STUDIES IN OCCULT CHEMISTRY
AND PHYSICS :

STUDIES IN OCCULT

CHEMISTRY AND PHYSICS

VOLUME I

BY

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INTRODUCTION

(Volume I)

THE present volume is the first of a series in which an attempt will be made to co-ordinate the facts and theories of western science and occult research. The writer regards himself primarily as a pupil in an eastern school of science and philosophy, and secondarily as an interested reader and student of western science. These two schools are in a sense complementary, the one supplying the concepts, and the other the substance which gives quantitative definition to those concepts. As far as possible equal weight has been given to the teachings of both the schools, but as the book has been written specially for the scientific mystic, and it is not expected that many outside this particular type will read it, a special aim has been to demonstrate the genuineness and reliability of the teachings of the eastern school to which the writer belongs.

This introductory volume is largely concerned with the exposition of concepts which are

unfamiliar to the science of the west. These
concepts are described, but, for the most part,
only partially demonstrated. The full demon-
stration being deferred to later volumes. In
this introduction it may be well to point out
a few important differences between conclusions
derived from occult studies, and the phase of
opinion at present prevailing in western scienti-
fic thought.

To illustrate one of these differences, we may
take the Theory of Relativity which at this
time dominates the west.

The fundamental fact of observation, which
has led to the Theory of Relativity, is thus
stated by Prof. Jeans: "No matter what the
velocity of the observer is, the light surface, as
observed by that observer, is invariably a
sphere having that observer as centre;"[1] or, as
he puts it in another place, "we now have as
an experimental fact that, independently of
the velocities of the source and observer, the
wave-surface is a sphere *having the observer
as centre.*"[2] And further commenting on this he
says: "If the observed constant velocity of
light is simply the constant velocity of propaga-
tion through an etheric medium, it would seem

[1] *Monthly Notices*, R. A. S., 1919, 80, 104.

[2] *Electricity and Magnetism*, p. 608.

to follow that *each observer must carry a complete ether about with him.*" [1]

Prof. Pickering commenting upon the same experimental fact says: " That is to say the light surface, or wave front, is a contracting, not an expanding sphere. This, if confirmed, would go a long way towards making our universe a subjective rather than an objective phenomenon. Again, imagine a flash of light, such as an explosion, to occur when an observer is in a given position. It makes no difference how the observer may move while the light is approaching him, whether several miles forward or backward, the light will reach him in exactly the same time, as is shown by Michelson's experiment. Or if two observers are at the same spot when the explosion occurs, and one moves forward, and the other backward, they will both see the explosion at exactly the same instant. This sounds ridiculous, but not only is it what Jeans says, but it is the logical interpretation of Einstein's second principle." [2]

Now since the observer is at the centre of the sphere of contracting ether, which is collapsing into its centre, it is now realised that unless we accept the theory of Relativity,

[1] *Electricity and Magnetism*, p. 619.

[2] *Relativity and Gravitation*, Bird, p. 291.

there is no escape from the alternative conclusion, that the observer, or rather the molecules of the observer's body, *are actually consuming a spherical volume of ether with the radial velocity of light.*

Einstein and the Relativists say this experimental observation is an illusion, and have devised theories to replace this illusion by the reality. The student of occultism, on the contrary, says this experimentally observed fact is not an illusion, but the actual reality. This therefore constitutes one of the important differences between the two schools. It is a fundamental teaching in occultism that it is the drop that swallows the ocean, and not the ocean that swallows the drop. It will be shown in the course of these volumes that every atom is engaged in swallowing the universe of ether, and that in this way it acquires its properties, gravitational, chemical, electromagnetic, etc.

What we know as electric current is a function of the volume of ether swallowed, whilst what we know as mass is a function of the square of that volume. Hence electrical dimensions always entail the square root of a mass, which is meaningless to the physicist, but which is replete with meaning to the occultist.

This square of the volume function which produces mass gives rise as a special case to the law of gravitation as at present understood. As to distance, it is usually regarded as a law of inverse square, though it is possible to give it a form varying as the inverse fifth. Let the sun be the centre of a spherical volume of ether of radius d, the distance of Mercury, so that Mercury lies on the surface of the sphere of which the sun is the centre. Then the attraction of the sun for Mercury is a function of this volume of ether divided by the fifth power of the distance between them. If the distance be increased to the orbit of Venus, the volume is increased as the third power of the distance, whilst the attractive force per unit volume is diminished as the inverse fifth, with the result that the combined effect is as the inverse square. Gravity in this form is a function of two variables, the volume of ether and the distance.

Its form is more cumbersome than that of Newton, but it will be shown in the course of these volumes that it more nearly represents the actual process at work.

The importance of this view of gravity will be better realised when it is demonstrated that the fifth power law applies not only to the variable volume, but also to the constant volume

contained in the central attracting mass. This part of the attractive force which is relatively small gives an effect varying not as the inverse square, but as the inverse fifth, and in the case of Mercury is large enough to be perceptible, as may now be shown.

As it is based on the square of the etheric volume it is fundamentally a sixth power law, which integrated between definite limits gives $(1/5) A/D^5$, where A is the acceleration of gravity at the surface of the body and D is the distance measured in terms of the body's radius taken as unity. The acceleration recognised in astronomy is A/D^2, so that $(1/5) A/D^5$, is a supplementary force which has not been taken into account. In the case of Mercury, the distance in terms of the sun's radius is 83·02, and the recognised acceleration $a = A/D^2$, is 3·981, whilst the unrecognised portion $a' = (1/5) A/D^5$, is only 0·0000013916. This it will be seen is exceedingly small, the ratio of the fifth power force to that of the second power force being

$$a'/a = 0\cdot0000013916/3\cdot981 = 1/2,861,000 \qquad (1)$$

The action therefore upon Mercury will be that of a diffused mass of matter, lying between the sun and Mercury, the mass of which is the $(1/2\cdot861,000)$th part of the sun's mass.

In 1896, Seeliger sought for an explanation of the motion of Mercury's perihelion by assuming a mass of diffused matter surrounding the sun, and causing the Zodiacal Light. He found that the mass of matter required to completely account for the unexplained motion of Mercury's perihelion was

1/2,860,000 of the sun's mass   (2)

The agreement between (1) and (2), it will be seen, is practically perfect.[1]

Newton's law left unexplained a motion of Mercury's perihelion amounting to $40''\cdot1$. per century. Einstein's theory gives a correction of $42''\cdot9$, which is about 7% too much.[2]

Einstein's correction is generally considered satisfactory, and has gone far to convince physicists of the truth of his theory, but the fifth power law, to be expounded in a later volume, would appear to correspond more accurately to the forces actually at work.

Atoms and light rays exhibit properties not only varying as the inverse square, but also as the inverse fifth power of the distance. Thus in the kinetic theory of gases, the force between

[1] *Encylopaedia Britannica*, Vol. 18, p. 155.
[2] *Report on the Relativity Theory of Gravitation*, Eddington p. 52.

the molecules is an inverse fifth power force;[1] whilst in the case of light the energy radiated is inversely as the fifth power of the wave-length for light waves which have the Wien's constant relation to the temperature.[2]

In the atom, the inverse fifth power law is primary, and the inverse square law secondary, whilst between the members of the solar system the inverse square is primary, and the inverse fifth secondary.

Probably the recognition of the fifth power law will be of the greatest importance in connection with the lunar theory. In spite of the enormous labours of Hansen, Delaunay, Hill, and Brown, the lunar tables are still not satis-factory, and after a time the moon gets out of its calculated course. According to Newcome, " the explanation of the outstanding differences may be regarded to-day as the most per-plexing enigma in astronomy ".[3] It appears to the writer that this enigma may be due to the non-recognition of this fifth power law.

At the surface of a body where the distance D is unity, the portion varying as the fifth

[1] *The Dynamical Theory of Gases*, Jeans, p. 248.
[2] *Laws of Physical Science*, Northrup, p. 108.
[3] *Encyclopaedia Britannica*, Vol. 18, p. 806.

power is (1/5)A, so that the total acceleration at the surface of the attracting body is (6/5)A.

The sun's surface acceleration is measured from the earth where the fifth power portion is infinitesimal, but the earth's acceleration is measured on the earth's surface, where it is (6/5)A, and there is no means of distinguishing the second power portion from that of the fifth. The part of the earth's gravity which operates upon the moon according to the inverse square is not g=981, but (5/6)g, and the part acting according to the inverse fifth power is (1/6)g. Now since the earth's force of gravity is the unit in which all astronomical forces are measured, this correction will affect almost every part of lunar and planetary theory.

Another result is an alteration of the gravitational constant.

Let E be the earth's mass, G the gravitational constant, R the earth's radius, and g the measured acceleration of gravity at the earth's surface. Then $GE=gR^2$, the unit of force used in astronomy. In place of this we must now put $(5/6) GE=(5/6) gR^2$. If we group the earth and moon together as a unit, the earth's mass, or the gravitational constant G, must be increased in the ratio p=1·0122, and we obtain

for this new force unit (5/6) pGE=(5/6) pgR², or grouping in a new gravitational constant

$$G'=(5/6)\ pG=5\cdot616 \times 10^{-8} \qquad (3)$$

we may write G'E=(5/6) pgR², for the new astronomical unit of force. Now this new gravitational constant G' has a remarkable property, which throws light on both the nature of electricity and gravity. Take the electromagnetic charge on an atom of hydrogen. Not $1\cdot591\times10^{-20}$, which is the charge on unit atomic weight, when the atomic weight of oxygen is 16, but the above charge multiplied by the atomic weight of hydrogen $1\cdot0077$, which is the observed charge in electrolysis, $e=1\cdot604\times10^{-20}$. Then we have

$$G'e=m=9\cdot008 \times 10^{-28}=\text{the mass of the electron}$$

$$(4)$$

$m/G'=e=$the electromagnetic charge on the electron (5)

Now note the two properties of the new gravitational constant G'. When we multiply a mass by G', we obtain the force of gravity; when we divide a mass by G', as in (5), we obtain the electromagnetic charge. But multiplication and division are inverse processes,

just as an expanding sphere of ether around a body is the inverse of a contracting sphere. In the course of this work it will be shown that gravity is one of the effects of an expanding sphere of ether, whilst electrical phenomena are functions of a contracting sphere.

The Relativist draws down the *Veil of Isis*, and says: this knowledge is for ever hidden from us. The Teachers in the Eastern Schools reverently lift the veil, and say: the solution of even these most inner mysteries, by searching, thou shalt find.

CONTENTS

CHAPTER I

THE ATOM

ALTHOUGH the results of occult investigation into the nature of the chemical elements have been before the world for more than a dozen years, the work of linking these up with those of Western science has made but little progress, and one of the objects of these studies is to effect this purpose. It will be well in the first place to note a few of the links already made.

1. At the meeting of the British Association in 1913, F. W. Aston announced the discovery of a new chemical element of atomic weight 22, to which he gave the name of Meta-neon, an account of which is given in Prof. Soddy's *Chemistry of the Radio-Elements* (Part II, p. 35), published in 1914. On June 3rd, 1920, Prof. Rutherford announced to the Royal Society the discovery of another new element of atomic weight 3, an account of which will be found in *Nature* of June 17th, 1920 (p. 501). In the first

edition of *Occult Chemistry* (p. 4), published in
1908, both the above elements are marked with
an asterisk, as being elements which had been
discovered by our occult investigators, but which
were unknown to Western science. It is thus
seen that Western physicists confirm these
discoveries, in the one case five, and in the
other twelve, years later. The above constitutes
perhaps the clearest proof so far published of
the reliability of occult methods of research, but
we hope to show in the course of these studies
that it is only one out of many proofs that are
now available.

2. One of the obstacles in the way of merg-
ing the results of occult research with those of
ordinary science is the use of different units of
mass. Western science has now adopted two
such units, the proton and the electron (*Nature*,
Vol. 108, p. 53, September 8th, 1921), which
carry equal but opposite charges of electricity ;
the charge of the proton being positive, and
that of the electron negative.

But though the charges are numerically equal,
the masses differ greatly ; the mass of the
proton is more than 1,800 times greater than that
of the electron, and is taken to be identical
with the mass of the element hydrogen. Both
these masses differ greatly from the unit of

mass of *Occult Chemistry*, which is one eighteenth of the mass of hydrogen.[1]

I give below the masses of these three units, the unit of measurement employed being a gramme divided by 10^{28}, or the twenty-eighth power of ten.

Mass in grammes multiplied by 10^{28}

The Proton	16620·0
The Atom of *Occult Chemistry*	923·34
The Electron	9·01

The above figures are said to contain errors of less than half per cent. They are taken from the 1920 edition of *Smithsonian Physical Tables* (p. 408), and are based on Prof. Millikan's most recent researches.[2]

3. An inspection of the above series of masses shows no apparent connection between the unit of mass of *Occult Chemistry* and the units of Western science, but after a few preliminary studies we shall be able to trace out a connection. One of the ways of doing this is through the molecular energy of gases.

The mean temperature of the atmosphere at the earth's surface, averaged from equator to pole, throughout the year, is about 15°C.[3] If

[1] *Occult Chemistry*, 2nd ed., p. 19.
[2] *Philosophical Magazine*, Vol. 34, p. 16, July, 1917.
[3] *Handbook of Climatology*, Hann, p. 201.

we take a depth of atmosphere of four kilometres, or a height measured from the earth's surface of $2\frac{1}{2}$ miles, the mean temperature throughout this volume is about $6\frac{1}{2}°$ Centigrade, or 44° Fahrenheit.[1] Since the molecular energy of translation of all gases at equal temperature is the same, whatever the mass of the molecule,[2] the molecular energy of air at the above temperature, $6\frac{1}{2}°$ Centigrade, or 279·6° K., as measured from the absolute zero, is a constant peculiar to the earth's surface. Its value in ergs, the energy unit of the C. G. S. system, is

$$5·7543\ 10^{14}\ \text{ergs} \hspace{3cm} (1)$$

or 5·7543, divided by the fourteenth power of ten. We will take this constant of molecular energy as a basis for investigating some of the important properties of the atom of *Occult Chemistry*.

4. It is significant, though not surprising perhaps, that in these studies the links between Occult and Western science usually emerge from the more recondite portions of Western researches. We have recently shown in the columns of 'The Times of India' that a bridge between the two schools has been constructed by the

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1 *Smithsonian Physical Tables*, p. 421.
2 *Laws of Physical Science*, E. F. Northrup, p. 76.

theory of relativity and that of Einstein. Similarly the link between the atom of Occultism and the physics of the West is effected through the recondite law known as " the equi-partition of energy ". For a complete study of this law in connection with radiation and molecular energy, the mathematical reader may be referred to Jeans' *Dynamical Theory of Gases* (2nd ed., p. 80), Campbell's *Modern Electrical Theory* (p. 229), and especially to Jeans' Report to the Physical Society of London on 'Radiation and the Quantum Theory,' in 1914. It will suffice for our purpose to point out that it necessarily follows from the law of the equi-partition of energy that if molecules of air are composed of atoms as given in *Occult Chemistry*, then, when the air has arrived at a state of equilibrium at the temperature of $6·5°$ Centigrade, so that the air molecules, on the average, have the energy given by (1), then each of the atoms composing the molecules must also possess the same energy. For instance, there are 290 atoms in the element oxygen, or $2 \times 290 = 580$ atoms in the molecule ;[1] hence each of these 580 atoms must have energy equal to that of the molecule as a whole, so that the atomic energy of oxygen in a state of equilibrium must be 580 times as great as the

[1] *Occult Chemistry*, p. 20.

molecular energy, and similarly for nitrogen and the other constituents of the atmosphere. Such is the law of the equi-partition of energy.

5. The energy of a body is its mass multiplied by half the square of its velocity ; and since we know the mass of our atom, and also its energy, as given by (1), we obtain for its velocity by a simple calculation the value

1,111,400 centimetres per second   (2)

or 11·164 kilometres=6·94 miles. This velocity, at first sight, may not appear to be very remarkable ; but to the astronomer or the physicist, its significance will be at once apparent, for it is identical with what is technically termed the earth's parabolic velocity, and half the square of this velocity is what is termed the earth's gravitational potential. This potential is equal to the earth's radius, 637,000,000 centimetres, multiplied by the acceleration of gravity at the earth's surface, 982, and is a well known terrestrial constant.[1]

We took as our basis the mean molecular energy of a surface stratum of the earth's atmosphere, $2\frac{1}{2}$ miles in height, and we have now found that this important energy-constant is the product of the mass of the atom of *Occult*

[1] Young's *General Astronomy*, p. 285.

Chemistry and the earth's gravitational potential; or, what amounts to the same thing, it is the product of the mass of the atom, the earth's radius and the earth's surface gravity. Thus the atom of Occultism indissolubly binds together the earth's surface temperature and the force of gravitation—two phenomena which physicists regard as independent.

6. When a body is let fall on the earth's surface from different heights, it reaches the earth with different velocities; and, in general, the greater the height, the greater the velocity. But as the height is increased, the velocity tends towards a maximum beyond which it cannot increase, however great the height from which it falls. This maximum velocity is known as the velocity from infinity, or the parabolic velocity at the earth's surface. Each heavenly body has a parabolic velocity peculiar to itself, which is the square root of the product of its diameter and the acceleration of gravity at its surface.

For the Sun this velocity is 383 miles per second, for Mercury it is 2·9 miles, for Venus 6·36, for Mars 3·34, and for Jupiter 40·1 miles. This velocity from infinity is therefore an invariable constant of the body, and in a sense defines its most essential physical characteristic.

When, therefore, we find that the atoms which compose the molecules of the atmosphere near the earth's surface all move on the average with this characteristic velocity, we have linked our occult atom with the most fundamental property of our terrestrial planet.

7. We have illustrated the principal feature of this unique velocity by the falling of bodies from different heights, and may study it also with advantage from the opposite point of view. If a body is projected vertically from the earth's surface with different velocities, it ascends to different heights, and again falls from these heights so as to reach the earth with the original velocity of projection. In general, the greater the velocity of projection, the greater the height. If the velocity is not too great, the attractive force of the earth will always bring the body back; but, should the velocity be as great as 6·94 miles per second, or the parabolic velocity of the earth, the body would ascend to an infinite height and so would never return.

One property, therefore, of the atoms, that follows from their possessing the parabolic velocity, will be that they are free to move out into space, beyond the range of the earth's attraction.

Hence, if space contains matter in the atomic form, or in the state of the highest sub-plane of the physical, as described in *Occult Chemistry* (p. 21), this matter will be attracted to the earth, and will arrive at its surface with the parabolic velocity, which will enable it to leave the earth again and wander away into space.

8. If we magnify the air molecules to the size of a ten-inch football, their average distance apart will be about three yards; whilst, on the same scale, the size of the occult atom will be that of a grain of sand, one fiftieth of an inch in diameter. We may therefore picture our atmosphere as a vast collection of footballs, poised in space at an average distance of three yards, and the atoms as clouds of fine sand blowing through and amongst the footballs. From the relative sizes, it will be evident that the sand can easily penetrate the interspaces between the footballs, or the molecules of the atmosphere. But although the molecules are so much greater than the atoms, the law of the equi-partition of energy ensures that the average energy of the atoms shall be equal to the average energy of the molecules, so that what the atom lacks in mass it makes up in velocity. The mean velocity of the molecules is about three-tenths of a mile per second, whilst the

atomic velocity, as shown by (2), is about seven miles per second.   In each case the mass multiplied by half the square of the velocity is equal to the mean molecular energy as given by (1).

9. Thus the atom as a unit and the molecule as a unit both possess the same energy. But we have to consider the molecule, not only as a unit, but as a group of several hundreds of atoms. The molecule of nitrogen contains 522 atoms, and the molecule of oxygen 580 atoms. These atoms constituting the molecules must not be confused with the clouds of atoms blowing through the widely spaced molecules. The atoms in the molecule revolve round different centres in groups of two to seven or more, as shown in *Occult Chemistry* (p. 37 *et seq.*, new ed.), but the law of equi-partition ensures that the groups, as well as the individual atoms, shall, as units, possess the same energy. In other words, a group of three atoms in the molecule will have a group-energy equal to the energy of the molecule, whilst the three atoms composing it, regarded as separate units, will each have this same energy.

10. By means of this important law of the equi-partition of energy, and the unit of molecular energy given by (1), we are able to link together, in a relation of equality, five different

elements of our atmosphere: (*a*) the atomic energy of the clouds of atoms from outer space, moving between the molecules with the parabolic velocity; (*b*) the energy of the molecules regarded as units; (*c*) the energy of the separate groups of atoms within the molecule; (*d*) the energy of the individual atoms within the groups; and (*e*) the mean temperature of the atmosphere. If, therefore, there is any combination of factors which determines any one of the above five elements, it will determine the whole five. But we have seen that the energy of the cloud of atoms, blowing through the molecules, is determined by the mass of the atom and the parabolic velocity of the earth, both of which are invariable constants of the earth. These two constants, therefore, determine the whole of the five elements.

11. It should be observed that it is only the mean or average value of the atmospheric temperature that is constant. As we know, the temperature of the atmosphere varies in different places and times, owing to the seasons, the days and nights, etc.; such variations being in general due to the sun.

When the temperature is higher than the mean temperature 44° F., the molecular energy is greater than given by (1), and the law of the

equi-partition of energy causes the excess to pass to the streams of atoms which convey this excess away into space. When the temperature is below the average, the defect is supplied to the molecules from the atomic streams which arrive at the earth's surface with the parabolic velocity and constant energy above explained. Thus these atomic streams act the part of a temperature adjuster, removing the excess and supplying the defect. These atomic streams are thus a missing link in the problems of cosmic physics.

12. The facts on which the above results are based are derived almost entirely from Western science, with the exception of the atom of *Occult Chemistry* and the existence of these atomic streams. If there are 18 atoms in hydrogen, then the mass of this atom is as given above (para. 2), and its energy, when reaching the earth from outer space, will be the mean molecular energy as given in (1). But the atomic streams play such an important part in the solution of modern physical problems, that it is desirable here to collect the evidence for their existence.

13. The atom of *Occult Chemistry* (p. 21, new ed.) is what is called the atomic sub-plane of the physical plane, and it is the first

or highest of these sub-planes. But the highest
sub-plane of the terrestrial physical plane is the
lowest sub-plane of the cosmic physical plane,
which exists for the most part in the cosmic
space between the stars of solar systems.[1]

This proposition will be found supported by
the following quotations from *The Secret
Doctrine*:

> The Initial Existence, in the Twilight of the
> Mahamanvantara, is a CONSCIOUS SPIRITUAL
> QUALITY. In the manifested . . . Solar Systems,
> it is . . . like the film from a Divine Breath to the
> gaze of the entranced seer. It spreads as it issues
> from Laya throughout Infinity as a colourless
> spiritual fluid. It is on the seventh plane, and in
> its seventh state, in our Planetary World. . . .
>
> It exists everywhere and forms the first . . .
> Foundation on which our . . . Solar System is
> built. Outside the latter, it is to be found in its
> pristine purity only between the . . . Stars of the
> Universe . . . There is not a finger's breadth of
> void space in the whole boundless Universe. . . .
>
> It is the guiding force in the cosmic and terres-
> trial elements. . . . It whirls in the breeze, blows
> with the hurricane, and sets the air in motion,
> which element participates in one of its principles
> also. (Vol. I, pp. 309—11.)
>
> The waves and undulations of science are all
> produced by atoms propelling their molecules into
> activity *from within*.
>
> Atoms fill the immensity of space, and by their
> continuous vibration *are* that motion which keeps

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[1] *First Principles of Theosophy*, by C. Jinarajadasa, pp. 95—
244; and *The Secret Doctrine*, Vol. I, p. 309.

the wheels of life perpetually going. It is that inner
work which produces the natural phenomena called
the correlation of forces. . . .

As described by Seers—those who can see the
motion of the interstellar shoals, and follow them
clairvoyantly in their evolution—they are dazzling,
like specks of virgin snow in radiant sunlight. . . .
Standing on an open plain, on a mountain summit
especially, and gazing into the vast vault above
and the special infinities around, the whole atmo-
sphere seems ablaze with them, the air soaked
through with these dazzling coruscations. (Vol. I,
p. 694.)

14. The above facts, attested by Western
science and Occult investigation conjointly, may
be taken as the scaffolding upon which may be
built a more advanced system of chemistry and
physics. The phenomena with which these
sciences deal are to a great extent due to the
interaction of the seven planes of our planetary
system with what is termed the cosmic physical
plane. Each of our seven planes is divided into
seven sub-planes, the highest sub-plane in each
case consisting of individual atoms, free and
uncombined. These free and uncombined atoms
blow through and interpenetrate the molecular
combinations of all the planes, and extend out-
wards into the cosmic spaces between the stars
and solar systems; and as such they constitute
the seven sub-planes of the cosmic physical
plane. By means of the well established law of

the equi-partition of energy, this cosmic physical plane governs the energy-content of space, and the mean temperature or molecular energy of planetary systems.

CONCLUSIONS AND SUMMARY

15. It has been shown that the mean molecular energy of the atmosphere is the product of the mass of the atom of *Occult Chemistry* and the gravitational potential of the earth.

The intermolecular spaces are occupied by shoals of atoms forming the highest sub-plane of the physical, which, possessing the parabolic velocity, are able to circulate freely between the earth and cosmic space. They constitute in their totality, when extended throughout the cosmos, the lowest sub-plane of the cosmic physical plane; whilst, viewed locally as a terrestrial phenomenon, they are the highest sub-plane of the physical.

The mean atomic energy of these shoals is a constant determined by the earth's gravity. It fixes the energy-content of space near the earth's surface, and, by the law of the equi-partition of energy, governs the mean surface temperature of our planet.

CHAPTER II

THE SPHINX OF WESTERN SCIENCE:
RADIATION

16. During the last decade Western physicists have been placed on the horns of a dilemma. This was due to the fact that the observed phenomena of radiation could not be made to fit in with the law of the equi-partition of energy, as described in the preceding article.

In the case of radiation, this equi-partition is between matter and the medium of space, or the hypothetical ether of science.

If the ether of space has the properties attributed to it by Western science, then the results that would follow from equi-partition do not agree with observation. In the words of Prof. Jeans,[1]

> So far as the radiation problem is concerned, we may summarise the conclusions obtained in the statement that, for equilibrium to exist between matter and ether, the law of partition of radiant energy in the ether, in terms of wave-length, must

[1] *The Dynamical Theory of Gases*, p. 397.

be that given by . . . the formula first given by
Lord Rayleigh in 1900.

It follows, as we have seen, that the temperature
of matter must be zero : there can be no equilibrium
between matter and ether until the matter has lost
all its energy to the ether.

