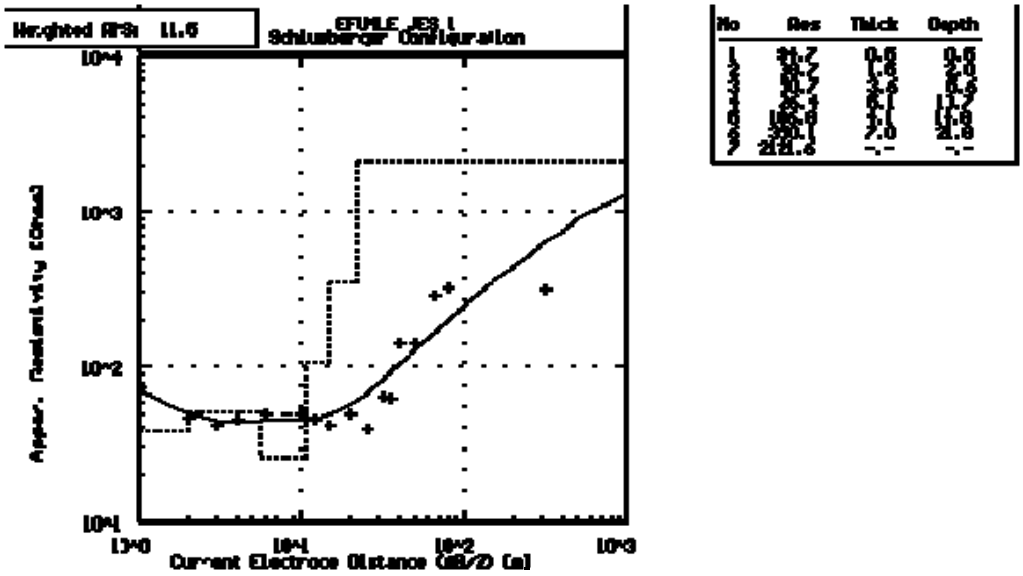
No	Res	Thick	Depth
1	62.0	1.3	1.3
2	[illegible]	2.0	[illegible]
3	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]
5	1287.2	20.9	28.0
6	172.7	7.1	36.1
7	611.1	-.-	-.-

Onibepe VES2=HAAKH

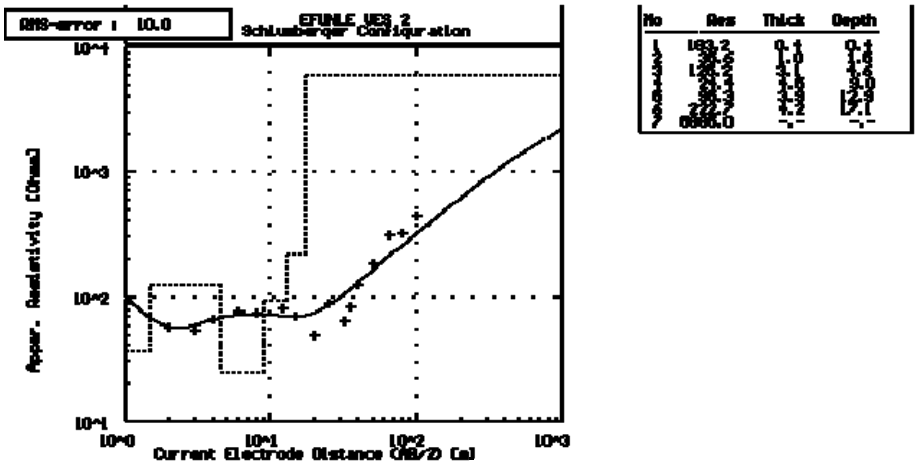


No	Res	Thick	Depth
1	61.6	1.2	1.2
[illegible]	[illegible]	[illegible]	[illegible]

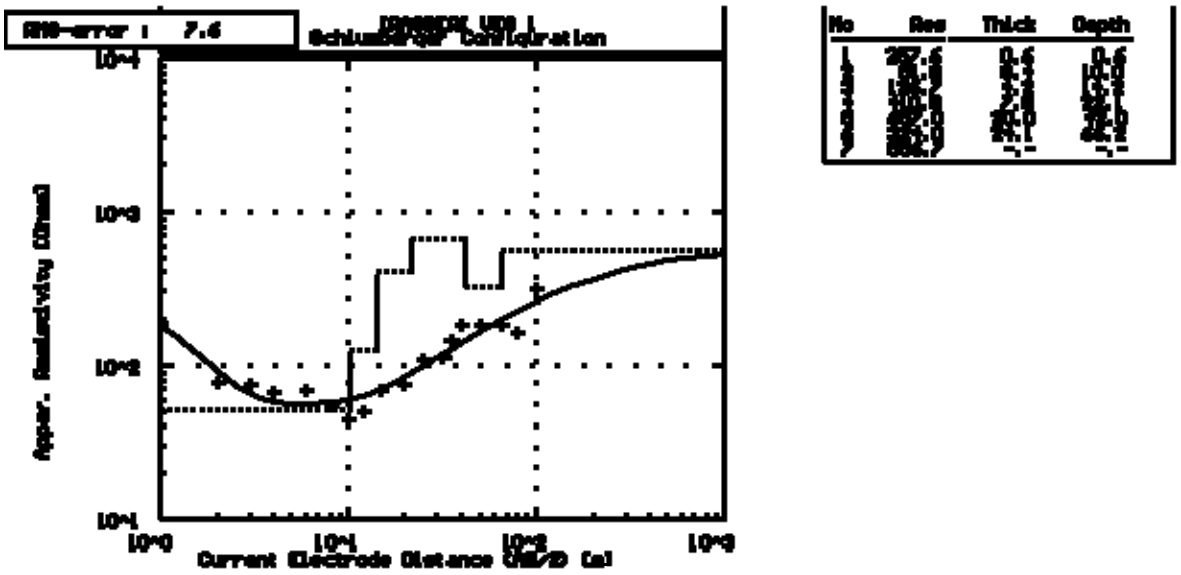
Efunle VES1=HKHAA



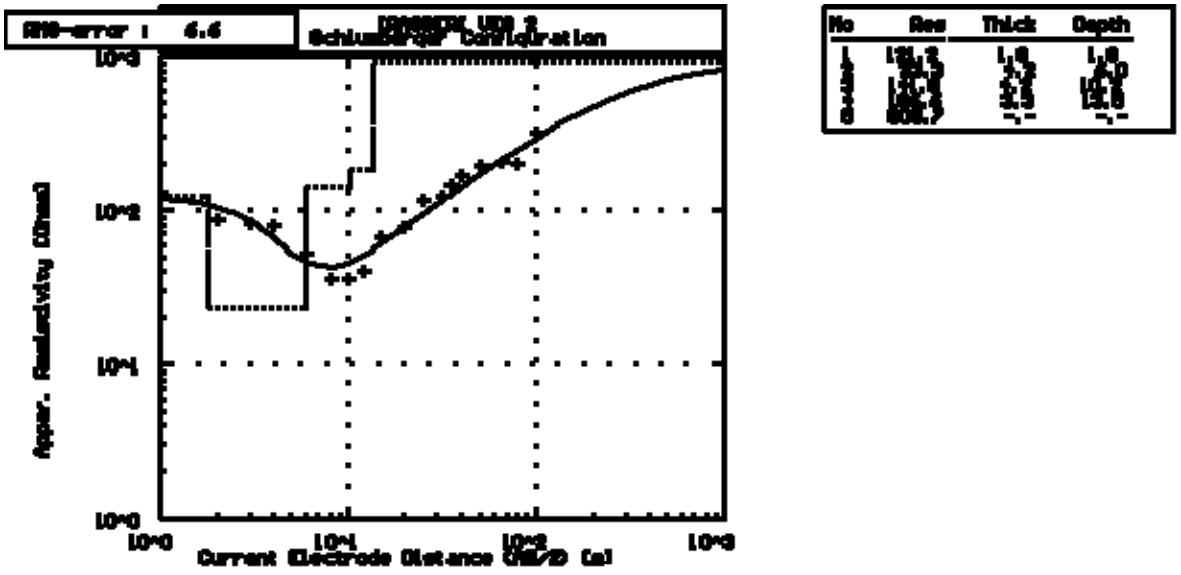
Efunle VES2=HKHAA



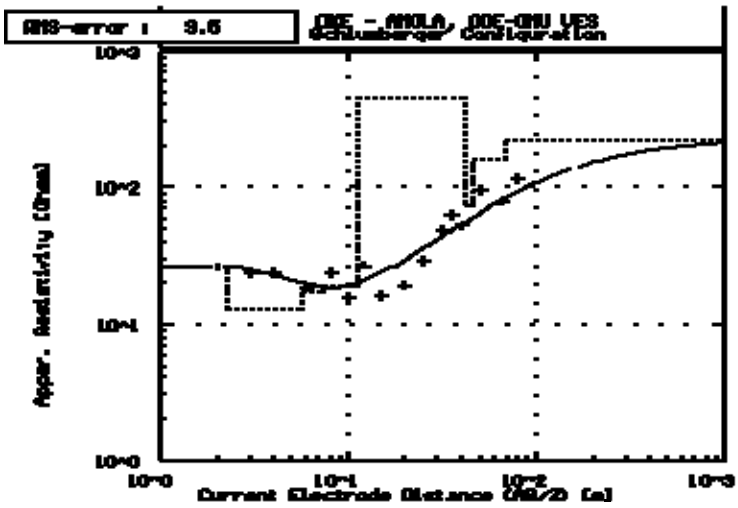
Iragberi VES 1



Iragberi VES2=HAAA

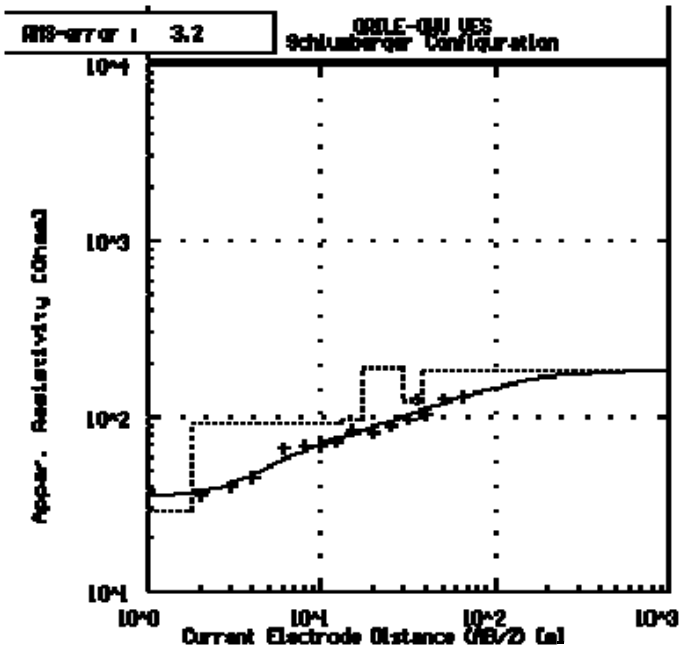


Oke-Amola, Ode-omu=HAAKHA



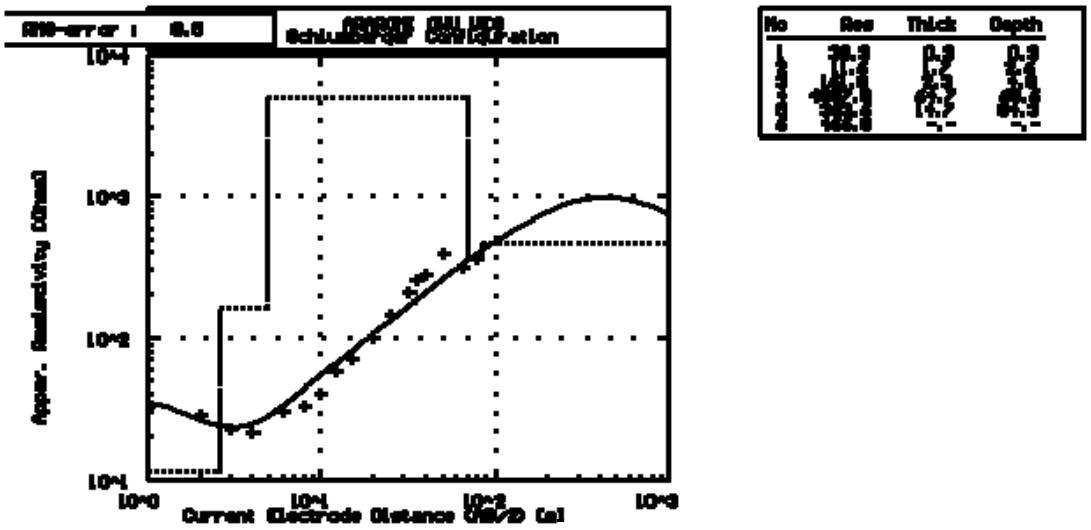
No	Res	Thick	Depth
1	22.3	2.3	2.3
2	12.6	3.3	5.7
3	48.1	4.3	10.0
4	38.3	36.9	46.9
5	163.2	21.8	68.8
6	89.4	-.-	-.-

Orile Owu

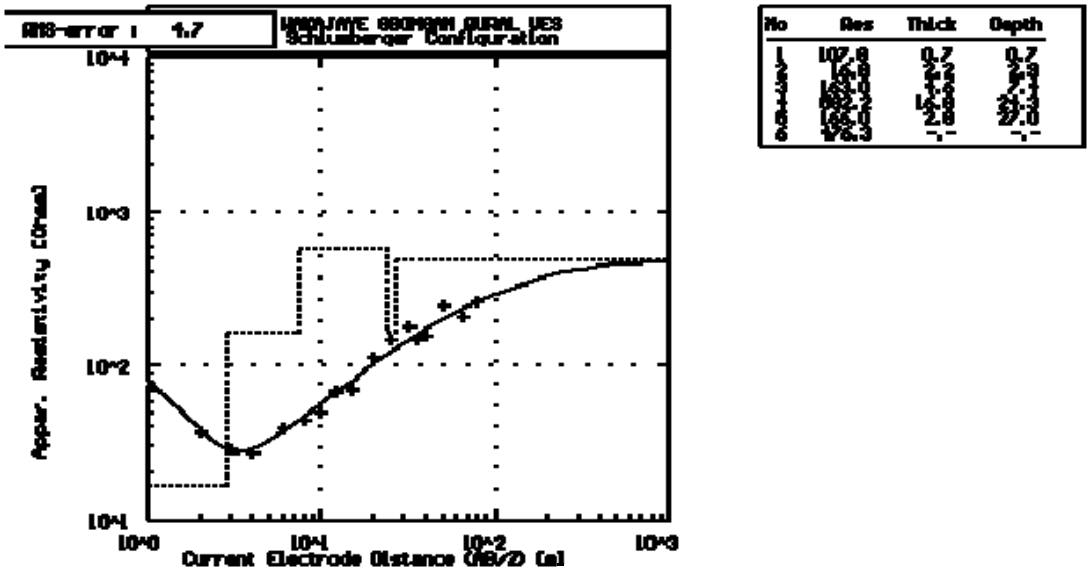


No	Res	Thick	Depth
1	36.8	0.3	0.3
2	28.1	0.3	1.8
3	82.1	11.0	12.7
4	38.7	4.4	17.1
5	182.9	12.1	29.9
6	82.7	7.7	37.1
7	181.3	-.-	-.-

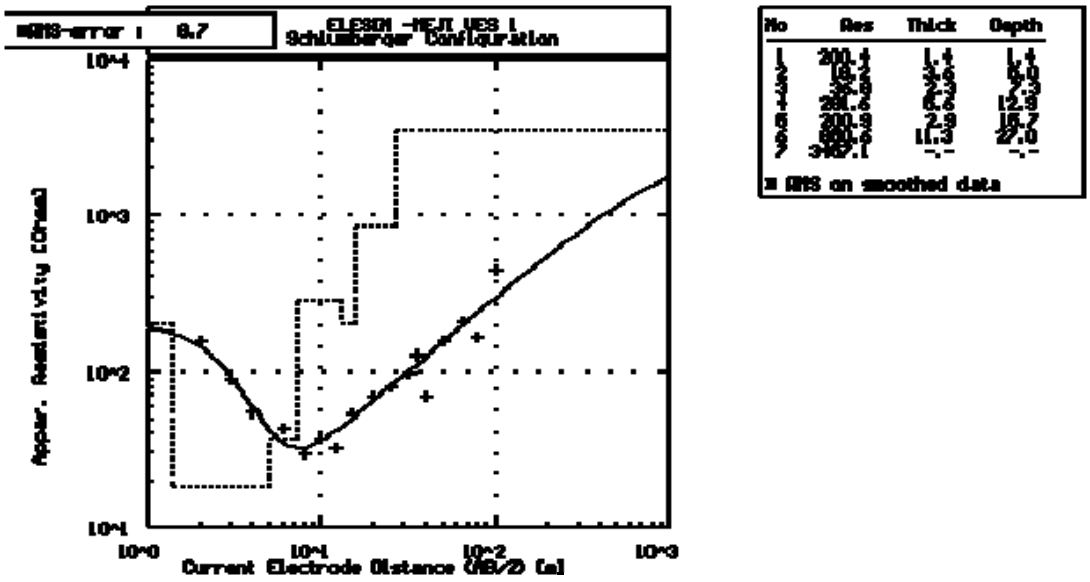
Araromi Owu



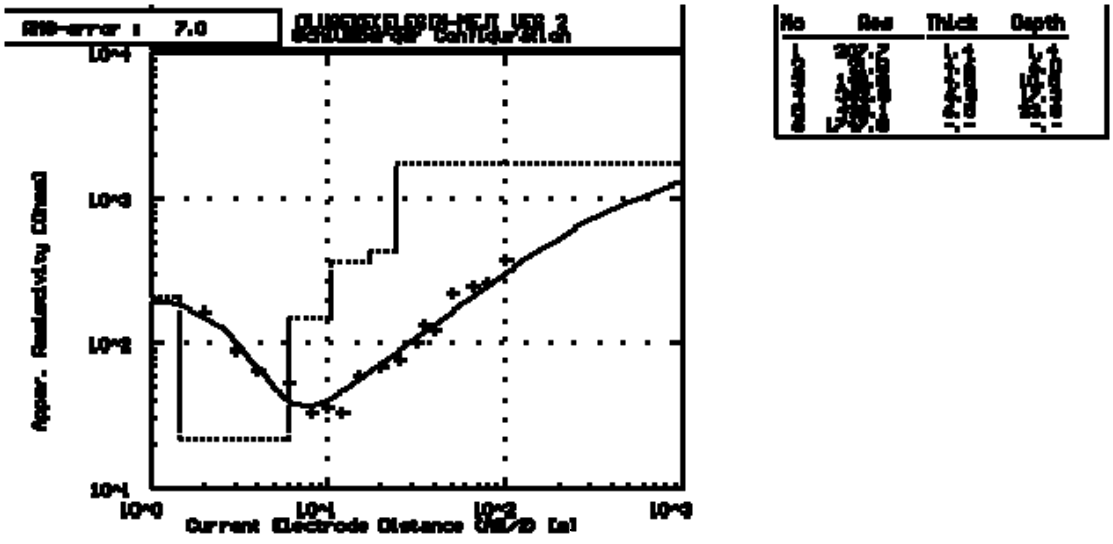
Wakajaye Gbongan Rural VES



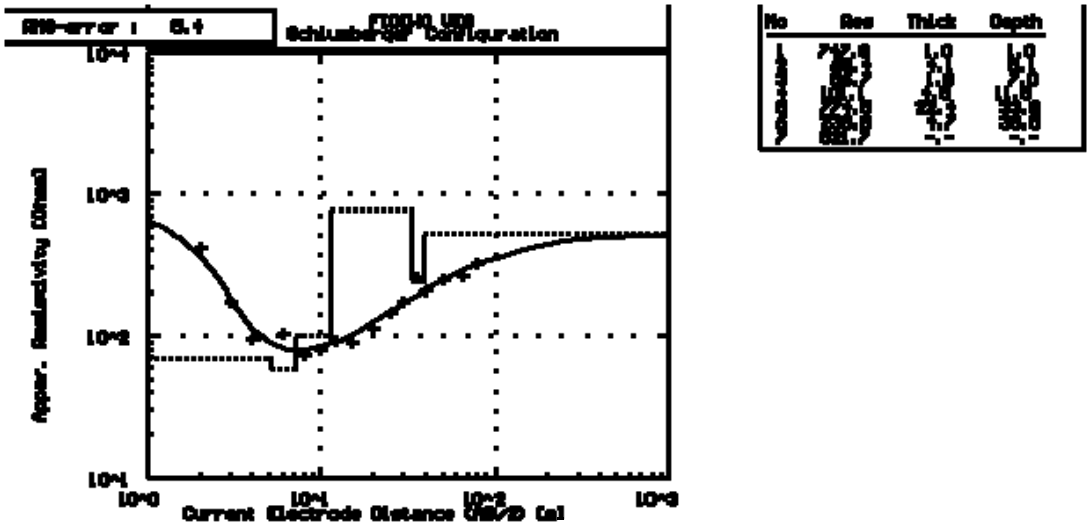
Elesin-meji VES 1=HAKHA



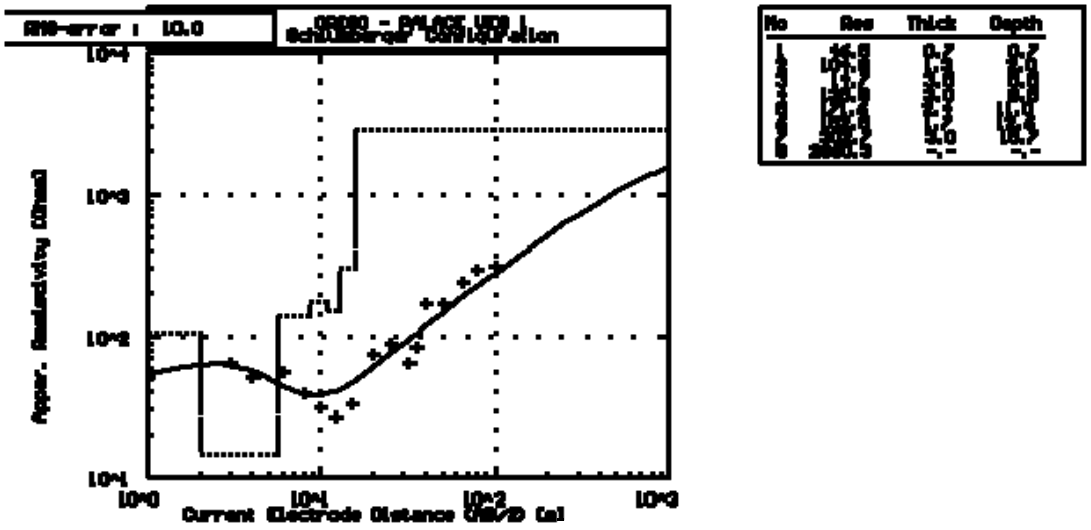
Oluseke(Elesin-mejiVES2)=HAAA



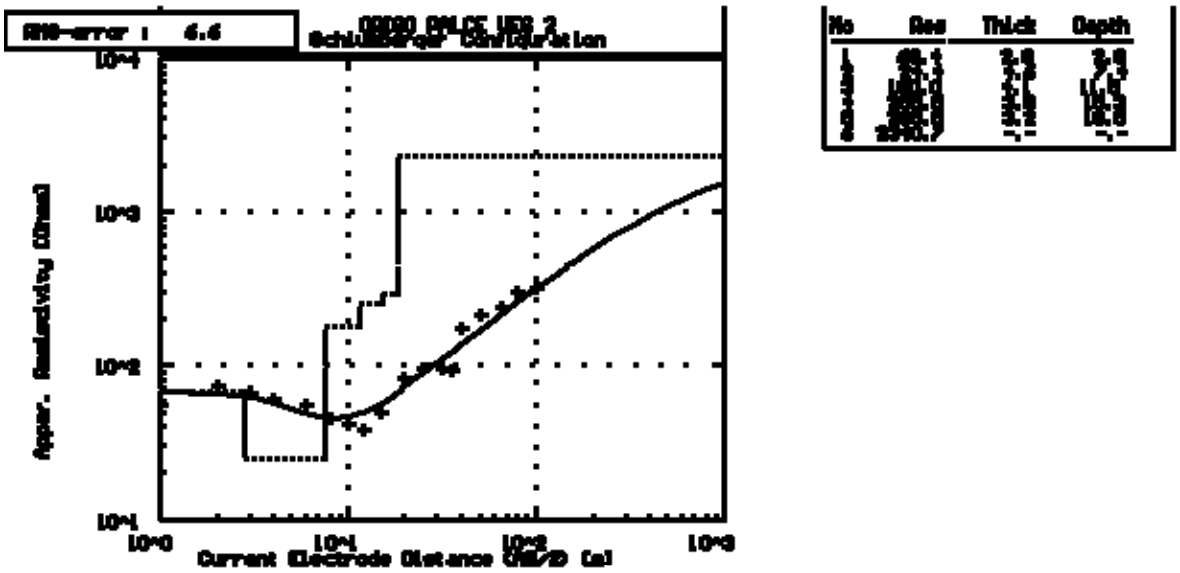
Fidiwo VES



Origo Palace VES 1



Origo Palace VES 2



3.1 Interpretation

For unity school, drilling should reach 28.2m depth.

Olupona,based on the curve(AAA) the yield may not be reliable.

Oke-Eso-omu, drilling must reached the depth of 44.7m

Wakajaye Gbongba, drill depth should be up to 30- 35m.

Orile-owu, drilling should be up to 40m for good yield

Onibepe, drilling should be up to 40m, the point may not be reliable but averagely good

Efunle VES2, drilling to depth of 15m.

Olota VES2, drilling should be 30m or more and the presence of an experienced Hydrogeologist during drilling is very important in order to determine when to terminate drill depth.

Balogun ward, Oju Court Gbongan, drilling should be 15m or more to create a reservoir, the hole should be screen properly to allow good yield.

Elesin meji VES1, drilling should be 27m or more.

Elesin meji VES 2, based on the curve it is not advisable to drill.

Iragberi VES 2 is not advisable to drill.

Oke-Amola, Ode Omu, drilling should not extend beyond 68m; further drilling could render the hole abortive.

4 Conclusion

For every drilling in the study area, a rotary and down the hole hammer (DTHH) should be adopted, the weathered basement zone should be properly screen cased, the boreholes should be drilled down to the fresh bed rock and a hydrogeologist should be present throughout the duration of drilling.

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References

COORAY P.G., (1974) Some Aspects of the Precambrian of Nigeria; A Review; Jour. Min. Geol. Vol. 8 No 1 & 2.

COORAY P.G., (1975) The Charnockitic Rocks of Nigeria; in Studies in Precambrian P 50-73.

