COSMOS WITHOUT GRAVITATION

ATTRACTION, REPULSION AND ELECTROMAGNETIC CIRCUMDUCTION IN THE SOLAR SYSTEM

Synopsis

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I

THE FUNDAMENTAL theory of this paper is: Gravitation is an electromagnetic phenomenon. There is no primary motion inherent in planets and satellites. Electric attraction, repulsion, and electromagnetic circumduction[(1)] govern their movements. The moon does not "fall," attracted to the earth from an assumed inertial motion along a straight line, nor is the phenomenon of objects falling in the terrestrial atmosphere comparable with the "falling effect" in the movement of the moon, a conjecture which is the basic element of the Newtonian theory of gravitation.

Aside from several important facts discovered in the study of cosmic upheavals, which are not illuminated here and only enumerated at the end of this paper, and which are discussed at length in a work of research entitled *Worlds In Collision* now being prepared for publication, the following facts are incompatible with the theory of gravitation:

1.

The ingredients of the air—oxygen, nitrogen, argon and other gases—though not in a compound but in a mixture, are found in equal proportions at various levels of the atmosphere despite great differences in specific weights. The explanation accepted in science is this: "Swift winds keep the gases thoroughly mixed, so that except for water-vapor the composition of the atmosphere is the same throughout the troposphere to a high degree of approximation." [(2)] This explanation cannot be true. If it were true, then the moment the wind subsides, the nitrogen should stream upward, and the oxygen should drop, preceded by the argon. If winds are caused by a difference in weight between warm and cold air, the difference in weight between heavy gases high in the atmosphere and light gases at the lower levels should create storms, which would subside only after they had carried each gas to its natural place in accordance with its gravity or specific weight. But nothing of the kind happens.

When some aviators expressed the belief that "pockets of noxious gas" are in the air, the scientists replied:

"There are no 'pockets of noxious gas.' No single gas, and no other likely mixture of gases, has, at ordinary temperatures and pressures, the same density as atmospheric air. Therefore, a pocket of foreign gas in that atmosphere would almost certainly either bob up like a balloon, or sink like a stone in water." [(3)]

Why, then, do not the atmospheric gases separate and stay apart in accordance with the specific gravities?

2.

Ozone, though heavier than oxygen, is absent in the lower layers of the atmosphere, is present in the upper layers, and is not subject to the “mixing effect of the wind.” The presence of ozone high in the atmosphere suggests that oxygen must be still higher: “As oxygen is less dense than ozone, it will tend to rise to even greater heights.” [(4)] Nowhere is it asked why ozone does not descend of its own weight or at least why it is not mixed by the wind with other gases.

3.

Water, though eight hundred times heavier than air, is held in droplets, by the millions of tons, miles above the ground. Clouds and mist are composed of droplets which defy gravitation.

4.

Even if perfect elasticity is a quality of the molecules of all gases, the motion of the molecules, if effected by a mechanical cause, must subside because of the gravitational attraction between the particles and also because of the gravitational pull of the earth. There should also be a loss of momentum as the result of the transformation of a part of the energy of motion into vibration of molecules hit in the collisions.[(5)] But since the molecules of a gas at a constant temperature (or in a perfect insulator) do not stop moving, it is obvious that a force generated in collisions drives them. The molecules of gases try to escape one another. Repulsion between the particles of gases and vapors counteracts the attraction.

5.

The weight of the atmosphere is constantly changing as the changing barometric pressure indicates. Low pressure areas are not necessarily encircled by high pressure belts. The semidiurnal changes in barometric pressure are not explainable by the mechanistic principles of gravitation and the heat effect of solar radiation. The cause of these variations is unknown.

“It has been known now for two and a half centuries, that there are more or less daily variations in the height of the barometer, culminating in two maxima

and two minima during the course of 24 hours. Since Dr. Beal's discovery (1664-65), the same observation has been made and puzzled over at every station at which pressure records were kept and studied, but without success in finding for it the complete physical explanation. In speaking of the diurnal and semidiurnal variations of the barometer, Lord Rayleigh says: 'The relative magnitude of the latter [semidiurnal variations], as observed at most parts of the earth's surface, is still a mystery, all the attempted explanations being illusory.'" (6)

One maximum is at 10 a.m., the other at 10 p.m.; the two minima are at 4 a.m. and 4 p.m. The heating effect of the sun can explain neither the time when the maxima appear nor the time of the minima of these semidiurnal variations. If the pressure becomes lower without the air becoming lighter through a lateral expansion due to heat, this must mean that the same mass of air gravitates with changing force at different hours.