This is the conclusion arrived at from a study
of the radiation problem based on the classical
system of dynamics ; the state of things predicted
is, however, so utterly different from that observed
in nature, that we are compelled to contemplate an
abandonment, or at least a modification, of the
classical mechanics.

17. The classical mechanics it is proposed to
abandon are the mechanics of Sir Isaac Newton,
upon which the laws established up to the end
of the nineteenth century have largely been
based.

These laws of mechanics had been hitherto
regarded as safe foundation-stones upon which
to build, and the law of the equi-partition of
energy is a mathematical deduction from them.

The proof of this, in its finished form, was
first given by Poincaré,[1] and the validity of
his mathematical reasoning has never been
challenged. In his *Dernières Pensées*[2] Poincaré
says, referring to this scientific impasse :

We see now how this question stands.   The
old theories, which seemed until recently able to

1 *Journal de Physique*, January, 1912.
2 Flammarion, Paris, 1913.

account for all known phenomena, have suddenly
met with an unexpected check. Some modification
has been seen to be necessary. A hypothesis has
been suggested by M. Planck, but so strange a
hypothesis that every possible means was sought
for escaping from it. The search has revealed no
escape so far, although the new theory bristles with
difficulties, many of which are real, and not simple
illusions caused by the inertia of our minds which
resent change· . . . It is impossible to predict the
final issue·

18. Prof. Jeans, in his *Report on Radiation
and the Quantum Theory* to the Physical Society
of London (1914, p. 3), illustrates the difficulty
as follows :

> To make the question as definite and as
> simple as possible, let us fix our attention on an
> enclosure with perfectly reflecting walls, in which
> there is a mass of, say, iron at $0°C.$, and
> let us suppose that there is a state of equi-
> librium inside the enclosure. The iron is con-
> tinually radiating energy out from its surface
> into the surrounding ether inside the enclosure,
> and is also absorbing energy from the ether. From
> the condition of equilibrium, the rates of exchange
> must just balance. If we assume, for additional
> simplicity, that the iron is coated with a perfectly
> absorbing paint, then, in point of fact, each square
> centimetre of surface emits 300,000 ergs of radiation
> per second into the ether, and also absorbs 300,000
> ergs per second of radiation falling on it from the
> ether. The energy in the ether is of density 0·00004
> ergs per cubic centimetre ; the heat energy in the
> iron is of the order of 8,000,000,000 ergs per cubic
> centimetre.

19. The above illustration shows that the volume of space occupied by the iron has an energy-content two hundred millions of millions of times as great as an equal volume of the ether; although the two spaces are in temperature-equilibrium, which is quite contrary to the law of the equi-partition of energy on any theory of the ether entertained in the West. Prof. Jeans continues :

A very little consideration will show that this state of things is different from what might be expected by analogy from other systems which are known to obey the ordinary dynamical laws. Consider, for instance, a tank of water (to represent the ether) in which is floated a system of corks (to represent atoms of matter) connected by light springs or elastics, so that they can oscillate relatively to one another. Suppose that initially the surface of the water is at rest. Let the system of corks be set in violent oscillation and placed on the surface of the water. The motion of the corks will set up waves in the water, and these waves will spread all over the surface of the water, undergoing reflection when they meet the walls of the tank. We know that ultimately the corks will be reduced to rest; the energy of their motion will be transformed, first into the energy of waves and ripples on the surface of the water, and then, owing to the viscosity of the water, into heat-energy in the water. A final state, in which the corks continue to oscillate with extreme vigour, whilst the water has almost no energy, is unthinkable; we expect a final state in which practically all the energy has found its way into the water.

Such is Prof. Jeans' illustration of the problem which is confronting Western science. The immense energy concentrated in the iron, as compared with the surrounding ether, is the same as if the floating corks continued in violent agitation whilst the water remained still and motionless, which, as Prof. Jeans says, is unthinkable.

20. Summarising our results so far, we may say that the law of the equi-partition of energy follows irrevocably from the principles of Newtonian mechanics, and that, when this law is applied to the case of radiation, it leads to conclusions that are quite contrary to the facts of observation. It would be unprofitable to search for some flaw in the mathematical reasoning, but it is possible that this reasoning may be based on an assumption which may repay scrutiny.

The assumption underlying Poincaré's mathematics is thus stated by Prof. Jeans : [1]

> The phenomenon which is believed to provide the crucial test as to the universal validity of the Newtonian mechanics is the following : *the total radiant energy per unit volume of ether in temperature-equilibrium with matter is finite, and not infinite.*
>
> It is a matter merely of mathematical demonstration that this fact is incompatible with Newtonian mechanics.

[1] *Report on Radiation and Quantum Theory*, p. 2.

It will be seen that the part in italics, quoted above, is given as a fact, and not as an assumption. But if it is a fact, it is certainly not an observed fact. It is in reality stated as a truism which no Western scientist is likely to question. But Western theories of the ether of space are so chaotic and contradictory that many leading physicists dispense with ether altogether, and disbelieve in its existence. Hence the whole of Poincaré's reasoning is based on an assumption which we now propose to examine.

21. When the statement is made that the total radiant energy per unit volume of ether is finite, and not infinite, what is really meant is that, if a volume of ether gives out radiant energy, its store of energy will diminish, and will fall to zero if the process is continued long enough. When put in this form we see that it may hide a fallacy. For instance, a bank may continually pay away money across the counter without its funds diminishing, if the money paid into the bank be equal in amount or greater. Similarly the Lake of Geneva can give out water at one end to the rivers of France, without the water in the lake getting less, provided that the water entering the lake is of equal amount. Under these conditions the funds of the bank, and the water of the lake,

are infinite. If, therefore, the ether of space is so constituted that, as energy is drained away from one portion, fresh energy flows into it from outer space, we may regard this energy as inexhaustible in the sense that the water in a lake is inexhaustible by the draining of the water from its outlet.

22. Now in the previous article we showed that the intermolecular spaces near the earth's surface are occupied by shoals of atoms from the lowest sub-plane of the cosmic physical plane, and that the mean atomic energy of these shoals is a constant determined by the earth's gravity. These shoals fix the mean energy-content of space, and are able to circulate freely between the earth and cosmic space.

The above amounts to a proof that the volume-energy of space is for all practicable purposes inexhaustible, and therefore, for the purpose of Poincaré's mathematics, we may say that *the total radiant energy per unit volume of ether in temperature-equilibrium with matter is infinite, and not finite,* which is a condition diametrically opposite to the assumption on which Poincaré's mathematical demonstration depends.

It follows from this that the observed facts of radiation are not necessarily in contradiction to

the established law of the equi-partition of energy, and that the principle of Newtonian mechanics may remain valid in the interchange of energy between ether and matter, as between matter and matter.

23. We have thus unearthed a fundamental difference in the teachings of Eastern and Western science, which was pointed out by the writer in 'The Times of India' of October 11th, 1921, as the following extract shows:

It may be as well here to set forth once for all the two main differences of the Eastern and Western schools of science. They are both contained in the problem of radiation, which is the problem on which Western science has wrecked its barque. It is the modern riddle of the sphinx, which the West has failed to answer correctly. The whole matter will be found in a nutshell in two Reports to the Physical Society of London, one by Prof. Jeans on the Quantum Theory (1914), and the other by Prof. Eddington on the Relativity Theory of Gravitation (1918). Prof. Jeans says (p. 2): "The total radiant energy per unit volume of ether in temperature-equilibrium with matter is *finite* and not infinite." In the Eastern school, as I have been taught, we say, as against the above: "The total radiant energy per unit volume of ether in temperature-equilibrium with matter is *infinite* and not finite." So that there is point-blank opposite teaching in the two schools. The reply of the West to the sphinxian riddle destroys the laws of Newton; the Eastern reply keeps them intact.

24. The above serves to illustrate two different principles, or the two distinct viewpoints,

from which Western scientists and students of
Occultism visualise the phenomena of Nature.
It is the difference between an equality and an
identity, and it has an important bearing on the
laws of conservation, the conservation of matter
and the conservation of energy. If we take a
unit mass of matter, the law of the conservation
of matter requires that this will always remain
a unit mass, whatever operations are applied to
it, and here both schools of thought are in
agreement.

But the Western scientist would further state,
or would subconsciously assume, that the con-
stituents of this mass, in their simplest form,
will remain identically the same from one
instant to the next, whilst the occultist would
say that the constituents may vanish and be
replaced by others in successive instants of time,
so that the total constituents remain equal
though not identical. Now this is an important
difference, for it permits of the creation and
destruction of matter, at an equal and constant
rate, whilst leaving the observed law of
conservation intact.

The element hydrogen may always consist of
18 atoms, but if one of these atoms vanishes
and is replaced by another, the mass of hydrogen
is not altered. We have seen in the previous

article that atoms interpenetrate the molecules from the cosmic sub-planes; and, as they possess the same mass and energy as the atoms in the molecules, they can change places with them without changing either the mass or the energy of the system, and thus without interfering with the laws of conservation of matter and energy.

25. The atomic or highest sub-plane of the physical is the lowest sub-plane of the cosmic physical; hence the illustration given is an interchange of matter and energy between different portions of the physical plane. But there can be interchanges also between the planes, without violating the laws of constancy, provided these interchanges are equal and opposite.

The processes taking place in the ultimate physical atoms, as described in *Occult Chemistry* (new edition, p. 21), are in reality interchanges of energy between the physical and astral planes.

Energy entering an atom from the astral plane makes it positive or male, whilst energy leaving an atom and passing to the astral makes it negative or female. This is a continuous process, but the conservation of energy on the physical and astral planes is not affected thereby,

for the quantity of energy remains equal though not identical. It is like the equal inflow and outflow of a lake, where the quantity of water in the lake does not change.

26. In addition to the methods of circulation of matter and energy already noted, there is a third, in which the atoms of one plane are transferred to another. This last is described in *Occult Chemistry* (new edition, Appendix, p. iv), and is also treated in *The Theosophist* for February of the current year, 1922 (Vol. XLIII, pp. 462—3):

It must be noted that a physical atom cannot be directly broken up into astral atoms. If the unit of force which whirls those millions of dots into the complicated shape of a physical atom be pressed back by an effort of will over the threshold of the astral plane, the atom disappears instantly, for the dots are released. But the unit of force, working now upon a higher level, expresses itself, not through one astral atom, but through a group of 49. If the process of pressing back the unit of force is repeated, so that it energises upon the mental plane, we find the group there enlarged to the number of $49 \times 49 = 2,401$ of those higher atoms.

Thus, from plane to plane, the matter can be transferred in either direction. The means of doing this appear to be living forces; but in Occultism all forces are living. This process is the equivalent of the creation and destruction of matter on the respective planes; and, as

stated in *The Theosophist* (*loc. cit.*), it is apparently the work of the Creative Hierarchies which preside over the forces of the cosmic planes.

27. Referring to two consecutive planes of matter, we are told in *The Secret Doctrine* (I, 172)

> that between these two planes of matter an incessant circulation takes place ; and if we follow the atoms and molecules of, say, the lower in their transformation upwards, they will come to a point where they pass altogether beyond the range of the faculties we are using on the lower plane. In fact, . . . the matter of the lower plane . . . passes on to the higher plane.

We are further told (p. 166) that

> Occult Science teaches that there is a perpetual exchange taking place, in space, of molecules, or rather atoms.

28. The above forms of interchange of the matter and energy of the planes will make it clear that matter in the atomic form, and the accompanying energy, cannot be insulated by enclosures within material walls. For instance, physical atoms, enclosed in a hermetically sealed vessel, could be transformed into astral atoms, and vice versa; and this, when viewed clairvoyantly, would give the appearance of entering and leaving the vessel without passing through the

walls, which is one of the properties of four-
dimensional space. This point is of interest,
since Western science, in order to solve out-
standing physical problems, has recently been
obliged to resort to the mathematics of four-
dimensional space.[1]

It is possible to insulate the molecules of solids,
liquids, and gases in enclosed vessels; and, if
the walls of the vessel are non-conducting, the
heat or molecular energy can also be insulated,
although this insulation is never quite perfect.
But neither the energy of the atoms, nor the
atoms themselves, can be thus insulated, since,
as was shown in the previous article, the atoms
can pass between the molecules; and, even if
the molecules are closely packed, as in the
solid state, the atoms can interpenetrate the
molecules, for these molecules consist of
atoms widely apart, as shown in the diagrams
of *Occult Chemistry*, and we are there told
(p. 32) that

the diagrams are not drawn to scale, as such
drawings would be impossible; the dot representing
the atom is enormously too large compared with
the enclosures, which are absurdly too small; a
scale drawing would mean an almost invisible dot
on a sheet of many yards square.

[1] See *The Principle of Relativity*, by Cunningham, p 85, and
The Theory of Relativity, by Silberstein, p. 129.

When, therefore, the molecules of matter are insulated in an enclosed space, the molecular energy, which in modern theory constitutes heat, may be isolated from surrounding space, whilst the atomic energy and the atoms themselves can communicate freely with outside space.

29. Now it so happens that the experiments which have caused physicists to doubt the validity of Newtonian mechanics, and the equipartition of energy, are based on the insulation of heat or molecular energy in an enclosure; and they have tacitly assumed that, when the molecular energy is insulated, the atomic energy is insulated likewise.[1] But this is inconsistent with the results of Occult researches, as explained above. Moreover, a somewhat similar conclusion has been arrived at by Western physicists, for Prof. Jeans says[2] that

the quantum theory makes it possible for the internal energy of the atom (element) to be entirely independent of the energy of the gas to which the atom (element) belongs. Any such independence, it need hardly be remarked, would be entirely at variance with the principles of the classical system of mechanics.

This last conclusion of Jeans is based on the conception that, if the molecular and atomic energy are independent, the partition of energy

[1] *Modern Electrical Theory*, by Campbell, pp. 224-8.
[2] *The Dynamical Theory of Gases*, p. 418.

between the atom and the molecule does not take place.   But this does not necessarily follow, for the partition of energy between the atoms in the molecule and those of outer space may be rapid, and that between atoms and molecules may be slow.   In other words, the cosmic sub-plane may exchange energy more rapidly with the inside of the molecule than with the outside, and it is the outside energy of the molecule that constitutes heat.   This would give an appearance of quasi-independence to the enclosed atomic energy, for any energy taken from the atoms to the molecules would be rapidly supplied from outside, or the cosmic plane, and any energy supplied to the atoms from the molecules would be rapidly drained away. Thus the atomic energy would be practically constant, whilst the molecular energy might vary greatly. This agrees with observation, but does not invalidate the law of the equi-partition of energy. For this law merely states that equi-partition will take place if sufficient time is given ; and, whether the time is one millionth of a second or a million years, this does not affect the validity of the law. Prof. Jeans has himself laid stress on this particular feature of the law of equi-partition.[1]

[1] *Modern Electrical Theory*, by Campbell, p. 232.

CONCLUSIONS AND SUMMARY

30.   Atomic matter and atomic energy cannot be insulated by material partitions from the atomic matter and energy of outer space, either of its own plane or of other planes, because the atomic matter can move through and between the molecules of bodies, as well as migrate from one plane to another. If, therefore, atomic energy be extracted from an enclosed space, an equal quantity of energy will be supplied from outside space from one or more of the planes, so that the supply of atomic energy in the enclosure is practically infinite.

On the other hand, molecules of matter, and molecular energy in the form of heat, may be more or less perfectly insulated from outer space by material partitions.

In an enclosure containing molecules of matter, if the partitions are impervious to heat or radiation, three kinds of partition of energy will be in operation : (a) partition of energy between atoms inside and outside the enclosure ; (b) partition of energy between molecules and molecules, inside the enclosure ; and (c) partition of energy between atoms and molecules, both inside the enclosure.

The rate of energy-transfer between atom and atom, and molecule and molecule, may be relatively rapid, and that between atom and molecule relatively slow, so that equilibrium will establish itself quickly for (a) and (b), but slowly for (c).

The molecules within the enclosure would, under such conditions, rapidly attain to a state of temperature-equilibrium, and the atoms in the enclosure would likewise rapidly attain equilibrium with the atomic energy of outer space. But a state of energy-equilibrium between the atoms and molecules in the enclosure might be long deferred, owing to the slow interchange of energy between atom and molecule. The result of this would be that the atomic energy would be practically constant, and equal to that of outside space. The energies of the enclosed molecules would be equal to each other, whilst the energies of the atoms and molecules might be widely different.

The different intensities of the atomic and molecular energies, whilst the molecules were in a state of temperature-equilibrium, would thus be quite consistent with the law of the equi-partition of energy, and the validity of Newtonian mechanics.

A fundamental distinction between the teaching of Western science and that of Occultism is that, according to Western science, " the total radiant energy per unit volume of ether in temperature-equilibrium with matter is FINITE, and not infinite "; whilst, according to Occult teaching, the total radiant energy per unit volume of ether in temperature-equilibrium, or otherwise, with matter is INFINITE, and not finite.

The awkward dilemma in which Western science is placed by the problem of radiation is largely the result of its unwillingness to recognise the established facts of Occult research on the nature of the atom, and the ether of space.

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CHAPTER III

THE TERRESTRIAL SUN

31. We have seen in previous studies that there is a rapid circulation of atomic matter and energy between the earth and space, or between the cosmic planes and the terrestrial planes; and one of the purposes of this article will be to trace out some further consequences of this interchange. Speaking generally, the partition of energy between bodies implies the corresponding partition of some form of matter, and physicists are now led to think that matter and energy are of the same nature.[1] The energy contained in light and radioactivity can be weighed just as matter can be weighed (*Ibid.*, p. 112). This identity in nature of matter and energy, if eventually established, combined with the free interchange between the terrestrial and cosmic planes, opens up the possibility of a free interchange of matter and energy between the earth and

[1] *Space, Time and Gravitation*, by Eddington, p. 146.

the heavenly bodies; and we shall now advance some evidence that such is the case.

32. The President of the British Association, Sir Edward Thorpe, on September 7th, 1921, told his audience [1] that

> the bearing of the electronic theory of matter, too, on Prout's discarded hypothesis that the atoms of all elements were themselves built up of a primordial atom—his protyle, which he regarded as probably identical with hydrogen—is too obvious to need pointing out. In a sense Prout's hypothesis may be said to be now re-established, but with this essential modification—the primordial atoms he imagined are complex and are of two kinds—atoms of positive and negative electricity, respectively known as protons and electrons. These, in Dr. Aston's words, are the standard bricks that Nature employs in her operations of element building.

As stated in the first article of this series, the mass of a proton is the same as that of hydrogen, and is more than 1,800 times as great as the mass of the electron. Since the number of electrons in a chemical element is about the same as the number of protons (*Ibid.*, p. 53), it follows that practically the whole of the mass of the chemical elements consists of a collection of hydrogen mass-units or protons, and could be broken up into such.

[1] *Nature*, Vol. 108, p. 53, September 8th, 1921.

33. Let us therefore, by way of experiment, break up the whole of the masses of the earth and planets into protons or hydrogen gas, and regard this as the protyle out of which these masses are built. This may have ,been the condition of things in some of the previous Rounds and Chains, as described in occult writings.

The volume of a gramme of hydrogen at normal temperature and pressure is 11,316 cubic centimetres, so that the 5.98×10^{27} grammes of matter which constitute the earth's mass, at this normal density, would have a volume of 6.67×10^{31} cubic centimetres. In the form of a sphere, it would have a diameter of 197,760 miles, and would reach a little less than half way to the moon.

If placed on the surface of the sun, it would form an atmosphere of hydrogen having a depth of

7,340 miles   (3)

34. If the masses of the planets were similarly reduced to hydrogen and placed on the sun's surface, they would form a solar atmosphere having a depth of

810,360 miles   (4)

The sun's diameter is 863,500 miles, so that this atmosphere would reach a height above the sun's surface equal to the sun's diameter. The corona, in Ball's *Atlas of Astronomy* (Plate 17), shows this solar appendage extending a distance above the surface equal to the sun's diameter, so that we may say that the masses of the planets, reduced to hydrogen, would form an atmosphere on the sun's surface having a volume equal to the sun's corona.

The height of the sun's chromosphere [1] is from 5,000 to 10,000 miles, or an average of 7,500 miles, which, from (3), is the height of a hydrogen atmosphere on the sun's surface having the same mass as the earth.

The chromosphere is so called, because, as seen for an instant during a total solar eclipse, it is of a bright scarlet colour, the colour being due to hydrogen, which is its main constituent.

35. We have thus, by breaking up the earth and planets into protons or hydrogen, discovered a curious series of facts, which may turn out to be significant. We find that the chromosphere, which is usually regarded as the sun's atmosphere, and is mainly composed of hydrogen, is just about sufficient to build up all the chemical elements in the earth's mass; whilst the corona,

[1] Young's *General Astronomy*, p. 219.

if similarly composed of hydrogen, is sufficient to build up the masses of the planets.

Bishop Leadbeater [1] tells us:

> The seven Planetary Logoi, although they are great individual entities, are at the same time aspects of the Solar Logos, force-centres as it were in His body. . . . Each of these centres has His special location or major focus within the body of the sun, and has also a minor focus which is always exterior to the sun. The position of this minor focus is always indicated by a physical planet.

In Mr. Jinarajadasa's *First Principles of Theosophy* (p. 238), a further description is given of this relationship between the Solar Logos and the Planetary Logoi, and the general arrangement is beautifully illustrated by the coloured frontispiece at the beginning of the book. We are further told: [2]

> As the centre of the earth is approached, matter is found to exist in a state not readily comprehensible to those who have not seen it; . . . The tremendous pressures which exist here are utilised by the Third Logos for the manufacture of new elements: . . . From this point also, incredible as it may seem, there is a direct connection with the heart of the sun, so that elements made there appear in the centre of the earth without passing through what we call the surface.

[1] *The Inner Life*, Vol. I, pp. 217-8.
[2] *Ibid.*, Vol. I, p. 357.

36. The above gives us another link in the cycle of operations of which we are in search. The seven Planetary Logoi operate in fields of force connecting the sun and planets. The sun's atmosphere contains the masses of the seven planets resolved into protons, which is the mass-unit out of which the chemical elements are built. These elements, when formed at the sun's centre, appear simultaneously at the centre of the planet, by the fourth-dimensional operation referred to in the preceding article (para. 28). We have thus a partial description of the circulation of matter and energy between the sun and planets.

37. Turning now to the facts supplied by Western science, we are told : [1]

When the corona is photographed in a "prismatic camera," which has a prism or prisms in front of its lens, the picture is composed of several rings (*seven in 1893*), *all of which, except the green one, are very faint* and lie in the violet portion of the spectrum.

These seven rings, shown in the photographs of the corona, are further suggestive of the seven Planetary Logoi, whilst the colour green, which is more distinct than the rest, may be the colour of our own Planetary Logos, since it

[1] Young's *General Astronomy*, p. 229.

corresponds to the *Fa*, or Great Tone of Nature.[1]

38. We are thus led to conclude that the seven Planetary Logoi, who are stationed in the sun, preside over portions of the sun's atmosphere which have the same mass as their physical planets. These planetary masses in the sun have their chemical elements, wholly or in part, disintegrated into their constituent units of mass, which, in the case of the earth, are protons and electrons, as described above (paras. 2 and 32). It seems likely also that the processes of disintegration and recombination are continually taking place, and that some of the solar activities are the manifestation of these operations. These protons and electrons, whether isolated or combined into chemical elements, carry an electric charge which is constant and invariable.

Its numerical value is the same for both proton and electron, but for the proton the charge is positive, and for the electron negative. This natural unit of electric charge has been very carefully measured, and its value, as given by Prof. Milikan [2] in electrostatic units is

$$0.000,000,000,4774 \qquad (5)$$

[1] *The Secret Dectrine*, III, 463; also *Theosophy in Relation to Human Life*, by Annie Besant, p. 110.
[2] *Phil. Mag.*, Vol. 34, p. 16, July, 1917.

Since there are the same number of these mass-units and electric charges presided over by our Planetary Logos, in the sun's atmosphere as in the earth, it is possible that they may be coupled together, each to each, by electric lines of force stretching from earth to sun, since each of these unit charges sends out lines of force into space. It is possible also that these lines of force may be the channels, and perhaps the only channels, by means of which light from the sun can reach the earth.

39. This would account for the observed fact that we can see the sun's chromosphere, but cannot see the sun's corona, except on the rare occasions of a total eclipse of the sun. We can see the chromosphere, because it is that portion of the sun's atmosphere which is connected by lines of force to our earth, atom for atom, each to each, and presided over by our Planetary Logos. We cannot see the corona, because it is similarly connected with the other planets, but not with the earth. If this be so, the sun as seen from the planets will be quite different from the sun as we see it, probably both in colour and in size ; and each planet will see a different sun, because its lines of force are connected with different portions of the sun's corona. In reality we do not see the sun at all,

but only the physical manifestation of our own Planetary Logos.

He who tells thee he has seen the sun, laugh at him . . . The Seven Beings in the Sun are the Seven Holy Ones, self-born from the inherent power in the Matrix of Mother-Substance. It is they who send (out) the seven principle Forces, called Rays.[1]

40. Although the corona is difficult to see, it is not quite invisible, and this may be explained by the fact that there is a sprinkling of terrestrial matter in all the seven planets, as well as a sprinkling of matter from all the planets in the earth. If the teachings of Astrology are true, that different individuals have unequal portions of planetary matter in their constitutions, one would expect that, when the corona is viewed by a Jovian person, its appearance would be different from the appearance as viewed by a Martian person, and that people in general would not agree in their descriptions of what they saw at an eclipse of the sun. Now this is a well known fact in connection with observations of the corona. Prof. Young, in his book *The Sun*,[2] remarks on this point:

A peculiarity in the manner of representing what one sees will often make the descriptions and

[1] *The Secret Doctrine*, I, 310.
[2] International Scientific Series, p. 215.

drawings of two observers, side by side, so discrepant that one would hardly imagine they would refer to the same object. For instance, in 1870, two naval officers on the deck of the same vessel made drawings of the corona, one of which represented it as a six-rayed star, while the other showed it as two ovals crossing at right angles.

In 1878, the writer [Prof. Young], on comparing notes immediately after the eclipse with other members of his party, found that about half of them saw the corona principally extended to east and west, while the other half, himself among them, were just as positive that it brushed mainly to the north and south.

The drawings on pages 217-8 and 222-3, of the above work (*The Sun*), which are of the same eclipse by two different trained observers, will show how widely divergent is the seeing of this solar appendage.

Now the above divergence is quite consistent with our assumption that the sun's corona bears the same relationship to the planets as the chromosphere does to the earth, and that the teachings of Astrology about our vehicles being composed in different proportions of planetary matter are true. The way in which this matter enters into our constitutions will be found explained in *The Hidden Side of Things*, by C. W. Leadbeater, Vol. I, p. 47.