COORAY P.G., (1977); Classification of the charnokitic rocks of Nigeria: In Jour. Min. Geol. Vol. 14 No 2 1977.

DOBRIN M.B. (1976) Introduction to Geophysical prospecting (3rd edition): McGraw Hills Books Coy. New York pp. 630.

Jones, H.A. & Hockey, R.D. (1964) The geology of southwestern Nigeria, Lagos, Geol. Surv. Nigeria Bull.,31-87.

Rahaman, M.A. (1975) Review of the basement geology of South-Western Nigeria. In: Geology of Nigeria (ed. by Kogbe, C.A.), 538 Rock View Limited, Nigeria.

ZOH DY, A.A.R, EATS N.G.P & MABEY, D.R., Application of surface Geophysics to Ground Water Investigations in Techniques of Water Resources Investigation of the United State Geological Survey, United States Government Printing Office, Washington.

Appendices

ST No.	AB/2 (m)	ρa (Ohm-m)						
		Efunle VES 1	Efunle VES2	Fidiwo VES	Elesinmeji Ves 1	Elesinmeji VES 2	Olota VES	Olota VES2
1.	1.00	74.14	99.29	606.11	182.15	192.30	41.76	134.81
2	2.0	46.81	58.07	414.75	154.50	164.50	43.37	137.22
3	3.0	42.04	54.33	174.72	89.50	90.30	39.04	120.93
4	4.0	44.93	67.15	95.17	54.10	64.10	33.82	121.26
5	6.0	48.98	77.87	104.25	42.70	52.70	42.70	135.65
6	8.0	50.24	75..36	73.27	29.30	33.30	50.39	117.22
7	10.0	50.24		78.50	37.60	35.70	53.38	119.32
8	12.0	45.21	81.38	90.42	31.65	33.30	67.81	122.06
9	15.0	42.42	70.89	90.13	53.01	59.00	74.22	148.44
10	20.0	50.24	50.24	113.04	69.08	68.20	119.52	138.16
11	25.0	39.27	88.36	147.26	78.54	76.60	127.63	206.17
12	30.0	64.34	64.33	176.43	96.51	100.50	144.72	193.02
13	35.0	62.80	83.73	257.48	125.60	135.80	188.39	188.04
14	40.0	140.74	127.88	208.61	67.86	123.15	218.24	253.84
15	50.0	140.06	186.75	249.00	155.62	221.10	202.31	264.56
16	65.0	288.87	315.13	262.61	210.08	245.30	183.83	315.15
17	80.0	325.00	367.15	321.00	294.07	262.60	260.00	162.50
18	100.0	314.16	493.87		421.04	376.40		376.99

ST No.	B/2(m)	ρa (Ohm-m)						
		Onibepe VES 1	Onibepe VES2	Iragberi VES 1	Iragberi Ves 2	Origo Palace VES 2	Origo palace VES 2	Oke Amola VES
1.	1.00	48.89	51.20	192.37	130.52	50.92	55.60	26.74
2	2.0	50.96	50.70	77.97	85.30	63.49	72.50	26.19
3	3.0	30.58	34.60	74.53	80.40	63.69	65.70	23.48
4	4.0	18.84	18.60	67.15	78.20	51.69	60.30	23.19
5	6.0	15.07	16.70	67.82	52.30	56.52	56.60	18.54
6	8.0	14.65	15.20	54.43	35.70	39.77	45.80	23.02
7	10.0	21.98	22.23	43.96	35.60	31.14	42.30	15.70
8	12.0	31.65	32.70	49.73	40.30	27.13	38.50	27.13
9	15.0	42.41	67.40	68.92	66.30	33.00	50.00	15.91
10	20.0	43.96	68.20	75.36	77.30	75.36	80.60	18.84
11	25.0	70.36	83.40	107.99	115.50	88.36	95.20	29.44
12	30.0	160.85	162.70	112.60	122.30	64.39	94.50	48.28
13	35.0	146.53	150.50	146.53	148.20	83.73	90.60	62.80
14	40.0	150.79	147.50	185.98	167.60	168.39	171.90	52.78
15	50.0	103.74	110.30	186.75	195.30	171.18	211.90	93.38
16	65.0	105.05	120.50	183.83	206.70	236.35	236.50	78.78
17	80.0	130.00	145.60	162.50	198.70	295.25	298.40	116.67
18	100.0		276.40	314.16	320.60	314.16	317.5	

ST No.	AB/2 (m)	ρa (Ohm-m)						
		Oke Eso Odeomu VES	Onibepe VES2	Orile Owu VES	Unity School VES	Wakajaye (Gbongan VES	Araromi Owu VES 2	Balogun Ward Gbongan VES
1.	1.00	33.09	19.86	37.93	1310.36	77.55	33.16	79.81
2	2.0	51.78	31.17	35.69	653.76	37.21	28.87	83.19
3	3.0	48.59	30.50	40.13	233.42	28.67	22.93	53.24
4	4.0	44.93	28.99	45.41	155.08	27.05	21.26	45.41
5	6.0	48.98	32.66	66.57	151.98	38.94	30.14	50.24
6	8.0	31.40	31.40	69.08	146.53	43.96	33.49	46.05
7	10.0	18.84	34.54	69.08	135.02	50.24	40.82	43.96
8	12.0	41.44	49.73	72.33	149.19	67.81	58.27	54.25
9	15.0	37.11	40.65	83.06	249.17	70.68	70.69	47.96
10	20.0	37.68	62.80	81.64	213.52	113.04	100.48	50.24
11	25.0	49.06	58.88	88.31	412.34	147.19	147.19	49.05
12	30.0	41.82	48.26	96.33	352.56	176.94	209.11	96.51
13	35.0	54.22	62.80	125.60	296.40	146.53	252.00	128.67
14	40.0	82.44	130.80	103.01	449.89	155.80	278.96	140.74
15	50.0	43.58	124.45	124.50	373.50	249.00	389.06	311.25
16	65.0	70.09	236.35	131.31	652.79	210.12	315.13	393.92
17	80.0	97.50	260.00		1244.76	260.00	357.00	487.50
18	100.0		376.99					

Fault effect at Volumetric modeling in shadegan oilfield using RMS softwar

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Abstract

The Shadgan petroleum oil field located in Dezful Embayment is a symmetrical anticline with 23.5Km length and 6.5Km width in the Asmari top horizon. The field trend is similar the regional Zagros trend.The aim of the present study is to fault 3D-modeling and distribution of fluids of the Asmari reservoir using RMS software. The computer program utilizes of advanced mathematical and geostatical function to provide 3D insight of different reservoir properties such as structure and geology, dynamic and volumetric fluids. Structural modeling is the first stage in modeling procces . these stage design reservoir geometry with fault and zones. To calculate in situ oil volume, fluid and reservoir data are input data to software. This model constructed by help of critical limit concerned porosity, water saturation and shale ratio. Generally, with adjustment of fault and volumes models apparent , faults effect to the petrophysical properties quality and rate of replacement fluids of reservoir. Generally, evaluation of the reservoir, fault effects and oil volume determination are the main out put results of RMS software. [New York Science Journal. 2008;1(4):36]. (ISSN: 1554-0200).

贝尔不等式与布尔代数

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内容提要：对于量子力学来说，经典概率论是不必要的。但是，如果有人硬是把经典概率论应用于微观物理学将会得到什么样的结果呢？是一定会与量子力学相矛盾呢？还是相反，在某种条件下经典概率论也会与量子力学殊途同归呢？迄今为止，没有人考察过这一问题，从而与该问题相关的领域在微观物理学形成了一个盲区。当问题涉及量子力学与经典物理学之间的关系时，人们就难免会在这个盲区里误入歧途，贝尔定理就是一个典型的例子。

贝尔定理的证明多种多样，但万变不离其宗，这些证明都用到经典概率论，特别是用到其中的关于“联合概率”的运算规则，这些规则是否适用于贝尔所考察的过程的问题，刚好落在这个微观物理学的盲区之内。人们在这里不自觉地遵循如下准则：当他们从量子力学的角度考虑问题时，默认这些规则全都不适用于微观过程，当他们从定域隐变量理论的角度考虑问题时，又默认这些规则全都适用于微观过程。贝尔定理就是这种荒谬的准则的产物。

在贝尔定理的证明中，那些被认为表现了“定域隐变量理论”特征的命题，可以归结为自旋相关函数的一个“经典表达式”，但绝不是这个表达式导致贝尔不等式。理由有二：第一，从这个表达式可以导出量子力学的自旋相关公式；第二，在导出贝尔不等式时，还用到了一个隐蔽的命题，从而用到了经典概率论的事件运算规则，即布尔代数的规则。由此得出结论：贝尔不等式之所以与量子力学相矛盾，既与定域性原理无关，也与隐变量理论无关；只不过是因为人们在推导它时，曾经对“非布尔”的微观事件空间应用了布尔代数的运算规则。

[New York Science Journal. 2008;1(4):37-46]. (ISSN: 1554-0200).

关键词：贝尔不等式；定域性原理；隐变量理论；自旋相关公式；经典概率论；联合概率；布尔代数；概率运算；事件运算；量子力学

1. 引言

1964 年，J. S. 贝尔在一份名为《物理》的杂志的创刊号上，发表了题为《论 EPR 佯谬》的论文，提出了“贝尔定理”，其原始形式是：

“在一个在量子力学上增添一些参量以确定单次测量的结果而又不改变其统计预言的理论中，必须有某种机制，使得一个测量仪器的安置会影响另一个仪器的读数，不论它们相距多么遥远。此外，所用的信号必须是瞬时传播的，因此这样的理论不可能是洛仑兹不变的。”

在这里，所谓“在量子力学上增添一些参量以确定单次测量的结果的理论”就是“隐变量理论”。另一方面，按照“定域性原理”，当两个测量仪器相距足够远时，一个测量仪器的安置

不可能影响另一个仪器的读数。因此，贝尔的上述结论可表成：“如果一个隐变量理论不改变量子力学的统计预言，就一定会违背定域性原理。”或者说：“如果一个隐变量理论遵循定域性原理，就一定会改变量子力学的统计预言。”人们把遵循定域性原理的隐变量理论称为“定域隐变量理论”，于是，贝尔定理最终表成现在常见的形式：“任何定域隐变量理论不可能重复量子力学的全部统计预言。”

因为“实在论”被认为是隐变量理论的哲学前提，从而所谓“定域实在论”（满足“定域性原理”的“实在论”）被认为是“定域隐变量理论”的哲学前提。因此，人们根据贝尔定理得出结论：量子力学与“定域实在论”相互排斥。同时人们还得出结论：可以用实验来判断量子力学与“定域实在论”孰是孰非，从而在物理学史上，开了一个通过物理实验来检验哲学观点的先例。

因此，贝尔定理对物理学的影响极为深远，1973 年诺贝尔物理奖得主约瑟夫森把它称为“物理学中最重要的新进展”，物理哲学家斯塔普则把它称作“科学中最深刻的发现”。

在本文中，我们将给出贝尔不等式的一种新推导，并重新认识贝尔定理。

2. 自旋相关函数的经典表达式

量子力学伴随着一种新的概率计算程式，对应地，原来的概率计算程式就被称为“经典概率论”。对于量子力学来说，经典概率论是不必要的。但是，如果有人硬是把经典概率论应用于微观物理学将会得到什么样的结果呢？是一定会与量子力学相矛盾，还是相反，在某种条件下经典概率论也会与量子力学殊途同归呢？这个问题并不艰深，可是由于人们一直不屑于思考它，迄今为止，与这一问题相关的领域还是微观物理学的一个盲区。对于量子力学自身的发展来说，这个盲区的存在并不碍事，但当问题涉及量子力学与经典物理学之间的关系时，人们就难免会在这个盲区里误入歧途，贝尔定理就是一个典型的例子。

贝尔定理的证明多种多样，但万变不离其宗，这些证明都用到经典概率论，特别是用到其中的关于“联合概率”的运算规则，这些规则既不属于量子力学，也不是定域隐变量理论的组成部分。因此，在没有弄清楚这些规则是否适用于微观过程之前，无论从量子力学出发还是从定域隐变量理论出发，都不能应用它们。不幸的是，关于这些运算规则是否适用微观过程的问题，刚好落在这个微观物理学的盲区之内。因此贝尔定理的研究引导物理学家们走进了该盲区，人们在这里不自觉地遵循如下准则：当他们从量子力学的角度考虑问题时，默认这些规则全都不适用于微观过程，当他们从定域隐变量理论的角度考虑问题时，又默认这些规则全都适用于微观过程。为了澄清由这一荒谬的准则所引起的混乱，现在我们就来考察经典概率论的运算规则是否适用于微观过程的问题，先考察一个特殊的联合概率。

实验证明：如果一个电子束（或其他自旋 1/2 的粒子束）L经过一个磁场方向为$\mathbf{a}$的斯特恩 - 革拉赫装置G_a，将被分裂为两束，其中一束向$\mathbf{a}$方向偏转，另一束则向$-\mathbf{a}$方向偏转。这个实验事实表明：电子自旋（电子的角动量）沿磁场方向的投影只能取两个值，以 $\hbar/2$ 为单位，这两个值分别是 1 和–1。用σ_a表示电子束L中的某一电子的自旋沿$\mathbf{a}$方向的投影，则测量的结果要么是

$\sigma_a = 1$，要么是 $\sigma_a = -1$。其中测量结果为$\sigma_a = 1$ 的诸电子形成一个新的电子束A，让它再经过一个磁场方向为**b**的斯特恩 - 革拉赫装置G_b，则它将再次分裂为两束，其中一束的自旋的测量值为 $\sigma_b = 1$；另一束为 $\sigma_b = -1$。如果电子束A有N个电子，其中有pN个在G_b中的测量结果为 $\sigma_b = 1$，则实验证明，当N足够大时，p的取值与N无关。根据概率的频率定义，p是A中的某一单个电子在其初态是 $\sigma_a = 1$ 的条件下，经过G_b，达到终态 $\sigma_b = 1$ 的概率，这是一个“条件概率”，我们把它记作$\Pr(\sigma_b = 1|\sigma_a = 1)$。一般地说，对于 $x,y \in \{1, -1\}$（即x与y要么是 1 要么是–1），$\Pr(\sigma_b = y|\sigma_a = x)$ 是A中的单个电子从 $\sigma_a = x$态“跃迁”至 $\sigma_b = y$态的概率。

设e是电子束L中的单个电子，它在G_a中获得测量值 $\sigma_a = 1$ 的概率依赖于电子束L的性质，因此这个概率应写作$\Pr(\sigma_a = 1|L)$。在一定条件下，表达式中的符号L可以略去，这个概率就被略写作$\Pr(\sigma_a = 1)$。

用X表示事件“e在G_a中获得测量值 $\sigma_a = 1$”；Y表示事件“e在G_b中获得测量值 $\sigma_b = 1$”，则根据概率的乘法公式，在略去符号L的前提下，积事件X · Y表示事件“e在G_a中获得测量值 $\sigma_a = 1$ 并且在G_b中获得测量值 $\sigma_b = 1$”，其概率为

$$\Pr(\sigma_a = 1, \sigma_b = 1) = \Pr(\sigma_a = 1) \cdot \Pr(\sigma_b = 1|\sigma_a = 1)。$$

一般地说，对于 $x,y \in \{1, -1\}$，概率的乘法公式表成

$$\Pr(\sigma_a = x, \sigma_b = y) \equiv \Pr(\sigma_a = x) \cdot \Pr(\sigma_b = y|\sigma_a = x)。 \quad (1)$$

这里的$\Pr(\sigma_a = x, \sigma_b = y)$ 就是我们要考察的联合概率，因为$\Pr(\sigma_a = x)$ 有一个隐蔽的初始条件L；这个联合概率也是如此。

在微观物理学中，联合概率$\Pr(\sigma_a = x, \sigma_b = y)$ 是没有定义的，我们可以把(1)式当作它的“操作定义”。

贝尔定理的中心点是贝尔不等式，而贝尔不等式是一个关于“自旋相关函数”的公式。下面，我们先给出该函数的定义，再为该函数给出一个人们在实践中反复应用，但却始终没有明确表述的“经典表达式”。

玻姆曾经提出如下的理想实验：一个电子源不断发射成对的电子，每对电子都处于“单态”，即总自旋为零的状态。设e和e’ 是其中的一对电子，e 向右飞遇到磁场方向为**a**的斯特恩 - 革拉赫装置，获得自旋（分量）的测量值σ_a，与此同时，e’ 向左飞遇到装置磁场方向为**b**的装置获得自旋的测量值τ_b。在这个实验中，σ_a和 τ_b可以同时测量，因此，如果我们将这个实验重复N次，则对于给定的 $x,y \in \{1, -1\}$，可以记录下其中的测量结果为 $\sigma_a = x, \tau_b = y$ 的实验的次数N_{xy}。根据概率的频率定义，当N足够大时，同时测量 σ_a和 τ_b时获得测量结果为 $\sigma_a = x, \tau_b = y$ 的概率为

$$\Pr(\sigma_a = x, \tau_b = y) = \frac{N_{xy}}{N}。$$

下面，我们规定$\sum_x$表示对 $x \in \{1, -1\}$取和，$\sum_{xy}$ 表示对 $x,y \in \{1, -1\}$取和，$\sum_{xyz}$ 表示对 $x,y,z \in \{1, -1\}$取和。借助于上面的概率，可以定义σ_a和 τ_b的乘积的平均值

$$P(\mathbf{a}, \mathbf{b}) \equiv \sum_{xy} xy \Pr(\sigma_a = x, \tau_b = y), \quad (2)$$

$P(\mathbf{a}, \mathbf{b})$ 就是e和e’ 的“自旋相关函数”。这个定义可以用测量的数据表成

$$\mathrm{P}(\mathbf{a},\mathbf{b}) \equiv \frac{1}{\mathrm{N}}\sum_{xy} xy\,\mathrm{N}_{xy},$$

从而是“自旋相关函数”的原始定义。

实验证明：如果$\mathbf{b}=\mathbf{a}$，则$\tau_b=-\sigma_a$。这一结果可表成

$$\tau_b=-\sigma_b。 \tag{3}$$

应用经典概率论，从(3)式可以得出

$$\sum_{xy} xy\,\Pr(\sigma_a=x,\ \tau_b=y) = -\sum_{xy} xy\,\Pr(\sigma_a=x,\ \sigma_b=y)。 \tag{4}$$

(2)式与(4)式给出

引理 1：任意给定单位矢量 **a** 和 **b**，对于由(1)式给出的联合概率，有

$$\mathrm{P}(\mathbf{a},\mathbf{b}) = -\sum_{xy} xy\,\Pr(\sigma_a=x,\ \sigma_b=y)。$$

这就是我们所说的自旋相关函数的“经典表达式”。为了重新考察贝尔定理，我们首先要弄清这个表达式是否适用于微观过程。

虽然$\Pr(\sigma_a=x,\ \sigma_b=y)$的取值与L有关，但根据引理 1，我们可以引进一个与L无关的函数

$$\mathrm{E}(\mathbf{a},\mathbf{b}) \equiv \sum_{xy} xy\,\Pr(\sigma_a=x,\ \sigma_b=y)。 \tag{5}$$

它与自旋相关函数的关系是

$$\mathrm{P}(\mathbf{a},\mathbf{b}) = -\mathrm{E}(\mathbf{a},\mathbf{b})。 \tag{6}$$

3. 两个定理

贝尔曾经证明：“贝尔不等式与量子力学不相容”，这一命题的正确性是不容置疑的，问题在于从这一命题是否真的能得出贝尔定理，即是否真的能得出定域隐变量理论与量子力学不相容。在这里，我们将对贝尔不等式给出一种新的推导，从这一推导可以看出：在贝尔导出贝尔定理过程中，实际上用到了两个前提，一个是显露的，另一个是隐蔽的。显露的前提就是所谓“定域隐变量理论”，它的作用实际上可以由一个自旋相关函数的“经典表达式”来取代，而从这一前提也可以导出量子力学的自旋相关公式。由此可见，那个隐蔽的前提才是导致贝尔不等式的真正元凶。

实验证明

A：对于任意单位向量**a**和**b** 及其夹角$\gamma=\angle(\mathbf{a},\mathbf{b})$，有：

$$\Pr(\sigma_b=1|\sigma_a=1)=\Pr(\sigma_b=-1|\sigma_a=-1)=\cos^2(\gamma/2);$$

$$\Pr(\sigma_b=1|\sigma_a=-1)=\Pr(\sigma_b=-1|\sigma_a=1)=\sin^2(\gamma/2)。$$

由于$\sigma_a=1$与$\sigma_a=-1$是两个相互对立的事件，经典概率论给出：

$$\Pr(\sigma_a=1|\mathrm{L})+\Pr(\sigma_a=-1|\mathrm{L})=1,$$

它可以略写为

$$\Pr(\sigma_a=1)+\Pr(\sigma_a=-1)=1。 \tag{7}$$

再把$\Pr(\sigma_a=x,\ \sigma_b=y)$略写成$f(x,y)$，则根据(1)式、(7)式与命题A，容易证明：

$$f(1,1)-f(-1,1)-f(1,-1)+f(-1,-1) = \mathbf{a}\cdot\mathbf{b}。$$

另一方面，根据定义，我们有：

$$\sum_{xy} xy\,f(x,y) \equiv f(1,1)-f(-1,1)-f(1,-1)+f(-1,-1)。$$

上面诸式给出

引理 2：任意给定单位矢量 **a** 和 **b**，对于由(1)式定义的联合概率，有

$$\sum_{xy} xy \Pr(\sigma_a = x, \sigma_b = y) = \mathbf{a}\cdot\mathbf{b}。$$

引理 1 与引理 2 给出量子力学的自旋相关公式

$$P(\mathbf{a},\mathbf{b}) = -\mathbf{a}\cdot\mathbf{b}。$$

在上面的推导中，引理 2 是从命题 A、(1)式和(7)式导出的，命题 A 是一个实验事实，而(7)式不证自明，因此我们证明了

定理 1：从(1)式与引理 1 的合取，可以导出量子力学的自旋相关公式。

定理 1 表明(1)式与引理 1 的合取与量子力学相容。从而得出结论：(1)式与引理 1 都与量子力学相容，即：

第一，联合概率 $\Pr(\sigma_a = x, \sigma_b = y)$ 的操作定义与量子力学相容。

第二，自旋相关函数的经典表达式与量子力学相容。

另一方面，经典概率论又给出：

$$\Pr(\sigma_a = x, \sigma_b = y) = \sum_z \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z); \tag{8}$$

$$\Pr(\sigma_a = x, \sigma_c = z) = \sum_y \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)。 \tag{8a}$$

$$\Pr(\sigma_b = y, \sigma_c = z) = \sum_x \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z); \tag{8b}$$

把 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$ 略写作 $F(x,y,z)$，考虑到概率不能取负值，则有：

B：任意给定单位矢量 $\mathbf{a},\mathbf{b},\mathbf{c}$ 和 $x,y,z\in\{1,-1\}$，存在函数 $F(x,y,z)\geqslant 0$，使得

$$\Pr(\sigma_a = x, \sigma_b = y) = \sum_z F(x,y,z);$$

$$\Pr(\sigma_a = x, \sigma_c = z) = \sum_y F(x,y,z);$$

$$\Pr(\sigma_b = y, \sigma_c = z) = \sum_x F(x,y,z)。$$

应用(5)式，可以从命题 B 得到

C：任意给定单位矢量 $\mathbf{a},\mathbf{b},\mathbf{c}$，存在函数 $F(x,y,z)\geqslant 0$，使得

$$E(\mathbf{a},\mathbf{b}) = \sum_{xyz} xy\,F(x,y,z),$$

$$E(\mathbf{a},\mathbf{c}) = \sum_{xyz} xz\,F(x,y,z),$$

$$E(\mathbf{b},\mathbf{c}) = \sum_{xyz} yz\,F(x,y,z)。$$

从命题 C 容易导出不等式

$$|\mathrm{E}(\mathbf{a},\mathbf{b}) - \mathrm{E}(\mathbf{a},\mathbf{c})| \leqslant 1 - \mathrm{E}(\mathbf{b},\mathbf{c})。 \tag{9}$$

(6)式与(9)式给出贝尔不等式：

$$|\mathrm{P}(\mathbf{a},\mathbf{b}) - \mathrm{P}(\mathbf{a},\mathbf{c})| \leqslant 1 + \mathrm{P}(\mathbf{b},\mathbf{c})。$$

从而我们证明了

定理 2：从引理 1 和命题 B 可导出贝尔不等式。

考虑到引理 1 与量子力学相容，而贝尔不等式与量子力学不相容，从定理 2 可得出结论：命题 B 是贝尔不等式唯一的前提。于是我们得出结论：命题 B 与量子力学不相容。

4. 事件运算的布尔代数

如果说从(1)式与引理 1 导出量子力学的自旋相关公式，是经典概率论与量子力学殊途同归的一个例子；那么，命题 B 与量子力学不相容则是经典概率论与量子力学相矛盾的一个例子。第一个例子表明，经典概率论的某些运算规则适用于微观过程，而第二个例子则表明并非经典概率论的所有运算规则都适用于微观过程。有待解决的问题是：在经典概率论中，哪些运算规则适用于微观过程，哪些运算规则不适用于微观过程。

我们已经看到，命题 B 是贝尔不等式唯一的前提，因此这一问题归结为弄清楚命题 B 有甚么毛病。

命题 B 可推导如下：

第一步，定义联合概率 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$。

第二步，从概率的频率定义得到(8)式：

$$\Pr(\sigma_a = x, \sigma_b = y) = \sum_z \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)。$$

第三步，适当交换 $\sigma_a = x$， $\sigma_b = y$ 和 $\sigma_c = z$ 的次序，从(8)式得到：

$$\Pr(\sigma_a = x, \sigma_c = z) = \sum_y \Pr(\sigma_a = x, \sigma_c = z, \sigma_b = y);$$

$$\Pr(\sigma_b = y, \sigma_c = z) = \sum_x \Pr(\sigma_b = y, \sigma_c = z, \sigma_a = x)。$$

第四步，根据经典概率论的公式

$$\begin{aligned}\Pr(\sigma_a = x, \sigma_c = z, \sigma_b = y) &= \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z);\\ \Pr(\sigma_b = y, \sigma_c = z, \sigma_a = x) &= \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z),\end{aligned} \tag{10}$$

从第三步的两个等式得到(8a)式与(8b)式。

第五步，从(8)式、(8a)式与(8b)式，以及 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z) \geqslant 0$ 得到命题B。

下面，我们逐步地审查这些步骤。

比照(1)式，联合概率$\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$ 可以定义如下：

如果 $\sigma_a = x$、$\sigma_c = z$和 $\sigma_b = y$是三个相继测量的结果，即一个有N个电子电子束通过一个磁场方向为**a**的斯特恩 - 革拉赫装置G_a时，有N_x个电子的自旋测量值为 $\sigma_a = x$，让这N_x个电子继续