The lowest pressure is near the equator, in the belt of the doldrums. Yet the troposphere is highest at the equator, being on the average about 18 km. high there; it is lower in the moderate latitudes, and only 6 km. high above the ground at the poles.

6.

Laplace, pondering the shape of the atmospheric envelope of the earth, came to the conclusion that the atmosphere, which rotates with the same angular velocity as the earth and which behaves like a fluid, must be lenticular in form; its polar and equatorial axes must be about 35,000 and 52,000 miles respectively; at the equator the atmosphere must extend more than 21,000 miles above the ground. At these distances from the ground the gravitational force of the earth is just equal to the centrifugal force due to rotation.

From the measurement of the pressure of the earth's atmosphere, measurement based also on the principles of gravitation, it has been deduced that the atmosphere is but 17 (not 21,000) miles high.

Observations of the flight of meteorites and of the polar auroras lead to the conjecture that the atmosphere reaches to a height of 130 miles (meteorites) or over 400 miles (polar auroras). Radio measurements yield about 200 miles for the upper layer recognizable through this method of investigation.

Two computations, both based on the principle of gravitation, differ in the proportion of 17 and 21,000. Direct observations do not justify either of the computed figures.

7.

Cyclones, characterized by low pressure and by winds blowing toward their centers, move counterclockwise in the northern hemisphere and clockwise in the southern hemisphere. This movement of air currents in cyclonic vortices is generally explained as the effect of the earth's rotation.

Anticyclones, characterized by high pressure and by winds blowing from their centers move clockwise in the northern hemisphere and counterclockwise in the southern hemisphere. The movement of anticyclones has not been explained and is regarded as enigmatic.

Cyclones and anticyclones are considered a problem of fluidal motion with highest or lowest pressure in the center. As the movement of anticyclones cannot be explained by the mechanistic principles of gravitation and rotation, it must be concluded that the rotation of cyclones is also unexplained.

8.

The area of land in the northern hemisphere of the earth is to the area of land in the southern hemisphere as three is to one. The mean weight of the land is two and three-quarter times heavier than that of water; assuming the depth of the seas in both hemispheres to be equal, the northern hemisphere up to sea level is heavier than the southern hemisphere, if judged by sea and land distribution; the earth masses above sea level are additional heavy loads. But this unequal distribution of masses does not affect the position of the earth, as it does not place the northern hemisphere with its face to the sun. A "dead force" like gravitation could not keep the unequally loaded earth in equilibrium. Also, the seasonal distribution of ice and snow, shifting in a distillation process from one hemisphere to the other, should interfere with the equilibrium of the earth, but fails to do so.

9.

Mountainous masses do not exert the gravitational pull expected by the theory of gravitation. The influence of the largest mass on the earth, the Himalaya, was carefully investigated with plumb line on the Indian side. The plumb line is not deflected as calculated in advance.[(7)] "The attraction of the mountain-ground thus computed on the theory of gravitation, is considerably greater than is necessary to explain the anomalies observed. This singular conclusion, I confess, at first surprised me very much." (G. B. Airy.[(8)]) Out of this embarrassment grew the idea of isostasy. This hypothesis explains the lack of gravitational pull by the mountains in the following way. The interior of the globe is supposed to be fluid, and the crust is supposed to float on it. The inner fluid or magma is heavier or denser, the crust is lighter. Where there is a mountainous elevation, there must also be a protuberance beneath the

mountains, this immersed protuberance being of lesser mass than the magma of equal volume. The way seismic waves travel, and computations of the elasticity of the interior of the earth, force the conclusion that the earth must be as rigid as steel; but if the earth is solid for only 2000 miles from the surface, the crust must be more rigid than steel. These conclusions are not reconcilable with the principle of isostasy, which presupposes a fluid magma less than 60 miles below the surface of the earth. There remains “a contradiction between isostasy and geophysical data.” (9)

10.