41. Since one of the fundamental distinctions between the teachings of Western science and

Occultism has reference to the circulation of matter and energy in space and among the heavenly bodies, the firm establishment of the relationship of sun and planets, above indicated, will be of importance. It is therefore desirable to collect sufficient evidence bearing on the question.

The relationship between sun and planets has certain points in common with that of the anode and cathode in an X-ray tube, the planet being the cathode and the sun the anode. In each case there is a more or less complete vacuum between the two. If, therefore, the sun and planets were at a difference of potential sufficiently great, the sun would be bombarded with electrons across the interplanetary spaces just as is the anode or anti-cathode, in an X-ray tube. In this process the anode is rendered incandescent.

Platinum may be fused, diamonds converted into coke; even tantalum and tungsten, with melting points in the neighbourhood of 3,000° C., can be rendered molten. Owing to the low pressure most metals can be vaporised with ease.[1]

42. It is now established that the polar auroras are permanent features of the earth's higher atmosphere,[2] and the aurora has its

[1] *X-rays*, by Kaye, p. 11.
[2] *Nature*, Vol. 109, p. 55, January 12th, 1922.

corresponding phenomenon at the cathode of a Crooke's tube, whilst the incandescent anode has its counterpart in our glowing sun.

Between the permanent aurora of our atmosphere and the sun's corona, there is the zodiacal light, acting as a bridge between the two, like the luminous striæ in the positive column of a vacuum tube. Angstrom observed the bright aurora line in the zodiacal light, and concluded that in it there is the same material as is found in the aurora and the solar corona. Archenius suggested that the phenomenon was due to the particles sent off by the earth.[1] The height of the lower fringes of the polar aurora is about 106 kilometres, or 66 miles,[2] where the atmospheric pressure is 0·006 millimetres of mercury. The pressure in a vacuum tube at which X-ray phenomena begin is 0·02 millimetres,[3] which is the pressure of the atmosphere at a height of about 75 kilometres;[4] but Dr. Simpson, the head of the Meteorological Department, London, has shown that even at a height of nine kilometres above the earth's surface there exists

[1] *Encyclopaedia Britannica*, Vol. 28, p. 1000.
[2] *Terrestrial Magnetism*, Vol. 20, pp. 159-62, December, 1915.
[3] *X-rays*, by Kaye, p. 3.
[4] *Smithsonian Physical Tables*, p. 421.

radio-activity ten times as great as any we are acquainted with at lower levels.[1] To quote Dr. Simpson :

> There can now be no doubt that the earth is giving off a constant stream of negative electricity which passes at least into the upper atmosphere, and probably into cosmic space . . . The results of Vegard's and Stormer's work on the aurora ... give ... indications of true radioactive radiation penetrating our atmosphere and producing the same apparent results as if the atmosphere were being bombarded from outside by the *alpha* radiation which is at present under investigation in our laboratories . . . Balloon ascents ... have given almost incontestible proof of a radiation entering the atmosphere from above, which has ten times the penetrating power of the hardest radiation sent out from radioactive substances ... if all the new radiation came from the sun, the latter would have to possess a specific activity 170 times as great as that of pure uranium ... these observations leave little doubt of the existence of a new, extremely penetrating radiation, which increases as one ascends in the atmosphere.

43. The above facts are in accord with the theory that the action between the earth and sun is somewhat similar to that of the cathode and anode of an X-ray tube, and serve to establish it. To present the available evidence in further support of it would expand this article into a treatise ; but our purpose at present is only to introduce certain concepts

[1] *Nature*, Vol. 99, p. 124, April 12th, 1917.

into modern physics, which bring it into accord
with the occult teachings, and to reserve the
complete treatment until later. *The Secret
Doctrine* lays stress on the importance of
the polar aurora as a key to physical processes,
particularly as to the nature and origin of
light.

> The agitation of the Fohatic Forces at the two
> cold ends of the earth . . . The two poles are
> said to be the storehouses, the receptacles and
> liberators, at the same time, of cosmic and terrestrial
> Vitality (Electricity), from the surplus of which the
> earth, had it not been for these two natural safety-
> valves, would have been rent to pieces long
> ago. (I, 226.)

We are, moreover, told that the trüe source
of light will be elucidated by a study of
Mr. Crooke's discovery of radiant matter :
" Further familiarity with the northern stream-
ers of the *aurora borealis* may help the
recognition of this truth." (I, 681.) Now
Crookes' radiant matter, which we are
advised to study, is the matter within the
X-ray tube, which we have likened to the
operation between the sun and earth ; just as the
incandescent anode in these vacuum tubes by
its incandescence gives light, so its cosmic
counterpart, the sun, gives light to the solar
system.

44. Several important treatises have been recently written to show that the aurora is due to the passage of electricity between the sun and the earth, and the reader may study them in the writings of Stormer,[1] and in those of Birkeland,[2] and those of Vegard.[3] Most excellent drawings of the aurora in colour will be found in the results of the Zeigler Polar Expedition.[4] Miss Clerk[5] expresses the opinion that the most promising electrical theory of the sun's corona is that of Prof. Bigelow of Washington.

His able discussion of the eclipse photographs of January 1st, 1889, showed a striking agreement between the observed coronal forms and the calculated effects of a repulsive influence obeying the laws of electrical potential, also postulated by Huggins in 1885. Finely subdivided matter, expelled from the sun along lines of force emanating from the neighbourhood of the poles, thus tends to accumulate at equipotential surfaces . . . Later, in 1892, Pupin in America, and Ebert in Germany, imitated the coronal streamers by means of electrical discharges in low vacua between small conducting bodies and strips of tinfoil placed on the outside of the containing glass receptacles. Finally, a critical experiment, made by Ebert in 1895, served, as Bigelow justly said, "to clear up the entire

[1] *Terrestrial Magnetism*, Vols. 18-20.
[2] *The Norwegian Aurora Polaris Expedition*, Vol. I, Longmans.
[3] *Phil. Mag.*, February, 1912, and Vol. 42, p. 47, July, 1921.
[4] National Geographical Society, Washington, 1907.
[5] *History of Astronomy*, p. 191.

subject and put the theory on a working basis ". Having obtained coronoidal effects in the manner described, he proceeded to subject them to a strong magnetic field, with the result of marshalling the scattered rays into a methodical and highly suggestive array. They followed the direction of the magnetic lines of force, and, forsaking the polar collar of the magnetised sphere, surrounded it like a ruffle. The obvious analogy with the aurora polaris and the solar corona was insisted upon by Ebert himself, and has been further developed by Bigelow.

What we really know about the corona can be summed up in a few words. . . . It does not gravitate upon the sun's surface, and share its rotation. . . . its gaseous constituents . . . are apparently in a state of efflux from, and influx to, our great luminary, under the stress of opposing forces, . . . it is almost certain that they are organised and arranged around it through electromagnetic action.

45. This efflux from, and influx to, the sun's surroundings is what we should expect to observe if there is a continual circulation of matter and energy between the sun and earth, as with the anode and cathode of a vacuum tube.

The theory that we are here propounding, that there is an atomic correspondence between the sun and earth, with a line of force joining each pair of atoms, must, if true, be of profound importance in the interpretation of physical phenomena. It pictures the atom as the

4

terminus of a line, and it is along this channel
or line of force that the most important pheno-
mena will occur.   Just as the termini of a
railway are less significant than the traffic
along the line, which is the real work of the
railway, so the happening along the line of
force, joining the atom on the earth with its
partner on the sun, is the main fact to be
studied.

As a cone stands on its point, or a perpendicular
straight line cuts a horizontal plane only in one
mathematical point, but may extend infinitely in
height and depth, so the essences of *things real*
have only a punctual existence in this physical
world of space; but have an infinite depth . . .
in the metaphysical world. . . This is the spirit,
the very root of Occult doctrine.[1]

Western science is thus, as it were, attempting
to understand the physics of a railway by
studying the stations at the termini and ignor-
ing the traffic along the line.

46.   Astrologers are sometimes asked what is
the astrological significance of the earth; and
the opinion has been expressed that the earth is
represented by the sun, but it would appear that
it is more than this, for on the above view the
sun actually is the earth, for the only part of
the sun that we are able to see is the physical

[1] *The Secret Doctrine*, I, 689.

vehicle of the Terrestrial Logos. The real sun
is a combination of seven suns, one for each of
the seven planets.

The one Cosmic Atom becomes seven atoms on
the plane of Matter, and each is transformed into a
centre of energy ; that same Atom becomes seven
Rays on the plane of Spirit ; and the seven
creative Forces of Nature, radiating from the
Root-Essence.[1]

CONCLUSIONS AND SUMMARY

47. The volume of the sun's corona is equal
to a volume of hydrogen at normal temperature
and pressure, having a mass equal to the sum of
the masses of all the planets; and the volume
of the sun's chromosphere is equal to a volume
of hydrogen having the same mass as the
earth.

The combination of scientific and occult
teaching point to the conclusion that for each
proton in the masses of the earth and planets
there is an atom of hydrogen in the sun's atmo-
sphere, each to each, and that between each
corresponding pair there is a line of force, or
channel, along which a rapid interchange of
matter and energy is taking place. The portion
of the sun's atmosphere to which the protons of

[1] *The Secret Doctrine*, I, 696.

the earth are attached is that known as the chromosphere.

The relationship between sun and planet is generally similar to that between anode and cathode in an X-ray tube.

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THE PROTON AND ELECTRON

48. In this article we propose to determine from the information given in *Occult Chemistry*, and the textbooks of Western science, the main differences between positively and negatively charged elements. References to *Occult Chemistry* will be generally to the new edition of 1919. On page 21 we are told that, in the ultimate state of physical matter,

two types of atoms have been observed; they are alike in everything save the direction of their whorls and of the force which pours through them. In the one case, force pours in from the " outside," from four-dimensional space (the astral plane), and passing through the atom, pours into the physical world. In the second, it pours in from the physical world, and out through the atom into the " outside " again, *i.e.*, vanishes from the physical world. The one is like a spring, from which water bubbles out; the other is like a hole, into which water disappears. We call the atoms from which the force comes out *positive* or *male*; those through which it disappears, *negative* or *female.*

In the terminology of Western science, according to the above description, the positive atom is a *source,* or *ether-squirt,* and the negative atom an *ether-sink* ; and theories of gravitation have been built up by physicists on the properties of such sources and sinks.[1]

49. Returning to *Occult Chemistry,* we read (p. 11):

> Speaking generally, positive bodies are marked by their contained atoms setting their points towards each other and the centre of their combination, and repelling each other outwards ; negative bodies are marked by the heart-shaped depressions being turned inwards, and by a tendency to move towards each other instead of away.

The drawings opposite page 7 shew the hydrogen atom as consisting of four triangular triplets, marked negative, and two linear triplets, marked positive ; we have therefore apparently twelve negative atoms and six positive atoms, which constitute the element hydrogen. But from the description of these linear triplets it would appear that the atoms composing them are not all positive, for we are told (p. 11):

> In the first positive hydrogen combination, E 2, an atom revolving at right angles to the plane of the paper, and also revolving on its own axis, forms the centre, and force, rushing out at its lower point, rushes in at the depression of two others.

[1] *Grammar of Science,* by Karl Pearson, p. 267.

From which we gather that the centre atom of the linear triplet is a source, and therefore positive, whilst the two end atoms of the linear triplet are sinks, and therefore negative.

50. As there are two linear triplets in hydrogen, we have from them four negative atoms, which, added to the twelve forming the four triangular triplets, make a total of 16 negative atoms, out of the total of 18 forming the element hydrogen. We have thus only two positive atoms, in hydrogen, to neutralise the 16 negative ones, and form the electrically neutral element.

A molecule of hydrogen consists of two groups of 18 atoms, and when the molecule is ionised, one of these is charged positively, and the other negatively. We can conceive this as happening by transferring the two positive atoms from one group to the other, so that the positive ion would consist of 20 atoms, and the negative ion of 16, hence the ratio of the masses, positive and negative, would be

$$20/16 = 1 \cdot 25 \qquad\qquad (6)$$

51. The velocity imparted to an ion by an electric force is proportionate to the charge on the ion, and inversely as its mass.[1] The charges

[1] *Conduction of Electricity through Gases*, by Thomson, p. 74.

on the two ions are the same, but their masses
are different; hence, under an electric force, the
velocity of the negative ion should be greater
than that of the positive in the ratio 1·25, as
shown by (6). The following observed velocities
of positive and negative ions are obtained from
the *Smithsonian Physical Tables* (p. 405), and
Kaye and Laby's *Physical and Chemical Con-
stants* (p. 95). They are the velocities under an
electric force of one volt per centimetre.

VELOCITIES OF IONS

	Negative	Positive	Ratio
Hydrogn	7·95	6·70	1·1866
Oxygen	1·80	1·36	1·3235
Air	1·78	1·40	1·2714
	Average Ratio		1·26

52. We thus see that the ratio of the velocities,
or, as they are technically termed, the mobilities,
of the negative and positive ions in the per-
manent gases is, on the average, 1·26, which
agrees, well within the margin of experimental
error, with the required ratio given by (6), and
thus supports our theoretical conclusion from
the description of *Occult Chemistry*, that the
proton, or positive ion, consists of 20 atoms, and
the negative ion of 16 atoms. In the following

table are given the masses in grammes of these positive and negative bodies, multiplied by 10^{28},

MASS IN GRAMMES $\times$ 10^{28}

Proton (20 atoms)	18424·0
Hydrogen (18 atoms)	16620·0
Negative ion (16 atoms)	14773·0
Electron	9·01

53. If now we take the electron and weigh it in the surface gravitational field of the earth, and the negative ion and weigh it in the sun's gravitational field, at the earth's distance from the sun, we obtain a remarkable result. The weight of a body is its mass multiplied by the acceleration of gravity, at the point where the weighing is performed. The acceleration of terrestrial gravity at the surface is 979·75, when the average value is used, and the acceleration of solar gravity, at the earth's distance, is 0·59491. If now we multiply the mass of the electron by 979·75, and the mass of the negative ion by 0·59491, we obtain,

WEIGHT IN DYNES $\times$ 10^{28}

Terrestrial weight of Electron	8826·3
Solar weight of Negative Ion	8788·6

54. The above result requires a little studious consideration. It will be seen that the weight

of the negative ion, in the sun's gravitational field, is practically identical with the weight of the electron in the earth's gravitational field, the difference being only about one half per cent. If, instead of taking the earth's gravity at the solid surface, we take it at about 11 to 14 kilometres above the surface, or in the lower part of what is called the isothermal region or stratosphere,[1] where ions and electrons are numerous, the weights, instead of being half per cent different, will be in exact agreement. Now occult students are familiar with the phenomenon of levitation, in which a body is removed from the earth's gravitational field, and in consequence rises in the air; so that the above result suggests that the electron is simply a levitated ion, that is to say, the electron may be simply an ion transferred from the earth's gravitational field to the gravitational field of the sun. If this were so, a very interesting consequence would follow, for the presence of an electron in a chemical element would not add to its weight, but would subtract from it, so that the atomic weight of an element would be the weight of its positive constituents, minus the weight of the electrons, for the electrons in the daytime, when weighings are mostly made,

[1] *Physics of the Air*, by Humphreys, p. 45.

would gravitate upwards, towards the sun, instead of downwards, towards the earth's centre.

According to modern theory, confirmed by experiment, the number of electrons in a chemical element is called its atomic number, and these atomic numbers increase from hydrogen, 1, to uranium, 92, one step at a time. Hence although the weight of the electron is small, when there are many in an element, their effect on the atomic weights will be quite measurable.

55. Mr. S. G. Brown, in a letter to *Nature* (Vol. 106, p. 342, November 11th, 1920), writes as follows:

> If we can consider that the element is composed of a number of hydrogen atoms, then the departure from the simple sum of the weight of the hydrogen atoms composing the element must be due to the negative electrons. For example, the element vanadium has an atomic weight of 51·06. Suppose we consider it to be composed of 51 hydrogen atoms, then its atomic weight should be $1·008 \times 51 = 51·408$; but its atomic weight is 51·06. The difference is—0·348, due, I take it, to the negative electrons which have entered into the composition of the element.
>
> I have obtained *minus* quantities for a number of the elements, starting from hydrogen, atomic weight 1·008, and stopping at Ge, and I find that they space themselves along a regular curve as shown in Fig. 1. That the minus quantities of the atomic weights should have arranged themselves in this regular way by pure accident, I cannot believe, so I suggest that there is some natural law at

work to account for it. The explanation is to be
sought, I think, in the supposition that the hydro-
gen atoms attract each other, producing the force
of gravity, whilst *the negative electrons are repulsed
by gravity* ; the elements are, therefore, lighter than
the sum of the hydrogen atoms themselves.

56. We thus see that Western scientists,
from a study of the atomic weights, are led
to contemplate a negative weight for the elec-
tron, which is the conclusion we have arrived
at, on quite other considerations, in paras. 53—4.
So far, therefore, as a comparison of weights
is concerned, our conclusion has the support of
observation ; but it so happens that, in physical
experiments on the electron, it is not in general
weighed, but its mass is measured directly from
its inertia, or its resistance to a change of mo-
mentum, and this brings us to a rather abstruse
department of physics. Those readers who have
not quite clear ideas on the difference between
mass and weight, will find a simple explanation
in Sir Oliver Lodge's *Elementary Mechanics*
(pp. 42—4), and may with advantage also
consult Everett's *C.G.S. Units* (p. 23). If we
kick an empty barrel, it rolls freely ; but if the
barrel is full of oil or water, a much more
powerful kick will be required to move it,
and the strength of the kick will be a rough
measure of the mass, or inertia, of the barrel.

In the same way the mass of the electron has been measured by its resistance to a kick, and not by weighing. Newton showed that the weight of a body, and its mass, are proportionate to one another within the limits of experimental error. The experiments of Bessel, and recent determinations by Eotvos, have also demonstrated this to a high degree of accuracy.[1]

But these experiments can only be tried under the small variations of gravity observed on the earth's surface, and the variation between terrestrial surface gravity and solar gravity at the earth's distance is

$$979 \cdot 75/0 \cdot 59491 = 1646 \cdot 9 \qquad (7)$$

which is great. Can we therefore go to the extent of saying that, when the weight is reduced in the ratio (7), which happens when a body is transferred from the earth's gravitational field to that of the sun, then the masses are reduced in the same enormous ratio? If this is permissible, we have a complete explanation of the relative masses of the negative ion and the electron.

57. The two greatest authorities recognised by physicists, on a question of this character, are probably Profs. Eddington and Einstein;

[1] *Nature*, Vol. 97, p. 321, June 15th, 1916.

and, as the settling of this problem is all-important for our further studies, it may be well to quote here the conclusions of these eminent physicists. In his book, *Space, Time and Gravitation* (p. 136), Prof. Eddington, dealing with this same problem of inertia and weight, writes :

One of the most important consequences of the relativity theory is the *unification of inertia and gravitation*.

The beginner in mechanics does not accept Newton's first law of motion without a feeling of hesitation. He readily agrees that a body at rest will remain at rest unless something causes it to move ; but he is not satisfied that a body in motion will remain in uniform motion, so long as it is not interfered with.

It is quite natural to think that motion is an impulse which will exhaust itself, and that the body will finally come to a stop. The teacher easily disposes of the arguments urged in support of this view, pointing out the friction which has to be overcome when a train or a bicycle is kept moving uniformly. He shows that if the friction is diminished, as when a stone is projected across ice, the motion lasts for a longer time, so that, if all interference by friction were removed, uniform motion might continue indefinitely. But he glosses over the point that if there were no interference with the motion—if the ice were abolished altogether —the motion would be by no means uniform, but like that of a falling body. The teacher probably insists that the continuance of uniform motion does not require anything that can be properly called a

cause. The property is given a name *—inertia* ; but it is thought of as an innate tendency, in contrast to *force* which is an active cause.   So long as forces are confined to the thrusts and tensions of elementary mechanics, where there is supposed to be direct contact of material, there is good ground for this distinction ; we can visualise the active hammering of the molecules on the body, causing it to change its motion.   But when force is extended to include the gravitational field, the distinction is not so clear. For our part, we deny the distinction in this last case. Gravitational force is not an active agent, working against the passive tendency of inertia. *Gravitation and inertia are one.* . . . Whether the natural track is straight or curved, whether the motion is uniform or changing, a cause is in any case required.   *This cause is in all cases the combined inertia-gravitation.* . . . Meanwhile this identification of inertia and gravitation, as arbitrary components of one property, explains why weight is always proportionate to inertia.

  58. Thus Prof. Eddington gives us the strongest support possible, for in his opinion gravitation and inertia are one, so that if the force of gravity varies in the ratio (7), as it does when changed from the terrestrial to the solar field, then the mass or inertia must also change in the ratio of the mass of the negative ion to that of the electron, or, as given in para. 52, the mass must change from $14773 \cdot 0$ to $9 \cdot 01$, which are to each other in the ratio (7).   Einstein lays stress on the same fact in his popular

exposition of *Relativity* (English Translation, p. 65) :

> If now, as we find from experience, the accelera-tion is to be independent of the nature and condition of the body, and always the same for a given gravitational field, then the ratio of the gravitational to the inertial mass must likewise be the same for all bodies. By a suitable choice of units we can thus make this ratio equal to unity. We then have the following law : *The gravitational mass of a body is equal to its inertial mass.*

> It is true that this important law had hitherto been recorded in mechanics, but it had not been *interpreted.* A satisfactory interpretation can be obtained only if we recognise the fact that the same quality of a body manifests itself according to circumstances as " inertia " or as " weight ".

59. Having now such high authorities to support us, we may say with confidence that if a negative ion were transferred from the earth's gravitational field to that of the sun at the earth's distance, its mass would be reduced in the ratio (7), and would thus be identical with the observed mass of the electron. In view of the evidence adduced, we shall there-fore conclude that *the electron is the negative ion consisting of 16, in place of 18 atoms, as given in para. 52, transferred from the earth's gravitational field to that of the sun.*

60. This view of the relationship of the negative ion to the electron is quite different

from that current in scientific circles, where the negative ion is usually regarded as an electron combined with one or more molecules. But recent researches by E. M. Wellisch, of the Sydney University,[2] appear to prove that the electron and the negative ion are quite distinct entities. In the above article he says (p. 56):

It has long been known that in air at very low pressures the current of negative electricity is due practically entirely to free electrons; at the higher pressures, however, the current is due to the motion of negative ions. What is the nature of the negative carrier at intermediate pressures? The answer hitherto given to this question was that the carrier altered in nature during its motion between the electrodes, but in such a manner that for a given pressure it possessed an "average" mass. If, for instance, we regard the ion as being constituted at high pressure by a cluster of molecules, then we should have to assume that, as the pressure was reduced, the average number of molecules in the cluster decreased; as the pressure was still further reduced, an individual negative carrier would be for part of the time in the ionic state (say now as a single molecule), and for the remainder would exist as a free electron; at this pressure we would have at any given instant a number of free electrons and a certain number of ions, but if we were to follow one electron throughout its motion, we should find it associated on the average with a mass intermediate between that of an electron and that

[1] *Electricity in Gases*, by Townsend, p. 119.

[2] *Phil. Mag.*, Vol. 34, p. 33, July, 1917.

of a molecule. Ultimately at very low pressures the carriers would be all free electrons. . . .

The answer afforded by the present experiments is fundamentally different. We now regard the electrons and ions as passing independently through the gas, each kind of carrier remaining constant in nature throughout. The transition from the ionic conduction at high pressures to the electronic conduction at low pressures is effected by means of *an increase in the number of free electrons relative to the number of negative ions, without any alteration in the nature of either kind of carrier.*

We may regard the above as the copingstone of the evidence required by our theory. The increase in the number of electrons, relative to the number of negative ions, can be due to the transformation from the terrestrial gravitational field to that of the sun, as the pressure of the gas is diminished. The change from the ion to the electron will necessarily be a *per saltum* change, in which there are no intermediate phases. The ion will step out of a terrestrial line of force into a solar line of force, and the transformation from ion to electron will be immediate. The ion will vanish, and the electron appear in its place. *Thus there will be an increase in the number of free electrons relative to the number of negative ions,* as the pressure falls; and this agrees with observation.

CONCLUSION AND SUMMARY

61. The element hydrogen consists of 18
atoms, two of which are positive, and sixteen
negative. When a molecule of hydrogen is
ionised, the two positive atoms of one half
of the molecule are transferred to the other
half, so that the positive half, or proton,
consists of 20 atoms, and the negative half
of 16 atoms, and the ratio of the masses, positive
to negative, is 20/16=1·25, whilst the ratio of
the velocities, or ionic mobilities, under an
electric force, negative to positive, is also 1·25.

The ratio of the mass of the negative ion (16
atoms) to the mass of the electron is the same
as the ratio of the intensity of the earth's
gravitational field at the surface to the sun's
gravitational field at the earth's distance, or,
using the figures from paras 52 and 56, we may
say :

Negative ion/Electron=14773·0/9·01=979·75/0·
59491=1646·9   (8)

The negative ion and the electron are inter-
changeable, by an interchange of the terrestrial
and solar gravitational fields. By a change
from the terrestrial to the solar, the ion is chang-
ed to the electron ; and, by a change from the

solar to the terrestrial, the electron is changed to the negative ion.

The postulate that weight and inertia are identical, which is a fundamental portion of the theory of Einstein, is confirmed by the results of Occult research.

CHAPTER V

THE TERRESTRIAL LABORATORY

62. In our four preceding studies we have aimed at building a kind of bridge between the results of Occult research and those of Western science. It was pointed out in the first of these studies, para. 2, that an obstacle in the way of combining the two systems of research was the use of different units of mass. Modern physical theories are at present largely concerned with the carriers of the positive and negative electronic charges, known as the proton and the electron, whilst *Occult Chemistry* is based upon the atom, the mass of which has no obvious connection with the units of mass of the West. Our fourth article appears to establish this connection, but in a way which Western science would regard as so startling and unexpected that its recognition would revolutionise the whole of the physical sciences.

The significance of the conclusions arrived at in studies III and IV will be best appreciated if

taken together.   In the third, we concluded that
each proton in the earth's mass had a hydrogen
element in the sun's atmosphere coupled with it
by a line of force, so that each constituent of
the earth's mass and of the sun's chromosphere
has a correspondence, each to each.