通过一个磁场方向为**c**的斯特恩 - 革拉赫装置G_c，设有N_{xz}个电子的自旋测量值为 $\sigma_c = z$，让这N_{xz}个电子继续通过一个磁场方向为**b**的斯特恩 - 革拉赫装置G_b，设有N_{xyz}个电子的自旋测量值为 $\sigma_b = y$，则当N足够大时，我们可以定义

$$\Pr(\sigma_c = z|\sigma_a = x) = N_{xz}/N_x; \qquad \Pr(\sigma_b = y|\sigma_c = z) = N_{xyz}/N_{xz};$$

$$\Pr(\sigma_a = x) = N_x/N; \qquad \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z) = N_{xyz}/N。$$

上面诸式给出如下操作定义：

$$\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z) \equiv \Pr(\sigma_a = x) \cdot \Pr(\sigma_c = z|\sigma_a = x) \cdot \Pr(\sigma_b = y|\sigma_c = z)。$$

由于(1)式给出的 $\Pr(\sigma_a = x, \sigma_b = y)$ 的操作定义与量子力学相容，上面给出的 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$ 的操作定义也不会与量子力学相矛盾。但是，对于这一操作定义，(8)式显然不成立。

现在考虑另一过程：还是考虑上面的三个斯特恩 - 革拉赫装置，其中G_a打开一个通道，通过它的诸电子获得自旋 $\sigma_a = 1$，G_b也打开一个通道，通过它诸电子获得自旋 $\sigma_b = 1$，G_c则同时打开两个通道。设有N个电子进入G_a，其中有N_1 个电子在G_c中获得 $\sigma_c = 1$并逸出G_b，有N_2 个电子在G_c中获得 $\sigma_c = -1$并逸出G_b。设e是进入G_a的N个电子之一，则按照概率的频率定义，当N足够大时，e在三个斯特恩 - 革拉赫装置中依次获得自旋 $\sigma_a = 1$、 $\sigma_c = 1$、 $\sigma_b = 1$的概率为

$$\Pr(\sigma_a = 1, \sigma_b = 1, \sigma_c = 1) = N_1/N;$$

依次获得自旋 $\sigma_a = 1$、 $\sigma_c = -1$、 $\sigma_b = 1$的概率为

$$\Pr(\sigma_a = 1, \sigma_b = 1, \sigma_c = -1) = N_2/N;$$

另一方面，实验证明，如果上面的实验中的其他条件不变，只去掉斯特恩 - 革拉赫装置G_c，让G_b直接连在G_a之后，则 e在G_a中获得自旋 $\sigma_a = 1$，在G_b中获得自旋 $\sigma_b = 1$的概率为

$$\Pr(\sigma_a = 1, \sigma_b = 1) = (N_1 + N_2)/N,$$

从而有

$$\Pr(\sigma_a = 1, \sigma_b = 1) = \sum_z \Pr(\sigma_a = 1, \sigma_b = 1, \sigma_c = z)。$$

一般地说，我们就得到(8)式。

诚然，在 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$ 的操作定义中，G_c的两个通道是轮流打开的，而(8)式右边的同一概率表达式却要求G_c的两个通道同时打开，从而是不能测量的。尽管如此，它还是可以算作是 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$ 的另一种定义。于是我们得出结论：“可以定义联合概率 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$，使得(8)式成立。”这样，推导命题C的第一步与第二步就同时通过了。

第三步也没有问题，(8)式是一个恒等式，在给定的交换之后确实仍然成立。

然而，第四步就大错而特错了！无论采用 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$ 的操作定义还是(8)式所要求的定义，(10)式都肯定不成立。为什么呢？

经典概率论立足于两大基石：概率的频率定义与事件运算的布尔代数规则。概率的频率定义乃是概率这一概念所固有的，它被公认为对于微观过程仍然适用，但事件运算的布尔代数规则却并非如此。

对于经典概率论，事件乘法的交换律

$$A \cdot B = B \cdot A \tag{11}$$

成立。但(11)式也适用于微观世界吗？

让我们考察(1)式的如下特例

$$\Pr(\sigma_a = 1, \sigma_b = 1) \equiv \Pr(\sigma_a = 1) \cdot \Pr(\sigma_b = 1 | \sigma_a = 1)。 \tag{12}$$

适当改变其中的符号可以得到

$$\Pr(\sigma_b = 1, \sigma_a = 1) \equiv \Pr(\sigma_b = 1) \cdot \Pr(\sigma_a = 1 | \sigma_b = 1)。 \tag{13}$$

用A表示 $\sigma_a = 1$，B表示 $\sigma_b = 1$，则事件运算规则$A \cdot B = B \cdot A$给出概率公式

$$\Pr(\sigma_b = 1, \sigma_a = 1) = \Pr(\sigma_a = 1, \sigma_b = 1)。 \tag{14}$$

但是，根据(1)式的操作定义，(12)式与(13)式表示迥然不同的过程，因此(14)式显然不成立，在这种意义下，(11)式不成立。

对于经典概率论，“积事件”$A \cdot B$ 表示“A 事件与 B 事件都发生”，而 $B \cdot A$ 表示“B 事件与 A 事件都发生”，这两个命题等价。但是，如果定义“积事件”$A \cdot B$ 表示“A 事件先发生而 B 事件后发生”，则 $B \cdot A$ 表示“B 事件先发生而 A 事件后发生”，这两个命题就不再等价。我们满可以保留概率的频率定义而适当修改经典概率论的事件运算的规则来建立某种“非布尔的”概率论，而把量子力学的概率运算规则看作其中的一种。

诚然，这是一个离题太远的数学问题，我们只需记住如下要点就够了：在微观世界可以定义(1)式那样的联合概率，并且允许各种概率运算，但不能任意应用布尔代数的事件运算规则。特别是，(11)式不成立。同样，公式

$$(A \cdot B) \cdot C = (A \cdot C) \cdot B。$$

也不成立。导出(10)式时，刚好用到(11)式和上式。因此，(10)式肯定不成立。

既然导出命题 B 的第四步曾用过(10)式，命题 B 的整个推导就是非法的，而贝尔不等式又来自命题 B，可见贝尔不等式的推导也是非法的。这样，我们就不必惊讶贝尔不等式与量子力学相矛盾，也不必惊讶它与实验结果不符了。

一般地说，对于微观过程，事件运算不遵循布尔代数的规则，换句话说，微观事件的事件空间是“非布尔的”。贝尔不等式的推导之所以非法，就是因为对“非布尔的”微观事件空间应用了布尔代数的规则。

5. 一个未证明的命题

由于量子力学的自旋相关公式与贝尔不等式都以引理 1 为前提，对于上世纪 70 年代的那些检验贝尔不等式的实验来说，这个引理不是被检验的对象。另一方面，证明这个引理的关键的前提是(4)式，而(4)式又容易被人认为是不证自明的：人们认为，根据实验事实 $\tau_b = -\sigma_b$，我们可以在 $\Pr(\sigma_a = x, \tau_b = y)$ 中把 $\tau_b = y$ 换成 $\sigma_b = -y$，从而得到

$$\Pr(\sigma_a = x, \tau_b = y) = \Pr(\sigma_a = x, \sigma_b = -y), \tag{15}$$

于是立刻得到(4)式。

但实际上问题不那么简单，(15)式的两边表示不同的过程：左边涉及两个电子；右边则只

涉及一个电子。左边涉及同时发生的两个事件，其物理意义不容置疑；右边则涉及先后发生的两个事件，我们仅能给出其操作定义。更糟糕的是：右边有一个隐蔽的初始条件而左边却没有。对于这样含义迥然不同的两个概率表达式，像上面那样的“替换”运算是相当可疑的。

可以证明，(15)式并不成立而(4)式却确实成立。在这里，我先不给出这一证明。原因有二：第一，这一证明极为冗长而又曲折，远不是引人入胜的，我担心读者没有耐心读它；第二，由于我对贝尔定理的看法冒犯权威，难免受到谴责。但是，如果有一天我的看法得到了公认，我又免不了从另一方面受到谴责，人们会说我的看法“没有任何新内容，它的全部公式与命题都只不过把别人的东西拿来改头换面而已。”明察秋毫的批评家们将揭露：文中有某一句话与张三说过的话雷同（至于这句话与我的证明有没有关系，倒是不必深究的），或者，文中有三两句话与李四说过的话意思相近，等等。由此就无情地得出结论：除了剽窃和故弄玄虚以外，我的看法一无是处。与其到那时我走投无路，倒不如今天留一个心眼，把这个关键的证明先装在口袋里，到时候我虽然铁定是剽窃者，但至少还拥有对于这个证明的优先权。

6. 结束语

我们已经看到，贝尔不等式起源于事件运算的布尔代数规则，它既与定域性原理无关，也与隐变量理论无关。因此，上世纪 70 年代的那些检验贝尔不等式的实验，只不过再一次确认“微观过程的事件空间是非布尔的”，这一工作似乎很难说是一个“物理学中最重要的进展”，更难说是一个“科学中最深刻的发现”。

Bell’s Inequality and Boolean algebra

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Abstract: As it is known that classical probability theory is unnecessary for quantum mechanics, but another problem remains to be solved: how goes it if applying classical probability to micro processes. It is sure to obtain some conclusion in conflict with quantum mechanics; or quite the reverse, from classical probability we will reach the same goal herein as quantum mechanics? Up to now, this problem has never been examined, and thereby the field it concerning forms a blind area in micro physics. When the question involves the relation between classical physics and quantum physics, it is hard to avoid going astray in this blind area. Bell’s theorem is just a typical example herein.

Despite for Bell’s theorem the proofs are varied, the same essential character remains. All of these proofs the laws of classical probability theory, specially, the laws of unite probabilities, has used. The question whether these laws suitable for the process that Bell consider exactly falls on the above blind area. Herein quantum physicists obey consciously the following norm: They tacitly approve that all these laws are unsuitable for micro processes when starting from quantum mechanics, and acquiesce those are suitable when starting from local hidden variable theory. Bell’s theorem is just a product of such an absurd norm.

In the proof of Bell's inequality, the theses, which characterize, as generally believed, local hidden variable theory, can be summed up as a classical expression of the spin correlation function. But this expression never leads to Bell's inequality for the following reasons: Firstly, from it we can derive the spin correlation function expression in quantum mechanics. Secondly, in the course to derive Bell's inequality, a proposition originating from Boolean algebra rules in classical probability theory is used unawarely. From the above two reasons it is concluded that Bell's inequality originates from the step applying Boolean algebra rules on the non-Boolean micro event space, and it is related neither to locality nor to hidden variables.

Key words: Bell's inequality; locality principle; hidden variable theory; spin correlation formula; classical probabilistic theory; probability operations; event operations; Boolean algebra; quantum mechanics

前人对贝尔不等式的误解

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内容提要：贝尔对自己的工作有两点误解：第一，贝尔用以导出贝尔不等式的隐变量理论具有极为特殊的性质：它原封不动地保留了全部经典概率论的运算规则，贝尔却把这种理论当成一般的“定域隐变量理论”。第二，当贝尔从他的隐变量理论导出贝尔不等式时应用了两个命题，他把其中之一理解为“定域隐变量理论”的特征，而实际上导出贝尔不等式的却是另一命题。

维格纳在 1970 年曾给出对贝尔定理的“最简捷的”证明。他用一个“联合概率”的表达式取代了贝尔的“自旋相关函数”。他的思路是：先导出两个关于该联合概率的命题，一个表现量子力学的特征，另一个表现定域隐变量理论的特征，然后把贝尔定理的证明归结为证明这两个命题不能同时成立。这个证明本来可以揭示贝尔定理的错误，可惜维格纳却以为自己通过另一途径证明了贝尔定理。从物理的角度来看，维格纳只不过因为有贝尔定理先入为主，误解了自己所证明的结果。他的证明之所以更简捷的，只不过应用了两个并不成立的前提，因此他的证明在数学方面也没有可取之处。

北京大学的张启仁教授为贝尔不等式给出了一种新的推导，完全去掉了过去那些推导中的多余环节，并把贝尔的工作改写为如下命题：贝尔不等式表现了定域性原理；而与量子力学的自旋相关公式则表现了“远距离相关”。这一命题已经使得贝尔不等式与“隐变量理论”脱钩。

最先对贝尔的工作提出异议的是法国物理学家吉·洛查克。他最先指出“贝尔不等式是经典概率论的结论，与定域性原理无关。”这是一个至关重要的结论。但是洛查克未能把经典概率论中的概率运算规则与事件运算规则这两个组成部分区别开来。因此，虽然他正确地指出了推导贝尔不等式的过程中用了经典概率论；但是他不曾指出这一过程的致命的一步是对非布尔的事件空间应用了布尔代数的运算规则。

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关键词：贝尔不等式；经典概率论；维格纳；张启仁；吉·洛查克；定域性原理；隐变量理论；布尔代数；自旋相关公式；概率运算规则；事件运算规则

1. 引言

在《贝尔不等式与布尔代数》一文中，我们证明了如下两个定理，

定理 1：借助于实验事实

A：对于任意单位向量**a**和**b** 及其夹角 $\gamma = \angle(\mathbf{a},\mathbf{b})$，有：

$$\Pr(\sigma_b = 1 | \sigma_a = 1) = \Pr(\sigma_b = -1 | \sigma_a = -1) = \cos^2(\gamma/2);$$

$$\Pr(\sigma_b = 1 | \sigma_a = -1) = \Pr(\sigma_b = -1 | \sigma_a = 1) = \sin^2(\gamma/2),$$

以及如下联合概率的操作定义

$$\Pr(\sigma_a = x, \sigma_b = y) \equiv \Pr(\sigma_a = x) \cdot \Pr(\sigma_b = y | \sigma_a = x), \quad (1)$$

可以从自旋相关函数的经典表达式

$$P(\mathbf{a}, \mathbf{b}) = -\sum_{xy} xy \Pr(\sigma_a = x, \sigma_b = y), \quad (2)$$

得出量子力学的自旋相关公式

$$P(\mathbf{a},\mathbf{b}) = -\mathbf{a} \cdot \mathbf{b}。$$

定理 2：贝尔不等式

$$|P(\mathbf{a}, \mathbf{b}) - P(\mathbf{a}, \mathbf{c})| \leqslant 1 + P(\mathbf{b}, \mathbf{c})。$$

可以追溯到(2)式和如下命题

B：任意给定单位矢量$\mathbf{a},\mathbf{b},\mathbf{c}$和$x,y,z \in \{1,-1\}$，存在函数$F(x,y,z) \geqslant 0$，使得

$$\Pr(\sigma_a = x, \sigma_b = y) = \sum_z F(x,y,z);$$

$$\Pr(\sigma_a = x, \sigma_c = z) = \sum_y F(x,y,z);$$

$$\Pr(\sigma_b = y, \sigma_c = z) = \sum_x F(x,y,z)。$$

根据这两个定理我们得出结论：第一，在某些条件下，经典概率论可能与量子力学殊途同归，例如应用经典概率论，可以从自旋相关函数的定义导出量子力学的自旋相关公式。第二，贝尔不等式的破坏只不过表明经典概率论中的事件运算的布尔代数规则不适用于微观过程，既与定域性原理无关，也与隐变量理论无关。

本文将考察另一问题：为什么人们会得出贝尔定理。

2. 贝尔的误解

贝尔对贝尔定理的原始推导用到一种由一组公理来定义的隐变量理论。将这个理论应用于处于单态的一对电子所组成的系统 S，可以得出如下结论：

I、在S的自旋态函数之上添加一组记作λ的隐变量，可以确定第一个电子的自旋在$\mathbf{a}$方向的投影σ_a和第二个电子的自旋在$\mathbf{b}$方向的投影τ_b的单次测量的结果，即存在函数

$$\sigma_a = A(\mathbf{a}, \lambda), \qquad \tau_b = B(\mathbf{b}, \lambda)。$$

II、在隐变量的相空间（全体隐变量λ所成之集）Λ中，可以定义概率分布函数$\rho(\lambda) \geqslant 0$，使得：

第一，$\int_\Lambda \rho(\lambda)\, d\lambda = 1$（归一化）；

第二，对于Λ的任意子集Γ，有$\Pr(\lambda \in \Gamma) = \int_\Gamma \rho(\lambda)\, d\lambda$。

III、处于单态的一对电子的“自旋相关函数”表成

$$P(\mathbf{a}, \mathbf{b}) = \int_\Lambda A(\mathbf{a},\lambda)\, B(\mathbf{b},\lambda)\, \rho(\lambda)\, d\lambda。$$

下面，我们从 I、II 与 III 三个前提导出贝尔不等式，其方法与贝尔的推导略有不同。

首先，根据 I，实验事实 $\tau_b = -\sigma_b$，可表成

$$B(\mathbf{b}, \lambda) = -A(\mathbf{b}, \lambda)。$$

于是前提 III 可以表成

$$P(\mathbf{a}, \mathbf{b}) = -\int_\Lambda A(\mathbf{a},\lambda) A(\mathbf{b},\lambda) \rho(\lambda) d\lambda。$$

对于给定的 $x,y \in \{1,-1\}$，定义 Λ 的子集

$$\Gamma(x, y) \equiv \{\lambda \in \Lambda \mid A(\mathbf{a}, \lambda) = x, A(\mathbf{b}, \lambda) = y\},$$

则根据 II 可得到

$$\int_{\Gamma(x, y)} \rho(\lambda) d\lambda = \Pr(\sigma_a = x, \sigma_b = y)。$$

和

$$\int_{\Gamma(x, y)} A(\mathbf{a},\lambda) A(\mathbf{b},\lambda) \rho(\lambda) d\lambda = xy \Pr(\sigma_a = x, \sigma_b = y)。$$

再根据积分的性质，得到

$$\int_\Lambda A(\mathbf{a},\lambda) A(\mathbf{b},\lambda) \rho(\lambda) d\lambda = \sum_{xy} \int_{\Gamma(x, y)} A(\mathbf{a},\lambda) A(\mathbf{b},\lambda) \rho(\lambda) d\lambda。$$

上面诸式给出(2)式。

其次，给定单位矢量$\mathbf{c}$与变量$z \in \{1,-1\}$以及 Λ 的另一子集

$$\Gamma(x, y, z) \equiv \{\lambda \in \Lambda \mid A(\mathbf{a}, \lambda) = x, A(\mathbf{b}, \lambda) = y, A(\mathbf{c}, \lambda) = z\},$$

则 II 又给出：

$$\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z) = \int_{\Gamma(x, y, z)} \rho(\lambda) d\lambda。$$

根据积分的性质

$$\int_{\Gamma(x, y)} \rho(\lambda) d\lambda = \sum_z \int_{\Gamma(x, y, z)} \rho(\lambda) d\lambda,$$

从上面诸式我们得到

$$\Pr(\sigma_a = x, \sigma_b = y) = \sum_z \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)。 \quad (3)$$

同样，从 I 与 II 也可得到

$$\Pr(\sigma_a = x, \sigma_c = z) = \sum_y \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z); \quad (4)$$

$$\Pr(\sigma_b = y, \sigma_c = z) = \sum_x \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)。 \quad (5)$$

再考虑到 $\rho(\lambda) \geqslant 0$，我们有

$$\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z) = \int_{\Gamma(x, y, z)} \rho(\lambda) d\lambda \geqslant 0。$$

上面诸式给出命题 B。

于是，从 I、II 和 III 可以导出了(2)式与命题 B。根据定理 2，从(2)式与命题 B 可以导出贝尔不等式，于是我们从 I、II 和 III 导出了贝尔不等式。

我们看到，所谓“定域隐变量理论”应用于贝尔所考察的问题，表现为前提I、II和III，而I、II和III之所以能得出贝尔不等式，则是因为它蕴含(2)式与命题B。但是，为了得到(2)式与命题

B，完全不需要“定域隐变量理论”这一深不可测而又富有哲理的前提，(2)式可从自旋相关函数的原始定义与实验事实 $\tau_b = -\sigma_b$ 得到，而命题B则可以从经典概率论的运算公式得到。这样，从贝尔证明的命题“贝尔不等式与量子力学不相容”得到的结论就不是贝尔定理，而是“(2)式与命题B的合取与量子力学不相容”。我们知道，定理 1 可知(2)式与量子力学相容，因此，I、II和III之所能导出贝尔不等式仅仅是因为它蕴含命题B，而不是因为它蕴含(2)式。由此我们得出结论：贝尔的工作实际上只不过证明了

C：命题 B 与量子力学不相容。

贝尔之所以得出贝尔定理，是因为他对自己的工作有两点误解：

第一，容易看出：I、II 和 III 之所以蕴含命题 B，是因为它原封不动地保留了整个经典概率论。而一般地说，遵循经典概率论的运算规则既不是隐变量理论的特征，也不是定域性原理的特征。因此，给出 I、II 和 III 的肯定不是一般意义下的“定域隐变量理论”，而是原封不动地保留了整个经典概率论的一种特殊理论，而贝尔却把自己应用的这一特殊理论当成一般的“定域隐变量理论”了。

第二，当贝尔从他的特殊理论导出贝尔不等式时，一方面用到了(2)式，另一方面用到了命题 B。但他用到命题 B 是间接的，而且还是不自觉的，他完全没有意识到自己应用了这个致命的命题。因此，他实际上把贝尔不等式追溯到(2)式，从而追溯到表达式

$$P(\mathbf{a},\mathbf{b}) = \int_{\Lambda} A(\mathbf{a},\lambda)\, B(\mathbf{b},\lambda)\, \rho(\lambda)\, d\lambda,$$

并且通过这个表达式，追溯到他认为表现了定域隐变量理论特征的 $A(\mathbf{a},\lambda)$、$B(\mathbf{b},\lambda)$ 和 $\rho(\lambda)$ 三个函数。

正是由于这两点误解，贝尔得出了贝尔定理。

这两点误解也是量子物理学家们共同的误解。由于这两点误解，贝尔定理在物理学领域里掀起了持续的热潮，有些人努力从贝尔不等式的破坏得出更加新颖、更加匪夷所思的哲学结论，另一些人则在 $A(\mathbf{a},\lambda)$, $B(\mathbf{b},\lambda)$ 和 $\rho(\lambda)$ 三个函数的组合上绞尽脑汁，希望能找到某种隐蔽的假设，以便同时“挽救”定域性原理与实在论。

3. 维格纳对贝尔定理的证明

匈牙利物理学家F. P. 维格纳在 1970 年曾给出对贝尔定理的“最简捷的”证明。他的思路是：先导出两个关于 $\Pr(\sigma_a = x, \tau_b = y)$ 的命题，一个表现量子力学的特征，另一个表现定域隐变量理论的特征，然后把贝尔定理的证明归结为证明这两个命题不能同时成立。这个证明本来可以揭示贝尔定理的错误，可惜维格纳却以为自己通过另一途径证明了贝尔定理，原因之一是在维格纳的原始论文中，往往用文字叙述来取代公式推导，从而有太多的含糊不清之处。迄今为止，也没有人尽举手之劳来澄清它。为了阐明维格纳的证明的意义，我不得不把它从头改写如下：

首先，维格纳未加证明地给出如下两个公式：

$$\Pr(\sigma_a = x) = 1/2, \tag{6}$$

和

$$\Pr(\sigma_a = x, \tau_b = y) = \Pr(\sigma_a = x, \sigma_b = -y)。 \quad (7)$$

应用这两个公式，他从(1)式与命题 A 得出结论：

D：对于任意单位向量**a**和**b** 及其夹角 $\gamma = \angle(\mathbf{a},\mathbf{b})$，有：

$$\Pr(\sigma_a = 1, \tau_b = 1) = \frac{1}{2}\sin^2\frac{\gamma}{2}。$$

这就是维格纳用以表现量子力学的特征的命题。

其次，维格纳认为，根据定域隐变量理论可得出结论：可以引进如下六个事件

$$\sigma_a = x,\ \sigma_b = y,\ \sigma_c = z;\ \ \tau_a = x',\ \tau_b = y',\ \tau_c = z'$$

的联合概率，维格纳把这个联合概率略写成 $(x, y, z; x', y', z')$，并应用经典概率论给出：

$$\Pr(\sigma_a = x, \tau_b = y') = \sum_T (x, y, z; x', y', z')。$$

其中符号 $\sum_T$ 表示对 $y, z, x', z' \in \{1, -1\}$ 求和。

根据实验事实 $\tau_b = -\sigma_b$，只有当 $x' = -x$，$y' = -y$，$z' = -z$ 时，维格纳引进的 $(x, y, z; x', y', z')$ 才不为零。因此从上式可以得出：

E：对于任意单位向量 **a** 和 **b**，存在联合概率 $(x, y, z; x', y', z')$，使得

$$\Pr(\sigma_a = x, \tau_b = -y) = \sum_z (x, y, z; -x, -y, -z)。$$

这就是维格纳用以表现定域隐变量理论的特征的命题。

应用(7)式，可以把命题D中的 $\Pr(\sigma_a = 1, \tau_b = 1)$ 改成 $\Pr(\sigma_a = 1, \sigma_b = -1)$，再适当轮换**a**、**b**和**c**，得到两个相似的等式，从而得到：

F：对于任意单位向量**a**,**b**,**c**及 $\alpha = \angle(\mathbf{b}, \mathbf{c})$，$\beta = \angle(\mathbf{a}, \mathbf{c})$，$\gamma = \angle(\mathbf{a}, \mathbf{b})$，有：

$$\Pr(\sigma_a = 1, \sigma_b = -1) = \frac{1}{2}\sin^2\frac{\gamma}{2};$$

$$\Pr(\sigma_b = 1, \sigma_c = -1) = \frac{1}{2}\sin^2\frac{\alpha}{2};$$

$$\Pr(\sigma_a = 1, \sigma_c = -1) = \frac{1}{2}\sin^2\frac{\beta}{2}。$$

另一方面，考虑在命题 E 中，

$$(x, y, z; -x, -y, -z) = \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)。$$

再次应用(7)式，可以把命题E中的概率公式改写成(3)式。同样，也可得到(4)式与(5)式。考虑到 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z) \geqslant 0$，我们得到命题B。而从命题B容易得出

G：对于任意单位向量**a**,**b**,**c**，有：

$$\Pr(\sigma_a = 1, \sigma_b = -1) = F(1, -1, 1) + F(1, -1, -1);$$

$$\Pr(\sigma_a = 1, \sigma_c = -1) = F(1, 1, -1) + F(1, -1, -1);$$

$$\Pr(\sigma_b = 1, \sigma_c = -1) = F(1, 1, -1) + F(-1, 1, -1)。$$

注意到 $F(x, y, z) \geqslant 0$，上面诸式给出不等式

$$\Pr(\sigma_a = 1, \sigma_b = -1) + \Pr(\sigma_b = 1, \sigma_c = -1) \geqslant \Pr(\sigma_a = 1, \sigma_c = -1)。$$