Over the oceans, the gravitational pull is greater than over the continents, though according to the theory of gravitation the reverse should be true; the hypothesis of isostasy also is unable to explain this phenomenon.(10) The gravitational pull drops at the coast line of the continents. Furthermore, the distribution of gravitation in the sea often has the peculiarity of being stronger where the water is deeper. “In the whole Gulf and Caribbean region the generalization seems to hold that the deeper the water, the more strongly positive the anomalies.” (11)

As far as observations could establish, the sea tides do not influence the plumb line, which is contrary to what is expected. Observations on reservoirs of water, where the mass of water could be increased and decreased, gave none of the results anticipated on the basis of the theory of gravitation.(12)

11.

The atmospheric pressure of the sun, instead of being 27.47 times greater than the atmospheric pressure of the earth (as expected because of the gravitational pull of the large solar mass), is much smaller: the pressure there varies according to the layers of the atmosphere from one-tenth to one-thousandth of the barometric pressure on the earth;(13) at the base of the reversing layer the pressure is 0.005 of the atmospheric pressure at sea level on the earth;(14) in the sunspots, the pressure drops to one ten-thousandth of the pressure on the earth.

The pressure of light is sometimes referred to as to explain the low atmospheric pressure on the sun. At the surface of the sun, the pressure of light must be 2.75 milligrams per square centimeter; a cubic centimeter of one gram weight at the surface of the earth would weigh 27.47 grams at the surface of the sun. Thus the attraction by the solar mass is 10,000 times greater than the repulsion of the solar light. Recourse is taken to the supposition that if the pull and the pressure are calculated for very small masses, the pressure exceeds the pull, one acting in proportion to the surface, the other in proportion to the

volume.[(15)] But if this is so, why is the lowest pressure of the solar atmosphere observed over the sunspots where the light pressure is least?

12.

Because of its swift rotation, the gaseous sun should have the latitudinal axis greater than the longitudinal, but it does not have it. The sun is one million times larger than the earth, and its day is but twenty-six times longer than the terrestrial day; the swiftness of its rotation at its equator is over 125 km. per minute; at the poles, the velocity approaches zero. Yet the solar disk is not oval but round: the majority of observers even find a small excess in the longitudinal axis of the sun.[(16)] The planets act in the same manner as the rotation of the sun, imposing a latitudinal pull on the luminary.

Gravitation that acts in all directions equally leaves unexplained the spherical shape of the sun. As we saw in the preceding section, the gases of the solar atmosphere are not under a strong pressure, but under a very weak one. Therefore, the computation, according to which the ellipsoidity of the sun, that is lacking, should be slight, is not correct either. Since the gases are under a very low gravitational pressure, the centrifugal force of rotation must have formed quite a flat sun.

Near the polar regions of the sun, streamers of the corona are observed, which prolong still more the axial length of the sun.

13.

If planets and satellites were once molten masses, as cosmological theories assume, they would not have been able to obtain a spherical form, especially those which do not rotate, as Mercury or the moon (with respect to its primary).

14.

The Harmonic Law of Kepler views the movements of the planets as depending only on their distance from the sun. According to Newton, the masses of the sun and the planets must also enter the formulas. The Newtonian orbits differ from the Keplerian, found empirically. The Newtonian formula has a sum of masses (instead of a product of masses), and in view of the largeness of the sun, the Newtonian orbits are supposed to not deviate substantially from the Keplerian.[(17)]

15.

Perturbations of planets due to their reciprocal action are pronounced in repulsion as well as attraction. A perturbation displacing a planet or a satellite by a few seconds of arc must direct it from its orbit. It is assumed that the orbits of all planets and satellites did not change because of perturbations. A regulating force emanating from the primary appears to act. In the gravitational system there is no place left for such regulating forces.

16.

The perturbating activity appears unstable in the major planets, Jupiter and Saturn: Between the minimum of the year 1898-99 and the maximum of the 1916-17 there was found an 18 percent difference.[(18)] As these planets did not increase in mass in the meantime, this change is not understandable from the point of view of the theory of gravitation, which includes the principle of the immutable gravitational constant.

17.

The pressure of light emanating from the sun should slowly change the orbits of the satellites, pushing them more than the primaries, and acting constantly, this pressure should have the effect of acceleration: the pressure of light per unit of mass is greater in relation to the satellites than in relation to their primaries. But this change fails to materialize; a regulating force seems to overcome this unequal light pressure on primaries and secondaries.

18.