63.   But, according to the science of the West,
each proton of the earth's mass has attached to
it an electron, so as to neutralise its charge, and
we have seen in our fourth article that electrons
are negative ions in the sun's gravitational
field.   Hence these electrons will not gravitate
towards the earth's centre, but towards the sun's
centre, with the result that there will be a
continual stream of electrons from earth to sun.
If, on arrival at the sun's surface, they are
supplied with two positive atoms, they will be-
come neutral hydrogen.   Recent observations of
the sun's atmosphere at the Kodaikanal Ob-
servatory show that at the centre of the sun's
disc, or that part of the sun diametrically opposite
the earth, there is a descent of the constituents of
the sun's atmosphere, which is rapid in the upper
atmosphere, but slows down as it approaches the
sun's surface or photosphere.[1]   This action can
only be interpreted as a kind of repulsion

between the earth and the sun's atmosphere,
since it acts only along the line joining the
earth and sun's centre. These observations of
Mr. Evershed have been found so inexplicable
to astronomers that every effort is made to
avoid the obvious explanation, that there is a
constant stream of hydrogen from earth to sun,
which, leaving the earth as electrons, as previ-
ously explained, arrives at the sun as hydrogen.

64. But, as we have seen, the phenomenon
above described, so puzzling to Western science,
is exactly the phenomenon for which our
researches would prompt us to look, since the
great difference between Occult teaching and
that of the West is that there is a continual
circulation of matter and energy between the
earth and the heavenly bodies, and particularly
between the earth and sun, which the West as
yet does not recognise.

For the same reason we should expect to find
evidence of a negative current of electricity
from earth to sun, which would show itself as
an upward current in the earth's atmosphere.

In Humphrey's *Physics of the Air* (pp. 416-7)
we read that at least four different currents
exist in the atmosphere, one of these being

due to the downward flow of one set of ions,
usually the positive, and the simultaneous upward

flow of the other, in response to the vertical potential gradient. It generally is less during the day than at night, and less in summer than in winter; but always of such value that the sum total of the current for the entire earth is roughly 1,500 amperes. How this constant current, always, on the whole, in the same direction, is maintained *is one of the greatest problems of atmospheric electricity.*

Here again we have an observed phenomenon, which Occult teaching would lead us to expect, but which is inexplicable to Western science.

65. When an electron is transformed into a negative ion by the process summarised in para. 61, its mass is increased more than 1,600-fold, and when a negative ion is changed into an electron its mass is reduced in the same ratio. Hence the transfer from one gravitational field to another, involves the creation and destruction of matter, which is in contradiction to the law of the conservation of mass. Thus the interchangeability of the ion and electron, when recognised in the West, will be revolutionary. It is possible to reconcile these changes, however, with the law of conservation, if we stipulate that the two opposite processes are always equal, just as, in the case of an electric current, the positive current may be accompanied by an equal and opposite negative current. There are, in fact, already indications that the

West is awakening to the necessity for some process which creates matter. Prof. Eddington says:[1]

> Some mechanism seems to be needed, whereby either gravitation creates matter, or all the matter in the universe conspires to define a law of gravitation.

Our conclusion, that gravitation does actually create matter, would therefore seem to be what the West is in search of.

66. As such creation of matter is the special subject of this study, it may be well to collect here some guiding hints on the subject from Occult writings.

> Our globe has its own special laboratory on the far-away outskirts of its atmosphere, crossing which every atom and molecule changes and differentiates from its primordial nature.[2]

When the laws of the solar system are completely developed, the atmosphere of the earth and of the other planets becomes a crucible in which is formed matter in the three states known to science—solid, liquid and gaseous —represented in Occult writings by earth, water and air; and the combining equivalents, or chemical properties, etc., are different for these on each planet, whilst between the planets and

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[1] *Space, Time and Gravitation*, p. 163.
[2] *The Secret Doctrine*, Vol. I, p. 638.

outer space there is a continual interchange of atoms. " Atoms are called Vibrations in Occultism ; also Sound—collectively." [1]

67. The kinetic theory of gases accounts for the phenomenon of the atmosphere, and other gases, by random molecular motions and collisions. But Prof. Jeans has recently shown that the properties of gases can be equally well explained as the energy of trains of sound-waves, [2] which is a distinct move in the direction of the views taught by Occultists.   For the present we will base our investigations on the kinetic theory, with a change of the fundamental assumption.   In the kinetic theory, the molecules of matter are supposed to be perfectly elastic, so that, when two molecules collide, they rebound from each other in such a way that their joint energy remains unchanged. Now it is possible to change this assumption in such a way that the phenomena based on it are in no way disturbed or invalidated.   The requirements of the assumption are that the energy before and after collision shall not be changed.   The kinetic theory fulfils the requirement by the assumption

[1] *The Secret Doctrine*, Vol. I, pp. 165-6.
[2] *The Dynamical Theory of Gases*, p. 387 ; also *Phil. Mag.*, Vol. XVII, p. 239,—1909.

of perfect elasticity ; we propose to fulfil the requirement by the assumption that, at every molecular collision, the energy is completely destroyed or vanishes, and is recreated or made to appear in exactly the same amount.

As far as the effect on the kinetic theory of gases goes, these two assumptions are interchangeable, without disturbing anything. It is only when we come to the problem of radiation, where Western theories have broken down, that the difference in the two assumptions becomes important. The " perfect elasticity " assumption imprisons matter in the planet or heavenly body to which it happens to belong, whilst the assumption of destruction and recreation of energy allows matter and energy to circulate freely between the sun and the planets, according to the teachings of Occultism.

68. But, in place of the random molecular collisions of the classical kinetic theory, we shall in general find it more suitable to follow the orderly sound-wave theory developed by Prof. Jeans. The sound-wave will have a wavelength, equal, on the average, to the mean free path of the air molecules. The length of this free path at normal pressure and temperature is 0·0000096 centimetres,[1] and the velocity of the

[1] *Physico-Chemical Tables*, by Castell-Evans, p. 670.

wave will be the length of the free path multiplied by the number of molecular collisions in unit time.

If we imagine a layer of air close to the earth's surface, of a depth equal to the mean free path, or 0·0000096 centimetres, then the amount of matter created and removed by these molecular sound-waves, in the interval between molecular collisions, will be the amount of matter in this layer, which can be obtained by taking the product of the earth's surface, the air density, and the mean free path, all of which are known. If now we multiply this by the number of collisions in unit time, we obtain the creation of matter per second by the earth's atmospheric crucible.

Since the product of the mean free path and the number of collisions is the molecular velocity, we can obtain the creation per second by the product of the earth's surface, the air-density, and the molecular velocity. But, since the second is an arbitrary time-unit, it will be better to measure this matter-creation in some time-unit established by Nature, such as the day or the year. We can obtain the yearly creation of matter by multiplying that created per second by 31,558,000, the number of seconds in a year.

69. The molecular velocity varies with the temperature; and, as our terrestrial laboratory is at the outskirts of the atmosphere, or in the isothermal layer, where the temperature is constant, at about 50°C. below zero, which on the absolute scale is 223°K., we may adopt this provisionally for our calculation. The arithmetically mean value of the molecular velocity of air at this temperature[1] is 40,400 centimetres per second, or two-fifths of a kilometre, that is, a quarter of a mile. Hence the amount of matter created and removed by our atmospheric laboratory, per second, is equal to a layer of air one quarter of a mile deep over the whole of the earth's surface. In order to obtain the creation of matter annually, we take the product of the following figures:

(a) The earth's surface in sq. cent.

$5 \cdot 101 \times 10^{18}$

(b) The molecular velocity of the isothermal layer   40,400

(c) The density of air at average temperature and pressure $0 \cdot 0012229$

(d) The number of seconds in a year

31,558,000

70. We have, however, still one point to take into consideration before proceeding with

[1] *Smithsonian Physical Tables*, p. 399.

our calculation, and that is the variation of mass with the gravitational field. The density of the air is the mass contained in unit volume, and this mass has been ascertained by weighing the air at the earth's surface, where the gravitational field intensity is that of the surface. But when this matter penetrates into the earth, between surface and centre, the gravitational field becomes less. The mean gravitational field intensity inside the earth, averaging from centre to surface, is only three-fourths the surface value, hence this created mass, when in the body of the earth, will have only three-fourths the value as measured at the surface, and this we must allow for. Taking, therefore, three-fourths of the product of the above figures, we have for the mass of matter in grammes created by our terrestrial atmospheric laboratory in one year :

$$6 \cdot 006 \times 10^{27} \text{ grammes} \qquad (9)$$

The earth's mass is [1]

$$5 \cdot 98 \times 10^{27} \text{ grammes} \qquad (10)$$

which is practically the same as that given by (9), so that the earth's atmospheric laboratory produces exactly the mass of the earth in the

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[1] *Physical and Chemical Constants*, by Kaye and Laby, p. 13.

time of the earth's revolution round the sun.
This annual output of our laboratory can be
represented by a simple algebraic formula, with-
in the range of the average schoolboy:

$$M = (\tfrac{3}{4}) \, Savy = E \qquad\qquad (11)$$

where M is the mass created per year, S is the
number of square centimetres on the earth's
surface, a is the density of the air at normal
temperature and pressure, or at 15° C., the aver-
age surface temperature of the earth, v is the
molecular velocity in the isothermal layer,
which is the position of the earth's laboratory,
and y is the number of seconds in a year. The
$(\tfrac{3}{4})$, as explained above, is due to the gravita-
tional field inside the earth's mass being only
three-fourths the intensity of the surface field.
E is the earth's mass in grammes.

71. From the list of the velocities of ions
given in para. 51, under an electric force of one
volt per centimetre, which is technically termed
the ionic mobility, the average mobility of the
air ion is $\tfrac{1}{2}$ (1·78+1·40)=1·59, which is the
average of the positive and negative velocities
of the air ion. This is at the atmospheric
pressure at the earth's surface, which is a pres-
sure of about 760 millimetres of mercury. Now
this ionic mobility varies inversely as the

pressure,[1] so that at the bottom of the isothermal
layer, at a height of about 11 kilometres, where
the pressure is about 176·2 millimetres of
mercury,[2] this ionic mobility would be increased
in the ratio 760/176·2, and the average ionic
velocity would be 6·858 centimetres per second.
If, instead of one volt per centimetre, we applied
an electric force of 6242·1 volts per centimetre,
the ionic velocity would be

$$6242 \cdot 1 \times 6 \cdot 858 = 42809 \tag{12}$$

centimetres per second, and would be very
nearly the same as the molecular velocity of the
isothermal layer, 40400, as given in para.
69. Since the measurements of ionic velocity
can be only obtained very roughly, these two
results may be regarded as equal.

72. In order to obtain the above equality,
we have used a special electric force, $viz.$, 6242·1
volts per centimetre, and a volt contains 10^8
absolute units of electric force, so that this
electric force in absolute units is

$$6 \cdot 2421 \times 10^{11}. \tag{13}$$

It was stated in the first of our studies, para.
5, that the earth's gravitational potential is the

[1] *Smithsonian Physical Tables*, p. 405.
[2] *Ibid.*, p. 421

product of the surface gravity (=979·75) and
the radius (= 6·371 × 10⁸); and

$$979·75 \times 6·371 \times 10^8 = 6·2421 \times 10^{11} \quad (14)$$

which is identical with (13), or the value of the
electric force required to make the ionic velocity
of the isothermal layer equal to its molecular
velocity.

73. From the above result some very import-
ant conclusions can be drawn. For it indicates
that gravitational potential operates in the
same way as electromotive force, and may be
regarded as identical with it. When an
electromotive force is operating along wires, say
in the lighting of a room, and a few of the
lights are switched off, the electromotive force
for these lights is screened off and the lights go
out. When, in a similar way, the earth's
gravitational potential is switched off a few of
the atmospheric molecules, their motion stops
and they become ions. Hence we may define
ions as gaseous molecules switched off from the
gravitational potential. If this be so, it is an
important generalisation, and may solve many
mysteries.

The molecular velocity is being continually
generated by this gravitational potential, which
causes a continual stream of matter from outer

space into the earth with the molecular velocity, in the form of sound-waves. The amount of matter entering the earth from space in the time of the earth's orbital revolution round the sun, or in one year, is just equal to the earth's mass, as shown by (11). Thus the earth is created annually, or its substance renewed, by the power of sound.

74. Hence we may regard the gravitational potential as continually generating air on Nature's sounding-board, the ether, in the way above explained.

Sound is the characteristic of Akasha (ether): it generates Air.[1]

The magic potency of Occult Sound in Nature and Æther—which . . . calls forth . . . the illusive form of the Universe out of Chaos.[2]

The Pythagoreans asserted that . . . the World had been called forth out of Chaos by Sound.[3]

Where there was no Æther there would be no "Sound," as it is the vibrating sounding-board in Nature.[4]

We say and maintain that Sound, for one thing, is a tremendous Occult Power; that it is a stupendous force, of which the electricity generated by a million Niagaras could never counteract the smallest potentiality.[5]

[1] *The Secret Doctrine*, I, p. 226.
[2] *Ibid.*, I, p. 161.
[3]   „   p. 467.
[4]   „   p. 535.
[5]   „   p. 606.

The knowledge which enables us to operate on Nature's sounding-board, and utilise a portion of the tremendous activities at work there, is known to Occultists as the science of *Mantra-Vidya.*

CONCLUSIONS AND SUMMARY

75. There is a continual stream of electrons from the earth to the sun. These electrons, on arrival at the sun's surface, are supplied with two positive atoms, which, with the 16 atoms already contained, which are negative, transform it into neutral hydrogen. The stream of hydrogen from the earth is seen as a descent of the gases of the sun's chromosphere, in the centre of the sun's disc.

There is a continual creation or emergence of matter in the isothermal regions of the atmosphere, the amount of which in one year is equal to the earth's mass.

The molecular velocity of the atmosphere is continually generated by the earth's gravitational potential, which is identical in operation with electromagnetic potential.

When molecules of gas are ionised, they are switched off from the operation of the earth's gravitational potential.

The molecular motions of the atmosphere do not conform to the methods contemplated in the kinetic theory of gases, but rather to the equivalent sound-wave theory developed by Prof. Jeans. These sound-waves have creative properties, and the science of their operation is that known to Occultists as *Mantra- Vidya.*

CHAPTER VI

THE CONSERVATION OF POWER

76. If we constructed two steam engines of
exactly the same size, and similar in every
respect, working under the same boiler
pressure, and against the same resistance to
their motion, then the energy-contents of the
cylinders would be the same in both engines.
If one of the engines made 20 revolutions per
minute, and the other 200, the energy-contents
of the cylinders of both engines would still
remain the same, though the power of the
engine running at 200 revolutions would be
ten times as great as that of the engine
running at 20 revolutions. An examination
of the energy-content of both engines, at any
instant, would show that they were equal,
and would give us no indication of the power
that was being expended. To obtain the
power, we must divide the energy by the
time in which it is expended. In the case
of a steam engine, we must divide the

energy-content of the cylinder by the time of
the stroke; and, in the case of a molecule, we
must divide the molecular energy, as given in
(1), para. 3, by the time-interval between two
energy creations, explained in para. 67. When
energy is divided by a time, it is technically
known as power or activity,[1] and is the rate
of expending energy, or the time-rate of
doing work.

77. The difference between energy and
power serves to define one of the main distinc-
tions between the teachings of Western science
and that of Occultism. Where Western science
says there is energy, the Occultist says there
is power. We may illustrate this difference
by measuring the energy in unit volume of
air at normal temperature and pressure,
according to Western science, and then, follow-
ing the indications of Occult teachings, meas-
uring also the power. In a cubic centimetre
of air there are $2 \cdot 705 \times 10^{19}$ molecules, each
having the energy given by (1), so that the
total energy per cubic centimetre of air is
1,556,000, and on this both teachings are in
fair agreement; but the Occultist would point
out that this energy is only the instantaneous
value, and that in the time of a " to and fro "

[1] *Smithsonian Physical Tables*, p. xxviii.

motion of the molecule along the length of its free path, or what in the kinetic theory would be two collision intervals of the molecules, this amount of energy is developed and drained away. The time of this " to and fro " motion is 0·000,000,000,3584 second, so that this amount of energy would be expended by the molecules 2,790,000,000 times per second. Thus the power or activity per unit volume of air is

$$2{,}790{,}000{,}000 \times 1{,}556{,}000 = 4\cdot343 \times 10^{15} \text{ ergs per}$$
$$\text{second} = 434{,}000 \text{ kilowatts} = 582{,}200 \text{ horse-power}$$
$$(15)$$

78. The above comparison may help us to visualise the two outlooks on Nature's operations. In the one case we have a small bundle of energy which cannot possibly be used, and in the other we find ourselves in the presence of a power which would drive all the factories in India. It is the difference between a fossil and a living organism. There may be as much molecular energy in the fossil as in the living organism, but the organism can do work, and this the fossil cannot do. In the one case, therefore, we are contemplating a mere skeleton, and in the other an organism pulsating with life and vigour, so that it is the difference between a dead and a living universe. The Western

concept presents us with myriads of isolated, dead masses; the Occult concept is that of an enormous vascular system, through which matter and energy circulate from planet to sun, and from star to star, making the whole into a living entity, governed by the laws of life and evolution.

79. We have seen above that we can change the energy aspect of Nature, as visaged by Western science, into the power aspect, as studied in Occultism, by dividing energy by time. But many physical problems in Western science are treated under their force aspect, particularly where the force of gravity is concerned. The force of gravity exhibits itself in the familiar example of weight, and weight is mass multiplied by acceleration, which in classical physics is the definition of a force. If we place a ten-pound weight on a table, it exerts a downward force against the surface of the table, and this force is identical with its weight. So long as the table supports the weight, no work is being done, according to current physical theories; and, in order that the force of gravity shall do work, or expend energy as power, we must remove the table and allow the body to fall. The energy is then the weight, or gravitation force of the body, multiplied by

the height of fall, and the power is this energy
divided by the time of the fall. Thus energy is
force multiplied by a length, and power is force
multipled by a velocity, for velocity is length
divided by time. Such are the accepted defini-
tions of force, energy, and power.[1]

80. But we saw, in para. 72, that through
the gravitational potential the force of gravity
is always generating molecular velocity, so that
if a body is prevented from falling, and thus
not allowed to exhibit energy and power in the
mass as a whole, this energy and power is mere-
ly transferred to the molecules, one of the results
of which is the creation of matter as shown by
(11). Thus gravitation is not a force, but a
power. It is the time-rate at which Nature
expends energy and creates physical matter.

81. To the above conclusion the physicist may
raise an objection. He may contend that there
is no evidence that gravity affects the molecular
energy, as exhibited in the form of heat; and
our contention certainly implies that where the
intensity of gravity is greater, then, other things
being equal, the temperature of bodies should be
greater. Let us examine this point.

The acceleration of gravity at the surface of
the sun is 27,436, and terrestrial gravity is

[1] *Smithsonian Physical Tables*, p. xxviii.

979·75 ; so the ratio of solar to terrestrial gravity is

$$27, 436/979·75 = 28·003 \qquad (16)$$

Hence the temperature of the sun should be about 28 times the temperature of the earth, in corresponding parts of its atmosphere. Measured on the absolute scale, the mean temperature of the earth's surface is 288·13 K., and that of the isothermal layer 219·13 K.

Multiplying these by the acceleration ratio in (16), we obtain for the sun's surface temperature 8068·4 K., and for its isothermal region 6136·2 K.

The computed effective temperature of the sun, from black body curves, is 6000° K. to 7000° K., and from total radiation 5830° K. [1] Prof. Bigelow [2] gives for the temperature of hydrogen 8476° K., at 14,000 kilometres below the photosphere, and 5370° K. at 15,000 kilometres above it, which agrees well with the temperatures calculated from the acceleration ratio. In fact, Bigelow, in comparing solar temperatures and the thermodynamic relations of the solar and terrestrial atmospheres, simply utilises the ratio of the gravitation intensities as given in (16). [3]

[1] *Smithsonian Physical Tables*, p. 418.
[2] *Treatise on the Sun's Radiation*, p. 60.
[3] *Ibid.*, p. 19.

Thus observation accords with the theory that molecular energy, or temperature, other things being equal, is proportionate to gravitational intensity.

82.   We may thus proceed with our conclusion that gravitation is not a force but a power, and that one of the functions of this power is to create physical matter.   If the earth's mass be taken as unity, and the period of the earth's orbital revolution as the unit of time, then the mass created in any interval of time by the earth's gravity is numerically equal to the number of years in the interval.   If the unit of mass is one gramme, and the unit of time one second, then the mass created per second is

$$\text{the earth's mass} / \; 131{,}558{,}000 = {\cdot}195 \times 10^{20}$$
$$\text{grammes} \qquad\qquad\qquad\qquad (17)$$

and the mass created in any time is the above multiplied by the time in seconds.   Hence the result of the exercise of gravitational power may be defined as "*mass multiplied by time*".

83.   But mass multiplied by time is a new principle in physics, known as action, and this new principle is given the name of "The Conservation of Action".   It is due to the general recognition in the physical sciences of a fourth dimension; thus in a recent article by

Dr. Stanley Allen [1] we read: " In the four-
dimensional world it is action, not energy, which
is conserved."   Again, Prof. Eddington says : [2]

After mass and energy there is one physical
quantity which plays a very fundamental part in
modern physics, known as *Action*. *Action* here is a
technical term, and is not to be confused with
Newton's " Action and Reaction ". In the Relativity
Theory in particular, this seems in many respects
to be the most fundamental thing of all. The reason
is not difficult to see. If we wish to speak of the
continuous matter present *at* any particular point
of space and time, we must use the term density.
Density multiplied by volume in space gives us *mass*
or, what appears to be the same thing, *energy*.   But
from our space-time point of view, a far more
important thing is density multiplied by a four-
dimensional volume of space and time ; this is
Action. The multiplication by three dimensions
gives mass or energy ; and the fourth multiplication
gives mass or energy multiplied by time. Action is
thus mass multiplied by time, or energy multiplied
by time, and is more fundamental than either.

84. Now these three conservations of the
physicist—the conservation of mass, the con-
servation of energy, and the conservation of
action—can be shown to be the triple aspect of
one unique law of conservation, which we may
name the law of the " Conservation of Power,"
as deduced from the teachings of Occultists. In

[1] *Nature,* Vol. 108, p. 342, November 10th, 1920.
[2] *Space, Time and Gravitation,* p. 147.

our quotations (para. 48) from *Occult Chemistry*
it is shown how a stream of matter pours into
the physical plane from the astral or fourth
dimension, through the positive atom, and,
simultaneously, how a stream of matter is
drained from the physical plane to the astral,
through the negative atom. If the two
streamings are at a constant rate, as well
as equal and opposite, then the circulation
of matter between the two planes, or its
emergence into and disappearance from the
physical plane, is equal to a mass multiplied by
a time, and is therefore a quantity of action,
which for any given time is a constant, and can
be expressed by the law of the conservation of
action.

Again, if the amounts of matter received from
the astral plane and delivered to the physical
by the positive atom are equal, the quantity of
matter contained in the atom will not vary, and
similarly for the draining away by the negative
atom. Hence we have the law of the conserva-
tion of mass. Now energy is mass multiplied
by velocity squared, so that, if the streaming is
constant, both mass and velocity are constant,
as well as energy, which is their product. We
thus obtain the third law of the conservation of
energy.

This constancy in the streaming of matter and energy implies the constancy of the power which drives the streams ; hence the one, unique law, which stands behind the three laws of conservation, as stated above, is " The Law of the Conservation of Power ". It is a fourth-dimensional law, as required by modern physics.

85. In our last study on " The Terrestrial Laboratory," we found that the molecular velocities were generated by means of the gravitational potential, as given in equation (14), para. 72, this potential being the product of the earth's surface gravity and the earth's radius. Thus the earth's gravitational potential was made identical with electric force. But electric force, or, as it is often called, electric field intensity, is the electromotive force divided by the distance through which it operates ;[1] hence, to obtain the total electromotive force expended throughout the earth's mass, we must multiply the electric force by the distance between the earth's surface and its centre, or by the earth's radius. Putting this in symbols, if g be the surface acceleration, and R the earth's radius, the gravitational potential, which is identical with the electric force, is gR, and the total electromotive force expended in the earth's

[1] *Smithsonian Physical Tables*, p. xxxiii.

mass, P, is R times this; hence we have, for the total electromagnetic potential of the earth :

$$P = g R^2 = 979 \cdot 75 \times (6 \cdot 371)^2 \times 10^{16}$$
$$= 3 \cdot 977 \times 10^{20} \qquad (18)$$

from (14)

86. The above expression is a familiar one, and will be at once recognised by the astronomer, because it is known as the astronomical mass of the earth. The astronomer does not measure the mass of a body in grammes, but by the amount of force it exerts. If the mass of the earth were compressed into a point at its centre, then the attractive force it would exert on unit mass, at the distance of one centimetre from the centre, would be the value given by (18), so that we might infer that the earth's electromagnetic potential and the earth's force of gravity are identical. But, before coming to this conclusion, it may be well to scrutinise the above equation rather carefully. When physicists find a numerical equality such as the above, they are careful to ascertain whether the equated quantities have the same mechanical dimensions. Now the acceleration, g, has the dimensions of a length divided by the square of a time; and, as the radius, R, is a length, the dimensions of $g R^2$ are the third power of a length divided by

the square of a time; and these, when length and
time alone are used, are the dimensions of a
mass.[1] The dimensions of electromotive force are
usually given in terms of mass, length, and
time; but, when the mass is transformed into its
equivalent in length and time, the resulting
dimensions are the third power of a length
divided by the third power of a time,[2] and, as
velocity is length divided by time, we may
say that the dimensions of electromagnetic
potential are the third power of a velocity.
It follows from this analysis that the two
quantities equated in (18) are *not* of the same
nature, the one being the cube of a length
divided by the *square* of a time, and the other
the cube of a length divided by the *cube* of a
time.

87. A little consideration will show us
where the error lies. Since the fall of potential
per centimetre per second in the earth's atmo-
sphere was gR, we concluded that, from sur-
face to centre, or for the whole mass of the
earth, it would be gR^2; but in equation (11),
para. 70, we see that a whole year is required
to produce the earth's mass; hence P, in (18),
is the fall of potential, not in one second, but

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[1] *Smithsonian Physical Tables*, p. xxviii.
[2] *Smithsonian Physical Tables*, p. xxxii.

in one year. Hence, if V be the fall of potential per second, and y the number of seconds in a year, we have P=Vy, and the fall of potential per second is

$$V=P/y=g R^2/y=1,26\times10^{13}$$
$$=126,000 \text{ volts} \qquad (19)$$

Thus the electromotive force is the earth's gravitational mass divided by a time, *viz.*, a year; and both sides of the equation have the same dimensions, the third power of a velocity.