应用命题 G，上面的不等式变成

$$\sin^2\frac{\gamma}{2} + \sin^2\frac{\alpha}{2} \geqslant \sin^2\frac{\beta}{2}。$$

然而这一不等式对某些α、β和γ的取值并不成立，因此，导出它的命题F与命题G不能同时成立。

按照维格纳的思路，命题 F 来自命题 D，从而表现量子力学的特征；而命题 G 则来自命题 E，从而表现定域隐变量理论的特征。于是，证明了命题 F 与命题 G 不能同时成立证明了命题 D 与命题 E 不能同时成立，而证明了命题 D 与命题 E 不能同时成立就完成了对贝尔定理的证明。

在维格纳证明命题F与命题G不能同时成立的上述中，除了应用了某些量子力学的结论以外，归根结底只应用了命题B。因此维格纳上面所证明的也不过是命题C，即“命题B与量子力学不相容”。与贝尔的原始证明比较，维格纳证明的优点是摆脱了完全多余的表现贝尔所用的那种隐变量理论的命题与公式，更直接地导出了贝尔的这一结论。但是我们知道，命题B实际上仅表现联合概率 $\Pr(\sigma_a = x, \sigma_b = y)$ 的性质，与“定域性原理”和“隐变量理论”都扯不上关系。因此，维格纳只要稍稍深入一步就会发现从他的工作并未得出贝尔定理。但是，在维格纳的推导过程中，尽管已经默认了导出(3)、(4)和(5)诸式的全部运算法则，从而完全可以不应用命题E直接导出命题B，却还是反复应用(7)式，绕来绕去最终用命题E取代(4)式导出命题B，造成贝尔不等式表现定域隐变量理论的特征的假象。因此，从物理的角度来看，维格纳只不过因为有贝尔定理先入为主，误解了自己所证明的结果。

另一方面，我们已经看到，贝尔的工作归根结底是证明了命题 C，而贝尔证明这一命题的途径是从命题 B 导出贝尔不等式，再证明贝尔不等式与量子力学不相容。维格纳的证明之所以“简捷”，乃是因为它没有通过贝尔不等式这一中间环节，直接证明这一命题，为此而付出的代价是：他应用了(6)式与(7)式。不幸的是，通过更细致的考察可以证明，这两个公式都不成立。因此，维格纳的证明在数学方面并无可取之处，他能通过更简捷的途径证明命题 C，只不过是侥幸从错误的前提得出了正确的结论。

4. 张启仁教授的工作

北京大学教授张启仁在他写的《量子力学》一书中[1]，有一节讨论贝尔不等式，这一节篇幅不大，却颇有新意。这里，按照我的理解，把张教授的论点改写如下：

按照量子力学，σ_a、σ_b和σ_c等可观察量是从测量中产生的。在玻姆的理想实验中，测量其中的一个粒子的自旋，则相互远离而又处于单态的一对粒子的“单态自旋的波函数”会立即“编缩”为两个粒子各自的自旋波函数的乘积，这一过程是“非定域的”，量子力学的自旋相关公式表现了这种非定域的“远距离关联”。

反之，如果电子自旋的测量值σ_a、σ_b和σ_c是客观存在的，与测量无关，则可以定义联合概率

$$F(x,y,z) \equiv \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z),$$

并得出如下结论：

第一，可以定义联合概率

$$\Pr(\sigma_a = x, \sigma_b = y) \equiv \sum_z \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z);$$

并得出命题 B。

第二，从命题 B 导出结论：

任意给定单位矢量$\mathbf{a},\mathbf{b},\mathbf{c}$，存在函数$F(x,y,z)\geq 0$，使得

$$E(\mathbf{a},\mathbf{b}) = \sum_{xyz} xy\,F(x,y,z),$$

$$E(\mathbf{a},\mathbf{c}) = \sum_{xyz} xz\,F(x,y,z),$$

$$E(\mathbf{b},\mathbf{c}) = \sum_{xyz} yz\,F(x,y,z),$$

并从该结论导出不等式

$$|E(\mathbf{a},\mathbf{b}) - E(\mathbf{a},\mathbf{c})| \leqslant 1 - E(\mathbf{b},\mathbf{c})。$$

第三，从$E(\mathbf{a},\mathbf{b})$的定义，自旋相关函数的原始定义，再应用经典概率论，可以把自旋相关函数表成

$$P(\mathbf{a},\mathbf{b}) = -E(\mathbf{a},\mathbf{b})。$$

第四，从上面两式导出贝尔不等式。

由此得出结论：如果 σ_a、σ_b和 σ_c是从测量产生的，则可以定义联合概率 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$，从而导出贝尔不等式，与量子力学的自旋相关公式相反，该式表现“定域性原理”。

我们看到，张教授对贝尔不等式的推导比维格纳的更简捷，其中再也没有多余的环节。根据这一推导，张教授使得贝尔的结论与“隐变量理论”脱钩，把它改写为如下命题：“贝尔不等式表现定域性原理，而量子力学的自旋相关公式表现了远距离关联。”

对张教授的上述论点，我们有如下异议：

第一，量子力学的自旋相关公式可以借助于经典概率论从(2)式得到，而(2)式很难说表现了“σ_a、σ_b和σ_c等可观察量是从测量中产生的”这一“量子力学的观点”。

第二，定义联合概率 $\Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z)$，并应用

$$\Pr(\sigma_a = x, \sigma_b = y) \equiv \sum_z \Pr(\sigma_a = x, \sigma_b = y, \sigma_c = z),$$

并不能导出贝尔不等式，导出贝尔不等式的致命的一步是应用命题 B，而命题 B 的毛病在于对非布尔的微观事件空间应用了布尔代数的事件运算规则，这一步不仅与隐变量理论无关，也与定域性原理无关，而且还与可观察量是否从测量中产生无关。

第三，可以证明，定域性原理与玻姆理想实验中的“远距离关联”并不矛盾。这一问题我们将在别处考察。

5. 洛查克的异议

最先对贝尔的工作提出异议的似乎是法国物理学家吉·洛查克。他在一篇文章[2]中写道：

“在贝尔的推理中，不仅用到一个表现定域性特征的假设，而且还用到一个统计学的假设……隐变量理论必须在全部测量结果的运算中恢复经典概率论。但这样立刻会在平均值的计算中与波动力学相矛盾。因为波动力学不遵循通常的概率论模式。这就不必惊讶以后会‘发现’波动力学与隐变量理论的计算结果之间的不一致。”

洛查克还在另一篇文章[3]中写道：

“在我看来，贝尔不等式与实验结果不一致与所谓‘非定域性’或‘不可分离性’完全无关。它只不过表明量子力学概率不是经典概率。这是一个我们已经发现了半个世纪多的事实。现在再次确认这一事实当然也是一件好事。但是，为了再次接受这一事实而动用这么多尖端而优秀的实验，似乎是不必要的。”

洛查克的论据似乎从来没有从数学 - 物理学的角度遭到反驳，但很多人由于它与权威的贝尔定理不一致而反对它，更多的人则不理睬甚至不知道它。他的论据已经使贝尔定理的讨论失去意义，可现在许多物理学的期刊仍然在讨论这一问题。

另一方面，洛查克的论点也是不能令人满意的。他认为只需指出在贝尔不等式的推导中用到经典概率论，特别是，指出这一推导中用到了不能同时测量的两个可观察量的联合概率，就已经足以使贝尔不等式与定域性原理脱钩。然而，这一论据是不充分的。

我们已经证明定理 1，它是显示经典概率论适用于微观过程的例子。因此仅仅知道在推导贝尔不等式时用过经典概率论并不能得出洛查克的结论：“贝尔不等式是经典概率论的结论，与定域性原理无关。”为了得出这一结论，我们还须弄清楚，究竟是经典概率论的哪个公式导致了贝尔不等式？这个导致贝尔不等式的公式究竟为什么不适用于微观过程？

在列举经典概率论的基本公式时，洛查克把乘法公式表成

$$\Pr(A \cdot B) = \Pr(A) \cdot \Pr(B|A) = \Pr(B) \cdot \Pr(A|B)。$$

在这里，洛查克事实上同时给出了两个公式，一个是

$$\Pr(A \cdot B) = \Pr(A) \cdot \Pr(B|A),$$

它来自概率的频率定义；另一个是

$$A \cdot B = B \cdot A。$$

它属于事件运算的布尔代数规则。洛查克未能把经典概率论的这两个前提区别开来。因此，虽然他正确地指出了推导贝尔不等式的过程中用了经典概率论；但是他不曾指出这一过程的致命的一步是对非布尔的事件空间应用了布尔代数的运算规则。

洛查克用了很多篇幅讨论隐变量理论问题，他坚持德布罗意的观点：隐变量应该遵循经典概率论的运算规律。按照这种观点，从隐变量的公式过渡到测量值之间的公式是一个颇为复杂的过程。这样的隐变量理论似乎只有使问题复杂化而无助于弄清楚贝尔不等式的起源。我们已经看到，贝尔不等式其实与隐变量理论无关。

尽管如此，洛查克的工作还是至关重要的，他第一个指出贝尔不等式与定域性原理无关，从而与量子力学中的所谓“远距离关联”的问题无关。如果人们接受这一论据，就会立刻失去对贝尔定理的兴趣。

6. 结束语

贝尔的工作引导我们对经典概率论对微观物理学领域的适用范围的问题的关注，我们由此得出结论：从概率的频率定义导出的概率运算规则（主要是加法公式与乘法公式）仍然适用于微观过程，但事件运算的布尔代数规则却不再适用。

上面我们考察了贝尔定理的三种证明，贝尔的原始证明，维格纳的“最简捷的”证明，以及张启仁教授的证明，并看到这三种证明实质上都是证明“命题 B 与量子力学相矛盾”。在贝尔的证明中，命题 B 被贝尔看作是“定域隐变量理论”的推论，它的应用是隐蔽的和间接的，这就为对贝尔不等式的误解定下基调；在维格纳的证明中，命题 B 以命题 D 的特殊形式出现，它与“定域隐变量理论”的联系已经很牵强；在张启仁的证明中，命题 B 直接应用于证明之中，实际上完全与“定域隐变量理论”脱钩并且本应得出结论：命题 B 仅仅是一个经典概率论的命题，从而贝尔的工作只不过再一次证明了经典概率论不完全适用于微观过程。在历史上，这一结论早已由洛查克给出。然而，还有一个关键的问题有待解决：为了导出命题 B，一方面要用到经典概率论的“概率运算规则”，另一方面要用到经典概率论的“事件运算规则”，到底是哪一个环节出了问题呢？我们的结论是：

第一，经典概率论的概率运算规则适用于微观过程。

第二，经典概率论的事件运算规则不适用于微观过程。

在这里，第二个命题众所周知，但第一个命题却似乎有点惊世骇俗。我们已经通过从经典概率论的概率运算规则导出量子力学的自旋相关公式，这一结论虽然并不是该命题的严格证明，但至少使得它不再是难以置信的。

这样就得出我们的主要结论：贝尔不等式乃是对非布尔的微观事件空间应用了布尔代数的运算规则的结果，它没有任何物理意义，更不表现任何哲学观点。

这个结论恐怕会令人失望：人们公认贝尔定理是“物理学中最重要的进展”和“科学中最深刻的发现”，而这个结论却揭示：这个定理实在是物理学家们不宜外扬的“家丑”。

参考文献

[1] 张启仁：《量子力学》高等教育出版社 1989 年版，p. 375。

[2] Lochak G. *Has Bell's Inequality a General Meaning for Hidden-Variable Theories*? [J]. Foundations of Physics, 1976, 6 (23),

[3] Lochak G. *De Broglie's Initial Conception of de Broglie Waves* [A]. Diner S et al. (ads.) The Wave - Particle Dualism [M]. D. Reidel Publishing Company, 1984.

Misunderstandings for Bell's Theorem

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Abstract: It is pointed that Bell had two understandings for himself work: Firstly, the hidden variable theory that he applied for deriving Bell's inequality keeps the operating rules of classical probabilistic theory wholly intact, but he regarded it as the general local hidden variable theory. Secondly, in Bell's work, the promise actually deriving Bell's inequality is not the one that Bell regarded as the character of local hidden variable theory.

In 1970, Wigner gave "the most concise proof" for Bell's theorem. It replaces the spin correction function in the concerning expressions by a joint probability. His thinking is firstly deriving two propositions about this joint probability, one expresses the properties of quantum mechanics; the other characterizes local hidden variable theory. Afterwards, he summed the proving Bell's theorem up as that these two propositions cannot hold true simultaneously. By means of such a proof Wigner could have revealed Bell's theorem in its true colors, but he believe that it proved Bell's theorem in another way. As viewed from physics, Wigner just misunderstood his proof as a result of the preconceive ideal from Bell's theorem. The reason why his proof is simpler is merely because that he used two faulty promises, and thereby has not any merits examined from mathematics.

Prof. Zhang qiren in Beijing University gave a new proof for Bell's theorem, which wholly removes the unnecessary part in the former proofs, and rewrote Bell's outcome in the following form: Bell's inequality manifests locality principle and quantum mechanics spin correlation formula indicates "correlation at a distance". This proposition makes Bell's inequality separates from hidden variable theory.

The first person who took objection against Bell's work is a France physicist G. Lochak. He pointed out that Bell's inequality is resulted from classical probability theory and has nothing to do with locality. This conclusion is of great importance. But Lochak has never distinguished between the laws of probability operations and those of event operations. Therefore, though he has pointed out that Bell has applied the formulae in classical probability theory in the process deriving Bell's inequality, but he has never demonstrated that the vital step in this process is to apply the laws of Boolean algebra to non-Boolean event space.

Key words: Bell's inequality; classical probabilistic theory; Wigner; Zhang Qiren; G. lochak; locality principle; hidden variable theory; Boolean algebra; spin correlation formula; probability operations; event operations

论因果律与决定论

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最近几十年来，随着科学技术的进步和观念的发展，对因果律及决定论原理提出了重重非难，甚至斥之为旧经典力学知识结构下产生的形而上学机械模式。但经过长期论战，因果——统计，决定——非决定这两个战场至今仍胜负难定。作为探讨与争鸣，本文从肯定角度对因果律与决定论进行论证尝试，观点不一定正确，仅提供一些思路和参考。

一、关于因果律

严格的因果律原理认为宇宙间任何现象作为原因都必定引起特定的结果，而任何结果的出现其背后必定有特定的原因。一因一果，一果一因，因果——对应。严格的统计原理则不考虑结果对原因的绝对依赖，主张时间链上的事件组不一定严格遵守因果律，而是按一定的概率统计律随机发生，从而否定宇宙间一切现象都受因果关系支配这一设想。还有一种追求统一的模式，认为客观世界是因果与统计规律共同作用的统一，它们各有不同的适应范围，适应于不同的层次和方向。从本体论意义讲，严格的因果律支配宇宙一切过程。

人们在现实中确实看到了大量因果链的存在，有可见的经验事实作依据证明因果联系存在。如，一对带正负电荷的质点在一定条件下必然吸引，一个实心铁球放在水中必然下沉，等等。肯定条件是充分的。在一部分客观现象中没有看到因果联系，如，微观粒子的运动等，这有理由对因果联系的普遍性与绝对性提出怀疑，但否定它成

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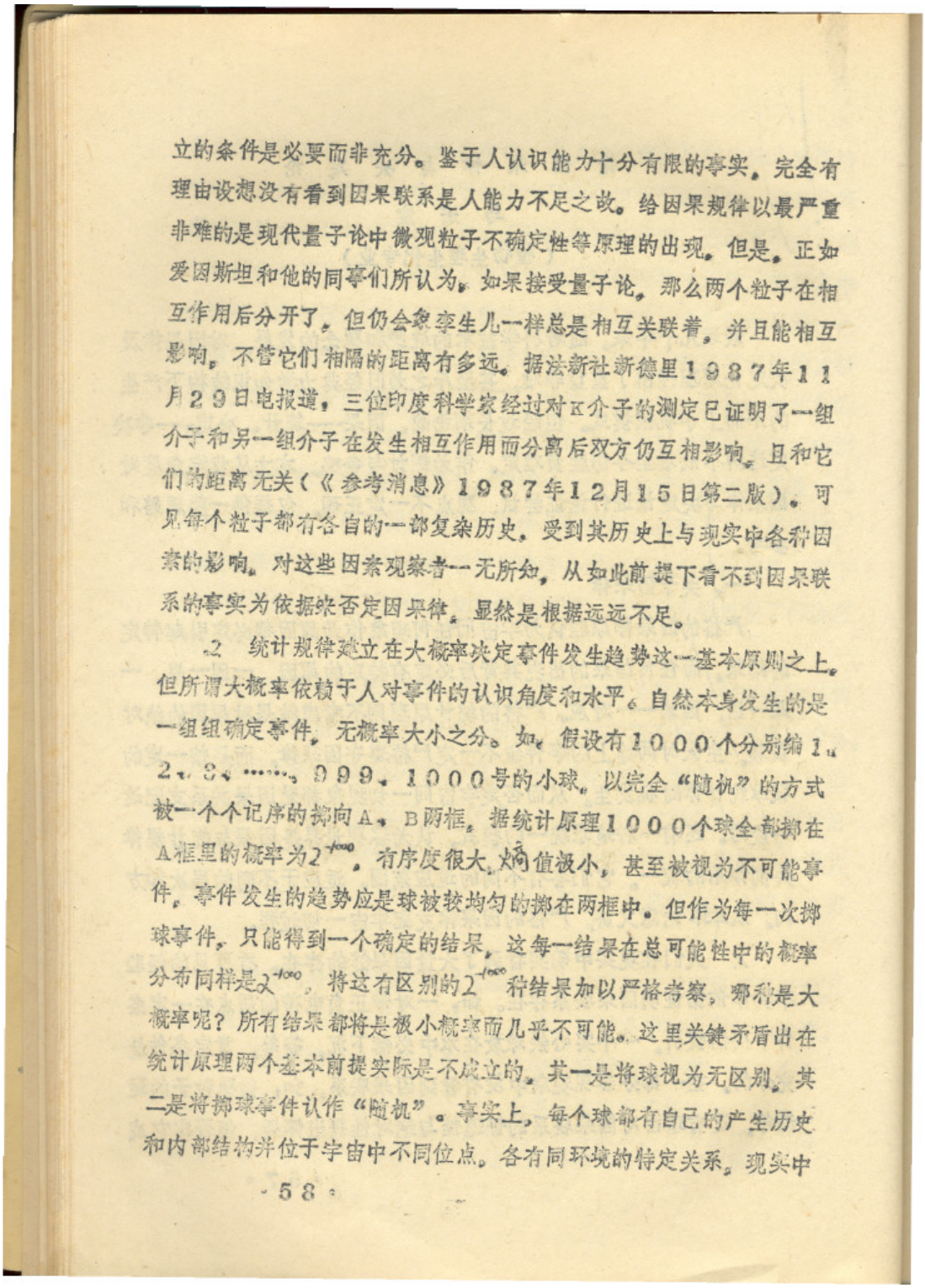

立的条件是必要而非充分。鉴于人认识能力十分有限的事实，完全有理由设想没有看到因果联系是人能力不足之故。给因果规律以最严重非难的是现代量子论中微观粒子不确定性等原理的出现。但是，正如爱因斯坦和他的同事们所认为，如果接受量子论，那么两个粒子在相互作用后分开了，但仍会象孪生儿一样总是相互关联着，并且能相互影响，不管它们相隔的距离有多远。据法新社新德里1987年11月29日电报道，三位印度科学家经过对K介子的测定已证明了一组介子和另一组介子在发生相互作用而分离后双方仍互相影响，且和它们的距离无关（《参考消息》1987年12月15日第二版）。可见每个粒子都有各自的一部复杂历史，受到其历史上与现实中各种因素的影响。对这些因素观察者一无所知，从如此前提下看不到因果联系的事实为依据来否定因果律，显然是根据远远不足。

.2 统计规律建立在大概率决定事件发生趋势这一基本原则之上。但所谓大概率依赖于人对事件的认识角度和水平。自然本身发生的是一组组确定事件，无概率大小之分。如，假设有1000个分别编1，2，3，……，999，1000号的小球，以完全"随机"的方式被一个个记序的掷向A，B两框，据统计原理1000个球全部掷在A框里的概率为2^{-1000}，有序度很大，熵值极小，甚至被视为不可能事件，事件发生的趋势应是球被较均匀的掷在两框中。但作为每一次掷球事件，只能得到一个确定的结果，这每一结果在总可能性中的概率分布同样是2^{-1000}，将这有区别的2^{-1000}种结果加以严格考察，哪种是大概率呢？所有结果都将是极小概率而几乎不可能。这里关键矛盾出在统计原理两个基本前提实际是不成立的，其一是将球视为无区别，其二是将掷球事件认作"随机"。事实上，每个球都有自己的产生历史和内部结构并位于宇宙中不同位点，各有同环境的特定关系，现实中

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绝不会有两个完全相同的球；任意两个框或两个球都有区别，两次掷球又必定发生在不同瞬间或不同位点。此两事件所处的宇宙环境关系必定有所不同，这样条件下所认定的所谓无区别的“随机掷球”显然不可能存在。由此推论：统计原理与方法只是人类智能无力区别诸事件差异及无力把握因果联系的权宜之计。热力学第二定律（即熵增原理）等统计规律在本体论上毫无意义。

3. 因果关系是严格的一因一果、一果一因。因果互为单值函数。这里的原因指宇宙间对某一结果的出现产生影响的全部因素之总和。结果指某特定原因在宇宙中产生的总结果，实质上应理解为确定事件影响范围内（或被影响范围内）客观世界的特定状态。一因多果（一果多因）只是把唯一的总结果（原因）主观的分成一些部分。把诸部分认作多果（多因）。如前证法，我们在现实中大量地看到一因一果（一果一因）的事实（如正负电吸引、水加热升温等）。肯定条件充分，而在微观领域等情况中看不到一因一果（一果一因）规律的事实最多只能对因果单值函数律提出怀疑。否定条件必要而非充分。限于人认识能力的局限，尚未能全部揭示自然界因果单值相关关系毫不为奇。支配因果链的本质是力场？是信息？是能量最低原理？还是至今我们尚未得知的某种自然定律或诸因素总和？此问题尚未确定并不足以否定因果链的存在。至少可以说，时间链上的宇宙状态展现顺序保证了因果链成立及因果互为单值函数的正确。

4. 相对论指出，两事件之间时间间隔的长短及它们出现的先后顺序与参照系有关。按前因后果的模式，对甲参照系是A事件先于B且A是B的原因（$\Longrightarrow$ B是A的结果），对某乙参照系完全可能是B先于A且B是A的原因（$\Longrightarrow$ A是B的结果）。由此可得，宇宙间客观实在的A与B互为因果，即因果关系是事件间的特定联系。

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二、关于决定论

严格的决定论认为宇宙中一切现象的出现有一个确定顺序，一切都预先确定，一切都出自必然，无限远以前的宇宙状态已严格地确定好了无限远以后的所有状态。非决定论则否定这种确定性与必然性的成立，认为一切出自偶然（随机）。再就是综合的观点，认为客观世界是必然与偶然的统一。必然中有偶然，偶然中有必然，各适应不同的层次和范围。从本体论意义上讲，决定论是绝对正确的。

1. 任一时刻的宇宙都是客观实在，并且有确定状态，其中存在的全部状态参数在本体意义上都是确定的。按因果律原理，每一状态作为原因确定了作为结果的下一状态，此结果作为新的原因又确定了再下一个状态，类推以至无穷。偶然性只是人们无力把握必然链规律性的认识论意义上的实用词语。

2. 按相对论时间相对原理，我们所感知到的时间链上发生的一系列事件先后顺序对不同观察者可以完全倒置过来。到底哪个观察者正确呢？连同其它存在一样，时间也是存在于宇宙中的客观实在。设想我们所感知的三维空间中插入一维静态时间轴，即构成四维静态宇宙模型，在此四维的静态宇宙中，全部所谓过去，现在与将来的事件都是现实的即存，它们之间的顺序差别仅仅是由于位于四维空间中的不同位点。观察者沿着自己的方向顺着时间维观察下去，先“遇到”的事件排在时间链前面，后“遇到”的事件排在时间链后面；观察者“运行”速度决定着所经过诸事件的时间间隔长短，观察者所在位置即“现在”。这样，宇宙时间链上的全部事件，包括所谓过去、现在和将来所发生的一切都是同样意义上客观即存，还有什么不必然？还有什么没预先确定呢？。

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所有经验事实都明确告诉我们：客观世界是一个个确定的宇宙状态沿着时间链不断地演化下去。这个链式宇宙在任何一段时间间隔里都具有唯一的链式过程。一切事件都在这个链中按特定的顺序发生着，形成唯一的连续统。这个链本身的客观实在性就是决定论成立的一个充分实证。是什么决定了宇宙链是此非彼？这个答案被人类智慧所找到并不是链存在的必要条件。起码可以这样讲。这个唯一的宇宙过程链消除了本体意义上的一切偶然性及非决定性。

同时还须指出，尽管在本体意义上因果律与决定论是宇宙根本法则，但从认识论意义讲统计与非决定论思想对人类仍具重要实际价值。面对宇宙这极其复杂的大系统，就现有科学事实和认识能力而言，人类尚无法在所有层次和领域把握诸事件发展演化必然规律（鉴于宇宙无限性，或许永远无法全部把握）。作为"参与的宇宙"，相对人类主体的客体部分受人各项活动所干预和影响。而作为人类精神和肉体这种特殊的物质运动形式，也需要一定程度的非决定论观念来刺激奋斗追求以获取心理上和生理上的各种满足。所以人类绝不能也不会甘心坐在宇宙必然链上不去作任何非必然性探索与追求，虽然这种探索与追求本身就是必然链上被预先确定的一部分。

最后说明一下，本文只是自然辩证法方法论上的习作，文中所述仅限于本体上和逻辑上的推理，是作者运用哲学基本原理进行的探索自然本质的方法论上的尝试和练习。限于篇幅和习作的需求，本文对所选的因果律与决定论两个命题完全从正论一面加以论证，强调正论方的合理而否定反论方的成立。至于命题正论方与反论方的真理性及相互关系等到底如何涉及更广泛的哲学和科学问题，不能简单的一概定论。所以，本文并不是作者对命题所持观点的表达，而仅是作者论证问题方法论上的实践。