88. Now what is this velocity of which the earth's potential is the cube? If a stream of matter of unit density is passing through a surface with a velocity v, the mass of matter passing unit surface in one second is v, and its energy is the mass multiplied by half the square of the velocity, or by $\frac{1}{2}v^2$; hence the flux of energy through unit surface in unit time is $v\times\frac{1}{2}v^2=\frac{1}{2}v$, and will have the same dimensions as electromotive force. If we equate $\frac{1}{2}v^3$ to the potential given by (19), we obtain for the velocity

$$v=29319 \text{ centimetres per second} \qquad (20)$$

which is the velocity of sound in air at a temperature of —59·7°C. The temperature of the isothermal layer in summer is—51°C.,

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and in winter—57° C. Even in winter the sun will contribute a little heat to the isothermal layer, so that, if this were omitted, the heat generated by the earth may be the equivalent of the temperature—59·7° C., as given above.

89. By applying formula (11), and using the sound velocity in (20), instead of that in para. 69, we obtain, for the density of the sound medium :

$$A = 0.001729 \qquad\qquad (21)$$

which is greater than the density of air in the ratio four to three. It is exactly the density of argon, at the temperature 8·24° C., which is the mean temperature of the earth's surface at about a mile above the sea level.

These sound-streams should not be regarded as seated in the molecules of the atmosphere. We saw in para. 77 that the air molecules were, in a sense, an illusion. They are created, and drained away, many millions of times a second. In *Occult Chemistry* (pp. 24—27) four states of matter are described, into which gaseous molecules split up. They are known as ethers 1, 2, 3 and 4, and, in some or all of these forms, they are able to interpenetrate the molecules of solid bodies, and cannot therefore be confined in closed vessels. It is probable that

the molecules, as they are created and destroyed, are drained away in some of these ether forms, each sound-vibration in this substratum of ether creating and destroying the molecules, in which case there are 2,790,000,000 sound-vibrations per second, as explained in connection with equation (15).

90. In the finest of the ether forms, ether 1, occult writers speak of matter as in the atomic form, and state that space is filled with matter in this etheric or atomic form.

> The waves and undulations of science are all produced by atoms propelling their molecules into activity from within. Atoms fill the immensity of space. . . . It is that inner work that produces the natural phenomena. Atoms are called vibrations, and collectively Sound.[1]

Occult writings contain abundant assertions of the creative power of sound, and this appears to be confirmed by the above investigations.

CONCLUSIONS AND SUMMARY

91. A fundamental principle, which emerges from the results of Occult researches, may be defined as " The Law of the Conservation of Power ". This is the unique law of conservation, and is the basis of the three laws of conservation

[1] *The Secret Doctrine*, I, 694.

known to Western science—the law of the
conservation of mass, the law of the conservation
of energy, and the law of the conservation of
action—which are triple aspects of the law of
the conservation of power, and can be deduced
from it.

This conservation of power exhibits itself
statically as the force of gravity ; but, when
molar motion is prevented, the power is expend-
ed in generating molecular motions and the
creation of matter and energy.

The quantities of matter and energy in the
molecules of the atmosphere are constant, but
not identically the same in successive instants.
They represent the quantities of matter and
energy in a single vibration of a sound-wave in
the underlying substratum of ether, and these
sound-waves repeat themselves 2,790,000,000
times per second, and develop the power shown
in (15).

The fall of potential per second, required to
generate the matter and energy of the gravita-
tion process, is 126,000 volts ; and the total fall
of potential in one year is equal to $g \, \mathrm{R}^2$, or the
earth's astronomical mass. Thus " mass is to
be regarded as potential energy that moves on
through space ".[1]

[1] Hermann Weyl, *Space, Time and Matter*, p. 200.

CHAPTER VII

THE GEOCENTRIC UNIVERSE

92. Near the close of a strenuous life, the
veteran scientist, Alfred Russel Wallace, the
co-discoverer with Darwin of the principle of
the survival of the fittest, wrote a book called
Man's Place in the Universe, the theme of which
was that our earth was the centre of the
universe, and that our solar system, as well as
the whole of the stars of the Milky Way, had
been specially created and designed to fulfil the
requirements of terrestrial man. The facts and
arguments on which he based this remarkable
conclusion were both sound and authoritative,
and there does not appear to have been any
serious attempt to refute them. Nevertheless,
in spite of the soundness of the evidence, the
arguments failed to carry conviction.

93. From the beginning of the present
century, physicists have been faced with a
similar difficulty in connection with the ether
of space. If we regard the earth as the centre

of the universe, so that the ether of space has
its centre fixed in the earth, and its circumfer-
ence in the ring of the Milky Way, then all
difficulties in connection with the ether of space
—mathematical, physical and electromagnetic
—which have so greatly puzzled men of science
during the last few years, at once vanish, and
theories of relativity, etc., become superfluous.

   Dr. Houston, of Glasgow University, has
recently shewn[1] that, if the ether of space is
attached to the earth, then all the problems
which have required the theory of relativity for
their solution can be solved without it. The idea
of an ether that was attached to the earth, and
dragged along with it, was first suggested by
Prof. Stokes in 1845.[2] Stoke's ether has been
since developed by Planck and Lorentz,[3] whilst
quite recently Dr. Silberstein[4] has demonstrated
how such an ether would account for observed
facts better than the theory of Einstein.[5]

   94. But in spite of the fact that all the
available evidence goes to prove that the earth
is a specially favoured planet, placed at the
centre of the universe, with the ether of space
attached to it and focused upon its centre,

[1] *Phil. Mag.*, Vol. 37, p. 214, February, 1919.
[2] *Ibid.*, Vol. 27, p. 9.
[3] *Theory of Electrons*, 1909, p. 314.
[4] *Phil. Mag.*, Vol. 39, p. 151, February, 1920.
[5] *Ibid.*, p. 169.

scientific men are not convinced by it. They
think, and rightly so, that out of the millions of
suns and planets in our siderial system, most of
them larger and more important than our little
earth, it is absurd to suppose that the earth we
happen to live on should have been chosen for
the centre of the universe, and for the material
nucleus to which the ether is attached. As
stated by Prof. Silberstein:

> I cannot help remarking here that it is
> repugnant to me to think of an omnipresent, *rigid*
> ether being once and for ever at rest relatively
> rather to one star than to another. . . . None of
> the celestial bodies, be it ever so conspicuous in
> bulk or mass, can claim for itself this primacy of
> holding fast the ether . . . there is nothing that
> could confer this distinctive privilege upon any one
> of them. But, then, I am quite aware that what is
> repugnant to think of may not necessarily be wrong
> altogether. [1]

95. Although the results of occult investiga-
tion confirm the fact that the earth is the centre
of the visible universe, and that the ether of
space is attached to it, as indicated by experi-
ment, nevertheless this confirmation is accom-
panied by teaching which makes the fact cease
to be repugnant.

In the third article we saw that the visible
portion of the sun's atmosphere was specially

[1] *The Theory of Relativity*, p. 88.

attached to the earth, but this conferred no
special privilege upon the earth over the rest of
the planets, for each of the planets had likewise
a portion of the sun's atmosphere assigned to it.
Similarly we are taught in Occultism that all
the heavenly bodies are the centres of universes,
and have attached to them an ether which
extends to the boundary of their special universe.
These boundaries are controlled by what is
called the Fohat of the body.

The elements of our planets cannot be taken as
a standard for comparison with the elements in
other worlds. In fact, each world has its Fohat,
which is omnipresent in its own sphere of action.
But there are as many Fohats as there are worlds,
each varying in power and degree of manifestation.
The individual Fohats make one universal collective
Fohat.[1]

96. Just as we found that the earth and
planets had different sections of the solar
atmosphere assigned to them, so with the
systems of stars. The siderial system, as seen
from the earth, is that portion of the universe
of stars which is specially attached to the earth
by the terrestrial Fohat. The other planets
may have an entirely different set of stars
attached to them, which are invisible to us.
When we examine the star systems visible to

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[1] *The Secret Doctrine*, Vol. I, p. 167.

us, we find many dark spaces, but we are told that there are really no spaces void of stars.

Another point most emphatically denied by the "Adepts" is that there exist in the whole range of the visible heavens any spaces void of starry worlds. There are stars, worlds and systems *within* as *without* the systems made visible to man.[1]

97. The pole of the Milky Way is in right ascension 190°, and 28° north.[2] On the plane of the ecliptic, the pole is in Virgo 27°, and 29° 27′ north latitude. Thus the plane of the Milky Way cuts the ecliptic at an angle of 60° 33′, the ascending node being in Sagittarius 27°, and the descending node in Gemini 27°. The width of the Milky Way is very variable ; but on a rough estimate it may be taken to have an average width of three-quarters of a Sign, so that the two crossings in Sagittarius and Gemini together occupy about a Sign and a half. There is thus room for seven or eight Milky Ways, if distributed evenly around the Zodiac. We have therefore ample room for the six additional galaxies required for our seven planetary Logoi, the visible one being assigned to our terrestrial Logos, in the same way as the Sun's chromosphere was assigned to Him in our third study.

[1] *Five Years of Theosophy*, p. 158.
[2] *Stellar Movements and the Structure of the Universe*, Eddington, p. 239.

98.   Occult students are aware that there are higher orders of Logoi which govern stellar universes in the same way as our solar system is governed by the planetary Logoi, according to the fundamental rule of Occultism—" As above, so below ".   Over the cosmos in general, there are, therefore, seven cosmic Logoi, one for each of the seven galaxies above described. Each planetary Logos may be regarded as specially linked with the corresponding cosmic Logos, and with the galaxy associated and controlled by Him.   The monads in evolution in any planetary Chain will hence be shut off from six of the existing galaxies, and only able to see the seventh, the galaxy governed by the cosmic Logos corresponding to the planetary Logos of the Chain.   The seven cosmic Logoi appear under different aspects according to the functions They are performing.   As the " Primordial Seven," They are the highest Beings in the scale of existence,[1] and may be regarded as the septenary soul of the universe.   As the seven " Son-brothers " of Fohat, They are the nervous and vascular system of the cosmos, having sprung from " the Brain of the Father and the Bosom of the Mother ".[2]   As the Lipika, They

[1] *The Secret Doctrine*, I, 116.
[2] *Ibid.*, p. 169.

are the great adjusters of the cosmic forces, keeping the balance between the planes, and making possible the laws of the conservation of matter, energy, etc., on all planes. They form the " Ring Pass-Not," which separates the seven galaxies of the cosmos, and the seven planetary evolutions of a solar system.[1] They occupy the middle wheels of the cosmos, which we may interpret to mean the material nuclei or planets of the cosmos.[2]

99. Applying the rule, " As above, so below," we may say that within a solar system the seven planetary Logoi in the sun correspond to the Primordial Seven of the cosmos, the Seven Spirits ensouling the planets correspond to the Lipika, whilst the lines of force joining the matter of the planet to the corresponding part of the solar atmosphere are the channels and vehicles of the seven Son-Brothers of Fohat. Fohat is therefore the interaction of the positive and negative aspects of the seven Logoi. The sun is positive or male, the planet negative or female, and Fohat represents or governs the laws of their interaction in the cosmic spaces. This triple aspect, or divine trinity, the Atma-Buddhi-Manas

[1] *The Secret Doctrine*, I, pp. 154-7.
[2] *Ibid.*, p. 144.

of the cosmos, is often spoken of in occult
writings as that of Father-Mother-Son. In the
sun the seven Logoi are united, and represent
the unifying quality of the spirit. In the
planets, the seven Logoi are separated, and
represent the separative quality of matter. This
work, of dividing the monads into seven separate
evolutions until the day " Be-With-Us," is one of
the functions of the Lipika.[1] Associated with the
seven Son-Brothers of Fohat are " the seven
forms of cosmic magnetism, called in practical
Occultism the Seven Radicals ".[2]

100. These seven ethers of space, or seven
forms of cosmic magnetism, are of great
importance to us in the further development
of our studies, particularly in connection with
the theory of relativity and that of Einstein.
" Space is called, in esoteric symbolism, the
' Seven-Skinned Eternal Mother-Father,' " [3] and
these seven skins, or magnetic substances,
divide the cosmos into seven virtually distinct
universes. By way of illustration we may say
that our earth has fixed to it one of these
seven ethers of space, of which it is the centre
and focus. From this centre, lines of force

[1] *The Secret Doctrine*, I, p. 154.
[2] *Ibid.*, p. 169.
[3] *Ibid.*, p. 38.

radiate into space, being attached at the outer ends to one-seventh of the sun's atmosphere, the chromosphere, and to one-seventh of the stars, those of the visible galaxy. Similarly the planet Jupiter forms the centre and focus of another of these ethers or cosmic magnetisms, lines of force from which are attached to a portion of the sun's corona, and to a galaxy of stars which is invisible to us, and may lie in a different portion of the heavens to what we may call our terrestrial galaxy. Similarly for the other planets. Hence we may say that each of the seven planetary chains of our solar system exists in a universe of its own, which is separate and distinct from the other six. Each planet, moreover, is the centre of its own universe, the ether of that universe being attached to it. Hence motion relative to the planet is motion relative to the ether of space attached to the planet.

101. The stars of our Milky Way are divided into eight classes; but one of these, the N type, has properties so distinct from the rest that it is generally kept apart from the other seven, which make a regular, progressive series based on the stellar spectra.[1] These

[1] *Stellar Movements and the Structure of the Universe,* Eddington, pp. 7-9.

seven types of stars are supposed to be due to
differences of temperature in the passage from a
nebula to a dark star, as the star gradually
cools down through loss of heat by radiation.
But we have seen that our own sun probably
exhibits a different appearance to each of the
seven planets; and, for all we know to the
contrary, it may appear to Jupiter and Mars
as of the Orion type and Sirius type, so that the
seven types of suns in our galaxy may be
identical with the seven different suns as seen
from the seven planets of our solar system.   In
any case, Occult teaching is positive in denying
that either our sun or the stars are losing heat
in such a way as to vary their temperature,
or that their energies are running down in the
way supposed by Western science.[1]   "The sun
is, as we say, the storehouse of our little cosmos,
self-generating its vital fluid, and ever receiving
as much as it gives out."[2]   We have seen
in previous studies how the earth is able by
the power of its own gravity to produce the
whole of its mass and energy every year, as
explained in para. 70 and elsewhere.   By
a similar process, which may be given later,
it can be shewn that the sun's energy is

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[1] *The Secret Doctrine,* I, pp. 172-3.
[2] *Five Years of Theosophy,* p. 165.

self-renewed in the sun-spot period, or a multiple
of this.

102. A further important difference between
the   teaching   of   Occultism   and   that   of
Western   science   is   in   the   interpretation   of
spectrum   analysis   as   applied   to   the   sun   and
stars.   In   our   laboratories,   when   chemical
elements,   in   the   state   of   incandescent   gases,
have their light examined by the spectroscope,
they exhibit spectral lines which are character-
istic. and generally different for each element.
Hence, in the laboratory, a chemical element is
often detected by its spectrum, and spectrum
analysis has become one of the surest methods
of chemical research. When, therefore, astrono-
mers found that the light of the sun and stars
exhibited these characteristic spectra, they felt
justified in concluding that the sun and stars
were composed of the same chemical constituents
as the earth.   But the occultist says this is not so.

    Now that the conditions and laws ruling our
solar system are fully developed, and that the atmo-
sphere of our earth, as of every other globe, has be-
come, so to say, a crucible of its own, Occult Science
teaches that there is a perpetual exchange taking
place,   in   space,   of   molecules,   or   rather   atoms,
correlating   and   thus   changing   their   combining
equivalents on every planet. . . . The spectroscope
shows only the probable similarity (on external
evidence) of terrestrial and siderial substance ; it is

unable to go any further, or to show whether or not
atoms gravitate towards one another in the same
way, and under the same conditions, as they are
supposed to do on our planet, physically and
chemically. The scale of temperature, from the
highest degree to the lowest that can be conceived
of, may be imagined to be one and the same, in and
for the whole universe; nevertheless, its properties,
other than those of dissociation and reassociation,
differ on every planet; and thus atoms enter into
new forms of existence, undreamed of by, and incog-
nisable to, Physical Science. . . Thus not only
the elements of our planet, but even those of all its
sisters in the solar system, differ in their combina-
tions as widely from each other, as from the cosmic
elements beyond our solar limits. . . . Therefore,
the elements of our planet cannot be taken as a
standard for comparison with the elements in other
worlds.[1]

103. Physicists generally assume that atomic
and molecular forces are the same throughout
the universe; whereas, as we shall see, they
are functions of the mass and gravitational
potential of the body on which they are placed.
Hence temperature, chemical affinity and elec-
tromagnetic forces have different quantitative
relationships for each of the heavenly bodies. The
following quotation gives a hint as to how the
spectroscopic evidence ought to be interpreted.

    The essence of cometary matter [AND OF THAT
WHICH COMPOSES THE STARS][2] is totally different from

    [1] The Secret Doctrine, Vol. I, pp. 166-7.
    [2] The capitals are the quoter's; ordinary Roman type is used
in the original.

*any of the chemical or physical characteristics with
which the greatest Chemists and Physicists of the
earth are familiar. . . . While the spectroscope has
shown the probable similarity* [OWING TO THE
CHEMICAL ACTION OF TERRESTRIAL LIGHT UPON
THE INTERCEPTED RAYS][1] *of terrestrial and siderial
substance, the chemical actions peculiar to the vari-
ously progressed orbs of space have not been detected,
nor proven to be identical with those observed on our
planet.*[2]

An important hint is contained in the words
"intercepted rays of terrestrial light". It is
usually supposed that we see the sun and stars
by means of solar light and stellar light, but
this is not so; we see the sun and stars by
means of terrestrial light which is *intercepted* by
these bodies. The earth, as it were, is a gigantic
octopus, having innumerable tentacles which
stretch out into space in all directions; where
these tentacles touch a sun or star, we perceive
the effect as light along the terrestrial tentacles.
These tentacles are the earth's vascular system,
through which it pours the whole of its mass
into sun and stars every year. As the terres-
trial elements are poured into sun and star, they
send the same vibrations along the tentacles as
when incandescent in our laboratories, and
hence give out the same spectrum. The spectrum

[1] The capitals are the quoter's; ordinary Roman type is used
in the original.

[2] *Ibid.,* I, pp. 653-4.

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of sun and star, therefore, is that of terrestrial matter circulating throughout the terrestrial universe, and not, as supposed by Western science, the spectrum of the chemical elements of which these heavenly bodies are composed.

104.   One of the great distinctions between Occult teaching and that of Western science is that Western science regards many things as constant throughout the universe, which are only constant for the earth.   Physicists think they have discovered the cosmic universe, whereas they have only discovered the terrestrial universe.   Each heavenly body, like our earth, is the centre of a universe, and has a framework of stars to mark its extent and boundaries.   Such planetary world-spaces, with masses of matter at their boundaries or horizons, technically called mass-horizons, are similar in mathematical structure to the cosmic world-space favoured by Einstein.[1]

The planetary universe, other than that of the earth, can be explored by the occult powers latent in man, but so far our physicists have not come into contact with them.   All phenomena known to Western science are those of our terrestrial universe.   The sun is the terrestrial sun, the stars the terrestrial stars, and the ether

[1] *Space, Time and Matter*, Hermann Weyl, p. 282.

of space is the terrestrial ether. The substance of all these is continually being interchanged between earth and star.

Paracelsus named it the siderial light. . . . He regarded the starry host (our earth included) as the condensed portion of the astral light . . . whose magnetic or spiritual emanations kept constantly a never-ceasing intercommunication between themselves and the parent fount of all—the astral light. . . . As fire passes through an iron stove, so do the stars pass through men with all their properties, and go into him as the rain into the earth.[1]

105. This astral light of Paracelsus is what in the West has been called the ether of space, whilst in reality it is the earth's electromagnetic field. The following description of this is taken from the writer's pamphlet, *Einstein's Theory* (p. 38), and is based on researches along the lines of Occult teaching.

The ether of space has been a source of bewilderment to Western science since the age of Descartes, as will be seen from Whittaker's *History of the Theories of Ether and Electricity.*[2] In my opinion, this is due to having confused it with the earth's electromagnetic field. If we throw a stone into a sheet of water and watch the ripples move away from the disturbance in ever-increasing circles, we have a sectional view of the ether as understood in the West. Sir Willian Bragg, in the recent Robert Boyle lecture at Oxford [3] illustrates

[1] *Isis Unveiled,* Vol. I, p. xxvi.
[2] Longmans, 1910.
[3] *Nature,* May 19th, p. 374.

one of the difficulties of this view of the ether, where he says: " It is as if one dropped a plank into the sea from a height of a hundred feet, and found that the spreading ripples were able, after travelling 1,000 miles and becoming infinitesimal in comparison with its original amount, to act upon a wooden ship in such a way that a plank of that ship flew out of its place to a height of a 100 ft." Bragg's description of the Western theory of the ether amounts practically to a *reductio ad absurdum*, and it may be well to compare it with the ether as taught in the East. Imagine an enormous bicycle wheel with a large number of thin, hollow, steel spokes, from hub to rim. This may be taken as a rough sectional view of the earth's electromagnetic field. Between the spokes is the ether of space, which may be of infinite extent. Each spoke begins on the earth and ends on a star, so that the electromagnetic field is finite. As the distance between the spokes increases with the distance from the earth, there is plenty of room for lines of force from other planets and suns. The different fields of force can therefore interpenetrate and cut each other. If the force of a falling plank is applied to a line of force at one end, it will be delivered undiminished at the other end, so that Bragg's difficulty does not apply to the Eastern theory. The number of spokes through unit area will diminish as the distance squared, and the force in the same ratio, but the force applied to an individual spoke will pass to any distance without loss. Vibrations pass along these lines of force according to the undulatory theory of light, whilst corpuscules pass within the hollow tubes in accordance with the corpuscular theory. It is not a question of which is true of the undulatory and corpuscular theories ; according to the Eastern view they are both true. . . The number of lines of force issuing from each square inch of the earth's surface is about thirteen millions

of millions, and the total number of spokes in the
terrestrial wheel requires thirty-two figures to
express it. Our sun's surface is 10,000 times that
of the earth, and the number of suns forming the
stars of our Milky Way is estimated at one thou-
sand millions. If each of these suns had the same
surface as our own, the earth would be able to
supply one line of force to each square inch of
surface of every star in our siderial system. Our
electromagnetic field, therefore, keeps us in
excellent telegraphic communication with the
heavenly bodies.

SUMMARY AND CONCLUSIONS

106. Each heavenly body is the centre of a
universe, so that there are as many universes as
there are suns and planets. These universes
overlap and interpenetrate each other, but
are, nevertheless, quite distinct and separate
universes. They consist of a central body, to
which is attached an ether of space, or an
electromagnetic field, of which the lines of force
are focused on the central body as origin, and
terminate in a framework of stars, which mark
the boundary and limits of the universe. This
ether of space may be of the type, and possess
the mathematical properties, of the metrical
and electrical fields of Einstein and Weyl.[1]

The universe, as known to us, is one such
universe, having the earth as centre, and having

[1] *Space, Time and Matter,* Weyl, pp. 220—227.

the earth's electric and gravitational fields as the ether of space attached to it, whilst the visible galaxy is the framework of stars forming the termini of the terrestrial lines of force, and the boundary of our space.   All the properties of this geocentric universe are specialised to the earth's requirements, and are more or less functions of the earth's mass.   Thus the visible sun is the terrestrial sun, and the stars are terrestrial stars, and both sun and stars, as seen from another planet, may be quite different in appearance and properties.

Whilst the planet and its field may be regarded as the domain, and under the control, of the planetary Logos, the framework of stars which bound the universe may be the domain, and under the control, of the corresponding cosmic Logos.

Since there is a constant circulation of matter between the central body and the bounding stars of the planetary universe, the stars, as seen through the spectroscope, will always appear to be composed of the same chemical constituents as the central body.

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CHAPTER VIII

THE MUNDANE EGG

The stars surround the whole earth, as a shell does the egg.--*Isis Unveiled*, I, xxvi.

107. From the conclusions arrived at in the previous studies it may be inferred that there are many things that may appear to be of cosmo-centric importance to Western science, which, nevertheless, may be of little interest outside our geocentric universe; and, as the interpretation of phenomena by Occultists and by Western science differs largely because, on the one hand, the phenomena are regarded as geocentric and, on the other, as cosmo-centric, it may be well here to examine a few of the more important cases.

It is now well known that the number of sunspots varies from year to year, increasing to a maximum, then decreasing to a minimum, in a cycle having an average period of about eleven years. Corresponding to this, there is a variation of the forces of terrestrial magnetism. This

sunspot variation is regarded by Western science as common to the solar system, and even to the stars of the cosmos. But these sunspots are merely openings in the chromosphere, which is only seen from the earth, and not from the other planets. There may be spots in parts of the corona which are seen from the planets but not from the earth, and the periodicity and laws of variation may be different in the two cases. Thus sunspots, as seen by us, may be a purely geocentric phenomenon, and not cosmo-centric as generally supposed.

108. To take another illustration, on 21st February, 1901, a new star blazed forth in the constellation Perseus, so that within three days its light increased 10,000-fold,[1] or from below an eleventh magnitude star to a little brighter than the first magnitude star Capella, and about the third brightest star in the heavens. By 25th June, 1901, or four months after its appearance, the star had vanished, and become transformed into a nebula.

Was the above event witnessed by the inhabitants of other stellar systems, or only by those in our geocentric universe ? In other words, was it a cosmic event, or was it only a terrestrial event ? Western science will reply emphatically

[1] *The Stars*, Newcome, p. 139.

that the event was cosmic, although this reply involves physical difficulties which so far cannot be surmounted. For instance, how can a body, larger and hotter than our sun, have its heat dissipated in a few months. According to Lord Kelvin, it will require at least 10,000,000 years for our own sun to cool down; how then can the heat of a larger and hotter body disappear in so short a period ? There is at present no satisfactory explanation of new star phenomena on the principles of modern physics.[1]

109. If, however, the event is merely geocentric, that is, merely a change in the relationship between our earth and the star, a satisfactory explanation presents fewer difficulties. Our earth sends out lines of force into space which terminate in the surrounding stars. Some stars are linked with us by many lines, some by few, and others by none at all. These linkages may vary from time to time, according to the motions and configurations of stellar systems. If the linkages increase the star will become brighter; if the linkages decrease, the brightness becomes less. If a star, previously disconnected with our lines of force, forms a contact, then an event will happen similar to the passage of an electric spark between charged

[1] *History of Astronomy*, Clerke, p. 399.

spheres. This would constitute a small disturbance in the higher regions of the atmosphere of the star, a disturbance so trifling as to be scarcely perceptible to the inhabitants of the system; but, as the whole of the effect would be transmitted along the terrestrial lines of force, it would be seen by us as a temporary blazing up of the star to ten thousandfold its normal brilliancy. Thus the geocentric effect would be enormous, and the cosmic effect infinitesimal.