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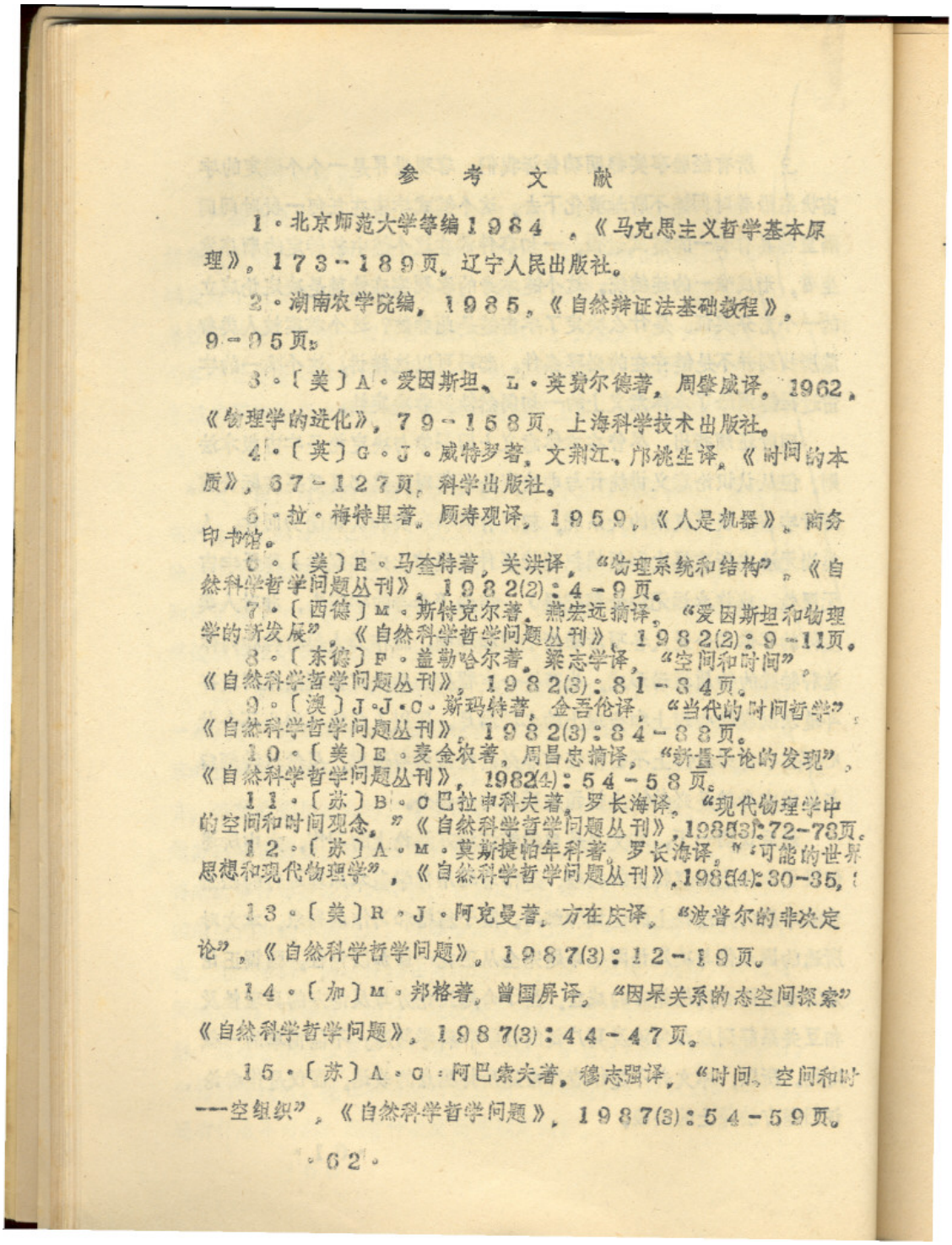


参 考 文 献

1．北京师范大学等编1984，《马克思主义哲学基本原理》，173－189页，辽宁人民出版社。

2．湖南农学院编，1985，《自然辩证法基础教程》，9－95页。

3．〔美〕A．爱因斯坦、L．英费尔德著，周肇威译，1962，《物理学的进化》，79－158页，上海科学技术出版社。

4．〔英〕G．J．威特罗著，文荆江、邝桃生译，《时间的本质》，67－127页，科学出版社。

5．拉．梅特里著，顾寿观译，1959，《人是机器》，商务印书馆。

6．〔美〕E．马奎特著，关洪译，"物理系统和结构"，《自然科学哲学问题丛刊》，1982(2)：4－9页。

7．〔西德〕M．斯特克尔著，燕宏远摘译，"爱因斯坦和物理学的新发展"，《自然科学哲学问题丛刊》，1982(2)：9－11页。

8．〔东德〕F．盖勒哈尔著，梁志学译，"空间和时间"，《自然科学哲学问题丛刊》，1982(3)：81－84页。

9．〔澳〕J．J．C．斯玛特著，金吾伦译，"当代的时间哲学"，《自然科学哲学问题丛刊》，1982(3)：84－88页。

10．〔美〕E．麦金农著，周昌忠摘译，"新量子论的发现"，《自然科学哲学问题丛刊》，1982(4)：54－58页。

11．〔苏〕B．C巴拉申科夫著，罗长海译，"现代物理学中的空间和时间观念"，《自然科学哲学问题丛刊》，1983(3)：72－78页。

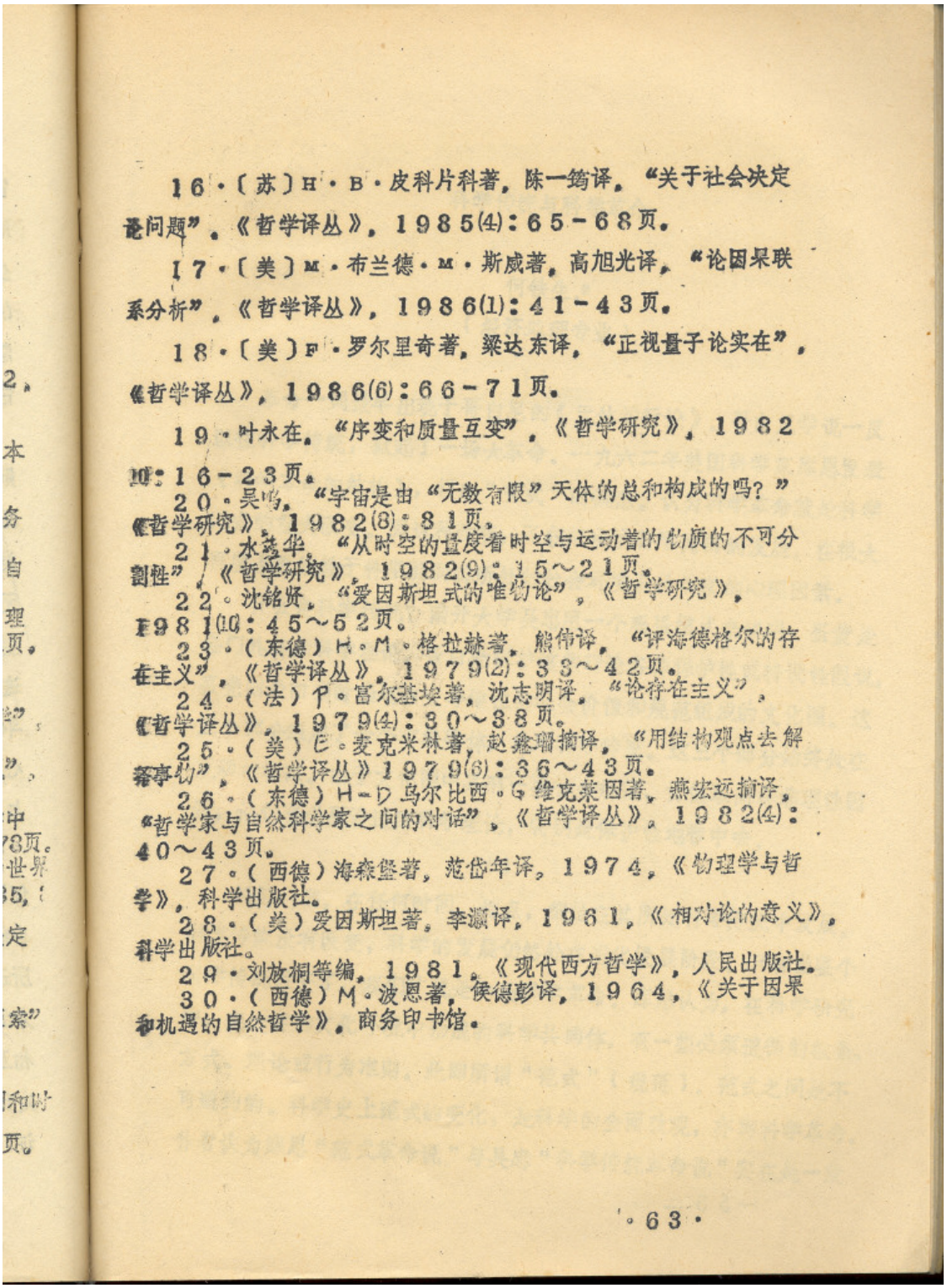
12．〔苏〕A．M．莫斯捷帕年科著，罗长海译，"可能的世界思想和现代物理学"，《自然科学哲学问题丛刊》，1983(4)：30－35，

13．〔美〕R．J．阿克曼著，方在庆译，"波普尔的非决定论"，《自然科学哲学问题》，1987(3)：12－19页。

14．〔加〕M．邦格著，曾国屏译，"因果关系的态空间探索"《自然科学哲学问题》，1987(3)：44－47页。

15．〔苏〕A．C．阿巴索夫著，穆志强译，"时间、空间和时空组织"，《自然科学哲学问题》，1987(3)：54－59页。

[New York Science Journal. 2008;1(4):57-63. (ISSN: 1554-0200).



16．〔苏〕Н·В·皮科片科著，陈一筠译，“关于社会决定论问题”，《哲学译丛》，1985(4)：65－68页。

17．〔美〕М·布兰德·М·斯威著，高旭光译，“论因果联系分析”，《哲学译丛》，1986(1)：41－43页。

18．〔美〕Р·罗尔里奇著，梁达东译，“正视量子论实在”，《哲学译丛》，1986(6)：66－71页。

19．叶永在，“序变和质量互变”，《哲学研究》，1982(10)：16－23页。

20．吴鸣，“宇宙是由“无数有限”天体的总和构成的吗？”《哲学研究》，1982(8)：81页。

21．水兆华，“从时空的量度看时空与运动着的物质的不可分割性”，《哲学研究》，1982(9)：15～21页。

22．沈铭贤，“爱因斯坦式的唯物论”，《哲学研究》，1981(10)：45～52页。

23．（东德）Н·М·格拉赫著，熊伟译，“评海德格尔的存在主义”，《哲学译丛》，1979(2)：33～42页。

24．（法）Р·富尔基埃著，沈志明译，“论存在主义”，《哲学译丛》，1979(4)：30～38页。

25．（美）Е·麦克米林著，赵鑫珊摘译，“用结构观点去解释事物”，《哲学译丛》1979(6)：36～43页。

26．（东德）Н－Д乌尔比西·G维克莱因著，燕宏远摘译，“哲学家与自然科学家之间的对话”，《哲学译丛》，1982(4)：40～43页。

27．（西德）海森堡著，范岱年译，1974，《物理学与哲学》，科学出版社。

28．（美）爱因斯坦著，李灏译，1961，《相对论的意义》，科学出版社。

29．刘放桐等编，1981，《现代西方哲学》，人民出版社。

30．（西德）М·波恩著，侯德彭译，1964，《关于因果和机遇的自然哲学》，商务印书馆。

[New York Science Journal. 2008;1(4):57-63. (ISSN: 1554-0200).

为什么近代科学的萌芽未能发生在旧中国而是发生在文艺复兴后的欧洲?

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摘要: 古希腊文化与中国古代文化有很大差别. 双方几乎在同时起源于大约在公元前 500 年.像两条长长的河流, 两个文明流向不同的历史方向. 结果,由于文艺复兴后的欧洲文化继承和发展了古希腊的文化传统,于是, 欧洲现代科学技术随着时间的前进发展得愈来愈快, 终于给欧洲带来了工业革命和资本主义. 相反, 中国则保持中央皇权的封建制度和古老的文化传统直到 19 世纪末, 而现代科学萌芽还没有诞生. 在这篇文章中,将探讨不同的自然环境和不同的社会-政治经济制度对文化所起的举足轻重的影响, 因此,导致古人的不同的思维方式和行为方式, 使现代科学萌芽在旧中国和在欧洲终于产生了不同的结果,但这篇文章不是对两个古老的文化做全面的总结和分析. [New York Science Journal. 2008;1(4):64-76. (ISSN: 1554-0200).

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注: 这篇文章是作者前篇英文文章"人类社会经济形态的改变和人类社会的发展的新观念"[15]的续篇,该文现已翻译成中文发表。

关键词:中国古代文化; 古希腊文化; 现代科学的萌芽; 思维方式和行为方式.

引言: 爱因斯坦说:"西方现代科学的基础是建立在两个伟大成就之上的. 他们是:古希腊哲学家发明的形式逻辑体系, 和可能通过系统的实验而发现因果关系.据我所知,中国的先贤并没有走那两步, 对此我并不会感到意外,应该惊奇的是不少科学发现仍然出现在旧中国. [1]" 最近杨振宁博士指 出:" <易经>在中国文化中影响了思维方式, 这种影响是现代科学萌芽没有出现在中国的一个重要原因. [2] "两个伟大的物理学大师、诺贝尔奖获得者, 爱因斯坦和杨振宁博士几乎达到了共识,即中国先哲,知识分子缺乏正确的思维方式和行为方式, 他们过度地迷信上天、君权、提倡道德哲学造成了科学技术在旧中国的落后. 相反的,古希腊先贤从亚里士多德起,几乎都把大自然作为观察和研究对象. 此外,在文艺复兴运动后,欧洲学者摆脱了对神权的迷信; 而符合当时的社会需求的现代科学的萌芽就从航海和天体观察中产生了. 两位物理学大师的观点真是击中要害,因为现代科学是建立在严格理论和系统的实验相结合的基础之上的, 是建立在 理论上计算的数值与实验数据一致性的基础之上的,而且只有通过严格的逻辑思维和系统实验结果才可以提炼成的正确科学理论. 为什么古代的西方先贤和知识分子能用形式逻辑和实验发展科学技术,但中国古圣贤和知识分子就不能呢? 在两个古老文明中所产生的不同的思维方式和行为方式应该从他们极不相同的古代历史、地理、社会经济、政治制度中去寻根问底.正是那些古代先贤的知识分子的不同的思维方式和行为方式最终导致现代科学的萌芽和发展在欧洲出现. 相反, 封建的旧中国直到 19 世纪后半期才刚刚开始从西方国家和日本引进现代科学技术.

1. 中国古老文化的起源:

中国古老文化大约起源于 2,500 年前的孔子。

(A). 孔子(551 -- 479 BC), [3] 作为中国文化的最了不起的代表, 出生在东周朝代。他的巨大的思想贡献表现在他所完成的<易经>和<论语>中. <论语>是由孔子的学生所记录的孔子的语录书。孔子的中心思想是"仁",它的主要内容是: "人人应该爱人如爱己, 正如天地爱人一样。己所不欲,勿施于人". “人人应该尊天命, 畏天命, 否则, 自作孽,不可活"。” 天地人是三

位一体。天地生养人,人应敬畏天地”, 因此,所有的人,从国王到官员到百姓只能敬畏和祭拜天地, 天地自然就不能成为被人们研究的对象. 孔子还教导: “人要畏天命,畏圣人之言" , “不怨天尤人, 不能怨恨上天对人的惩罚,一切都是咎由自取”.“ 百姓要服从君王 (天子), 官吏., 因为国王是上天的儿子, 官员是百姓的父母”。” 君王要为政以德, 官吏要忠君爱民, 百姓不能犯上作乱”.总之, 孔子"仁"为中心思想为给各种地位的人制定了思想和行为不可逾越的准则, 从而为维护封建制度和保持封建社会的稳定起了重大作用. 旧中国社会在 1949 年之前, 每个家庭的正厅中央墙壁上, 必有"天地君亲师" 的牌位供全家常年祭拜。结果, 所有人特别是古代的知识分子的思想和行为被对上天,君王和孔子的教条 **“三位一体”**的迷信所禁锢, 从而使现代科学萌芽所需要的逻辑思维和对自然界的探索无法成为旧中国的知识分子的追求对象.

(B). 约在孔子时代, 还有其它的伟大哲学家, 老子(大约 571 – 471BC), 他成了道教的始祖.[4] 他的思想也对中国文化产生了巨大的影响。他主张"清心寡欲" 和"与世无争" 。因而,如果某些人不满意现状,他们也许可以隐居住在深山老林而与世隔绝,终老一生。大概那时由于人口稀少有许多深山老林可供人们隐居以逃脱现实。另一方面, 他认为一位好的君王应“无为而治”, “顺其自然”,他教导说: "无为而无不为".

大约在 孔子死后 100 多年, 他的追随者孟子(大约 372-289 BC)[5] 继承和发扬了孔子的思想, 孟子除了提倡"仁"之外, 还强调了"义" 的重要性.此外, 孟子特别反对"利" , “争利”和"为利而奋斗" 。"不争利" 和"寡欲"就使旧中国的学者对现代科学的萌芽缺乏探索的动力。

大约公元 200 年, 佛教 [6]开始在古老中国传播。在伦理上佛 (566 - 486 之间 BC) 与孔子的教导没有其他巨大区别。佛教导说: "勿作恶。栽善根。净化自己的灵魂". 佛教与孔子和道教最重要不同是宣扬"因果报应和轮廻转世", "死后灵魂能去天堂或地狱" 和"为来世而信佛" 。约在公元 230 – 630 年之间, 中国在南北朝时期, 大约有 400 年的连年不断的战争大灾难。人民的生活遭受长期而深重的痛苦。罪恶不能受到适当的惩罚。人们相信佛的保佑自己能有更好的来世从而提高个人生活的信心和增强克服困难的勇气.

所有上述教条之所以能广泛被传播, 因为它们符合当时社会和人的灵魂的需要.但是, 人的科学思维和行为无法从封建伦理和迷信中产生, 因为封建伦理和迷信是远离理性和逻辑思维.上述所有圣贤都共同地宣扬; "人人应该行善", "人人应该服从自然和上天的意志", "人人都应该清心寡欲" 。结果, 在 10 世纪后期宋朝建立后, 孔子 教条, 老子和佛教三者被结合在一起,成为儒释道的 **“三位一体”**, 之后就成为中国古老文化的主流,规范着全中国人的思想信仰和行为。

(C). 在孔子时代, 东周王朝已大大地衰落了, 诸侯们在天子的名义下实际上统治自己的领域和百姓..那时是一个社会的转型期,当时正值奴隶制解体而向新兴的封建制度转变,农业生产正逐渐变为主要产业, 各个诸侯国都有过剩的土地,而缺少人口,劳动力和谋士. 于是,各种学者和有技艺的平民可自由地出入各个诸侯国,而各诸侯国几乎是完全的独立王国,他们可以按自己的意志用自己的方式方法统治其臣民.那时还没有一个诸侯强大到足以灭亡东周王朝而统一中原, 各个诸侯国只是为争夺霸权而频繁发动战争. 那是中国历史上第一次经济繁荣而文化上百花齐放的时代.于是,各种学说学派蓬勃发展出来了. 那时,一个政治家或军事家为了实现自己的理想或成为诸侯的座上宾,可以周游许多国,向诸侯们兜售自己的政治或军事主张,以便得到某一诸侯的采纳作为而后治国安民的理念或方畧.

在孔子时代,大多数人都住在江河流域的大平原上,那里气候温暖雨量充分,较适宜于农业发展..除非发生了大的洪水或旱灾而又有诸侯的暴虐统治,老百姓均能过自给自足的生活.气候

的四季变化并非难以预测. 因此, 生活在平原上的人们的风险比靠海洋生活的人们要小得多, 因而人们也就会缺乏冒险精神.结果, 知识分子和学者也就无心探索自然和科学, 也无心为改善现有的生产条件和生活条件而奋斗, 而一心只想如何躲避未来的灾难.而老百姓的唯一愿望是顺从天意以行好运, 其次是幻想能有 “君君,臣臣,父父,子子”的和睦社会..因此,中国古代的圣贤们不探索自然而只想建立特自的伦理学以维持人们之间次序以便保持社会关系的和谐和稳定. 孔子思想的产生和广泛持久的转播是符合封建王朝政治需要和自给自足的小农经济的需要的,特别有利于在中国大陆维持一个统一的大封建王朝.结果是几千年来, 几乎所有的中国人都满足于封建王朝统治下的小农生产, 而对自然科学不屑一顾, 只有那些对封建统治者有利的技术才得到大力地发展. 比如, 用于战争所需的火药与刀箭, 用于官文所需的印刷和造纸,和用于治病伤的中医药等.

(D).自从秦始皇在公元前 221 年统一中国后, 2000 多年来, 大统一的封建王朝是符合农业生产的需要的,也较符合广大民众安居乐业的需要,因此大统一一直是人心所向.加之,在广大的平原上各处都是易攻难守,难以形成像古代欧洲那样的长期城邦式的独立王国.因此,一旦统一破裂分为若干独立小王朝时,为统一而长期频繁的发动战争是必然的趋势,正如南北朝时一样, 老百姓只能过颠沛流离的痛苦生活.对老百姓来说,统一总比内战的日子好过些.这也正是老百姓宁可忍受元清外族王朝统治的原因.更重要的历来的封建王朝都是从战争中打出来的,甚至在其家族内部也不可能实行民主,因为民主必然导致内战. 两千多年的专制统治导致中国没有产生真正意义上法典,法律,契约,诉讼争辩,面对面的平等争论等民主所需要的东西.因而就不需要精确的语言和严格的逻辑思维.这就使得古代中国圣贤和知识分子缺乏探索自然科学的思维能力.

(E).然而,帝王和官吏很难得不作坏事,而这关系到每个人未来的命运,这对官吏和读书人尤其重要. 这也就是孔子的 <易经>两千多年来在中国流行的原因.因为每个人特别是官吏和读书人总想从<易经>的扑卦中预知自己未来的命运以谋避凶趋吉.什么是<易经>的思维方式呢? 它用比喻的方法取代具体的分析,用形象化取代逻辑思维, 模棱两可的类比和影射取代定量分析, 用归纳法取代演绎法,用空谈取代明确的语言,用虚构的天地物的行为比喻人的行为等等.<易经>学家总是用模棱两可的影射给别人算命,並常显示自己高深莫测的学问以谋私利.

中国语言和思维的不精确性在<易经>中充分反映出来了,它妨碍了古代中国学者作精确的科学分析和逻辑思维. <易经>中的每一个卦都是用天象和地象去比喻人的命运.结果许多古代中国的聪明学者终生都沉醉于<易经>的神秘玄学, 他们不去研究天地的具体的规律与人类社会和各种事物规律之间的差异, 最后, 他们甚至将天上的每颗星星与地上的每个人的命运相对比. 古代中国文化主要来源于<易经>和孔子老子的思想,这成为旧中国农业社会中大多数人的共识,也成为维持封建王朝的帝王和官吏的需要.

(F). 在旧中国,每一个知识分子除了读圣贤书,旧文学和政治历史文献外,就无所作为,因为只有学好这类书才能通过封建的科举考试而做官,即 “学而优则仕”. 旧知识分子们不屑于参加各类生产劳动,他们 “四体不勤,五谷不分”,对物理世界的观测和试验毫无兴趣, 好的知识分子一生中唯一的 “兴趣” “欲望” 和 “理想”就是力行孔子的教导 “修身,齐家,治国,平天下”,而坏知识分子就是 “贪官污吏,鱼肉百姓”.

(G). 在旧中国, 老师对学生的教育不是用启发式的对话式的平等的教学法,而是用训斥甚至体罚的方式老师对学生的关系是 “一日为师,终生为父”,而学生只有 “尊师重道”,即要谨守孔孟之道,因此,学生极难产生科学所需的批判和创造精神.

(H).自给自足的小农经济长期的年复一年的有条不紊的循环养成了人们靠天吃饭的循规蹈矩的思想和行为.几千年来整个旧社会都重农业,轻工商, 因而人们缺少追求财富,科学和真理的欲望.加之,整个中国大陆周边都是贫穷落后的民族地区和国家,没有财富可供掠夺,甚至封建统治者也缺乏对外掠夺的欲望.

(I).文字是思想的工具和载体.古中文是象形文字而且有多种意义, 文法不严格而往往缺乏谓语,一个字可用之于多词类,一句话的准确含意往往只有对照前后文才能确定,因而较适宜于形象思维和类比,[7]较难用于逻辑思维和严格的概念和论证. 这也是旧知识分子难于运用逻辑思维的原因之一. 例如,人人皆知的中国格言 “江山易改, 本性难移”,其实, 江山和人的本性之间并无必然的因果关系,而江山一词本身也是多义的.这类类比在中国古文中俯拾即是,而又往往成为完美的佳作被人赞颂.

如上面所分析, 旧中国文化中缺乏近代科学萌芽所必需的许多条件,例如, 旧中国从皇帝官员文人到老百姓都不把自然界当作研究和实验的对象,而是 “听天由命”, “畏天命,畏圣人之言”.封建的科举制度使旧知识分子把做官作为自己终生的奋斗目标, 而他们所读的书籍全部都是缺乏逻辑思维的古典文学和政治历史文献.因此, 古人的思维能力和行为方式就是如何用卜卦和各种迷信对自然灾害 “避凶趋吉”.

总而言之, 在旧中国, 一个建立在全大陆的大统一的中央集权的封建王朝, 一个建立在全大陆的自给自足小农经济,一个统一的象形文字和儒释道文化,这种经济政治文化三者所结合成的 **“三位一体”**是中国社会几千年来成为一种难以进步的 “超稳定结构”.在这种结构里,由于中央王朝的重农抑商和垄断资源，就无法形成为利益而竞争的自由市场，也就没有可能发生近代科学的萌芽.

然而,当中国近代知识分子认识到的古代中国文化的缺点后,他们是能够毫无困难的运用逻辑思维和做系统的实验为近代科学作出贡献的.而中国的传统文化在清除封建糟粕和吸收西方近代科学技术之后会成为更加灿烂的中国新文化,因为中国文化具有非常大的包容性和吸收能力.例如,中国现代语言和结构已经西化,而许多中国现代知识分子在学习西方的科学技术后已在科技上也取得了巨大的成就.

2. 古希腊文化的根源:

西方文化发源与约公元前 500 年的古希腊文化.

苏格拉底 Socrates (469--399 BC.), 柏拉图 Plato (427--347 BC.)和亚里士多德 Aristotle (384--322 BC.)被誉为古希腊三圣,他们是古希腊文化的伟大代表,而亚里士多德是古希腊文化的思想和学问的集大成者,他们三位都宣扬科学的思维方式所需要的理性. 欧洲人继承了古希腊文化的优良传统导致了近代科学在文艺复兴后在欧洲的萌芽和发展.那么, 古希腊文化是如何从当时古希腊的特定的社会政治经济和历史地理等等的条件下产生的呢?