110. If we regard the system of visible stars as the number of points of contact which our geocentric universe makes with other universes, and with the cosmos in general, then the total mass of the visible stars may, perhaps, have a definite relationship to some fundamental property of our earth. The number of stars in our Galaxy, according to Eddington's estimate,[1] lies between 770 millions and 1,800 millions. Taking the mean of these, we have, for the number of stars in our Galaxy,

$$\tfrac{1}{2}(770 \times 1800) \text{ millions} = 1,235,000,000 \quad (22)$$

He further estimates that on the average 30 of the stars have a mass equal to 10 times the mass of the sun,[2] so that each star averages

[1] *Stellar Movements*, p. 195.
[2] *Ibid.*, p. 255.

one-third the mass of our sun. The sun's mass in grammes is 1.97×10^{33} ; hence, taking one-third of this, and multiplying by the number of stars, as given by (22), we have, for the mass of matter in our siderial system,

$$81.1 \times 10^{40} \text{ grammes} \qquad (23)$$

We are told in *The Secret Doctrine* (I, 398), that the interval between one Night of Brahma and the next is 311,040,000,000,000 years, and that half of this has transpired in the present Mahamanvantara (p. 393). The Pralaya which terminates this period is called Prakritika, because it is the time when the elements are broken up into their original protyle. The matter of our physical plane has, therefore, had a life of 155,520,000,000,000 years, during the current Mahamanvantara. Now in para. 70 it is shown that the earth generates its own mass every year, so that in half a kalpa the mass generated will be

$$\text{Earth's mass} \times 155,520,000,000,000 = 93.0 \times 10^{40} \text{ grammes} \qquad (24)$$

On comparing this with the total mass of matter in the siderial system, it will be seen that it is of the same order of magnitude ; and, if we had accurate data to measure both masses

correctly, it is possible that they might be exactly equal.

111.   According to Occult teaching electricity is matter,[1] and, if the usual dimensions of an electric charge, in electrostatic units, be analysed into length and time, as is done in para. 86, they will be found to be the same as the dimensions of a mass.   We will therefore ascertain the earth's electrostatic charge, and compare it with the mass of the Galaxy as given by (23). According to the accepted theory of Rutherford, the positive charge on an element, or the charge on its positive nucleus, is the atomic number multiplied by the electronic charge.   This electronic charge is given in (5), para. 38, and the atomic numbers of the elements are given in the *Smithsonian Physical Tables* (409) for all the elements.   Using these data, we find that the electrostatic charge on the element iron is 134,780,000,000,000 times its mass, so that, if the earth were composed of iron, its charge would be $80 \cdot 6 \times 10^{40}$, which is very close to the mass of the Galaxy as given by (23). If we take 10^{40} as the unit of measurement, then a copper earth would have a charge $79 \cdot 2$; one of zinc, $79 \cdot 4$; of silver, $75 \cdot 4$; of arsenic, $76 \cdot 2$; and of tin, $72 \cdot 9$. The average of the above six elements is $77 \cdot 3$.

[1] *The Secret Doctrine*, I, 136.

If we take the entire system of elements, from hydrogen (=1) to uranium (= 92), and assume the earth is built up of equal masses of each element, then the earth's electrostatic charge would be

$$76 \cdot 57 \times 10^{40} \qquad (25)$$

112. On comparing the values of (23) and (25), we see that they are of the same order of magnitude, so that within the limits of observational error we see that the ratio of the earth's charge to its mass is the same as the ratio of the mass of the visible universe to the earth's mass, and this equality of the earth's charge with the mass of the visible universe is significant. We saw in para. 110 that the visible stars may be regarded as points of contact between our terrestrial universe and the cosmos. The stars are, as it were, pouring matter and energy into our universe like inflating a bubble, and this matter and energy is drunk up by the earth, and vanishes through the atomic nuclei, as described in *Occult Chemistry* (p. 21) and quoted in paras. 48—49. In the stars we have matter and energy radiating and diverging throughout our space, whilst in the earth, as centre, we have this same matter and energy converging upon the atomic nuclei, and constituting the

electric charge of the chemical elements, and of the earth. Now, according to the most recent developments of Einstein's theory, mass is the measure of the flux of matter and energy through the surface of the body.[1] Hence the influx through the star surfaces measures the mass of the stars, whilst the outflux through the matter of the earth measures the earth's charge; and, since the influx and outflux of our terrestrial universe must be equal, the mass of the visible stars must be equal to the earth's charge.

Some of the developments of Einstein's theory have an interesting bearing on the above result. This theory has evolved by attributing properties to cosmic space which we hope to show later are only the properties of the earth's electromagnetic field. By such a proceeding he arrives at conclusions which, though erroneous as applied to cosmic space, may be taken as quite correct in connection with our geocentric universe. One of these conclusions is that space is curved, and that the amount of matter in the universe is limited by this curvature. From our point of view we may regard this curvature of space as the conformation of our Mundane Egg. To quote Prof. Eddington :[2]

[1] *Space, Time and Matter*, Weyl, pp. 300-303.
[2] *Space, Time and Gravitation*, p. 148.

Wherever there is matter there is action, and therefore curvature ; and it is interesting to notice that in ordinary matter the curvature of the space world is by no means insignificant. For example, in water of ordinary density the curvature is the same as that of space in the form of a sphere of radius 570,000,000 kilometres. The result is even more surprising if expressed in time units ; the radius is about half-an-hour.

It is difficult to picture what this means ; but at least we can predict that a globe of water of 570,000,000 km. radius would have extraordinary properties. Presumably there must be an upper limit to the possible size of a globe of water. So far as I can make out, a homogeneous mass of water of about this size (and no larger) could exist. It would have no centre and no boundary, every point of it being in the same position with respect to the whole mass as every other point of it—like points on the *surface* of a sphere with respect to the surface. Any ray of light, after travelling for an hour or two, would come back to the starting-point. Nothing could enter or leave the mass, because there is no boundary to enter or leave by ; in fact, it is co-extensive with space. There could not be any other world anywhere else, because there isn't an "anywhere else".

The mass of a sphere of water having a radius of 570,000,000 kilometres, which according to the above is the maximum amount of water that could exist, is

$$77 \cdot 57 \times 10^{40} \text{ grammes} \qquad (26)$$

and is apparently identical with the earth's electrostatic charge as given by (25). From this

we may infer that Einstein's theory attributes
properties to cosmic space which are in reality
properties of our geocentric universe.

113. One of the difficulties encountered by
physicists is due to the existence of two distinct
systems of units in which electrical quantities
are measured, the one system being called elec-
trostatic, and the other electromagnetic. These
units are not of the same order of magnitude,
the one being enormously greater or less than
the other; thus the unit quantity of electricity
in electromagnetic measure is thirty thousand
million units in electrostatic measure, and in all
cases measurements in the two systems are to
each other in the ratio of some power of the
above number. The two systems of units are
due to the fact that the ratio of the elasticity of
the ether (which we may regard as the etheric
pressure) to its density is the square of thirty
thousand millions; and, until the actual values
of these etheric constants are known, it is not
possible to dispense with the two systems of
measurement, whilst retaining the C.G.S. Units.[1]

At the end of Everett's *C. G. S. System of
Units*[2] an interesting attempt is made to equalise

[1] *Modern Views of Electricity*, by Sir Oliver Lodge,
pp. 227-235.
[2] Fourth Edition, 1891, Macmillan & Co.

the electrostatic and electromagnetic systems
by the adoption of new units of mass, length,
and time (p. 206). These new units had to fulfil
the three following conditions: (i) The accelera-
tion due to the attraction of unit mass at unit
distance shall be unity. (ii) The electrostatic
units shall be equal to the electromagnetic units.
(iii) The density of water at 4° C. shall be unity.

The result of the calculation is that the new
unit of time will be 3928 seconds, or one hour,
five and a half minutes, the new unit of length
$1\cdot178 \times 10^{14}$, or a little less than Saturn's dis-
tance from the sun, and the new unit of mass
163×10^{40} grammes, or about twice the mass of
the siderial system as given by (23).

114. The above calculation is based on the
assumption that the unit of mass is a mass of
water in the form of a cube, the distance from
corner to corner being the unit of length. If we
take the unit of mass in the form of a sphere,
having the unit of length as radius, then the new
unit of time is $1893\cdot2$ seconds, or $31\cdot56$ minutes,
the unit of length $5\cdot679 \times 10^{13}$ centimetres, or
567,900,000 kilometres—the same length as the
radius of Eddington's sphere of water in para.
112, with four significant figures instead of two
—and the new unit of mass

$$76\cdot72 \times 10^{40} \tag{27}$$

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which is in almost exact agreement with the earth's electrostatic charge as given by (25). The sole data on which both the above calculations are based, are the density of water=1, the gravitational constant=0·000,000,06658, and the velocity of light=29,990,000,000 centimetres.

115.   In the following table is given for comparison the quantities so far obtained :

	$\times 10^{40}$
Mass of matter in our siderial system	81·10 (23)
Mass of matter generated in half a kalpa	93·00 (24)
Earth's electrostatic charge	76·57 (25)
Einstein's maximum mass of water	77·57 (26)
Unit of mass equalising electrostatic and electromagnetic units	76·72 (27)

There is one significant property about the above figures, *viz.*, in cases where the data from which they are calculated are known with accuracy, the agreement is close, as in (25), (26), and (27), whilst in cases where the data can be only roughly estimated, as in (23) and 24), the agreement is correspondingly rough.   This implies that the difference may be entirely due to errors of observation, or rough estimates, and that in reality all the figures are equal.   This can be proved in the case of (26) and (27), for

Einstein's mass is based on Eddington's state-
ment of 570,000,000 km. for the radius of the
sphere of water, which is evidently a rough
measurement, since only two significant figures
are given. The actual radius, however, is
567,900,000 km., which brings it into exact
agreement with the unit of mass (27).

116. The above results lend support to the
following hypothetical statements. *The amount
of matter generated by the earth's gravity from
the beginning of the kalpa is equal to the mass of
matter visible to us in our siderial system. It is
the unit of mass which equalises the electro-
magnetic and electrostatic systems of units, and
is identical with the earth's electrostatic charge,
and Einstein's maximum mass of water.*[1]

Such a result may, at first sight, appear weird
and fantastic, yet the consequences of Einstein's
theory of gravitation are somewhat similar.
Thus in Eddington's *Space, Time, and
Gravitation* (p. 157) we read :

> Now, if all intervals vanished, space-time would
> shrink to a point. Then there would be no space,
> no time, no inertia, no anything. Thus a cause

[1] The idea that the earth may have existed as such from the
beginning of the kalpa may be regarded as absurd, even by
Theosophists, since a few thousand million years ago the earth
is generally considered to have been a molten mass, and,
previously to that, a gaseous nebula, whereas the above implies
that the earth has remained about the same in general physical

which creates intervals and geodesics must, so to speak, extend the world. . . . An alternative way is to inflate the world from inside, as a balloon is blown out. . . . For Einstein's cylindrical world it is necessary to postulate the existence of *vast quantities of matter.* . . . This additional matter may either be in the form of *distant stars and galaxies* . . . or it may be uniformly spread through space (p. 162). . . . The revised law of gravitation involves a new constant which depends upon the *total amount of matter in the world*; or, conversely, the total amount of matter in the world is determined by the law of gravitation (p. 163). . . . Some mechanism seems to be needed, whereby either gravitation creates matter, or all the matter in the universe conspires to define a law of gravitation. . . . It leads to the result that the extension of space and time depends upon the amount of matter in the world. . . . The more matter there is, the more space is created to contain it; and, if there were no matter, the world would shrink to a point (p. 164).

characteristics for an immensely longer period. The theory of the earth being once a highly heated body is, however, now being abandoned by geologists, though still held by some physicists. There is absolutely no evidence that the earth was ever hotter than at present. There have been tropical and glacial periods; but, on the average, the study of geological strata implies no material difference in temperature from that which prevails at present. This is implied in our first study, para. 15, and by our fifth, para. 75, where it is shewn that the earth's mean temperature is fixed by the mass of the occult atom and the gravitational potential, and that the terrestrial mass and energy is reproduced every year by the law of the Conservation of Power. The igneous rocks of so-called Archæan age are now found to be more recent than the sedimentary, which were formed when the earth was as cool as at present. "If the earth was ever a molten sphere, there is no evidence of this condition in the geological record." (*Nature*, Vol. 109, p. 775, June 17th, 1922.)

117. In the above, Einstein finds for the cosmos properties similar to what we find for the terrestrial universe, or the Mundane Egg; he suggests that the gravitation process, which creates matter, is something like that of blowing bubbles in space, the amount of matter created being proportionate to the number of bubbles blown, and this is the process of matter-creation, as disclosed by Occult investigations. The atom " is formed by the flow of the life-force and vanishes with its ebb. When this force arises in space . . . atoms appear; if it be artificially stopped for a single atom, the atom disappears; there is nothing left ".[1] The units of force, out of which the atoms are built,

are all alike, spherical and absolutely simple in construction. Though they are the basis of all matter, they are not themselves matter; they are not blocks but bubbles. They do not resemble bubbles floating in the air, which consist of a thin film of water separating the air within them from the air outside, so that the film has both an outer and an inner surface. Their analogy is rather with the bubbles that we see rising in water, before they reach the surface, bubbles which may be said to have only one surface—that of the water which is pushed back by the contained air. . . . Fohat " digs holes in space" of a verity, and the holes are the airy nothingnesses, the bubbles of which " solid " universes are built. . . . What are they, then, these bubbles? Or rather, what is their

[1] *Occult Chemistry*, pp. 21-2.

content ? . . . The ancients called that force " the Breath ". . . it is the Breath of the Logos. . . . The Breath of the Logos, then, is the force which fills these spaces : . . . And when He draws in His Breath, the waters of space will close in again, and the universe will have disappeared. It is only a breath.[1]

This is the equivalent Occult version of Eddington's statement at the end of para. 115 : " If there were no matter, the world would shrink to a point."

118.   It would thus seem that each Planetary Logos generates not only the mass of the planet, or physical nucleus, but also the surrounding space which constitutes its universe. This process of generation appears to be connected with, and perhaps identical with, the gravitation process, which creates matter by blowing bubbles, or impregnating the inert substance of space with the Divine Breath, or life of the Logos. As the creation proceeds, the planet's universe expands, and contacts a larger and larger portion of the cosmos, and this continues for a period equal to the Mahamanvantara of the planet. In the case of the terrestrial Logos, this period is an Age of Brahma ; and, as the earth's mass is produced annually, as shown in (11), para. 70, the total mass produced from the beginning of the kalpa is the earth's mass multiplied by the

[1] *Occult Chemistry*, App., p. v.

number of years elapsed from the beginning of
the kalpa to now, and is equal to : the electro-
static charge, the mass of the whole of the stars
visible to us, the unit of mass which equalises
the electrostatic and electromagnetic systems of
units, and the maximun mass deduced from
Einstein's theory. This ever-growing mass
constitutes the framework of the geocentric
universe, enclosing it within and without, as an
egg encloses an unhatched chicken. It is known
in Occultism as the Mundane Egg, from which
the terrestrial Logos, Brahma, is born.

> The One Supreme Planetary Principle, who
> blows the Egg out of his mouth, and who is, there-
> fore, Brahma.¹

It may be well here to emphasise that the
terrestrial universe is enclosed *within and with-
out* from the cosmos in general. The outside
enclosure corresponds to the shell of the egg, or
the stellar system visible from our planet, whilst
the inside enclosure corresponds to the nervous
system of the enclosed embryo, through which
alone impulses can be conveyed to it. This
nervous system is the network of lines of force
constituting the earth's electromagnetic field,
which in Occultism is known as " the Web of
Life ". This web is apparently identical

¹ *The Secret Doctrine*, I 393.

with the geodesics, or the meshwork which controls the geometry of space in a gravitational field. It is the "metrical field" of Einstein, which governs the motions of falling bodies, and, as such, agrees with Occult teaching, which attributes gravitation to the cosmic *prana*, or Life-Force, circulating in Nature's Life-Web. These lines of force in the terrestrial universe shut us off from the cosmos in general, and only allow contact with it in a limited and specialised form, which is impressed with some terrestrial property, such as the vibrations of terrestrial matter, or the velocity of radiation in the earth's electromagnetic field. This Mundane Egg is the unique system of co-ordinates discussed in theories of relativity, and is the only system of co-ordinates of which humanity in general can have any physical experience.

At the end of human evolution, humanity, as it were, hatches out of this Mundane Egg, and experiences the same expansion of consciousness as that of a chicken issuing from its shell to the light of its farm-yard. This process is known in Occultism as Initiation. Then man's Ray becomes seven Rays, his sun, seven suns, and his system of stars, seven systems. Thus man is the embryo of a God, and awaits his birth into divinity.

CONCLUSIONS AND SUMMARY

119. Matter and energy radiate from the
stars and spread in a divergent form throughout
our terrestrial universe, from where they sub-
sequently converge upon the earth as focii.
Hence, in our system, forces are divergent from
the star, and convergent for the earth, so
that stellar changes, such as light-variations
and new star phenomena, may have only
infinitesimal effects in the star systems them-
selves, whilst the effects on the earth may be
great.   This is the *raison d'être* of stellar
influences, as taught in Astrology. The stars
pour their influences upon man " as rain upon
the earth ".

This radiating or diverging energy of the
stars is the expression of their inertia or mass,
whilst the corresponding converging energy
upon the earth is the expression of the earth's
electric charge, and the two are necessarily
equal. Thus the total mass of our Galaxy is
equal to the earth's electrostatic charge, and
electricity is matter, as taught in Occultism.

As the earth creates its own mass every year,
its increasing mass enlarges its universe,
increasing its points of contact with the cosmos,
in such a way that the total mass produced

from the beginning of the kalpa is equal to the mass of the visible stars and to the earth's electric charge.

This mass is the natural unit of mass for our terrestrial system, and unifies all electrical quantities in the electrostatic and electromagnetic systems of units. It is identical also with the maximum mass of matter deduced from the theory of Einstein.

Our terrestrial universe has some of the properties of a living embryo, called in Occultism the Mundane Egg, in which evolutionary systems are undergoing a process of hatching out.

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CHAPTER IX

EINSTEIN AND GRAVITATION

120. There are certain numbers used by physicists which are regarded by Western science as fundamental constants of Nature, the values of which, given below, are taken from the 1920 Edition of the *Smithsonian Physical Tables* (pp. 408—427).

NATURE'S CONSTANTS

Velocity of light, $c =$	$2 \cdot 99860 \times 10^{10}$
Planck's element of action, the "quantum," $h=$	$6 \cdot 547 \times 10^{-27}$
The constant of gravitation, $G=$	$6 \cdot 66 \times 10^{-8}$
Boltzmann gas constant, $k =$	$1 \cdot 372 \times 10^{-16}$
Elementary electrical charge, or charge on electron, $e =$	$4 \cdot 774 \times 10^{-10}$
Mass of electron, $m =$	$9 \cdot 01 \times 10^{-28}$
Mass of hydrogen =	$1 \cdot 662 \times 10^{-24}$
Rydberg's constant, $N =$	$109678 \cdot 7$

All the above are looked upon as unchangeable throughout the cosmic universe; and the

first three—the velocity of light, Planck's quantum, and the constant of gravitation—are regarded as pre-eminently the expression of what is most fundamental in Nature.[1]

121.   Einstein's theories are, in general, based on the assumption that the velocity of light is a constant throughout the whole of space, and it is admitted that, if this assumption were invalid, the whole structure built up by Einstein would collapse.[2]

Professor Jeans recently pointed out[3] that

> our whole knowledge of physics is "surface-physics"; we ought to remember that our knowledge of physics is derived wholly from experiments conducted on the surface of a planet with the aid of light emitted from the surfaces of sun and stars. . . . There may be a more general physics applicable inside a star, and this may contain sources of energy unknown to us . . . Conservation of mass and of energy may be only phenomena of "surface-physics".

Thus, if we could conduct our experiments in the interior of the earth, or in the spaces between the heavenly bodies, we might need to modify our physical laws, even the most fundamental ones, such as the conservation of matter and energy. This word of caution applies particularly to Einstein's basic assumption of the

[1] *Report on the Relativity Theory of Gravitation*, Eddington, p. 91.
[2] *Relativity and Gravitation*, Bird, p. 104. (Methuen & Co.)
[3] *Nature*, Vol. 103, p. 64, March 27th, 1919.

constancy of light velocity throughout the cosmos. All experiments on the velocity of light have been confined to the earth's surface. How do we know that we should find the same velocity if these experiments were tried on Mars or Jupiter? The physicist will reply that the velocity of light is a property of the space between the heavenly bodies, and that we have proved that between the planet Jupiter and the earth the velocity of light is the same as at the earth's surface.

Against this it may be urged that the velocity of light is not a property of space, but of a special medium of space, and that space may contain many such media, differing in radiation velocity as well as other properties. In this alternative possibility lies the whole crux of the problem. If, as taught by Occultism, each planet has its own Fohat, or medium of space, then the velocity of light is a property of the medium attached to the earth, and this velocity may be quite different from that of the media attached to other bodies.

122. In what way can we obtain evidence that will enable us to decide between the contention of Western science, that space contains only one medium, or none at all, and that of Occultism, which maintains that space contains

many media ? One way would be to try experiments on the surfaces of different planets, but this is not at present feasible.   Another way, not quite so satisfactory, is to search for internal evidence bearing on the question.   In other words, trace out each assumption to its natural consequences, and see whether these favour the one assumption or the other.   Einstein has traced out the consequences of his assumption, and these consequences should be something that is applicable to the whole cosmos.   If Einstein's results are meaningless as applied to the cosmos, but have a definite physical meaning as applied to the earth, then this is presumptive evidence that Einstein's theory is wrong as applied to the cosmos, but may be right as applied to the terrestrial universe.   Now we saw in the previous study that Einstein's maximum mass of matter was incomprehensible as a cosmic fact, but tremendously significant as applied to the earth alone, because it gave us a relationship between a property of our medium of space and the earth's electrostatic charge. Both Einstein and Everett obtained this maximum, or unit of mass, by the simple process of making the density of water, the velocity of light c, and the gravitational constant G, each equal to unity.   In other words, by changing

the assumption from that of Einstein to that of Occultism, we find that, by making the two properties of the terrestrial space-medium, c and G, and the density of the earth's surface-substance, water, each equal to unity, we are able to deduce the earth's electrostatic charge ; a fact of great *terrestrial* importance, but without meaning for the cosmos as a whole.

123. The above result contains one weak point which the man of science will easily detect, for this result is based not only on two constants of space, c, and G, but on the density of water ; and it will be asked : Why should water be chosen, rather than any other substance ? No reply can be given to this that will be regarded as fully satisfactory to Western science, for the complete answer involves the recognition of the facts observed by Occultists. But, even to the science of the West, the properties of water are somewhat unique. It is the general solvent of other substances, it occupies the great bulk of the earth's surface, where the electrical charge of a sphere is situated. Its molecular number is 10, which confers upon it remarkable properties, as pointed out by Prof. H. Stanley Allen.[1] He shows that there must

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[1] *Proceedings of the Physical Society of London*, Vol. xxvii, p. 425, 1915, and *Phil. Mag.*, Vol. 35, p. 339, April, 1918.

be a numerical connection, involving powers of 10, between the unit of length and the unit of mass in the C. G. S. system. Such a relationship gives us water as the standard substance of our planet, the density of which must be unity in order to satisfy this relationship. Its density bears the ratio 4 *pi* (4×3·14159) to the earth's volume intensity of Magnetism, which again is significant.

To occult students it may be further pointed out that its molecular weight is 18, and in hydrogen, the unit of atomic mass, there are 18 atoms, so that water bears the same ratio to unit atomic weight as hydrogen bears to the atom of Occultism. If water were broken up into 18 atoms of hydrogen, it would carry 18 electronic charges; and, in the periodic table of the elements, 18 electronic charges is a periodic set in which the chemical properties of the elements repeat themselves. From argon, atomic number 18, to krypton, atomic number 36, is a cycle of 18 charges or a periodic set. Similarly from potassium to rubidium, etc. Now argon has the same chemical properties as krypton, and potassium the same as rubidium, so that the electronic charges, manifested or hidden in water, added to an element, generate another element with similar chemical properties. We

may therefore regard the elements as built up, by steps down the columns of the periodic table, of successive additions of water, or the periodic set of charges on its constituent hydrogen. Such is a brief sketch of the reason why water is a unique substance and specially related to the charge of the earth. It could be greatly expanded, did space allow.

124. Our previous study, therefore, gives presumptive evidence in favour of the Occult teaching as against the assumption of Einstein, but it may not be sufficient to constitute a proof. If true, however, there must be other facts which confirm it, for the facts in favour of a truth, if it be really a truth, are infinite, since every other fact must be in conformity with it. We may therefore search for other evidence, which may be obtained from the following easily proved theorem :

" The ratio between the mean force of terrestrial gravity and the mean force of terrestrial magnetism is the square of the velocity of light."

125. The demonstration of this theorem has been given in the pamphlet, *Einstein's Theory* (p. 27), and to this the reader may be referred for details, which may be omitted here. The mean force of terrestrial magnetism is the mean

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intensity of magnetisation per unit volume, 0·07903, multiplied by $(4/3)$ $pi=(4/3)$ 3·14159; and the following values are obtained from *A Tretise on Magnetism and Electricity*, by Dr. Andrew Gray (Vol. I, p. 67):

Intensity of terrestrial magnetism I=   0·07903
Mean force of terrestrial magnetism $f=(4/3)pi$
$$I = 0·33104 \quad (28)$$

One of the quantities, therefore, required by our theorem is $f = 0·33104$, the mean force of terrestrial magnetism, as observed by Western physicists. The force of terrestrial gravity is given in equation (18), and is explained in para. 86. It is identical with the earth's astronomical mass, and is equal to the mean acceleration of gravity at the earth's surface, g multiplied by the square of the earth's radius, R; or gR^2, as given by (18). This is the total force of terrestrial gravity outside the earth's surface; but what is meant by the mean force of terrestrial gravity is the average value of this force *inside* the earth's surface, or at every point of the earth's volume. This can be ascertained by means of the calculus, on the assumption of uniform density, with the result that it is exactly three-fourths of the surface value. Thus we have for the mean force of terrestrial gravity, from (18),

$$F = (3/4)\, g R^2 = 2 \cdot 9826 \times 10^{20} \qquad (29)$$

Now our theorem states that the square of the velocity c is equal to the ratio F/f, or

$$c^2 = F/f = 9 \cdot 0101 \times 10^{20}$$
$$c = (F/f)^{\frac{1}{2}} = 3 \cdot 0016 \times 10^{10} \qquad (30)$$

126. The velocity of light, as given in para. 119, is $2 \cdot 9986 \times 10^{10}$, and this is the most probable value. Physicists generally use the value 3×10^{10}, and the actual measurements range between $2 \cdot 986 \times 10^{10}$ and $3 \cdot 153 \times 10^{10}$.[1]

The result of our theorem, as given by (30), is therefore well within the errors of observation, and is proved.

Here then we have a fundamental property of outside space, the velocity of light, shewn to be a function of the forces operating inside the earth's mass, the forces of terrestrial gravity and magnetism. Does this amount to absolute proof that the velocity of light is a property of the terrestrial universe? In the opinion of Western physicists, perhaps not. They may contend either that it is accidental, or that the ratio of the mean force of gravity to the mean force of magnetism is the same for all the heavenly bodies. This would not explain why

[1] *Physical and Chemical Constants*, Kaye & Laby, 1918, p. 69.

this velocity of light gives us the earth's electro-
static charge, as shewn in the preceding study,
unless it is held that the electrostatic charge of
all the heavenly bodies is the same as that of
the earth.   This would make the electric charge
of the chemical constituents of the sun's mass
exceedingly small as compared with the terres-
trial elements, whilst the magnetic intensity
per unit volume of the sun's mass would be
329390   times the magnetic intensity of the
earth.   Both these deductions would be contrary
to observation, for astronomical facts imply that
the matter of the sun is highly electrical as
compared with the matter of the earth, and that
the magnetic forces are not nearly so great as
three hundred thousand times those of the earth.
Moreover, by the known laws of physics, electric
and magnetic forces vary together, so that
when the one is great, the other is great;
whereas the above supposition would make
them vary inversely, the magnetic force
varying directly as the mass, and the elec-
tric force varying inversely.   This would be
a very improbable hypothesis, for the laws
of the electromagnetic field require that
the electric and magnetic energies shall be
equal.

¹ *Philosophy and the Physics*, Louis Rougier, p. 45.

127. But let us proceed with further proofs, for, as stated above, if a proposition is true, all other facts help to establish it. There is a region of our terrestrial laboratory at the outskirts of the atmosphere which has recently greatly attracted the attention of Western science on account of the development of wireless telegraphy. The possibility of sending wireless messages for such long distances has greatly puzzled physicists, for it is contrary to the laws of the earth's electromagnetic field, according to which these electrical vibrations should dissipate into space instead of passing round the earth's surface. The observed strength of the Marconi rays is two million times greater than that predicted by theory.[1] In order to explain this, physicists have to suppose that at a height of about one hundred kilometres above sea level (62 miles) there is a layer of the atmosphere composed principally of hydrogen and helium, which is permanently ionised with negative ions or electrons, so as to enclose the earth in an electrically charged spherical shell, like the charge on a sphere, which always resides at the surface. This electrical shell prevents the Marconi rays from dissipating into space, thus confining them to the earth's

[1] *Nature,* Vol. 109, p. 140, February 2nd, 1922.

surface, and rendering wireless telegraphy a possibility.[1]

128. This region of the atmosphere, at a height of about one hundred kilometres, has many other features that are of interest to us. From the surface up to a height of a little more than six hundred kilometres, the viscosity of the atmosphere remains practically constant, and then, above this height, when the pressure falls below one ten thousandth of an atmosphere, the viscosity suddenly becomes zero.[2] At the height of one hundred kilometres the pressure is 0·0067 millimetres of mercury, or less than one hundred thousandth of the pressure at the surface, and is composed of 95·5% hydrogen, 3% nitrogen, and 1·3% helium.[3] In an X-Ray tube, a pressure so low as this would produce very hard rays, and with a fall of potential of 126,000 volts, as shewn by (19), para. 87, the velocity of the cathode rays would be more than two-thirds the velocity of light.[4] It is at such pressures that Thomson   and Aston have investigated the positive rays, measured the mass of individual atoms, and counted the number of isotopes of which the chemical

[1] *Nature* Vol. 109, p. 181, February 9th, 1922.
[2] *Ibid.*, p. 179.
[3] *Smithsonian Physical Tables*, p. 421.
[4] *X-Rays*, Kaye, p. 233.

elements consist. At this pressure matter takes on a new form: cohesion and viscosity have vanished, and atoms and molecules exist as separate units. In para. 71, we shewed that at the bottom of the isothermal layer, at a height of 11 kilometres, the ionic velocity developed by the earth's gravitational field was equal to the molecular velocity. But, as this ionic velocity is inversely as the pressure, the velocity developed at a height of 100 kilometres would be $1\cdot12\times10^9$ for the air molecule, and $5\cdot17\times10^9$ for hydrogen. The *alpha* rays from the radioactive elements have a velocity which ranges from $1\cdot45\times10^9$, for Uranium I, to $2\cdot22\times10^9$, for Thorium C. Hence molecular velocities at 100 kilometres are of the same order of magnitude as the *alpha* rays.

129. It was stated in para. 43 that the action between the earth and the sun is similar to that of the cathode and anode in an X-Ray tube, and this position of the spherical shell at 100 kilometres may be taken as corresponding to the surface of the cathode, where gaseous matter is divided into two opposite streams, the cathode rays moving in the direction of the anode, and the positive rays moving through the surface of the cathode, and away from the anode. The cathode rays consist of electrons, which in the

case of our terrestrial cathode move towards the
sun, and the positive rays consist of the chemical
elements, molecular or atomic, moving down-
wards into the earth's atmosphere. It was shewn
in para. 70 that this motion of the molecules
at the height of 11 kilometres is in one year
sufficient to renew the whole of the earth's
mass; and, although the density of the atmo-
sphere at 100 kilometres is very much less, the
molecular velocity is proportionately greater, so
that in this region also an amount of matter
equal to the earth's mass will enter the earth
annually. Stormer has shewn [1] that the average
height of the lower fringes of the polar aurora
is about 100 kilometres, so that these fringes
also mark the position of our terrestrial cathode.
In the works cited in para. 44, Stormer, Birke-
land and Vegard have shewn that the variations
of terrestrial magnetism can be explained by
the motions of positively and negatively charged
bodies, or *alpha* and *beta* rays, in the auroral
regions, whilst Vegard has shewn [2] that the
·characteristic fringes of the aurora can be
accounted for by the clear-cut ranges of *alpha*
particles. When we add to this the fact that
the aurora is now discovered to be a permanent

[1] *Terrestrial Magnetism*, Vol. 21, p. 45, June, 1916; also *Ibid.*,
September, 1913, and March and December, 1915.
[2] *Phil. Mag.*, Vol. 23, p. 231, February, 1912.

feature of the upper atmosphere,' we have both fact and deduction to confirm our theory.

130.   At this cathode, or electrical surface of our planet, two opposite processes are apparently taking place.   The atmosphere, which at this height, as stated above, consists of 96% hydrogen, is greatly ionised, so as to form an electrical screen for Marconi rays. These ions, as suggested in para. 73, are molecules which have been switched off from the earth's gravitational potential and are relatively stationary.   It is now further suggested that the process here taking place is a mutual transfer of molecular or atomic matter between the solar and terrestrial gravitational fields; the negative ions being transferred to the sun's gravitational field, and becoming electrons which move towards the sun, as explained in para. 61, whilst positive ions from the sun enter the earth's gravitational field and become positive hydrogen or protons, which hydrogen, by a later process taking place between the electrical surface and the lower atmosphere, is built up into the elements of higher atomic weight.

These two reverse processes may be defined as radioactive and inversely radioactive, and are processes of alchemy or transmutation.

one year also, the earth's surface gravity
develops the characteristic velocity of outside
space, the radiation velocity or velocity of light.

Now this is a property which, like the others,
occurs only in the case of the earth. The sur-
face gravities of Jupiter or Saturn, in their
respective periods, would develop velocities
quite different to the velocity of light. In both
cases they would be much larger. This relation-
ship of the velocity of light, like that of the
others we have investigated, is a property
peculiar to the earth, and to the earth alone.

CHAPTER X

EINSTEIN AND GRAVITATION

132. Although the physicist may, perhaps, be a little shaken in his contention that the relationship between the earth's mass and the velocity of light, as shewn above, is purely accidental, he will probably assert that the last relationship, given by (30), can have no physical meaning. He may point out that the earth's gravity, however long applied to a body, could never make it move with the velocity of light. The highest velocity that can be generated by terrestrial gravity on a falling body is 11·16 kilometres, or 6·94 miles, as given by (2) in para. 5. This is quite true; but the validity of this objection depends upon the reply to the question : " When a body falls to the ground, is this due to the ether pushing the body downwards, or is it due to the body pushing the ether upwards ? "

Owing to the Newtonian law that action and reaction are equal and opposite, either of these processes would cause the body to fall. Put in

other words we may ask: " In the mechanism
of gravitation, is it the ether that accelerates
the mass, or is it the mass that accelerates
the ether?" We propose to shew that it is
the mass that accelerates the ether, and that
the mass falls, or has weight, because of the
reaction to this process. When a falling body
reaches the earth's surface, its motion stops, but
the body still has weight; and this weight is the
reaction of the acceleration of the ether, which
is a continuous process; and this continuous
process is the force-aspect of what we have
termed the conservation of power, as described
in para. 84.

133. The above theory of the gravitation
process is in contradiction to certain physical
ideas prevailing in Western science, and has
been deduced from the investigations of Occult-
ists as given in *Occult Chemistry* and *The
Secret Doctrine.* It is therefore desirable to
compare it with the conclusions of Western
physicists, amongst whom Einstein stands out
pre-eminent.

The statement of Einstein, quoted in para.
58—" The same quality of a body manifests
itself according to circumstances as ' inertia ' or
as ' weight ' "—may be taken as the latest
dictum of science on the nature of gravity. He

gives an illustration of its meaning in his popular exposition, *Relativity*,[1] He imagines a man in a box, placed in outer space where there is no gravitational field owing to the absence of attracting matter.

As reference-body let us imagine a spacious chest, resembling a room, with an observer inside who is equipped with apparatus. Gravitation naturally does not exist for the observer. He must fasten himself with strings to the floor, otherwise the slightest impact against the floor will cause him to rise slowly towards the ceiling of the room.

To the middle of the lid of the chest is fixed externally a hook with rope attached, and now a "being" (what kind of a being is immaterial to us) begins pulling at this with a constant force. The chest, together with the observer, then begins to move "upwards" with a uniformly accelerated motion. In course of time their velocity will reach unheard-of values—provided that we are viewing all this from another reference-body which is not being pulled with a rope.

But how does the man in the chest regard the process? The acceleration of the chest will be transmitted to him by the reaction of the floor of the chest. He must therefore take up this pressure by means of his legs, if he does not wish to be laid out full length on the floor. He is then standing in the chest in exactly the same way as anyone stands in a room of a house on our earth. If he release a body which he previously had in his hand, the acceleration of the chest will no longer be transmitted to this body, and for this reason the body will approach the floor of the chest with an

[1] Methuen & Co., p. 66.

accelerated relative motion. The observer will further convince himself *that the acceleration of the body towards the floor of the chest is always of the same magnitude, whatever kind of body he may happen to use for the experiment.*

Relying on his knowledge of the gravitational field, the man in the chest will thus come to the conclusion that he and the chest are in a gravitational field which is constant with regard to time. . . .

We must note carefully that the possibility of this mode of interpretation rests on the fundamental property of the gravitational field, of giving all bodies the same acceleration, or, what comes to the same thing, on the law of the equality of inertial and gravitational mass. . . .

Suppose that the man in the chest fixes a rope to the inner side of the lid, and that he attaches a body to the free end of the rope. The result of this will be to stretch the rope, so that it will hang "vertically" downwards. If we ask for an opinion of the cause of the tension of the rope, the man in the chest will say : " The suspended body experiences a downward force in the gravitational field, and this is neutralised by the tension of the rope : what determines the magnitude of the tension of the rope is the *gravitational mass* of the suspended body." On the other hand, an observer who is poised freely in space will interpret the conditions thus : " The rope must perforce take part in the accelerated motion of the chest, and it transmits this motion to the body attached to it. The tension of the rope is just large enough to effect the acceleration of the body. That which determines the magnitude of the tension of the rope is the *inertial mass* of the body."

In the above illustration, it is seen that to the man in the chest it is the *gravitational mass*

that causes the tension of the rope, whilst, to
the man outside, it is the *inertial mass* that is
the cause of this tension. By gravitational
mass is meant the weight; and what Einstein
wishes to lay stress upon is that this property of
bodies can be regarded either as their weight
or their inertial mass, according to the position
of the observer, or, in technical language, accord-
ing to the system of co-ordinates chosen.

134. This identity of weight and inertial
mass is the fundamental assumption of Einstein's
general theory of relativity, and is known as
the Principle of Equivalence, or the Equi-
valence Hypothesis.[1] In the earlier or special
theory of relativity, the fundamental assump-
tion was the constancy of the velocity of light,
but this is now modified or partially abandoned.[2]
The velocity changes slightly in a gravitational
field, but only to an infinitesimal amount.

This Equivalence assumption of Einstein is
justified by the experiments of Eotvos, which
have proved its truth to a high degree of
accuracy. It is quite possible that it may be a
cosmic fact, and not confined to the terrestrial
universe, which we contend is the case with the

[1] *Relativity and Gravitation*, Bird, p. 221, and *Space, Time and Matter*, Weyl, p. 225.
[2] *Philosophy and the New Physics*, Rougier, p. 97, and *Electricity and Magnetism*, Jeans, p. 598.

velocity of light. But the truths that follow from this assumption were truths before Einstein demonstrated them. Given the assumption, there may be many methods of deducing these truths besides that of Einstein, so that the resulting truths are independent of the method of demonstration.

They may be even independent of the assumption, and may follow from other assumptions, or from observed facts not at present recognised by Western science. We propose to shew that the observed facts and teaching supplied to us by Occultists enable us to dispense with Einstein's assumption, though admitting its truth, because we are able to demonstrate that it necessarily follows from the mechanism of the gravitational process, and hence becomes a secondary deduction from still more primary principles.

135. If we trace out the path of Einstein's box as it moves with accelerated velocity through space, it would, as it were, bore out a channel in space, along which the medium inside the box, if confined to the box, would move with accelerated velocity, so that the medium inside the box would be an instance of a continually accelerated medium. If the channel traced out by the motion of the box be also full

of the medium, and the motion causes the medi-
um for the whole length of the channel to move
with the same velocity as the box, we have a
long tube in space along which a medium is
moving with continually accelerated velocity.
Suppose now the box is without a bottom, so
that the man falls out of it. The man would
really be stationary inside the tube, with the
medium moving upwards past him ; but, viewed
from the box, he would appear to be falling in a
gravitational field. Let us now dispense with
the box, but retain the tube, the man, and the
medium ; and let us give the man the power to
accelerate the medium continually by pouring
it out through the surface of his body with ever-
increasing velocity ; then, if the man had a solid
foothold, say on the earth's surface, the medium
would still be accelerated along the tube, and
the reaction of this accelerated medium on the
man would cause his feet to press against the
earth's surface, and give him weight. The
accelerating medium in the tube would be the
man's gravitational field.

  If we reduce all this to the atomic scale, so
that, in place of the man and tube, we have an
atom and a line of force issuing perpendicularly
from the earth's surface—the etheric medium
inside the line of force being continually

accelerated by the atom pouring it forth through its surface as described in *Occult Chemistry* (p. 21)—we obtain a model mechanism of a unit gravitational field giving a unit atomic weight. The earth's gravitational field, or that of a sun or planet, is simply a multiplication of such units.

There is nothing difficult or mysterious about the mechanism of the operation ; it violates no law of mechanics, and is as simple as holding a hose-pipe. When water issuing from a hose-pipe is accelerated whilst passing along the conical nozzle, the hose-pipe pushes against the man who is holding it, just as a body resting on the earth pushes against the earth's surface and constitutes a weight. The resisting push of the man against the hose-pipe is the force which accelerates the water issuing from the nozzle. Similarly the push of the earth's surface against the weight is the force which accelerates the medium in the lines of force issuing from the weight. Without the resisting push of the earth's surface, the weight would fall or be accelerated, instead of the medium.

136. This explanation of the mechanism of gravitation is not based on theory, but on facts carefully observed by students of Occultism, which are recorded in *Occult Chemistry*, *The*

Secret Doctrine, and elsewhere. One of the functions of the atom is to pour out a continual stream of substance through its surface as assumed in the above explanation, and previously described in these studies (para. 48, etc.). It is the work of Fohat, which is the living force of the cosmos. " Fohat is everywhere : it runs like a thread through all " (*Secret Doctrine*, III, 555). " All the ' Forces ' of the scientists have their origin in the Vital Principle, the One Life collectively of our Solar System " (*Ibid.*, I, 647). Occultism teaches most definitely that gravitation is caused by the cosmic " prana," or the vital principle in nature, and " prana " is one of the aspects of Fohat (I, 572). Fohat is the guiding spirit, immanent in every atom of matter, and is behind all such manifestations as light, heat, sound, adhesion, etc. (I, 163). It is the one instrument with which the Logos works (I, 161). Fohat is called the " pervader " because He pervades the atoms and gives them shape (I, 137). He is the personified electric vital power, the transcendental binding unity of all cosmic energies (I, 136). The force which causes the atoms to aggregate and combine, or in other words to gravitate and enter into chemical combination, is a transformation of Fohat (I, 135). He unites and brings together

all forms (I, 135), and is the mysterious link between Mind and Matter, the animating principle electrifying every atom into life (I, 44).

137. The objection referred to in para. 131, that the acceleration of gravity cannot develop a velocity equal to the velocity of light, whilst true of a falling body, is not true of the medium of space. The acceleration of a falling body ceases when it reaches the earth's surface, and so its velocity has a definite maximum, whilst the acceleration of the medium can go on indefinitely, and, if continued for a year, will develop the velocity of light. We may therefore conclude that the force of gravity acts by the body accelerating the medium, and not by the medium accelerating the body. Moreover, this acceleration is continuous, whether the body is falling or stationary.

It was shown in para. 70, that gravity creates the whole of its mass in one year, and, since in the same time it develops a velocity in the medium equal to the velocity of light, as shewn in (30), it follows that, when an atom has generated the light velocity in its line of force, it vanishes and is replaced by newly created matter. Since this process is going on continuously all the year round, there must be lines of force with velocities everywhere between zero

and the velocity of light, so that the average velocity of the medium travelling along the terrestrial lines of force, for the whole earth, will be exactly half the velocity of light.

If S be the number of square centimetres on the earth's surface, then $S = 5 \cdot 101 \times 10^{10}$, and half the velocity of light $\frac{1}{2}c = 1 \cdot 4993 \times 10^{10}$, so that the volume of ether issuing from the earth's surface in one second is $S.\frac{1}{2}c$. If I' be the density of this issuing stream, the mass passing out from the earth's surface in unit time will be $SI'. \frac{1}{2}c$; and, to account for the earth's inertial mass by the same process as that of gravitation, we must make the above etheric mass equal to the earth's inertial mass, so that, if E be the earth's mass, we have

$$E = SI'.\tfrac{1}{2}c = 5 \cdot 98 \times 10^{27} \text{ grammes}$$
$$I' = E/S.\tfrac{1}{2}c = 0 \cdot 07818 = \text{etheric density} \qquad (31)$$

If we compare the density of the outgoing ether, $I' = 0 \cdot 07818$, with the value of the earth's magnetic intensity, $I = 0 \cdot 07903$, as given in (28), para. 124, we see they are practically equal. If we assume that these two are exactly equal, and then recalculate the earth's mass from the formula $SI. \frac{1}{2}c$, we obtain $6 \cdot 04 \times 10^{27}$, in place of $5 \cdot 98 \times 10^{27}$, and the sum of the masses of the earth and moon is $6 \cdot 05 \times 10^{27}$. Hence we see

that, on the theory that the volume-intensity of magnetism I is identical with the density of the ether streams I' issuing from the earth's surface, and determines the value of the inertial mass, we obtain the sum of the masses of the earth and moon, instead of the earth's mass alone.

138. Now it often happens that a small discrepancy, such as the above, gives us more insight into the workings of nature than an exact agreement. Physicists have often wished that they could find some small discrepancy in the law of gravitation, because that would give them a hint as to its real nature; and in fact such a discrepancy, in the case of the orbital motion of Mercury, has served to establish Einstein's theory of gravitation and his principle of equivalence. Hence the above discrepancy, when analysed, becomes more convincing than if it had not occurred. It is well known that when two magnets are set alongside each other, the north pole of the one sets itself to the south pole of the other, and the magnetic lines then pass through both magnets, and add to each other's magnetic intensities, so that we may consider it extremely likely that the north-seeking magnetism of the moon is opposite to the south-seeking magnetism of the earth, and that the lunar magnetism, passing through the

body of the earth, adds itself to the intensity of terrestrial magnetism. Hence, when physicists measure the magnetism of the earth, they are really measuring the sum of the magnetisms of the earth and moon, instead of that of the earth alone. Hence the discrepancy shewn above.

139. We are now in a position to prove our claim that the Equivalence Hypothesis of Einstein is a deduction from the mechanism of gravitation as shewn by occult investigations. Let us suppose that the force of gravity at the earth's surface became twice as great as it is at present. The velocity generated in a year would then be twice the velocity of light, as will be seen from (30), and the average velocity of the ether in the terrestrial lines of force, as shewn in para. 136, would be half of this, or $\frac{1}{2}(2c)=c$, the velocity of light. The expression for the earth's inertial mass, as given in (31), instead of $E = \dot{S}I'.\frac{1}{2}c$, would be $2E = SI'c$. Hence, if the value of the surface gravity were doubled, the inertial mass would also be doubled, and so proportionately with any other variation. This is Einstein's principle of Equivalence, that the inertial mass and the acceleration of gravity shall vary together, and it follows as a simple deduction from the first principles derived from occult studies.

140. The theory of the gravitation mechanism expounded in this study implies, in a sense, that each body should have its own ether, and each atom its own line of force. Such a theory is at present attracting the attention of a few Western scientists.

Prof. Lenard has recently set forth some such view in an article which first appeared in Stark's *Jahrbuch*, and has since been published in pamphlet form.[1] Prof. Jeans[2] also agrees that such a theory would satisfy all the requirements of the electromagnetic theory, but appears to prefer dispensing with an ether altogether. In the classical text books of electromagnetism the phenomena of electricity and magnetism have been explained, wholly or in part, by strains in the ether. The view of the ether propounded in these studies requires that these strains should be replaced by motions in the ether having mass, momentum and energy. The most recent developments of these theories in the West are in accordance with this view, since the theory of relativity requires that strains in the ether should be replaced by the flow of momentum in space.[3] The propensity

[1] It was reviewed in *Nature* (Vol. 109, p. 740, June 10th, 1922).
[2] *Electricity and Magnetism*, p. 619.
[3] *Ibid.*, p. 618.

amongst modern physicists to dispense entirely
with the ether of space is not general ; several
physicists of eminence, like Sir Oliver Lodge,
still hold on to an ether. Prof. D. N. Mallik,
in the Second Edition of his *Optical Theories* [1]
based on lectures delivered before the Calcutta
University, expresses the opinion that the theory
of relativity will not " dispose of the physical
existence of the *ethereal model,* until a better
one has been found, which shall explain the
intimate nature of the various concepts of
modern physics, corpuscules and negative parti-
cles, electric charge and magnetic force, gross
matter and gravitation, in one comprehensive
scheme ".[2] Such a comprehensive etheric model,
in the opinion of the writer, cannot be construct-
ed until Western science is willing to recognise
the results of Occult researches, or until Occult
students can construct it for themselves.

CONCLUSIONS AND SUMMARY

141. There are a number of constants which
Western science regards as " Nature's Con-
stants," common to the cosmos as a whole,
some of which, such as the velocity of light, are

[1] Cambridge University Press, 1921.
[2] *Nature,* Vol. 109, p. 707, June 3rd, 1922.

constants of the terrestrial universe, but not of the cosmos.

The whole of Western physics is surface physics, and some of its laws may not be applicable to the interior of suns and planets, or to the inter-planetary and inter-stellar spaces.

The density of water is not an arbitrary constant, since water is a unique and standard substance for terrestrial matter.

The ratio of the mean force of terrestrial gravity and the mean force of terrestrial magnetism is the square of the velocity of light, and the acceleration of gravity at the electrical surface of the earth in the earth's orbital period generates the velocity of light. Hence the velocity of light is a function of the earth, and not of cosmic space.

At the height of the fringes of the earth's permanent aurora, about 100 kilometres above sea level, where the acceleration of gravity generates the velocity of light in one year, the composition of the atmosphere is mostly hydrogen in an ionised state, or switched off from the earth's gravitational field, the pressure is one hundred thousandth of the surface pressure, and the viscosity of gases is zero. The general condition is that of the surface of a cathode in an X-Ray tube where experiments

are being conducted in positive rays. The velocities are of the same order as those of *alpha* and *beta* particles in radioactive substances, and a process of radioactivity and inverse radioactivity is in continuous operation on all elements, the positive rays moving towards the earth, and the electrons or negative rays towards the sun by an interchange between the solar and terrestrial gravitational fields, the amount of matter transmuted in one year being equal to the earth's mass. It is this cathode surface of our planet which acts as an electrical screen, without which wireless telegraphy would be impracticable.

The generation of the light velocity, and the creation of the earth's mass, each in the period of one year, may be regarded as complementary and mutually explanatory facts.

Gravitation is the force-aspect of what we have termed the conservation of power; and, when a body falls to the ground, it is not because the ether pushes it downwards, but because that body pushes the ether upwards; or, in other words, it is not the ether that accelerates matter, but it is matter that accelerates the ether. The maximum velocity that can be generated is not the parabolic velocity, or velocity from infinity, which is the maximum for matter, but this

maximum for the ether is the velocity of light, or the velocity generated in one year. When an atom has generated the light velocity in its line of force, it vanishes and is replaced by another atom, and so on continuously.

Einstein's illustration of his Principle of Equivalence can be transformed, without any change of principle, into an atom accelerating the contents of its line of force, so that the atom and its line of force are the embodiment of Einstein's Equivalence Hypothesis. Conversely this fundamental assumption of Einstein can be deduced from the mechanism of the atom and the line of force, as deduced from occult investigations. Hence, taking the observed facts of Occultism as a basis, Einstein's assumption is superfluous and unnecessary, since it can be deduced from a higher principle in Nature, *viz.*, the flux of the Fohatic energy through the atom in accordance with the law of the conservation of power. It follows from this that everything that can be deduced by Einstein from his theory of gravitation can be likewise deduced from the teachings of Occultism, along with much besides, since the greater includes the less.