(A). 苏格拉底. Socrates[8] 生于公元前 469 BC, (即孔子死后 10 年,). 苏格拉底时代是雅典帝国的黄金时代,特别是伯里克利作为雅典帝国 10 人执政委员会的首席执政官的 15 年(443--429 BC),这时候是雅典帝国的奴隶制民主达到了灿烂的顶峰.在伯里克利时代,雅典帝国统治着超过 200 个附属国,1000 多万人口,建立了约有上千船舰的庞大舰队,爱琴海变成了雅典帝国的内海, 雅典成了当时最大的港口.

在地理上, 希腊是一个小的半岛,三面环海,背后是山脉.半岛上多为山丘,而缺少大平原和大草原. 因此,农业和畜牧业在雅典帝国难有大规模的发展.大部分人只能从事海上贸易和从海外城邦掠夺财富.然而,海洋气候常常迅猛变化莫测而造成海上波涛汹涌.因此,生活在海洋上

人们逐渐养成了冒险精神,征服自然的精神和对自然做斗争的精神,他们养成了踏实工作和作周密的试验的习性,他们有从海外赚钱和掠夺财富的强烈欲望.所有上述溶合在古希腊文化中的精神财富都被西方文化所继承而有利于近代科学萌芽在欧洲出现.

长期生活和奋斗在海洋上的民众逐级建立和发展出了一种 “海洋文化”.其主要内容就是:冒险精神—人们相信自己的判断能力和力量而不是 “靠天吃饭” 和 “畏天命”,科学态度—注重试验以获实效,不空谈,手脑並用,仔细的计算和準确的数据, 强烈的掠夺和征服的欲望—信奉丛林规则,崇尚武力,为满足掠夺和征服的欲望而不顾艰险地奋斗..

(B). 伯里克利 Pericles (495 – 429 BC)[9] 出身于贵族家庭,他有大量的田产和商业产业.他有广泛的学问和才能.在奴隶主中,他是心胸开阔的民主主义者.他把奴隶制民主提升到最高峰.他认为: “人本主义—人民(不包括奴隶)是第一重要的”, “人民只有有了自由才有幸福”, “平等,自由,法制是民主的基本原则”.在伯里克利的领导下, 雅典成为雅典帝国中经济发达,政治稳定,文化繁荣的中心城市. [9]当然, 雅典帝国的繁荣强大是建立在剥削,压迫,奴役和屠杀附属国以及奴隶的基础上的. 但是, 伯里克利所坚持实施的完全民主和平等权利只限于雅典城中的年龄 20 以上的男性公民(贵族和平民),而不包括女性,奴隶和非本地人. 雅典帝国权力的最高机关是雅典的公民大会和公共法庭.

公民大会选出 10 个执行官的委员会成为雅典帝国的最高权力执行机关. 10 个执行官的候选人必须作许多的演讲和参加许多的辩论会以宣传自己的政治纲领. 伯里克利是一个最好的演说家. 公民大会每 10 天举行一次,以决定重大的内政和外交问题: 战争或者和平,惩罚或是罢免执行官或选出新执行官等.

公共法庭是雅典帝国的最高审判权力机关.在伯里克利时期, 公共法庭的作用被大大地加强了. 雅典的法官增加到约 6000 人.所有附属国之间的诉讼, 附属国与雅典之间的诉讼都由雅典的公共法庭审判.公共法庭还要管理所有的重大的民事和刑事案件.因此,那时整个雅典几乎成为一个到处都是政治和各种各样的演讲和辩论的巨大的会议厅.在所有的演讲和辩论的场所, 演讲和辩论者都需要会运用精确的语言文字,古希腊人特别善于在法庭上运用数学和数据分析,他们不满足于经验的证据.他们要求所提供的证据具有普遍的确定性,也就是说,要求所提供的有关政治的哲学的和法律的论证是可靠的,这种可靠性只能用数学和数据的确定性表示出来. 所有上述雅典帝国的政治社会和历史条件为发展数学和逻辑学创造了良好的环境,以导致古希腊学者的思想和行为特别注重数学,科学和逻辑学,而这些后来逐渐成为古希腊文化和哲学的重要内容.

(C). 形式逻辑产生在具有完善的奴隶制民主的古希腊不是偶然的.为什么那种民主会出现在古希腊而不出现在古中国呢? 这是古代二者不同的历史社会和地理等条件所造成的. 古希腊在雅典帝国时期是由许许多多小的和相对独立的城邦组成的. 希腊本土是一个不大的半岛,多山和丘陵,而没有大的像中国一样平原.因此,很难建立成一个长期的统一的像中国一样的大帝国,而只能依丘陵的山势和海中的岛屿等地理优势来建立小的能自保的独立的城邦. 各城邦为了自卫而不致被其它城邦掠夺或被打败而沦为奴隶,就需要贵族和平民一起当兵以集体自卫,同时也是为了能集体去打败和掠夺别的城邦.因为奴隶不能当兵,这样一来,贵族和平民之间因集体自卫和集体掠夺的共同利益和命运而逐渐形成为奴隶制民主,而这种民主也有利于镇压奴隶的暴动.在城邦之间谁也不能打败谁的情况下,就要发展平等的贸易或联合起来对抗强大的共同敌人,这也需要民主.民主给古希腊雅典帝国和各小城邦带来了宪法法律诉讼法庭竞选辩论等,所有这些都需要严格的思维和精确的语言.民主也有利破除迷信和发现真理.这就是形式逻辑和逻辑思维在古希腊产生的条件和土壤.

古希腊人从与腓尼基人[7]的贸易中学会了字母最后形成了古希腊语言.这种语言是有利于逻辑思维的. 因此,形式逻辑在古希腊诞生是有社会历史基础的.

(D). 在伯里克利执政的 15 年期间,正是苏格拉底 26 ~ 40 岁的年龄. 苏格拉底用启发式和辩论式的方法教育他的学生.他本身就是当时的一位辩论大师.他是雅典帝国黄金时代的时势造就出来的,是当时社会需要的产物. 苏格拉底创造了道德哲学,他特别提倡伦理学.他特别强调: “理性导向道德”, “善来源于学识,而恶来源于无知”. 苏格拉底的上述的思想和观念大概是当时社会实际情况的反映.他生活在繁荣昌盛,民主和法治的伯里克利执政时代,眼见为实的某些官员,特别是像伯里克利都充满着善,理性,智慧和广泛的学识,而使苏格拉底突出地看到了人性中善的一面, 从此建立了他的伦理学.他还提倡归纳法,告诉人们如何从许多具体的事例中得出正确的判断. 然而最后, 苏格拉底却由于宣扬出自于他的理性的新 “神”而被判处死刑.

(E). 柏拉图[10]是苏格拉底的学生, 生于公元前 427 BC 年,比苏格拉底小 42 岁. 伯里克利在公元前 429 BC 年死后, 雅典帝国极大的腐败和衰落了,最终在公元前 405 年被斯巴达所取代. 在柏拉图的生活中,他经历的是雅典帝国极大的腐败衰落和斯巴达的统治.在柏拉图的眼里, 真实的世界是非常腐败和丑恶的,他对当时的政治,法典和常规特别地厌恶. 苏格拉底在公元前 399 年为自己的信仰而被处死给柏拉图非常强烈的刺激. 柏拉图把苏格拉底看成是理想和智慧的真正化身,却终于被民主暴力所处死. 由于对雅典帝国末期民主暴政和斯巴达混合统治制度 (皇帝加贵族加监督官的统治)的失望, 柏拉图认为感性的识识和世界是纯粹的幻觉,而只有理性的认识和世界才是真实的和可靠的. 柏拉图里决定将其老师苏格拉底的哲学思想加以发挥,把苏格拉底关于理性和善的观念推广到最高的境界而成为 “真,善,美”. 他最后探究在世上建立理想国的理论. 一方面, 柏拉图认为理性的和善的政治家在未来的任何制度中是必然需要的, 而善只来源于理性, 理性从知识中产生. 于是, 柏拉图在雅典创立学院招收学生学习哲学和数学. 他实行毕索哥拉斯 Pythagoras 的观点; “任何事物皆是数”. 在他的心中, 数学和几何是最理性的,所以是最可靠的,因而可以精确的应用到商业,航海,天文和建筑等等中.因此,只有掌握数学和几何的理性的人才有智慧,才能导致理性的行为和善,也只有这种人才能成为好的执政者. 在柏拉图学院的大门前,门牌上写着: “不懂几何者不得入内”. 当时许多的政治家和数学家曾在柏拉图学院学习过. 另一方面, 柏拉图把斯巴达的军事共产主义的某些社会制度当作他的理性国的芻型.上述两方面的结合就成了柏拉图的 “乌托邦” 的主要内容.

(F). 亚里士多德 Aristotle,[11] 生于公元前 384 BC 年,是柏拉图的学生之一,他从 17 ~ 38 岁在柏拉图学院学习了 20 年. 稍后, 亚里士多德成为亚历山大三世 Alexander III 大帝的老师. 亚历山大大帝是马其顿的伟大皇帝,在他 13 年的讨伐战争中,他创立了一个包括部分欧亚非三个大陆的庞大帝国. 公元前 338 年, 亚历山大大帝的父亲菲力普二世 Philip II 统一了希腊各城邦. 雅典成为亚历山大帝国的附属国而得到了短暂的和平和繁荣. 亚里士多德从公元前 338 年直到他在公元前 323 年亚历山大逝世的 15 年内在雅典创立了学院,並在学院内从事科学研究和著书立说.他的学院从亚历山大大帝那里得到了大量的金钱捐助. 亚里士多德在公元前 322 年逝世,即亚历山大大帝死后 1 年去世.

亚里士多德在他创立的的雅典学院的光辉灿烂的 15 年生活期间,正是亚历山大大帝统治着雅典. 亚里士多德作为教授教书的同时,大量的著书立说,他完成了<物理学>,<天论>,<伦理学>,<形而上学>,<政治学>,<工具论>等流传下来的 30 多种巨著.他的著作不仅集中体现了灿烂的古希腊文化,而且使其发扬光大到顶峰,它是欧洲文化和科学产生和发展的根源. 亚里

士多德的著作是批判的,平淡的和细致的,而非热情洋溢.他不是充满激情的先知. 亚里士多德批判了许多柏拉图的观念,比如,理性主义,乌托邦等.他说: “吾爱吾师, 但吾更爱真理”. 柏拉图坚信: “理念是物质客体的原始模型,它的存在是不倚赖物质客体的, 感觉不可能成为真正知识的来源”. 然而, 亚里士多德喜好独立地观察和思考,他认为: “知识来源于感觉. 物质客体本身已经包含了它自己的本质,” 亚里士多德在其认识论中将物质客体,实在,世界和事物的存在放在第一位和最重要的地位.他极其重视观察和研究自然现象和自然规律,他卓有成效地研究了天文,气象,动物,鸟类等等.他在其著作著中表达了他的观念: “宇宙,人类生活以及社会的各个方面统统都是分析和思考的对象.宇宙中的各个事物不是被神,运气或魔术所控制,而是按照某些确定的规律运动.因此,自然界是值得人们系统地研究的,人们应通过实验和逻辑分析而得出结果.” 亚里士多德的反传统,反神秘主义和反迷信的主张对以后的西方文化产生了重大的影响.

亚里士多德的主要政治观点有: “好的政府有三种:君主制度优于贵族统治,而贵族统治又优于共和制.然而,一旦最好的制度腐化堕落,它就成为最坏的了”.在他的眼中, “富人的寡头统治和平民大众的民主(专政)都是坏政府”.他的著名的论点是: “民主是政治家的敌人”. 亚里士多德坚信 “中庸之道”.在他看来, 斯巴达和雅典帝国是两个极端.显然,他的政治观点深受他的经历和当时政治现实的影响.他清楚地认识到雅典帝国和斯巴达消亡以及苏格拉底被处死的意义.他经历了斯巴达的混乱统治,经历了不可预见的庞大的菲力普--亚历山大帝国在 15 年内的迅速建立和迅速崩溃.这些历史的巨变使亚里士多德确信一个强大而不腐败君主政体才是大大优于雅典的民主制和斯巴达的混乱的共和制的.

亚里士多德力图将存在与思维模式统一起来.他在<工具论>中,着重阐述了演绎法.因此,他成为形式逻辑的奠基者.为了保证思维的可靠性. 亚里士多德将思维的规则规范化,那些规则就称之为“逻辑”. 他还首创用形式逻辑研究了几何学.

事实上, 亚里士多德几乎创导了正确的 “认识论”或者说在科学研究中的 “方法论”,即对客体的正确的观念和结论只有建立在系统实验的基础上和通过逻辑分析才能得到.在以后一千多年的长期历史中,他的上述观念只不过是未被大多数学者所公认的一种假说,因为稳定的自给自足的小农经济的长期存在和充满迷信,那时的知识分子无需也无法认识到将自然介当作实验的对象.特别是 “中世纪”,在罗马天主教和使徒信经的统治下,几乎所有亚里士多德的错误观点都成为维护罗马神权统治的教条,比如, “天体是神圣的天神”就是他的错误观点之一.这就是为什么近代科学萌芽只能在文艺复兴后的欧洲产生.

(G) 欧几里德 Euclid,[14] 出生于公元前 330 BC 年,即亚里士多德逝世前 8 年,他是古希腊最伟大的数学家.他在其著作中成功地将亚里士多德的逻辑学运用于几何学;他从 5 条公理和 5 条公设出发通过演绎法井井有条地证明了 467 条最重要数学定理.**这是人类历史上首次成功地运用演绎法于科学思维从而导致演绎法成为建立科学理论的规范**.而且, 欧几里德还发现了光的反射定律和浮力原理.

3.比较,分析和结论

(A). 根据前面的陈述可知, 系统的实验和运用形式逻辑仅仅是科学研究成功的必要条件,特别是近代科学萌芽产生的必要条件.然而,学者们能自觉地掌握运用形式逻辑和系统的实验去从事科学研究还需要经历一个长期的历史过程.也就是说,成熟的社会政治经济条件是近代科学萌芽产生的充分条件. 在欧洲,只有当中世纪的对罗马天主教神权的迷信在文艺复兴后被破除了,而且当航海天文和其它技术的发展能给当时的科学家和社会带来财富时, 近代

科学萌芽才能发生和发展壮大以满足社会经济的需要. 这就是为什么虽然亚里士多德早在公元前 320 年就清楚地指明了科学研究的正确途径,而近代科学萌芽却只能在 2000 年后,在 16 世纪文艺复兴后的欧洲发生的原因. 反观古代中国,在 600 多年前的明朝,即在哥伦比亚 Columbus 出生前,太监郑和 [12] 率领庞大的舰队 7 次到南海诸岛和印度洋,他的舰队约由 300 艘舰艇和 30000 人组成,其航海技术和规模在当时无疑是世界第一的.然而,由于郑和的舰队并不是为了寻找或掠夺财富,人们仍然迷信封建王朝的皇权和孔孟之道,因而,此后 500 年来,近代科学萌芽仍不能在旧中国出现,因为直到 1840 年鸦片战争前,**旧中国的大统一封建王朝,自给自足靠天吃饭的小农经济和统一的文字文化的 "三位一体"所形成的超稳定结构一直没有被打破**.

(B). 近代科学萌芽的产生需要适当的气候和土壤. 文艺复兴就是适当的气候,而那时欧洲各国和城邦之间的繁荣的海上贸易就是土壤.望远镜的发明和使用可作为近代科学萌芽产生的标志.

中世纪亦称之为 "黑暗世纪",约从公元 400 ~ 1500 年,那时, 罗马天主教和基督信条非常严厉地统治着人们,它宣扬禁欲主义和经院哲学. 罗马天主教堂建立了宗教裁判以严厉地惩罚异教徒和严格地控制科学思想的传播,甚至于几乎将所有亚里士多德的错误观点当作维护罗马天主教的教条. 基督教的核心信条是人类中心主义,它宣称地球是宇宙的中心,而人是地球和万物的中心. 因此,只有上帝能统治人类,而人类应当按照上帝的旨意在地球上统治万物,同时,上帝也付给每个人平等权利和自由.如此,在中世纪的欧洲, 近代科学是无法产生的.

早在文艺复兴 Renaissance[13] 前,马可孛罗 Marco Polo 从陆地到中国旅游 20 年后,于 1298 年回到了意大利.之后,欧洲知道了在世界上,有许多美丽而富裕的东方国家.在文艺复兴时期和之前, 意大利有许多自由贸易的港口城市,那里的经济和手工业都很发达.他们都仰慕东方国家的财富和繁荣.

早在文艺复兴前,在中世纪的欧洲,一些国家已经建立了以古代柏拉图学院为前辈的许多大学,这些大学教授数学和科学.公元 1150 年,创建了巴黎大学,1168 年,正式建立了牛津大学[14].

文艺复兴发生在 15 世纪的意大利,它宣扬人本主义和破除中世纪对罗马天主教神权的迷信. 文艺复兴给欧洲带来了宗教改革.新的基督教改革宣扬平等,自由和博爱,提倡恢复原来的基督教导和早期朝气蓬勃的教堂生活,反对现有的罗马天主教教条.宗教改革完全符人本主义和古希腊文化的传统精神.结果, 宗教改革又反过来帮助了文艺复兴的发展.

一方面, 文艺复兴反对禁欲主义,而提倡享乐主义.因而文艺复兴所赞颂的个人自由和个人英雄主义与改革后新基督教的教规相符合.因此, 大大地激发了个人寻找财富的欲望.哥伦布 Columbus (1451 – 1506 AD)在坚信地球如园球的信念下,他要远洋航海到西印度群岛去寻找财富和黄金,但是他却意外地在 1492 年发现了美洲大陆.

另一方面, 文艺复兴恢复和发扬了古希腊和罗马文化的优秀传统,特别是民主和科学的传统精神. 文艺复兴的优秀代表们特别重视亲自参加各种实验. 列昂纳多•达•芬奇 Leonardo da Vinci (1452 – 1519AD)说过: "真正的科学起始于观测", "如果科学不是从实验中产生, 不是从准确无误的实验中产生,它就是毫无用处的,而将充满错误,因为只有实验才是真实的母亲." 达•芬奇言行一致, 他反对流行的亚里士多德的观点,认定: "天体正如一部机器,它遵守自然界的某种确定规律." 在 1490 年, 达•芬奇研究了水在毛细管中的运动.[14] 文艺复兴的杰出人物们对欧几里德和阿基米德的尊敬更甚于对亚里士多德的尊敬. 在亚里士多德之后, 科

学家们放弃了企图对自然界完整体系的探索,並转向对具体问题的研究.这正是亚里士多德的正确的研究方式对后世科学家们的重要影响.

地球是世界中心的教条是中世纪维系罗马天主教神权的主要支柱. 伽里略 Galileo (1564 – 1642AD)[14] 是长期的哥白尼 Copernicus' [14](1473 - 1543)理论的信徒. 哥白尼认定地球是在围绕太阳运动. 从 1610 年 1 月 10 日起, 伽里略为了验证哥白尼理论的正确性,用自己制造的望远镜对准天空中的月亮,金星,太阳和土星等进行观察. 在观察了月亮之后,他感叹道: "原来, 月亮和地球是一样的." 从此以后,神权的迷信就被彻底地破除了. 于是, 近代科学萌芽就在 1610 年 1 月 10 日在欧洲从伽里略的望远镜中产生了.人类应该永远记住这个伟大的日子.**人类从此以后认识到整个自然界中的天地人有统一的物质结构。**

大约在欧几里德之后 2000 年,在 1687 年, 牛顿 Isaac Newton (1642 - 1727)[14]完全照搬公元前 300 年欧几里德在其几何原本中所运用的演绎法,应用到自己伟大著作<自然哲学之数学原理>中,取得了辉煌的成就. 牛顿的成就用他自己的话说是 "站在许多科学巨人的肩上"取得的. 牛顿的另一伟大成就是严格地按照演绎法推导和发明了微积分,他还发现了以他的名字命名的万有引力定律和物体的运动三定律.**他首次让人们得知, 自然界任何物体的运动, 不管是天上的还是地上的, 都不是毫无规则的, 而是都必须服从统一的确定的规律, 而这些规律是可用精确的数学公式来描述和计算的.**他所发现的那些定律是近代科学的大树上永不凋谢的花朵和果实. "通过与实验的比较来检验和改进理论的现代科学研究方法实际上也是他创立的."[14]

克卜勒 Kepler (1571 - 1630)[14]通过许多年的系统的观察计算和推导发现了行星运动的三大规律.他的伟大成果为牛顿发现万有引力定律奠定了结实的基础.

在 1784 年,瓦特 James Watt (1736 - 1819)[14] 利用炮筒作为气缸发明制造了完善的蒸气机. 这是人类现代科学技术上最伟大的成就.从此以后,人类就可利用自然界的无穷力量为自己服务.人类就可全靠自己的智慧而不是单靠自己的体力劳动为自己谋幸福.

文艺复兴首次为欧洲带来了文学艺术革命,然后带来了,从而使欧洲最终走向科技革命和资本主义.因此, 文艺复兴就成为欧洲近代科学萌芽的最佳气候,而欧洲当时的许多独立国家和相对独立的城邦和港口城市之间的繁荣的海上贸易是近代科学萌芽的最佳土壤.

(C). 为什么古代希腊人和以后的欧洲人喜欢对自然和事物进行观测和实验而古代中国人就没有这种喜好呢? 如上所述,古代二者长期的大不相同的生活环境造成了他们不同的生活方式, 思维方式和行为方式.生活在海上和海边的古希腊人认识到个人命运的改变和凶险正如海上的气候一样是难以预测的,他们只得靠自己对大自然和事物的观测实验以避凶趋吉.而古代中国人生活在大陆平原上靠天吃饭,他们的生活作息都是日复一日年复一年的循环有序的进行,生活是相对稳定的.隔几年偶有洪水或旱灾,也认为是"上天"对 "子民"罪过的惩罚, 于是从皇帝官员到老百姓都跪下向"上天"祈祷. 孔子教导说: "获罪于天.无所祷也." 这就是说,在中国古人和圣贤的心里,只要不做坏事得罪老天爷,就能过风调雨顺的平安日子.因此, 中国古人和圣贤既不敢也懒得对自然界和事物进行观测和实验了.

(D).一个民族或国家的人们的思维方式和行为方式主要为其文化所决定,而文化主要为其生活方式所决定,而生活方式又为其社会政治经济制度和自然环境所决定.因此,归根结底, 人们的思维方式和行为方式是为其社会政治经济制度和自然环境所决定的,也会随着社会政治经济制度的改变而改变.反之, 人们的思维方式和行为方式的改变也会促进或阻滞其社会政治经济的发展.在古代,由于科学技术发展很慢,导致生产力停滞不前,而社会政治经济往往循环往复而无发展, 因此, 自然环境对当地人们的思维方式和行为方式的影响是很大的.但

到现代,由于科学技术发展很快, 社会政治经济也跟随着快速发展以至于改变了人们的生活方式,最后也改变了人们的思维方式和行为方式,而自然环境对人们的思维方式和行为方式的影响力也就越来越小了.这就是说, 人们的思维方式和行为方式并不是先天固有的,而是能够改变的,是一定的社会生活环境的产物,只是在其传统的影响下改变得早晚快慢的不同而已.

因此, 人们的逻辑思维和作实验的能力并不是某特定民族的天赋,是一定的生活环境和生活方式作用下形成的,是不难学习到的.现在许多发展中国家正在走向工业化和现代化,就足以证明那些国家的知识分子能够运用逻辑思维和作实验的能力以掌握和发展近代科学技术. 再看许多中国的学者年青时虽然受了中国的传统教育,但以后到美国学习和工作后,在科学技术上取得了巨大的成就,一些中国学者还获到了诺贝尔奖.

然而,在严重的危机或极大的诱惑面前或生死关头,人们的个人欲望或情感会强迫自己迅速地改变思维方式和行为方式. 一个集团或一个国家民族也有类似的情况.这就是促使一个国家发生改革进步或革命的原因,也是导致个人或集团犯罪或者转危为安的原因.

(E),在中国古代,在大陆平原上的中国人是长期的过着自给自足的小农生活,是靠天地的恩赐生活,这就是孔子<易经>老子和佛教的思想能站主导地位的原因. 一个由自给自足小农经济, 大统一的封建王朝,和统一的象形文字和上述保守的儒释道文化所组成的这种经济政治文化三者所结合成的**"三位一体".**两千多年来这种"超稳定结构"阻碍了社会的进步和发展,也禁锢了知识分子的思想和行为. 从而使近代科学萌芽无法在中国发生. 因此,如果没有外力的强烈冲击, 中国人的旧思想习惯是很难逃出那儒释道**"三位一体"**的控制的, 旧知识分子也就只有墨守成规, "学而优则仕",而不可能从事科学观测和逻辑思维. 在 1840 年鸦片战争以后, 旧中国由于科学技术落后而遭受西方列强的侵略和掠夺. 到 20 世纪初,中国的本土又被一次又一次的瓜分.在这国家命运的生死存亡的关口, 中国知识分子在 1919 年的五四运动中提出了学习西方民主和科学,并提出了打倒孔家店的口号. 此时, 旧中国的**"三位一体"在 1911 年的辛亥革命推翻了封建王朝和五四运动后已经被打破了两位,而只剩下小农经济了**. 相反,古希腊文化源于古希腊的完善的奴隶制民主和海洋贸易,这种民主导致古希腊知识分子产生了逻辑思维,平等讨论和争论的精神,服从真理和事实的精神. 而海洋贸易使希腊人产生了冒险精神,实验的习惯,赚钱和掠夺财富的欲望.所有这些思想精神传统都被文艺复兴所继承和发扬了.

(F)简要地总结以下,不同的古代文化对近代科学萌芽的影响主要地取决于古代知识分子和人们的不同的思维方式和行为方式.**古希腊哲学基本上是自然哲学**,因而古希腊先哲所创造的形式逻辑和演绎法是他们对自然界和社会进行观测比较的结果.在古希腊的雅典,经历过奴隶制的民主,共和制和君主制,既统治过别人,也被统治过.因此,形式逻辑和演绎法是从仔细的观测,详尽的比较和有理有据的辩论中发展总结出来的.**而古代中国的哲学基本上是一种道德哲学,或伦理哲学,** 是一种教各种人安分守己的行为哲学,它教人要如何各安其位,各行其事,而 "不逾矩". 每个人都要 "畏天命", "畏圣人之言",和不能 "犯上作乱".所有这些都被以后的封建统治者利用以维护其统治,保持社会的稳定.而古代中国从 4000 年前的夏朝起就一直实行帝制,因为在大陆的大平原上不可能存在象古希腊那种能独立自卫自保的城邦,因此,皇帝之被尊为 "天子"已成为古代中国圣贤和老百姓思想中不可动摇的信仰.这就是说,古代中国没有产生近代科学萌芽的思想基础. 那么,这是不是就表明古代西方的文化传统和哲学在各个方面都优于古代中国的文化传统和哲学呢? 当然不是,每种文化传统和哲学都是博大精深的,各有其优势和劣势和其存在的价值,都是长期地特定的社会政治经济制度和自

然环境的产物,并都经过几千年的历史考验未被淘汰反而都仍在发展.这就表明,在现代,**各大文化之间的冲击不是谁战胜谁的问题,而是相互取长补短相互促进和溶合问题**.但也都要与时俱进,不能抱残守掘.