The density of the ether issuing from the earth's surface is identical with the volume-intensity of terrestrial magnetism, and the

earth's inertial mass is identical with the mass
of the ether leaving the earth in unit time.
Thus the flux of magnetism through the earth's
surface in unit time, the flux of the ether in
unit time, and the earth's inertial mass, are
identical.

The velocity of this magnetic or etheric flux
is half the velocity of light, and since the atomic
mechanism which produces inertia also produces
gravity, the relationship between the inertial
mass and the gravitational mass is invariable, as
required by Einstein's theory.

CHAPTER XII

FOHAT, AND THE LAWS OF PHYSICS

142. The process of the preceding study is, in a sense, the converse of the method adopted by Einstein. By applying mechanical principles to the facts observed by occult investigators, we obtained the law of gravitation, and then from the gravitation mechanism deduced the Principle of Equivalence of Einstein. The method based on Occultism, therefore, includes that of Einstein as a particular case, but includes much else besides. It is a larger base from which to work, and if properly handled, should prove more fruitful in results.

But Einstein's fundamental assumption is deservedly regarded by physicists as remarkably fruitful. Prof. Eddington points out[1] that the equations of hydro-mechanics, the laws of the conservation of matter and energy, and Newton's first law of motion, can be obtained from Einstein's law of gravitation, and remarks: " It

[1] *Report on the Relativity Theory of Gravitation*, p. 65.

is startling to find that the whole of the dyna-
mics of material systems is contained in the law
of gravitation." This Equivalence Hypothesis
has been thus formulated:[1] "A gravitational
field of force is precisely equivalent in its effects
to an artificial field of force introduced by
accelerating the framework of reference, so that
in any small region it is impossible to distin-
guish between them by any experiment what-
ever." Prof. Eddington, in the Report above
referred to (p. 19), puts it a little differently :
"A gravitational field of force is exactly equi-
valent to a field of force introduced by a trans-
formation of the co-ordinates of reference, so
that by no possible experiment can we distin-
guish between them."

143. The above will probably convey little
meaning to the non-mathematical lay reader,
so that we will try to illustrate it by means of
the gravitational model constructed in the
preceding study. To an atom is attached a line
of force, which is a hollow tube bored out in
space in a direction perpendicular to the earth's
surface. Along the interior of this tube a
stream of ether is moving with continually
increasing velocity. If we stand in the atom,
and fix our attention on a point in the stream

[1] *Relativity and Gravitation*, Bird, p. 221.

of ether, this point will appear to be receding from us with ever-increasing velocity, like a stone falling to the ground. If now, instead of standing in the atom, we stand at this fixed point in the ether, and regard ourselves as stationary, the atom appears to be falling. Hence, either the atom or the point in the ether can be transformed into the falling body, according as we shift our position from one point to the other. When we shift our position we transform our co-ordinates, and this is what is meant by the phrase. When we fix our position in the ether stream, by a mathematical artifice, we create a gravitational field for the atom, which is the exact equivalent of the gravitational field in which it is immersed. This is Einstein's Principle of equivalence. It is like the common experience of two trains in a station, when one begins to move. By looking at the train alongside of us, we cannot at first say whether we are moving or the other train. Einstein asserts that for movements in space we can never say which train is moving. Nature has so contrived things that we can never find out. If we jump from one train to the other, the train we have jumped from is moving, and that we have jumped into is station-ary. Motion depends upon the position of the

observer. It is, in a sense, subjective, not objective.

144. This power to transform away a gravitational field has its limitations.

A limitation of the Principle of Equivalence must be noticed. It is clear that we cannot transform away a natural gravitational field altogether. . . . They were concerned with a practically infinitesimal region, and for an infinitesimal region the gravitational force and the force due to a transformation correspond.[1]

Motion along a line of force in India will not transform away a gravitational field in America, because the direction of motion is different. It will only transform away the field in its immediate neighbourhood. In reality it will transform away the field only from one line of force to the next adjoining it; and, as these lines of force are very close together, the space occupied by each is the infinitesimal region of Einstein. The distance between two adjoining lines of force is Einstein's infinitesimal length (*ds*), which is termed a geodesic. Although a part of a curve, it is so short that it may be treated as a straight line, and it is the shortest distance between two consecutive points. The new law of inertia is that *a particle left to itself moves along the geodesics or shortest lines in the*

[1] Eddington's Report, p. 20.

space.[1] If the particle is remote from other bodies, so that there is no gravitational field, the space has the Euclidean character, and we have Newton's law of inertia ; otherwise the particle is in a space of non-Euclidean character (the space being always the four-dimensional space), and the path of the particle is along a geodesic in that space. (*Ibid.*). Newton's law of inertia is therefore termed the limiting case of that of Einstein, and is only obeyed when there is no other matter in the neighbourhood. Newton's first law of motion, or the law of inertia, is as follows : " Every body continues in its state of rest, or of uniform motion in a straight line, except in so far as it may be compelled by force to change that state."[2]

145.   Since this is a deduction from the basis of Einstein's theory, and this basis is a deduction from the mechanism of gravitation disclosed by Occult observations, this mechanism should also enable us to deduce Newton's first law of motion, as well as Einstein's generalisation of it. We will now shew how this can be done. Take a sphere of matter like the earth, and divide it into two hemispheres by a plane through its

[1] *Relativity and Gravitation*, Bird, p. 282.
[2] *Treatise on Natural Philosophy*, Thomson and Tait, Part I, Art. 244, p. 241.

centre. If the plane divide it into an eastern
and western hemisphere, it will best serve our
purpose. If we stand on the edge of this divid-
ing plane in the northern hemisphere, looking
south at noon, then the western hemisphere is
on our right, and the eastern on our left.   Let
us suppose for the moment that the earth is
stationary in its orbit ; then in the hemisphere
to the west there are the same number of lines
of force as in the eastern hemisphere, and they
have the same average velocity, *viz.*, half the
velocity of light.   Moreover, each line of force
in the western half can be paired off with one
in the eastern half, which is exactly opposite in
direction.   The reactions, therefore, in the two
hemispheres, which, taken separately, would
tend to move the earth in opposite directions,
are exactly equal and opposite, so that they
cancel each other.   Similarly with the northern
and southern hemispheres, or any other division
into hemispheres we choose to make.   Thus the
part of Newton's law which says : " Every body
continues in its state of rest, except in so far
as it may be compelled by force to change
that state," is fulfilled, because, there being
no unbalanced force ˙to compel the earth to
change its state of rest, it remains stationary.
There are many forces operating on it, but,

when added up algebraically, their sum is zero.

146. Now let us suppose one of the cosmic gods gives the earth a push in a direction which, to the above observer, is exactly from east to west, the direction in which the earth is moving in its orbit. Then in the western hemisphere the lines of force are pointing wholly or partially in the direction of motion, and any resistance in the surrounding space to the motion of the lines of force, as they accompany the earth, will cause them to open out like the ribs of a fan. If an umbrella is turned with its hollow or concave side to a strong wind, it is turned, and the ribs, instead of curving towards the handle, curve away from it. A similar thing happens to the lines of force in the western hemisphere ; they are curved backwards into the eastern hemisphere. When this happens, the reactions between the lines of force in the two hemispheres are thrown out of balance. They are opened out in the west and crowded together in the east, hence the reacting force pushing the earth eastward is reduced, and that pushing the earth westward is increased, so that there is ·a balance of force always pushing the earth westward, or in the direction in which it was originally pushed, and this continuous push

will remain constant until some other force is applied in the opposite direction to stop it. In the absence of any attracting body such as the sun, the motion will continue in a straight line directed from east to west, as originally pushed. Thus we have the second portion of Newton's law: " Every body continues in its state . . . of uniform motion in a straight line, except in so far as it may be compelled by force to change that state."

The fan-like opening out of the lines of force in the forward direction is due to the resistance of the medium to the motion of the lines of force sweeping through it, so that the greater the resistance the greater the opening out, and the greater the balance of push in the eastern hemisphere. Hence, however great the resistance of the medium to the motion of a body, the push in the direction of motion will be correspondingly great, so that Newton's law of inertia is independent of the resistance of the medium of space. Physicists usually assume that space is absolutely frictionless, and therefore offers no resistance to motion, but we see from the above that this assumption is not necessary, since, whether the resistance of space is great or small, constant or variable, it will not affect the law of inertia as above

explained. The germ of the above theory of inertia will be found in the writer's " Scientific Notes" in *The Theosophist* of August, 1913, Vol. XXXIV, p. 764.

147. But the conditions that permit of Newton's law of inertia rarely or never occur in practice, and the general motions of bodies in space, if left to themselves, are along the geodesics of Einstein. The earth, therefore, does not move in a straight line, but in a curved line, which at every point is a geodesic conformable to the sun's gravitational field. We will therefore attempt to describe the mechanism which determines the curve of the earth's path.

The light from the sun divides the earth's surface into two equal hemispheres, the light and the dark. In the absence of the sun or other body, the lines of force in these two hemispheres would be equal and opposite, and the forces would cancel, as in the illustration of a stationary earth. But there are also lines of force issuing from the sun, and these strike against the terrestrial lines in the light hemisphere, and operate upon them as would a wind that turned an umbrella inside out. The earth's lines of force are hence condensed in the dark hemisphere, and open out fan-like in the

hemisphere turned towards the sun. This gives
a balance of force in the dark hemisphere
directed towards the sun; and this force, com-
bined with the westward motion, determines
the form of the earth's orbital motion along the
geodesics of Einstein.

148. The process described in the last para-
graph is made quite clear and visible to us in
the case of comets. As shewn by equations (30)
and (31), the velocity, on the average, of the
ether in the lines of force is the product of the
surface gravity of the body and half the orbital
period; and, although comets sometimes have
long periods, their surface gravity, owing to
their low mass and density, is always very
small. Hence the resulting velocity in the
lines of force is much less than in the case of
planets, and the lines of force are in conse-
quence more flexible to any forces tending to
alter their direction. In the field of the power-
ful lines of force from the sun, they will there-
fore bend and dispose themselves something
like a woman's hair blowing in the wind. They
will be parted in the middle and stream out be-
hind. The tails of comets are always directed
away from the sun, and stream out in ever-
increasing length as the comet approaches the
sun. The lines of force issuing from the head, in

the hemisphere facing the sun, jut out for a little way, and then turn back, much as described above in the case of the earth, that is, like an umbrella turned inside out.   Agnes Clerke, in describing the return of Halley's comet in 1835,[1] says:

> Some curious phenomena accompany the process of tail-formation. An outrush of luminous matter, resembling in shape a partially opened fan, issued from the nucleus *towards* the sun, and at a certain point, like smoke driven before a high wind, was vehemently swept backward in a prolonged train. The appearance of the comet at this time was compared by Bessel, who watched it with minute attention, to that of a blazing rocket.

Hence the bending of the lines of force of comets is greatly exaggerated as compared with planets, and, being illuminated, they give a very perfect illustration of the inertial mechanism. The earth, however, exhibits the same phenomena, though on a much reduced scale. The turning back of the lines of force from the light to the dark hemisphere is seen on the earth, after sunset and before sunrise, as the zodiacal light, whilst the earth's cometary tail is illuminated near the apex of the earth's conical shadow, and is sometimes seen at a point of the sky diametrically opposite the sun at midnight.   It is known as the *Gegenschein.*[2]

[1] *History of Astronomy*, Fourth Edition, p. 102.
[2] *Encyclopaedia Britannica*, Vol. 28, p. 1000.

149.   It was shewn in paras. 126—129 that observed facts in connexion with Marconi rays, etc., require the earth to have an electrical surface at a height of about 100 kilometres above sea level, which reflects Marconi rays and keeps them from being dissipated into space.   If the lines of force are denser in the dark hemisphere than in the light, then in the dark half the reflecting power of this electrical screen must be greater than in the light half, and Marconi rays should show an increase of efficiency in the night as compared with the day.   Now this is found to be the case.

An important epoch in this connexion is the year 1902, when Senatore Marconi discovered, during one of his early voyages across the Atlantic in the S.S. *Philadelphia* in February, 1902, that radio signals from Poldhu could be received at night about thrice the distance they could be read in day-time, being detectable only up to 700 miles by day, but readable up to 2,099 miles by night.[1]

Another interesting feature is that, if a wireless message is being sent between two places where it is required to cross a region where the sun is rising or setting, that is, if it is required to cross the margin between the light and dark hemispheres of the earth, there is a special action on the Marconi rays which is very perceptible.[2]

[1] *Nature*, Vol. 109, p. 140, February 2nd, 1922.
[2] *Ibid.*, p. 180, February 9th, 1922.

150. In the illustrations given above, one particular feature should be noticed. It is not the sun that pulls the earth towards it; it is the surplus lines of force in the dark half of the earth that push the earth towards the sun; and these accelerating forces are produced by the earth's mass, and not by the mass of the sun. It is not the sun that attracts the earth, it is the earth which pushes itself towards the sun, and the force of the push comes from the reaction on the accelerated ether in the terrestrial lines of force. The real prime mover is Fohat, operating at the atomic centres of the matter of the earth, as described in *Occult Chemistry* (p. 21) and quoted in para. 48 and elsewhere. The direct force between the sun and earth, as between any two bodies, is a repulsion, and not an attraction, and this repulsion shows itself as the pressure of radiation, which physicists have measured. This pressure per square centimetre is numerically equal to the radiation energy per cubic centimetre for totally absorbing bodies.[1]

There is no such thing as a pull, or force of attraction, in the whole of the universe—or, at least, so it appears—for, when the mechanism of the pull is analysed, it always turns out to be

[1] *Nature* Vol. 109, p. 142, February 2nd,1922.

a push. It remains a pull, only so long as we do not understand it. When we realise its true nature, we immediately see that the real force is a *vis a tergo*, or push from behind. A horse does not pull a cart, it pushes its collar. The sun does not pull the earth towards it, it directs the terrestrial lines of force, so that the inertial forces of the earth push the earth towards the sun. Inventors have recently been working out a process whereby aeroplanes and submarines can be guided by wireless telegraphy. When this is accomplished, it will still be the engines of the aeroplanes and submarines that do the work of propulsion, and the energy of the wireless rays will only determine the direction. So in the case of the gravitational forces between the earth and sun; the sun determines the direction in which this force shall be applied, but it is the inertial forces of the earth that exercise the actual propulsion.

151. The whole process of inertia-gravitation is so beautifully illustrated by the illuminated lines of force of comets, that by the study of comets physicists can examine it in detail.

The keys to the problem are: (i) The operation of Fohat at the atomic centres, as described in *Occult Chemistry ;* (ii) the acceleration of the etheric medium, due to this action of Fohat, as

given by equation (30); and (iii) the expression for the inertial mass, as given by (31).

With these as keys, the configuration of the lines of force, made visible to us in the case of comets, enables us to see and deduce the entire phenomenon of inertia-gravitation, as assumed in the theory of Einstein. The action between two bodies is one of repulsion, and this repulsion is proportionate to the area exposed to it. The lines of force issuing from a body expose a larger area to this repulsion than the central body from which the lines emerge; and, being more easily moved, they are driven behind the body, and the reaction of the acceleration in these lines of force is directed along the line joining the centres of the two bodies, and towards each other. This directed force being greater than the direct repulsion, the bodies tend to move towards each other. Thus a repulsive force is transformed into an apparent attraction.

152. The complete operation of the inertia-gravitation mechanism can be illustrated by a mechanical toy; and, although some physicists have regarded it as for ever insoluble, it would appear to be so remarkably simple that it could be explained to an infant class.

Take an ordinary weather-cock and fix it to a trolley running on railway lines, these lines

being parallel to the direction of the wind. Attach a small hose-pipe to the flat body of the cock, with the nozzle at the head, and the flexible hose at the tail. If this be held directly across the railway lines, and therefore at right angles to the wind direction, the force of the wind against the flat body of the cock will drive the trolley along the lines; thus the wind will act as a repulsive force, driving away the trolley.

If now the mechanism be left free to turn on its vertical axis, the head of the cock, with its attached nozzle, will turn in the direction of the wind and the railway lines. Everyone who has handled a hose-pipe has felt the reactionary back-push of the issuing jet, and will easily understand that this back-push will drive the trolley against the wind. We have therefore a repulsive force, that of the wind, transformed into an *apparent* attraction.

The water issuing from the hose-pipe is performing the same mechanical operation as the tail of a comet. In the above, the wind corresponds to the lines of force issuing from the sun, and the jet of water corresponds to the accelerated ether in the lines of force of the attracted or gravitating body.

The turning of the cock on its vertical axis in the direction of the wind corresponds to the

pushing of the lines of force from the light hemisphere into the dark. The only principle of mechanics assumed in the mechanism is Newton's third law of motion : " To every action there is always an equal and contrary reaction ; or, the mutual actions of any two bodies are always equal and oppositely directed." [1] This third law of Newton therefore becomes the unique principle of mechanics, from which the inertia-gravitation laws can be deduced.

153. An important property, which should be carefully noted in the above, is that the same mechanism which produces Newton's laws of inertia performs the operation of gravity. Hence inertia and gravitation necessarily vary together, since they are but two different aspects of the same operation. Thus, in place of the Newtonian laws of inertia, we have the combined inertia-gravitation law, assumed by Einstein, upon which his chief conclusions are based. This mechanism, in spite of its simplicity, apparently contains the whole mystery of gravitation. There are, however, several reasons why it was not possible for Western physicists to discover it. In the first place, the inertia-gravitation law of Einstein is quite new, and

[1] *Treatise on Natural Philosophy*, Lord Kelvin and Tait, Part I, p. 246, Art. 261.

has not yet been fully assimilated by the scientific mind. Secondly, gravitation can only be explained by the action of Fohat and the observations of Occult investigators, which physicists will not recognise. Thirdly, the minds of scientific men have been obsessed by the two laws of conservation, those of energy and matter, in a form which effectively shut out the solution.

These laws are true, but they are not the whole truth. They are merely aspects of the wider law of the conservation of power, as shown in our sixth study, para. 91. This law, to the Western mind, will appear extravagant, and at first sight it seems to be. To expend all this energy in order merely to cause bodies to gravitate looks like an unpardonable waste of power. Here again the view-point which has recently prevailed in philosophical circles has blocked the way. To the old-fashioned scientist of the nineteenth century type, the universe was the result of the fortuitous concourse of atoms, and the life-evolutions on a few of the planetary surfaces were accidental excrescences. But, from the point of view of the Occultist, it is the laws of physics that are the excrescence, and the main purpose of the universe is the evolution of a race of gods, the divine sons of

the Logos. It is for the evolution of divinity, therefore, that this enormous expenditure of energy is maintained, so that physical laws are but the lower aspect of the life of the cosmos. The master-key to the problem was not contained in science. It was concealed in religion. Fohat is one of the Divine Trinity. His operations are the expression of the Divine Immanence in nature; and, until this was recognised, no solution was possible. The truth taught us by our pious nurses, as we toddled to and fro from our infant class—that God did all these things—was after all the real truth, and : " Thou hast hid these things from the wise and prudent, and hast revealed them unto babes." [1]

CONCLUSIONS AND SUMMARY

154. The conclusion arrived at in the preceding study, that Einstein's Principle of Equivalence can be deduced from the observed facts and teachings of Occultism, is further illustrated.

The mechanism of gravitation can be observed in detail by the study of comets, in which bodies the lines of force which cause the force of gravity are illuminated. The partial

[1] *Luke*, X, 21.

illumination of the terrestrial lines of force in the zodiacal light and the *Gegenschein* will also serve this purpose.

The principle can be illustrated by a simple mechanism, which only involves Newton's third law of action and reaction, and the observed operation of Fohat.

The force of gravity is not a pull but a push, and the mechanism which produces the laws of inertia also performs the operation of gravity, so that the two phenomena are essentially the same.

Newton's law of action and reaction is the unique axiomatic law of mechanics, since the other mechanical laws are deducible from it.

An explanation of the law of gravitation involves the operation of Fohat, the physical aspect of which is the law of the conservation of power.

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LIST OF EQUATIONS

p. x.   Introduction.

$$a' / a = 0.0000013916 / 3.981$$
$$= 1 / 2,861,000 \tag{1}$$

p. xi.

$$1 / 2,860,000 \text{ of the sun's mass} \tag{2}$$

p. xiv.

$$G' = (5 / 6) \, pG = 5.616 \times 10^{-8} \tag{3}$$

p. xiv.

$$G'e = m = 9.008 \times 10^{-28}$$
$$= \text{the mass of the electron} \tag{4}$$

p. xiv.

$m / G' = e =$ the electromagnetic charge on the electron   (5)

p. 4, para 3.

$$5.7543 / 10^{14} \text{ ergs} \tag{1}$$

p. 6, para 5.

$$1,111,400 \text{ centimetres per second} \tag{2}$$

p. 36, para 33.

$$7,340 \text{ miles} \tag{3}$$

$$810,360 \text{ miles} \tag{4}$$

p. 40, para 38.

$$0 \cdot 000,000,000,4774 \tag{5}$$

p. 55, para 50.

$$20 / 16 = 1 \cdot 25 \tag{6}$$

p. 61, para 56.

$$979 \cdot 75 / 0 \cdot 59491 = 1646 \cdot 9 \tag{7}$$

p. 67, para 61.

$$\text{Negative ion} / \text{Electron}$$
$$= 14773 \cdot 0 / 9 \cdot 01$$
$$= 979 \cdot 75 / 0 \cdot 59491 = 1646 \cdot 9 \tag{8}$$

p. 78, para 70.

$$6 \cdot 006 \times 10^{27} \text{ grammes} \tag{9}$$

$$5 \cdot 98 \times 10^{27} \text{ grammes} \tag{10}$$

p. 79, para 70.

$$M = (3 / 4) \text{ Savy} = E \tag{11}$$

p. 80, para 71.
$$6242{\cdot}1 \times 6{\cdot}858 = 42809 \tag{12}$$

p. 80, para 72.
$$6{\cdot}2421 \times 10^{11} \tag{13}$$

p. 81, para 72.
$$979{\cdot}75 \times 6{\cdot}371 \times 10^{8}$$
$$= 6{\cdot}2421 \times 10^{11} \tag{14}$$

p. 87, para 77.
$$2,790,000,000 \times 1,556,000$$
$$= 4{\cdot}343 \times 10^{15} \text{ ergs per second}$$
$$= 434,000 \text{ kilowatts}$$
$$= 582,200 \text{ horse-power} \tag{15}$$

p. 90, para 81.
$$27,436 / 979{\cdot}75 = 28{\cdot}003 \tag{16}$$

p. 91, para 82.
the earth's mass / 31,558,000
$$= 1{\cdot}895 \times 10^{20} \text{ grammes} \tag{17}$$

p. 95, para 85.
$$P = gR^{2}$$
$$= 979{\cdot}75 \times (6{\cdot}371)^{2} \times 10^{16}$$
$$= 3{\cdot}977 \times 10^{20} \tag{18}$$

p. 97, para 87.

$$V = P\,/\,y$$
$$= gR^2\,/\,y = 1{,}26 \times 10^{13}$$
$$= 126{,}000 \text{ volts} \tag{19}$$

p. 97, para 88.

$$v = 29319 \text{ centimetres per second} \tag{20}$$

p. 98, para 89.

$$A = 0{\cdot}001729 \tag{21}$$

p. 122, para 110.

$$\tfrac{1}{2}\,(770 \times 1800) \text{ millions}$$
$$= 1{,}235{,}000{,}000 \tag{22}$$

p. 123, para 110.

$$81{\cdot}1 \times 10^{40} \text{ grammes} \tag{23}$$

Earth's mass

$$\times\ 155{,}520{,}000{,}000{,}000$$

$$= 93{\cdot}0 \times 10^{40} \text{ grammes} \tag{24}$$

p. 125, para 111.

$$76{\cdot}57 \times 10^{40} \tag{25}$$

p. 127, para 112.

$$77{\cdot}57 \times 10^{40} \text{ grammes} \tag{26}$$

p. 129, para 114.

$$76 \cdot 72 \times 10^{40} \tag{27}$$

p. 146, para 125.

Intensity of Terrestrial
Magnetism I
$= 0 \cdot 07903$
Mean force of Terrestrial
Magnetism f

$$= (4/3) \, \pi \, \mathrm{I} = 0 \cdot 33104 \tag{28}$$

p. 147, para 125.

$$\mathrm{F} = (3/4) \, \mathrm{g R}^{2} = 2 \cdot 9826 \times 10^{20} \tag{29}$$

p. 147, para 125.

$$\mathrm{c}^{2} = \mathrm{F/f} = 9 \cdot 0101 \times 10^{20}$$
$$= (\mathrm{F/f})^{\frac{1}{2}} = 3 \cdot \quad \times 10^{10} \tag{30}$$

p. 154, para 131.

$$\mathrm{c} = 31{,}558{,}000 \times 950 \cdot 32$$
$$= 2 \cdot 9986 \times 10^{10}$$
$$= \text{the velocity of light} \tag{30a}$$

p. 166, para 137.

$$E = SI' \cdot \tfrac{1}{2}c = 5 \cdot 98 \times 10^{27} \text{ grammes}$$

$$I' = E/S \cdot \tfrac{1}{2}c = 0 \cdot 07818$$

$$= \text{etheric density} \qquad\qquad (31)$$

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ERRATA

Introduction p. x, bottom line

In place of (1 / 2·861,000)

read (1 / 2,861,000)

p. 4, para 3, equation (1)

In place of

5·7543 10^{14} ergs

read

5·7543 / 10^{14} ergs

p. 91, para 82, equation (17)

In place of

the earth's mass / 131,558,000

= ·195 × 10^{20}

read

the earth's mass / 31,558,000

= 1·895 × 10^{20}

p. 97, para 88, line 8 from bottom,

In place of

time is $v \times \frac{1}{2}v^{2} = \frac{1}{2}v,$

read

time is $v \times \frac{1}{2}v^{2} = \frac{1}{2}v^{3},$

p. 146, para 125, equation (28)

In place of

Mean force of Terrestrial
Magnetism $f = (4/3)\pi$
$I = 0.33104$

read

Mean force of Terrestrial
Magnetism $f = (4/3)\pi I$
$= 0.33104$

p. 147, para 125, equation (30)

In place of

$c = (F/f)\frac{1}{2} = 3.0016 \times 10^{10}$

read

$c = (F/f)^{\frac{1}{2}} = 3.0016 \times 10^{10}$

p. 166, para 137, line 6 from top,

In place of

then $S = 5.10\text{I} \times 10^{10}$

read

then $S = 5.101 \times 10^{18}$