(G). 西方文化来源于古希腊文化,该文化传统的是奴隶制的民主和海上贸易的冒险精神和求实精神.**但古希腊的奴隶制民主只是狼与狼之间的民主,**即只承认奴隶主之间的民主,而不承认狼与羊之间的民主,即奴隶主与奴隶之间的民主,这就形成了西方文化中的主要内容和特点是: 一方面是,个人主义,个人英雄主义,个人自由主义, 强烈的个人竞争欲望,追寻和掠夺财富的欲望,冒险精神等.按照基督教导,人人都有原罪,这样一来,人类的本性与动物就没有本质的区别,因此,弱肉强食的丛林则,社会达尔文主义和种族主义也深入许多人的心中.. 另一方面是,科学和求实精神,民主,平等,自由和博爱等精神.特别是经过文艺复兴和宗教改革后以及数百年来科技和社会经济的进步,资本主义的发展,再加上广大中下层民众不懈的争取平等的斗争,上述许多好的精神和传统得到了发扬,而某些坏的精神和传统得到了抑制,从而使西方发达国家实现了现代较全面的民主制度.在现代西方社会,人与人之间的关系主要是横向的金钱关系,而其它的所有关系都是次要的,而且可以说是完全平等的. 个人欲望的恶性膨胀是社会中个人犯罪的根源, 已成为西方社会的毒瘤.而西方发达国家的执政者和垄断资本家的个人欲望的恶性膨胀就成为霸权主义和国际间战争的主要原因.这似乎是继承了古希腊奴隶制的民主对外掠夺的劣根性.

相反,古代中国文化将"天" "地" "人"当作 "三位一体", 三者都产生于 "道",即自然, 三者应和谐共处. 但 "人"为"天" "地"所生,所以"人"应该感谢和敬畏"天" "地".在旧中国,人与人之间的关系都是 "上下" "主从"的垂直关系,如皇帝官民关系,父子,夫妇,师生,长幼等关系,而所有这些关系都是不能颠倒的,妇女地位在旧中国处于最下下层,必需 "三从",即 "在家从父", "嫁后从夫", "夫死从子". 似乎**没有两个人可以处于完全平等的地位**,不知道两双胞胎之间是否能有完全平等的地位.**没有平等就很难产生自由的思想和行为**.任何人都不能 "犯上".所以这些出自圣贤教导和制定的纲常和礼仪完全禁锢了旧知识分子和中国人的思想和行为,使他们只有服而从不可能违背 "天意", "上意"和 "圣贤的教导",对自然界和事物进行观测和探究.这种流毒还多少残留在现代中国知识分子的思想中.

(H). 然而, 现代科技的高速度发展已给西方国家的民众带来了丰富的物质和文化生活. 一方面,人们能花更多的时间以满足自己的精神和文化的需要. **在过去,大多数人的困苦主要来自生活物品的缺乏. 在现代, 西方国家的民众的不幸福主要来源于个人欲望的恶性膨胀而不是生活的贫困,**结果导致个人犯罪的大量发生,而执政者个人欲望的恶性膨胀是导致霸权主义和国际战争的根源.这是西方文化传统中过分强调个人主义和个人自由的结果. 因此,人们就更需要正确的世界观和人生观以避免自寻烦恼和灾难从而害己害人害社会.不幸的是西方的流行文化已成为牟利的有效工具而大肆宣扬和美化暴力和犯罪.另一方面,资本家为了获取超额利润或暴利以满足自己的欲望,常造成环境污染而危害人类社会.西方发达国家的垄断资本集团及其政府在经济全球化的名义下,为了私利在国际间实行霸权主义,对发展中国家实行掠夺,造成国际间的冲突和战争,这是毁灭地球文明的真正的危险因素.难道世界的永久和平是靠核威慑的平衡达到呢还是靠道义的力量达到呢? 这就是说, 光靠发展科技和经济不能解决上述重大问题,而应该从中国文化的一些好的传统中寻找解决方法.在现在地球村的时代,各种文明冲击的最终结果必然是彼此之间取长补短的溶合发展. 例如,**中国在几千年的历史中从未发动过对外掠夺财富的战争.另外,中国近代革命史上有一种非常重要而有趣的现象,无论康有为,孙中山和毛泽东的革命目的和手段有多么大的区别,他们的最**

终目的都是要建立一个 “大同世界”,而不是一个世界超级霸权. 这就是中国文化好的传统与西方文化现行传统的大不相同之处.

(I). 文化是一个国家或民族的灵魂. 社会经济的发展一定会影响甚至改变该国家或民族民众文化生活和精神状态,即民众的内心世界,生活习惯,思想和行为的方式等. 然而,影响总是有正反或好坏两方面同时发生. 总而言之,随着科技和经济的快速发展,全社会民众的物质生活是日益丰富了. 相反,民众的道德品质在总体上是下降了. 这种结果可能是来源于西方文化中一些固有的缺点,因为西方文化将个人主义,个人利益,个人自由等放在第一位. 一个充满物欲而缺少道德偶像和偶像崇拜的文化可以说是一种病态的表现,对青少年的影响特别的坏.

由此可见, **西方文化是以个人和以物质利益为中心的.相反, 中国文化是以社会和道德为中心.两者各有所长和所短.** 西方文化有利于发挥个人的才能智慧和创造性,同时易于导致个人欲望的恶性膨胀和个人犯罪. 中国文化则偏重于 “修身,齐家,治国,平天下”这一套规范,使人的思想行为社会化政治化,从而限制了个人才能智慧和创造性的发挥.可见, 西方文化和中国文化似乎是走了两个极端.**值得回味的是中西文化的始祖孔子和亚里士多德都主张 “中庸之道”,**因此,在现代,中西文化各自的相互取长补短的溶合是必然的趋势.然而,中国文化是多有包容性而少有排斥性的,古代中国文化就以吸纳了印度的佛教而将其中国化,实际上,中国现在已经迅速地大量地吸纳了西方文化,特别是中国现代语言文字的西化已相当成功.因此, **中国文化吸收西方文化和其它文化正如顺水行舟**.而西方文化中浓厚的个人英雄主义和丛林法则等所产生出的优越感和排斥性使其过去和将来都较难吸纳了其它文化的优点.因此, **西方文化吸纳了其它文化的优点就象逆水行舟了**,只能费力地被推动着缓慢前进. **这或许是中国现代化的发展可能较快地赶上西方发达国家的重要原因之一.**

概括而言,中西文化的主要差异就是: 中国文化重“义” 轻“利”,而西方文化则重 “利” 轻“义”. 现在,科学技术的高度发展已将世界变成为一个地球村,人,集团,组织,国家和民族之间的关系已非常紧密,**各种现有的优良文化之间的冲击不可避免,而总的趋势是强势文化很难消灭弱势文化。因此，文化之间的冲突和斗争是会很激烈的。**但愿各种现有文化之间的冲突不会导致国际之间的大战,然而,各种文化相互取长补短的溶合是历史发展的必然趋势,**因为在这诺大而复杂的世界不可能只有一种单一的文化存在,人们期待着相互取长补短的溶合后的世界的各种文化更加具有包容性和更加光辉灿烂.**

----全文完----

参考资料:

[1]. 胡星斗: 中国人思维的缺陷. http://www.creaders.org/forums/messages/468917.html, 2/27/2003.
[2]. 杨振宁: 在中国北京人民大会堂的演讲. 9/3 2004.
[3]. 孔子: www.sdinfo.net/sdonline/lishi/kz.htm.
[4].老子: http://en.wikipedia.org/wiki/lao-zi.
[5]. 孟子: www.cnread.net/cnread1/gdwx/m/mengzi/002/001.htm.
[6]. 佛教简介: http://www.ship.edu/~cgboeree/buddhaintro.html.
[7].李小宁: 我对东西方思想方法的看法. http://www.cnd.org/HXWZ Express/03/01/030122.
[8]. 苏格拉底: http://www.nioerar.edu.tw/basis1/693/a33.htm.
[9]. 伯里克利: www.housebook.com.cn/200305/16.htm. Athenian Empire, www.ntsf.edu.cn/dy/dililishi/dili5.hym.
[10]. 伯拉图: www.zh.wikipedia.org/wiki/plato.
[11]. 亚里士多德: www.scitom.com.cn/history/person/psn031.html.
[12]. 郑和: Admiral Zheng’s Fleet. http://www.google.com.
[13]. 文艺复兴: http://www.gamex.diy.myrice.com/xwenyifuxin.htm

[14]. 约翰 & 格里宾: 大宇宙百科全书. ISBN 7-5443-0145-1, 海南出版社, 2001, 9.

【15】。Dongsheng: English Edition,发表在“The Journal of American Science. 2005. 1(1):78-86 ”.. 其网址是:http://www.americanscience.org/journal/am-sci/0101.

张洞生：人类社会经济形态的改变和人类社会的发展的新观念

1. 中文版。 Academia Arenna, http://www.sciencepub.net/academia./0102, 2008.8.
2. 中文版。New York Science Journal, http://www. sciencepub.net/newyork/0103, 2008.8.

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Schistosoma mansoni: Partial Molecular Characterization of The Gene Encoding Zinc Finger Protein ,The Transcriptional Regulatory Protein Of Lung Stage (7-Days Schistosomula)

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ABSTRACT: Schistosomiasis is a serious parasitic disease with world-wide distribution, causing an estimated 200 000 deaths per year. Despite the fact that the global distribution of schistosomiasis has changed significantly in the past 50 years, particularly in regions where control strategies have been successfully employed, the disease remains endemic in over 70 developing countries and more than 200 million people are estimated to be harbouring the disease. Schistosomes also infect livestock and cause serious economic hardship in many developing nations. Chemotherapy, does not provide a satisfactory solution since, although effective, it does not prevent re-infection, and in addition, partial drug resistance to the most commonly used chemotherapeutic agent against schistosomiasis, Hence, immunological intervention in the form of a vaccine would contribute to the success of the present efforts if added to existing control strategies. Most of the trials in the development of antischistosomiasis vaccine were involving membrane-associated antigens contained in the adult *Schistosoma mansoni* tegument because they are capable of stimulating protective immunity , but in the recurrent study we tried to find another antigens which could be vaccine candidates by incorporating internal antigens of the parasite lung stage (7-days schistosomula) and not depending on tegumental proteins only , so , instead of extracting surface proteins ,we obtained the soluble extract of 7-days schistosomula which was coupled to Sepharose-4B column for affinity purification of pooled sera obtained from patients with chronic infection of schistosomiasis. The purified sera were used to immunoscreen λgt11 cDNA library of 7-days schistosomula. The plaques purification after the three rounds of immune-screening gave a number of cDNA clones. Phage DNA of one of the isolated clones (clone 2-4) was amplified by polymerase chain reaction (**PCR**) using λgt11 forward and reverse primers , then , cloned in plasmid vector **(PCR™II)**. The cloned insert was partially sequenced 270 bp from the 5′- end using Sp6 primer and 187 bp from the 3′-end using T7 primer and was found to encode the gene of **Zinc Finger** protein (the transcriptional regulatory protein) having two open reading frames (ORF) , the sequenced part of the insert showed 31-36% identity to the gene of **Zinc Finger** protein from a number of eukaryotic species including human , rat and mice. [New York Science Journal. 2008;1(4):77-88]. (ISSN: 1554-0200).

Key Words: 7-days schistosomula; **Zinc Finger** protein; antischistosomiasis; *Schistosoma mansoni*

INTRODUCTION

Most current viral and microbial vaccines were developed empirically, but in the knowledge that first exposure to the pathogen generated a strong immunity to re-infection. For parasites the situation is altogether more complex, not least because they have evolved efficient mechanisms to evade host immune responses. In the case of

schistosomiasis mansoni, the result is a chronic debilitating infection that may persist for more than 30 years (***Harris et al., 1984***). In these circumstances the development of a schistosome vaccine was always going to be a difficult task. In what might be termed the classical approach, the strategy is to identify protected individuals in an endemic population. The immune mechanisms that such people deploy to limit or prevent establishment of invading cercariae should form the basis of a successful vaccine. In the last two decades great progress has been made in characterizing human responses to schistosomes (Dunne & Mountford 2001), but no immune mechanisms or specific antigens *strongly* associated with a protected status have been identified . In recent years, considerable effort has been made to develop a protective vaccine against schistosome infection and several potential DNA constructs encoding several candidate molecules have been identified (***Yang et al., 1995, Waine et al., 1999, Nascimento et al., 2002, Sidiqui et al. 2003., Shalaby et al., 2003, Sidiqui et al., 2005, Fonseca et al., 2006, Zhu et al., 2006***). Schistosome tegumental antigens have been shown to play a pivotal role on the evasive mechanisms of ***Schistosoma mansoni*** in a mammalian host. Additionally, the principal membrane-associated antigens contained in the adult ***Schistosoma mansoni*** tegument do not cross-react with egg antigens of the parasite, which are involved in immunopathology (***Smithers et al. 1990***). Thus, the characterization of proteins within the tegument is relevant in a more basic level to improve the understanding of the function of this structure and in a more applicative level to identify molecules that are useful for diagnosis, or may act as targets of protective immunity and/or chemotherapy (Abath *et al.,* 2000). Part of the problem may be due to the ability of the parasite to evade host immune mechanisms. In the case of schistosomiasis, a sterilizing vaccine, although desirable, is not essential. Since schistosomes do not multiply within the final host, a vaccine that induces even a partial reduction in worm burdens could considerably reduce pathology, limit parasite transmission and be less expensive than repetitive drug treatment (Chitsulo *et al.,* 2004). Many world health agencies agree that the development of an antischistosomiasis vaccine should be seeked. Several studies are in progress in this field, testing different antigens of the parasite and different vaccination strategy (*Chitsulo et al., 2004*) . Vaccine candidate antigens are often secreted by or anchored on the surface of pathogens. Proteins that are secreted or anchored on the surface of schistosomes are exposed to host tissues and thus present as potential candidate molecules for the development of new vaccines. It has been shown that isolated tegumental membranes are capable of stimulating protective immunity in mice (*Smithers et al., 1990*).

The expression of eukaryotic genes is controlled primarily at level of transcription initiation , although in some cases , transcription may be attenuated and regulated at subsequent steps. As in bacteria , transcription in eukaryotic cells is regulated by proteins that bind to specific regulatory sequences and modulate the activity of RNA polymerase (*Hochschild and Dove, 1998, Nikolove and Burley,1997*) , in addition the packing of DNA into chromatin and its modification by methylation impart further levels of complexity to the control of eukaryotic gene expression *(Felsenfeld ,1996 , Kadonaga , 1998 , Wolffe, 1998 , Razin and Cedar, 1994).*

Many different transcription factors have now been identified in eukaryotic cells, as might be expected, given the intricacies of tissue-specific and inducible expression in complex multi-cellular organisms . DNA binding domains in eukaryotic transcription factors exhibit variety of structure, among the most common structural motifs are the homeodomain, basic zipper (leucine zipper), helix-loop-helix and several types of zinc fingers (*Pabo and Sauer, 1992*). Zinc finger domains contain repeats of cystiene and histidine that bind central Z^{+2} ions and fold producing a compact domain from a relatively short length of the polypeptide chain termed a zinc finger , this structural motif was first recognized in DNA- binding domains , but now is known to occur in proteins that do not bind to DNA. These domains were initially identified in the polymerase II factor TFIIIA but, are also common among transcription factors that regulate polymerase II promoters, including Sp1. Other examples of transcription factors that contain domains are the steroid hormone receptors , which regulate gene expression in response to hormones such as estrogen and testosterone (*Pabo and Sauer, 1992 , Mitchell and Tjian, 1989, Ptashne and Gann, 1997, Johnson and McKnight, 1989 , Burley and Roeder, 1996*).

The first zinc finger structure is C_2H_2 zinc finger, containing three or more repeating finger units and bind as monomers, it is the most common DNA binding motifs in eukaryotic transcription factors. The second type is designated C_4 zinc finger , found in more than 100 transcription factors , identified as specific intracellular high affinity binding proteins or receptors for steroid hormones , it contains only two finger units and bind to DNA as homodimers or heterodimers. The DNA binding domain in the yeast Ga14 proteins exhibits a third type of zinc finger motif, known as C_6 zinc finger , binds to DNA as homodimer in which the monomers associate through hydrophobic interactions along one face of their α-helical regions (*Pabo and Sauer, 1992, Kustu et al,. 1991 , Burley and Roeder, 1996*).

In the recurrent study we aimed to isolate some clones from λgt11 cDNA library of 7-days schistosomula , after cloning in a plasmid vector and sequencing the isolated clones , one of them showed 31-36% identity to zinc finger protein (the transcriptional regulatory protein) from some eukaryotic species and although it is not a surface protein but, we hoped to provide a new potential vaccine antigen against schistosomiasis.

MATERIALS AND METHODS

Soluble extract of 7- days schistosomula:

Schistosomula mansoni NMRI strain was maintained in the laboratory of Theodore Bilharz Researsh Institute using Biomphalaria glabrata snails, cercariae were obtained from infected animals (*Fletcher et al., 1981*). Schistosomula were obtained by mechanical transforming cercariae where cercarial bodies were separated from tails by centrifugation 2000 rpm for 15 min over 70% percoll gradient (*Lazdins et al., 1982*). Cercarial bodies were recovered from tube bottom and washed three times with Minimum Essential Medium (MEM) containing 10% fetal calf protein , then , incubated in Modified MEM at 37^0C in a humidified 5% CO_2 incubator for 7 days. Finally, the medium was collected and living schistosomula were separated by centrifugation at 2000 rpm for 15 min over 60% percoll gradient (*Basch, 1981***).** The soluble extract was made by sonication of the parasites in a buffer containing 20 mM Tris, pH 7.2 and 2 mM phenyl methyl sulphonyl fluoride (PMSF) , then , centrifuged at 6000 rpm for 20 min. The supernatant was removed and stored at -70^{o}C.

Affinity purification of sera:

Sera used in immunoscreening experiment were pooled from schistosomiasis chronically infected patients admitted to Department of Tropical Medicine, Zagazig University Hospitals. Cyanogen bromide – activated Sepharose 4B was used to purify sera according to instructions of manufacturer by coupling 6-8 mg of 7- days schistosomula soluble extract to the column. Pooled sera were precipitated with 45% ($NH_4)_2SO_4$, the precipitate was redissolved in phosphate buffered saline (PBS) (0.4 g NaCl, 1.44g Na_2HPO_4 and 0.24 g KH_2PO_4/L) and dialyzed against PBS overnight. The dialysate was ,then, passed onto the column containing the NP-40 schistosomular extract. The flow through from the column was collected and tested using ELISA for reactivity to the extracted proteins. The column was washed with 30 ml PBS. Antibodies bound to the column were eluted by 0.1 M glycine–HCl, pH 2.6 and collected as 1 ml fractions. The pH of the elute was immediately adjusted to 7.0 with 100 µl 1M Tris-base., then, they were dialyzed against PBS over night to be ready for immunoscrening.

Screening of 7-days schistosomula λ gtll cDNA Library with antibody (*Huynh, 1985*):

To grow cells for transfection with schistosomula library , a single colony of *E.Coli* Y1090 was incubated in 50 ml LB-ampicilline medium (LB-amp) (10 g Bacto-tryptone, 5 g Bacto-yeast extract, 10 g NaCl, and distilled H_2O up to 1L , pH 7.0) containing 0.2% maltose and ampicilline 100 mg/ml allowed to grow overnight with good aeration at 37^{o}C, to used as hosts for plating the library. For the primary screening of the library, 150 mm LB-amp plates were used and 90 mm plates were used for secondary and tertiary screenings. An overnight bacterial culture, about 0.6 ml for each large plate and 0.2 ml for the small one , was incubated with 0.1 ml of SM medium (5.8 g NaCl, 2.0 g $MgSO_4$.7 H_2O, 50 ml 1M Tris ; pH 7.5 and 5 ml of 2% gelatin solution/ L). The cell suspension was incubated at 37^{o}C for 15 min to allow the adsorption of the phage to the bacterial cells. Molten top agar, cooled to 50^{o}C was added to the infected cells, 7 ml / large plate and 3.5 ml / small plate are poured onto the LB-amp plates pre-warmed to 37^{o}C, then, the plates were incubated at 40^{o}C for 3-4 hours (hrs). Dry nitrocellulose (132 mm and 82 mm) circular filters were used for large and small plates, respectively. The filters were saturated in 10 mM IPTG and air dried, then, placed onto the plates. The plates were transferred to a 37^{o}C incubator for another 3 hrs. then, removed from the plates and transferred to the Blotto buffer (non fat dry milk 5g in 100 ml PBS-0.05% Tween-20) to block the non-specific binding protein sites and shook at room temperature for 30 min. The filters were then washed 3 times in TBST (37.5 ml 4M NaCl, 10 ml 1M Tris; pH 8.0, double distilled H_2O up to 1L and 0.05% Tween-20) for 10 min each, followed by incubation for 3 hrs with primary antibody (the purified sera over schistosomula soluble extract column) ,then, washed 4 times at room temperature in TBST for 20 min each. The anti-rabbit IgG alkaline phosphatase conjugate, diluted in TBST according to the data sheet, was used to bind the

primary antibody-antigen complex. Following 1 hr incubation at room temperature in the secondary antibody, the filters were washed 4 times in TBST as before for 10 min each , dried and transferred to the color development substrate solution [33 µl of 50 mg/ml Nitro Blue Tetrazolium (NBT) + 16.5 µl of 50 mg/ml BCIP per ml AP buffer (10 ml of 1 M Tris; pH 9.5, 2 ml of 5 M NaCl 0.5 ml of 1 M MgCl , distilled H_2O up to 100 ml)]. The filters were incubated in dark until the desired color intensity had been developed , then, rinsed in distilled water. The developed filters were used to pick up agar plugs containing phage particles corresponding to the signals on the filters (the positive plaques) to be suspended into 0.5 ml of SM medium (5.8 g NaCl, 2 g $MgSo_4.7\ H_2O$, 50 ml 1 m Tris, pH 7.5 , 5 ml 2% gelatin solution and distilled H_2O up to 1 L) and placed on a shaker for 1 hr at 37°C. the purified phage plaques were used for the next round of screening.

Small scale preparation of bacteriophage DNA (*Maniatis et al., 1982*):

A bacteriophage suspension in ***E.Coli Y1090*** culture (O/N) culture , incubated at 37°C without shaking for 15 min, then to which 4 ml of NZCY-ampicilline medium (10 g NZ amine, 5 g bacto-yeast extract, 5 g NaCl, 2 g $MgSo_4.7\ H_2O$ and distilled H_2O up to 1 L ,then , autoclaved at 121°C and ampicilline 100 mg/ml). The culture was agitated at 37°C for 9 hours (hrs), followed by adding 0.1 ml chloroform. The lysate was , then , centrifuged at 8000 rpm for 10 min. Ribonuclease A and DNase I (Sigma) were added to supernayant to final concentration 1 µg/ml of each. An equal volume of ice cold solution containing 20% PEG-8000 and 2 M NaCl in SM medium were added to lysate and chilled on ice for 1 hr, followed by centrifugation at 10000 rpm at 4°C to pellet the phage particles which were suspended in 0.5 ml SM medium. To the suspension 5 µl of each 10% SDS and 0.5 M EDTA, pH 8 were added and incubated at 68°C for 15 min. The solution was , then , extracted with phenol, with phenol-chisam and with chiasm each extraction was done once, then , precipitated by adding 1/10 volume of sodium acetate and 2.5 volume of ice-cold absolute ethanol and stored at -20°C O/N , then, dissolved in 100 µl distilled H_2O , then , checked by running an aliquot of 10 µl using 0.7% agarose gel electrophoresis.

Polymerase Chain Reaction (PCR) (*Saiki et al., 1988*):

The isolated phage DNA from plaques was amplified using a pair of primers, λ gt11 forward (5′-GGTGGCCACGACTCC TGGA GGCGG-3′) and λ gt11 reverse (5′-TTGACACCAGACCAACTGGTAATC-3′). Taq DNA polymerase (Perkin-Elmer Cetus and Stratagene) was used in this reaction to synthesize the new strands generated by that process. A typical PCR reaction mix (100 µl reaction) was prepared (10 µl 10 X Taq DNA polymerase buffer, 16 µl of 1.25 mM dNTP, 5 µl forward primer , 5 µl reverse primer , 2 µl (100 ng) phage DNA template, 0.5 µl Taq DNA polymerase, sterile distilled H_2O up to 100 µl). The reaction components were mixed in 0.5 ml microfuge and a drop of mineral oil was added on top of the reaction mix. The samples were amplified using a programmable thermal cycler Gene Amp 9600, Perkin-Elmer, using a 3-file program. Samples were denatured in the first file at 94°C for 1 min , then , the primers were annulled to the denatured templates at 55°C for 2 min and finally extended at 72°C for 10 min. The samples were maintained at 4°C. The amplification products (amplicons) were withdrawn from underneath the oil and 10 µl aliquots were separated on 1% agarose gel.

Subcloning of the recombinant gene in PCR™II plasmid vector (*Hanahan, 1983*):

The original TA cloning Kit (Invitrogen) was used for direct insertion of the amplicon into PCR™II vector at EcoR1 site. A typical ligation reaction was prepared as follows (1 µl PCR product , 1 µl of 10X ligation buffer, 2 µl plasmid vector, sterile H_2O up to 9 µl , 1 µl DNA ligase). The ligation reaction was incubated overnight at 15°C till ready for transformation. the readymade INV competent cells of the original TA cloning kit were used. The vial containing the ligation reaction was spun down briefly and placed on ice. Two µL of 0.5M B- mercaptoethanol (B-ME) and 2 µl ligation reaction were pipetted into each vial of the competent cells and mixed by gentle stirring with the pipette tip , then, the vial was incubated on ice for 30 min , and exactly 30 sec in 42°C water bath. The vial was removed from the water bath and placed on ice for 2 min 450 µl of SOC medium were added to the vial which was shaked at 37°C for 1hr . Aliquot of 50 µl was spread onto LB-amp plate and the plate was placed inverted at 37°C for at least 18 hrs finally the plate was shifted to 40°C for 2-3 hrs for the proper color development. Positive transformants can be selected by using Cracking gel procedure (*Maniatis et al., 1982*), where the non-recombinant transformants migrate faster than the recombinant ones when checked by 1% agarose gel electrophoresis.

Small scale preparation of plasmid DNA (*Sambrook et al., 1989*):

A single bacterial colony that contains the desired plasmid was used to inoculate 100 ml of LB-amp medium incubated at 37^{o}C with vigorous shaking overnight (O/N). The bacterial cells were harvested by centrifugation at 10000 rpm for 10 min. The cells were lysed using solution I (50 mM glucose, 25 mM Tris HCl, pH 8, 10 mM EDTA, pH 8), freshly prepared lysozyme was added , then , followed by solution II [0.2 M NaOH , 1% sodium dodecyl sulphate (SDS)] , the suspension was incubated at room temperature (RT) for 10 min. 20 ml of solution III was added (3 M potassium acetate, 2 M glacial acetic acid). DNA can be recovered by adding equal volume of isopropanol and precipitated by centrifugation at 10000 rpm for 10 min at (RT). The pelleted DNA was dissolved in 100 µl distilled H_2O to which RNase (10 mg/ml) was added, then, left for incubation at 37^{o}C for 2 hrs. The DNA solution was , extracted with phenol-chisam , then , precipitated by ethanol 2.5 volumes and 0.1 volume of 3 M sodium acetate and dissolved in 50 µl distilled H_2O. The plasmid DNA was quantitated by determining the **O.D$_{260}$** , then , stored at – 20^{o}C.

DNA sequencing (***Sanger et al., 1977***):

5 µl of the plasmid DNA were denatured by 20 µl of 0.2 M NaOH for 5 min , neutralized by 8 µl of 5 M ammonium acetate pH 7.4 , incubated at -70^{o}C for 30 min after precipitation with 100 µl ice-cold absolute ethanol. The DNA was pelleted and dried , then, dissolved in 4 µl distilled H_2O , 4 µl dNTPs and 2 µl of 5X sequanase reaction buffer were added to the denatured template , this mixture was boiled , then , cooled gradually to room temperature (RT). 2 µl of labeling mix (0.1 M DTT , ^{35}S-dATP and 2 µl 1:4 diluted sequanase enzyme were added to the reaction mix and the tube was incubated at RT for 5 min . 3.5 µl aliquots were added to 4 different tubes each containing 2.5 µl of each of the ddNTPs termination mixes. The reaction was stopped by adding 4 µl stop dye. The 4-tube set were labeled G,A,T,C was heated for 5 min , then , chilled on ice and loaded onto sequencing gel (8% polyacrylamide-8 M urea gel), the run was continued for 2-8 hrs. After electrophoresis , the gel was fixed in a solution of 10% acetic acid and 105 methanol for 30 min , dried and exposed to X-ray film. After 24 hrs exposure , the film was developed and read from the bottom. The informations obtained from DNA sequence were analyzed using the Genetics Computer Group Sequence analysis Software package.

RESULTS

Sera obtained from *Schistosama mansoni* chronically infected patients was purified over an antigen column made from soluble extract of 7-days schistosomula coupled to Sepharose-4B beads. The affinity purified eluted antibodies were , then , used to immunoscreen 7-days schistosomula λgt11 cDNA library. One of the isolated cDNA clones (clone 2-4) which was identified by affinity purified antibodies obtained from serum of the chronically infected patients contained a 0.7 kb insert. The partial DNA sequence (270 bp from 5$^{/}$-end and 187 bp from 3$^{/}$-end) of the insert identified two open reading frames (ORFs) of 90 amino acids (aa) that showed 31-36 % identity with zinc finger protein from a number of eukaryotic species (including rat, mice and human) , The 0.7 clone was partialy sequenced in both directions using Sp6 at 5$^{/}$-end and T7 at 3$^{/}$-end (Fig. 1). After the three rounds of immune-screening bacteriophage DNA was prepared by small scale procedure and checked by running the prepared phage DNA on 0.7 % agarose gel (Fig. 2). The original TA cloning Kit (Invitrogen) was used to provide a quick, one-step cloning strategy for direct insertion of the PCR products into a plasmid vector (PCR^{TM}II vector) at EcoR1 site. Some of the isolated clones were checked for size after being inserted in the desired plasmid vector using two restriction enzymes EcoR1 and BamH1 (Fig. 3), which showed no BamH1 site in the insert , while the plasmid DNA was digested by EcoR1 giving the actual size of each insert . The cloned insert (2-4) was sequenced using two oligonucleotides (primers), Sp6 from the 5$^{/-}$ end and T7 from the 3$^{/}$-end, the sequence gel was run for 2.5 and 6.5 hours , then , exposed to an X- ray film for 24 hrs , then , developed and read from the bottom of the autoradiogram (Fig. 4).

Sp6:

```
1   GCUAUGAUUCAAGCUUGGUACCGAGCUCGGAUCGCACUAGUAACGGCCGCCAGUGUGCUG 60
      A  M  I  Q  A  W  Y  R  A  R  I  A  L  V  T  A  A  S  V  L
61  GAAUUCGGCUUGGUGGGCAGGACUCCUGGAGCCCGUCAGUAUCGGCGGAAUUCCUCACAC 120
      E  F  G  L  V  G  R  T  P  G  A  R  Q  Y  R  R  N  S  S  H
121 CAACAGUGCGGCGUCGUAAGCAAACAAUUCACCCAUACCCACCAAAAAGGAAGGCACCUU 180
      Q  Q  C  G  V  V  S  K  Q  F  T  H  T  H  Q  K  G  R  H  L
181 CGGUUAAACAGACCCUGGAGUUUUCCAGUAUGCCCAGGUACAAAUCACAUCUCAUCAGCC 240
      R  L  N  R  P  W  S  F  P  V  C  P  G  T  N  H  I  S  S  A
241 GUGAAUUCCCAGAGUCUUUCAGUUCAAUCU270
      V  N  S  Q  S  L  S  V  Q  S
```

T7:

GCC GCC AGT GTG ATG GAT ATC TGC AGA ATT CCG GCT TTT CGC ACC AGA CCA ACT GGT AAT GGT AGC GAC CAG TTT CAG CTG GAA TTC CAG CGG AGG AAA AGA AAC GTA ACA AGG ATT CCC CTA GTA ACT GCG AGT GAA CAG GGA TTA GCC CAA CTC CGA AGC CTG CGT TAT TTG ATC GTA AGG CAA T

Fig. 1: The partial nucleotide and deduced amino acids sequence of the gene encoding zinc finger protein isolated from λ g11 cDNA library of 7-days schistosomula, sequenced by Sp6 from 5′-end and T7 from 3′-end.

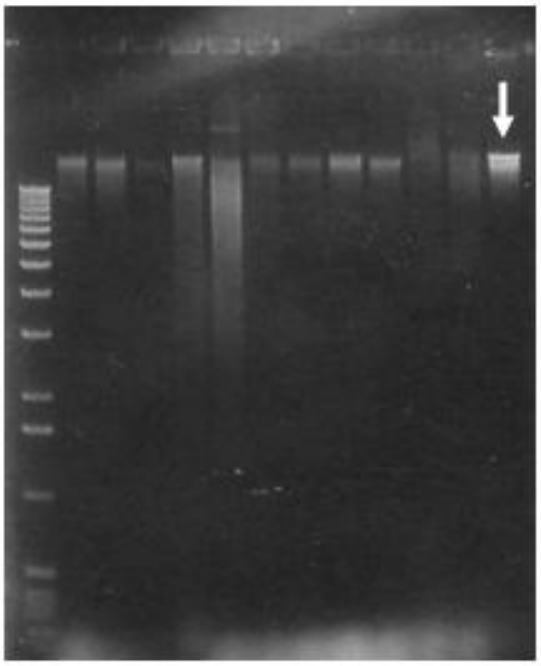

Fig. 2: 0.7% agarose gel representing the preparation of phage DNA of the plaques isolated from λ g11 cDNA library of 7-days schistosomula , the last lane is the selected clone.

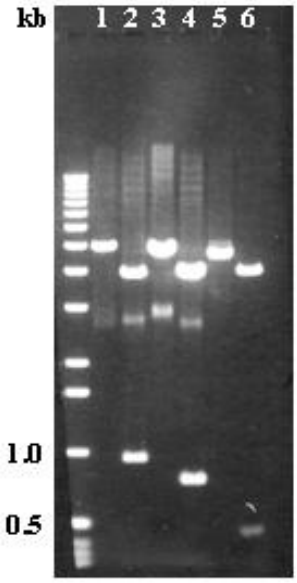

Fig. 3: 1% agarose gel showing the digestion pattern of three isolated inserts from λgt11 cDNA library of 7-day schistosomula, cloned in PCR^{TM}II plasmid vector , digested by two restriction enzymes EcoR1 and BamH1, the plasmid DNA samples were arranged in double, each represents from left to right, EcoR1 digested and BamH1 digested DNA. The selected clone (2-4) was run in lanes 5 and 6 The size of the insert is 0.4 kb.

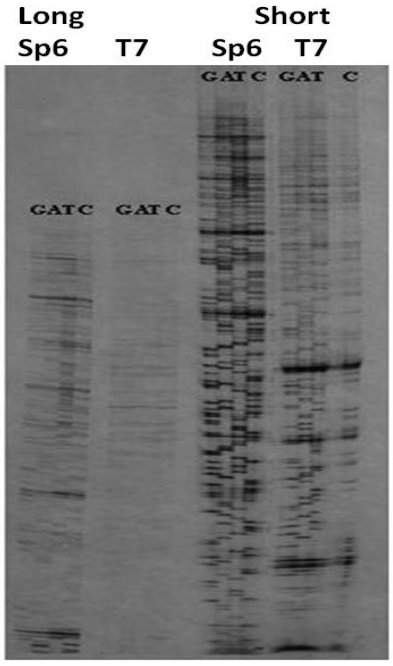

Fig. 4: An autoradiogram showing sequence of the gene encoding zinc finger protein isolated from λ gt 11 cDNA library of 7-days schistosomula cloned in PCR^{TM}II plasmid vector from 5$^{/}$- and 3$^{/-}$ends using Sp6 and T7 primers.

DISCUSSION

Schistosomiasis remains a serious public health problem with an estimated 200 million people infected in 76 countries. It is a major strategy to develop vaccines against schistosomiasis recommended by the World Health Organization (*Bergquist et al., 2002*) . In recent years, studies on vaccines have progressed rapidly, and a series of vaccine candidates have been identified and tested against schistosome infection in experimental models (***Carpron et al., 2001***). Nevertheless, these vaccines provide only 20-40% protection against the challenge of schistosoma cercariae. Scientists have studied different types of schistosomiasis vaccines. Despite the progress achieved, a feasible anti- schistosomiasis vaccine for humans or livestocks has not been found (*Min et al., 2005*). A schistosome vaccine would provide a useful tool for the control and eradication of ***Schistosoma mansoni*.** In spite of several decades of research an effective vaccine remains elusive. Current advances in post-genomic techniques are providing new avenues to identify the secreted and surface exposed antigens that mediate protection (*Curwen et al., 2004, Dillon et al., 2006*).

The sequencing of the *Schistosoma mansoni* transcriptome (*Verjovski-Almeida et al., 2003*) and genome has opened up exciting new possibilities for antigen discovery. In the present study we reported the discovery of the gene encoding zinc finger protein of 7-days schistosomula, isolated from cDNA library of the lung stage of *Schistosoma mansoni* using sera obtained from schistosomiasis chronically infected patients and purified over Sepharose-4B column made of soluble extract of sonicated 7-days schistosomula. By sonicating the lung stage to obtain the soluble extract for increasing the chances for developing a schistosome vaccine ,although what we have discovered is not a surface associated proteins. Transcriptional factors are classified according to the type of DNA-binding domain they contain. Most of the structural classes of DNA-binding domains have characteristic consensus amino acids sequences.

The genomes of higher eukaryotes may encode dozen of classes of DNA-binding domains and literally hundreds of transcription factors as homeodomain , zinc finger , leucine zipper and helix loop helix proteins (*Patikoglou and Burley , 1997*). Zinc finger proteins are the most popular DNA binding proteins in mammals (*Yuko , 2008*), involved in protein-DNA interactions and is also known to be involved in binding of RNA, lipids and proteins (*Gamsjaeger et al., 2007*). The most common zinc finger proteins are C_2H_2 finger proteins whose structure is consisted of ˜30 aa stabilized by a Zn ion bound to two cystiene and two histidine residues of each finger containing two β- sheets and one α- helix (*Wolfe et al., 2000*). C_2H_2 finger proteins can bind to different target sequences depending on the amino acid sequence of the fingers, the number of the fingers and the combination of fingers (*Luchi, 2001*), originally thought to be confined to the eukaryotic kingdom could be wide spread throughout the living kingdom from eukaryotic, both animal and plant to prokaryotic (*Gaetano et al., 2007*). Zinc finger proteins participate in a variety of cellular activities, including development, differentiation, cell cycle and tumor suppression. It has been estimated that up to 1% of the genes in human genome may encode proteins with zinc finger domains (*Hoovers et al., 1992*). Recently, there has been a great deal of progress in the development of modular protein domains that recognize specific DNA triplets. The C_2H_2 zinc finger motif is the ideal structural scaffold on which a sequence specific protein may be constructed (*Lee et al., 2003*). DNA structural domain of zinc finger proteins usually consist of 3 or 6 zinc fingers, artificial zinc finger proteins technology allows DNA sequences to be selected directionally and a DNA binding domain to be constructed (*Dreier et al., 2005*). The structural studies accomplished on classical zinc finger protein-DNA complexes have revealed the sequence-specific recognition is achieved by contacts between the α- helix of the zinc-finger and bases in the major groove of the DNA. A single zinc-finger domain in itself is not sufficient for high-affinity binding to a specific DNA target sequence. In fact , proteins containing multiple zinc finger domain usually require a minimum of two zinc-fingers for high-affinity DNA binding (*Klug and Schwabe, 1997*). Various screening procedure and artificial design strategies have also been attempted to make zinc finger proteins to bind to desired sequences (*Mandell and Barbas, 2006 , Papworth et al., 2006*). Such artificial zinc finger proteins are expected to be artificial transcriptional factors and nucleases (*Varshavsky, 2007*).

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REFERENCES

Abath, F.G.C., Xavier, E.M., Allen, R., Gomes, Y.M., Lucena-Silva, N., Baliza, M. and Simpson, A.J.G. (2000): Characterizaton of Sm13, a tegumental antigen of ***Schistosoma mansoni.*** *Parasitol. Res., 86*: 745-752.

Basch, P . F. (1981) : Cultivation of *Schistosama mansoni* in vitro. I. Establishment of cultures from cercariae and development until pairing. J. Parasitol., 67:179-185.

Bergquist, R., Al-Sherbiny, M., Barakat, R. and Olds, R. (2002): Blueprint for schistosomiasis vaccine development. Acta Trop., 82: 183-192.

Burley, S.K. and Roeder, R.G. (1996): Biochemistry and structural biology of transcriptional factor IID (TFDII). Ann.Rev.Biochem.,65:769-799.

Capron, A., Capron, M., Dombrowicz, D. and Riveau, G. (2001): Vaccine strategies against schistosomiasis: from concept to clinical trials. Int. Arch. Allergy Immunol., 124:9-15.

Chitsulo, L., Loverde, P. and Engels, D. (2004): Schistosomiasis. Nat. Rev. Microbiol.,**2**:12–3.

Curwen, R.S., Ashton, P.D., Johnston, D.A. and Wilson, R.A. (2004): The ***Schistosoma mansoni*** soluble proteome: a comparison across four life-cycle stages. *Mol. Biochem. Parasitol., 138*: 57-66.

Dillon, G.P., Feltwell, T., Skelton, J.P., Ashton, P.D., Coulson, P.S., Quail,M.A., Nikolaidou, Katsaridou, N., Wilson, R.A. and Ivens, A.C. (2006): Microarray analysis identifies genes preferentially expressed in the lung schistosomulum of ***Schistosoma mansoni.*** *Int. J. Parasitol., 36*: 1-8.

Dreier, B., Fuller, R.P., Segal, D.J., Lund, C.V., Blancafort, P., Huber, A., Kokasch, B. and Barbas, C.F. (2005): 3rd : Development of zinc finger domains for recognition of the 5/-CNN-3/ family DNA sequences and their use in the construction of artificial transcription factors. J. Biol. Chem., 280: 35588-35597.

Dunne, D.W. and Mountford, A.P.(2001): Resistance to infection in humans and animal models. In AA Mahmoud, *Schistosomiasis*, Imperial College Press, London, p. 133-212.

Felsenfeld, G. (1996): Chromatin unfolds. Cell 86:13-19.

Fletcher, M . , LoVerde ,P . T and Woodruff, D. S. (1981): Enzyme polymorphism in population from Africa, South West Asia , South America and West indies . Am. J . Trop. Med . Hyg . , 30 : 406-421

Fonseca, C.T., Pacifico, L.G., Barsante, M.M., Rassi, T., Cassal, G.D. and Oliveira, S.C. (2006): Co-administration of plasmid expressing IL-12 with 14-kDa ***Schistosoma mansoni*** fatty acid-binding protein cDNA alters immune response profiles and fails to enhance protection induced by Sm14 DNA vaccine alone. *Microbe.s Infect.,* Jul 24: [Epub ahead of print].

Gaetano, M., Luigi, R., Sabrina, E., Ilaria, B., Laura, Z., Emilia, M., Pedone, Benedetto, DiBlasio, Carla, I., Paolo, V. Pedone and Roberto, F. (2007): The prokaryotic Cys2His2 zinc finger adopts a novel as revealed by the NMR structure of Agrobacterium tumefaciens Ros DNA-binding domain. Proc.Natl.Acad.Sci.USA 104: 17341-17346.

Gamsjaeger, R., Liew, C.K., Loughlin, F.E., Crossley, M., Mackay,T.P. and Crossley, M. (2007): Sticky finger : zinc-fingers as protein-recognition motifs. Trends Biochem. Sci., 32(2): 63-70.

Hanahan, D . (1983): Studies on Transformation of Escherichia Coli with plasmids . J . Mol . Biol . , 166: 557-80.

Harris, **A.R., Russell, R.J. and Charters, A.D. (1984).:** A review of schistosomiasis in immigrants in Western Australia, demonstrating the unusual longevity of ***Schistosoma mansoni***. *Trans. R. Soc. Trop. Med. Hyg., 78*: 385-388.

Hochschild, A. and Dove, S.L. (1998): Protein-protein contacts that activate and repress prokaryotic transcription. Cell 92:597-600.

Hoovers, J.M., Mannens, M., John, R., Bliek, K., Van Heyningen, V., Proteous, D.J., Leschot, N.J., Westerveld, A. and Little, P.F. (1992): High resolution localization of 69 potential human zinc finger protein genes. A number are clustered. Genomics 12:254-263

Huynh , T . V . , Young , R. A. and Davis , R .W . (1985): Construction and screening cDNA libraries in lambda gt 10 and lambda gt 11 in DNA cloning :A practical Approach (Glover, D. M. ed.), vol . 1, pp. 49 – 78 . IRL Press. Washington, D.C.

Johnson, P.F. and McKnight, S.L. (1989): Eukaryotic transcriptional regulatory proteins. Ann.Rev.Biochem.,58:799-839.

Kadonaga, J.T. (1998): Eukaryotic transcription: An interlaced network of transcription and chromatin modifying machines. Cell 92:307-313.

Klug, A. and Schwabe, J.W. (1997): Protein motifs 5.zinc fingers. FABES J., 9(8): 597-604.

Kutsu, S., North, A.K. and Weiss, D.S. (1991): Prokaryotic transcriptional enhancers and enhancer- binding proteins. Trends Biochem.,16:397-402.

Lazdins, J.k., Stein, M., David, J.B. and Sher, A. (1982): *Schistosoma mansoni*: rapid isolation and purification of schistosomula of different developmental stages by centrifugation on a discontinuous density gradients of percoll. Exp. Parasitol., 53: 39 –44.

Lee, D.K., Seal, W. and Kim, J.C. (2003): Custom DNA-binding proteins and artificial transcription factors. Current Tropics in medicinal Chemistry 3: 339-353.

Luchi, S. (2001): Three classes of C_2H_2 finger proteins. Cell Mol. Life Sci., 58: 625-635.

Mandell, s. g. and Barbas, C.F. (2006): III Zinc finger tools , custom DNA binding domains for transcription factors and nucleases. Nucleic Acids Res., 34: W516-W523.

Maniatis, T., Fritsch, E.F. and Sambrook, J. (1982): Molecular cloning. A laboratory manual. Cold Spring Harbor Laboratory, Cold Spring Harbor. NY.

Miller,S., Rekosh, D.M. and LoVerde , P.T. (1989) : ***Schistosoma mansoni*** : identification and characterization of ***Schistosoma*** polypeptides Exp. Parasitol., 69:249-262 .

Min, W., Xin-Yuan, Y., Xian-Ping, L., Dong-Ming. Z., McReynolds, L. and Xian-Fang, Z. (2005): Phage displaying peptides mimic schistosoma antigenic epitopes selected by rat natural antibodies and protective immunity induced by their immunization in mice. World J. Gastroenterol., 11(19):2960-2966.

Mitchell, P. and Tjian, R. (1989): Transcriptional regulation in mammalian cells by sequences-specific DNA binding proteins. Science 245:371-378.

Nascimento, E.J.M., Leão, I.C., Pereira, V.R.A., Gomes, Y.M., Chikhlikar, P., August, T., Marques, E. and Lucena-Silva, N. (2002): Protective immunity of single and multi-antigen DNA vaccines against schistosomiasis. *Mem. Inst. Oswaldo Cruz 97*: 105-109.

Nikolov, D.B. and Burley, S.K. (1997): RNA polymerase II transcription initiation: a structural view. Proc.Natl.Acad.Sci.USA 94:15-22. Cell 86:13-1

Pabo, C.P. and Sauer, R.T. (1992): Transcriptional factors: Structural, families and principles of DNA recognition. Ann. Rev.Biochem., 61:1053-1095.

Papworth, M., Kolasinska, P. and Minczuk, M. (2006): Designer zinc finger proteins and their applications. Gene 366: 27-38.

Patikoglou, G. and Burley, S.K. (1997): Eukaryotic transcription factor-DNA complexes.Ann.Rev.Biophys.Biomol.Struct., 26:289-325.

Ptashne, M. and Gann, A. (1997): Transcriptional activation by recruitment. Nature 386:569-577.

Razin, A. and Cedar, H. (1994): DNA methylation and genomic imprinting. Cell 77: 473-476

Saiki, R. K., Gelford, D. H., Stoffel, S., Scharf, S. J., Higushi, R., Harn, G. T., Mullis, K. B. and Erlich, H. A . (1988) : Primer –directed enzymatic amplification of DNA with thermostable DNA polymerase. Science 239 : 487-91.

Sambrook , J., Fritsch ,E.F. and Maniatis, T. (1989): "Molecular Cloning : A laboratory Manual, " 2nd. ed . Cold Spring Harbor. Laboratory Press., New York.

Sanger, F., Nichlen, S. and Coulson, A.R. (1977): DNA sequencing with chain terminating inhibitors. Proc.Natl.Acad.Sci.USA 74:5493-67.

Shalaby, K.A., Yin, L., Thakur, A., Christen, L., Niles, E.G. and LoVerde, P.T. (2003): Protection against ***Schistosoma mansoni*** utilizing DNA vaccination with genes encoding Cu/Zn cytosolic superoxide dismutase, signal peptide-containing superoxide dismutase and glutathione peroxidase enzymes. *Vaccine 22*: 130-136.

Siddiqui, A.A., Phillips, T., Charest, H., Podesta, R.B., Quinlin, M.L., Pinkston, J.R., Lloyd, J.D., Pompa, J., Villalovos, R.M. and Paz, M.(2003): Enhancement of Sm-p80 (large subunit of calpain) induced protective immunity against ***Schistosoma mansoni*** through co-delivery of interleukin-2 and interleukin-12 in a DNA vaccine formulation. *Vaccine 21*: 2882-2889.

Siddiqui, A.A., Pinkston, J.R., Quinlin, M.L., Kavikondala, V., Rewers-Felkins, K.A,, Phillips, T. and Pompa, J. (2005): Characterization of protective immunity induced against ***Schistosoma mansoni*** via DNA priming with the large subunit of calpain (Sm-p80) in the presence of genetic adjuvants. *Parasite 12*: 3-8.

Smithers, S.R., Hackett, F., Braga. V. and Simpson, A.J. (1990): Immunoblotting identifies additional antigens recognised by mice protectively vaccinated with adult ***Schistosoma mansoni*** tegumental membranes. Parasitol, Res., **76**:454–6.

Varshavsky, A. (2007): From the cover: targeting the absence, homozygous DNA deletions as immutable signposts for cancer therapy. Proc.Natl.Acad.Sci.USA 104: 14935-14940.

Verjovski-Almeida, S., DeMarco, R., Martins, E.A., Guimaraes, P.E., Ojopi, E.P. Paquola, A.C., Piazza, J.P., Nishiyama, M.Y., Jr., Kitajima, J.P., Adamson, R.E., Ashton,P.D., Bonaldo,M.F., Coulson, P.S., Dillon, G.P., Farias, L.P., Gregorio, S.P., Ho, P.L., Leite,R.A., Malaquias, L.C., Marques, R.C., Miyasato, P.A., Nascimento, A.L., Ohlweiler, F.P., Reis, E.M., Ribeiro, M.A., Sa, R.G., Stukart, G.C., Soares, M.B., Gargioni, C., Kawano, T.,

Rodrigues, V., Madeira, A.M., Wilson, R.A., Menck, C.F., Setubal, J.C., Leite, L.C. and Dias-Neto, E. (2003): Transcriptome analysis of the acoelomate human parasite ***Schistosoma mansoni*.** Nat. Genet., 35: 148-15

Waine, G.J., Mazzer,D.R., McManus, D.P. (1999): DNA immunization by intramuscular injection or gene gun induces specific IgG antibodies against a ***Schistosoma japonicum*** 22kDa antigen, Sj22, when fused to the murine Ig k-chain secretory..*Parasite Immunol., 21*: 53-56.

Wolffe, A. (1998): Chromatin: Structure and function. 3rd.ed.New York.Acad.Press.

Wolfe, S.A., Nekludova, L., and Pabo, C.O. (2000): DNA recognition by Cys_2 His_2 zinc finger proteins. Ann. Rev. Biophys. Biomol. Struct., 29: 183-212.

Yang, W., Waine, G.J. and McManus, D.P.(1995): Antibodies to ***Schistosoma japonicum*** (asian bloodfluke) paramyosin induced by nucleic acid vaccination. *Biochem. Biophy.s Res. Commun., 212*: 1029-1039.

Yuko, O., Kazunori, I., Hiroaki, M., Takafumi, M., Michio, H. and Koji, S. (2008): The simple and rapid detection of specific PCR products from bacterial genomes using Zn finger proteins. Nucleic Acids Res., 36 (11) e68.

Zhu, Y., Si, J., Harn, D.A., Xu, M., Ren, J., Yu, C., Liang, Y., Yin,X., He, W. and Cao, G.(2006): ***Schistosoma japonicum*** triose-phosphate isomerase plasmid DNA vaccine protects pigs against challeng infection. *Parasitology 132*: 67-71.

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