The sun moves in space at a velocity of about twenty kilometers a second (in relation to the nearby stars). This motion, according to Lodge, must change the eccentricities of some of the planetary orbits to an extent which far exceeds the observed values.[(19)]

19.

The motion of the perihelia of Mercury and Mars and of the nodes of Venus differ from what is computed with the help of the Newtonian law of gravitation. Einstein showed how his theory can account for the anomaly of Mercury; however, the smaller irregularities in the movements of Venus and Mars cannot be accounted for by Einstein’s formulas.

20.

Unaccounted for fluctuations in the lunar mean motion were calculated from the records of lunar eclipses of many centuries and from modern observations.

These fluctuations were studied by S. Newcomb, who wrote: “I regard these fluctuations as the most enigmatic phenomenon presented by the celestial motions, being so difficult to account for by the action of any known causes, that we cannot but suspect them to arise from some action in nature hitherto unknown.” (20) They are not explainable by the forces of gravitation which emanate from the sun and the planets.

21.

It was found that “the strength of radio reception was nearly doubled with the passing of the moon from overhead to underneath the observer ... It does not appear reasonable that the relatively small gravitational tide in the earth’s atmosphere, which changes the barometric pressure by less than half of one percent, could account for a sufficient change in altitude of the ionized layer to produce such marked changes in the intensity of reception.” (21)

The lifting of the ionosphere generally results in better radio reception, and the small tidal action by the moon when overhead should improve reception a little, not impair it; in any event, the moon cannot have a marked effect on the ionosphere without being itself a charged body. But if the moon is charged, it cannot behave in its motion as though the gravitational force alone acts between it and the earth.

22.

The tails of the comets do not obey the principle of gravitation and are repelled by the sun. “There is beyond question some profound secret and mystery of nature concerned in the phenomenon of their tails” ; enormous sweep which it (the tail) makes round the sun in perihelion, in the manner of a straight and rigid rod, is in defiance of the law of gravitation, nay, even of the recorded laws of motion” (J. Herschel).(22)

“What has puzzled astronomers since the time of Newton, is the fact that while all other bodies in the sidereal universe, as far as we are aware, obey the law of gravitation, comets’ tails are clearly subject to some strong repulsive force, which drives the matter composing them away from the sun with enormously high velocities” (W.H. Pickering)

23.

The change in the angular velocity of comets (especially of the comet Encke) is not in accord with the theoretical computations based on the theory of gravitation.(23)

Meteors, after entering the terrestrial atmosphere at about 200 km. above the ground, are violently displaced toward the east. These displacements of the meteors are usually ascribed to winds blowing in the upper atmosphere.[(24)] The atmospheric pressure at a height of 45 km. is supposed to be but "a small fraction of one millimeter of mercury." [(25)] On the other hand, the velocity with which the meteors approach the earth is between 15 and 75 km. per second, on the average about 40 km. per second or over 140,000 km. per hour. If winds of 150 km. per hour velocity were permanently blowing at the height where the meteors become visible, it would not be possible for such winds of rarefied atmosphere to visibly deflect stones falling at the rate of 140,000 km. per hour.

Approaching the earth, the meteorites suddenly slow down and turn aside, and some are even repelled into space. "A few meteors give the appearance of penetrating into our atmosphere and then leaving it, ricocheting as it were." [(26)]

25.

The earth is a huge magnet; it has electric currents in the ground and is enveloped by a number of layers of electrified ionosphere. The sun possesses an electric charge and magnetic poles; also the sunspots are found to be powerful magnets. The ionosphere is permanently charged by particles arriving from the sun; sunspots actively influence terrestrial magnetism, ground currents, the ionosphere's charge, and auroras. As the principle of gravitation leaves no room for the participation of other forces in the ordinary movements of the celestial mechanism, these obvious and permanent influences of the electromagnetic state of the sun on the magnetic field of the earth, the ionosphere, the auroras, and the earth currents are not allowed to have more than zero effect on the astronomical position of the earth, and this for the sake of maintaining the integrity of the gravitational principle.

Sun and moon, comets, planets, satellites, and meteorites - all the heavenly host - air and water, mountain massifs and sea tides, each and all of them[(27)] disobey the "law of laws" which is supposed to know no exception.

* * *

To the empirical evidences of the fallacy of the law of gravitation four well known difficulties of the gravitational theory can be added:

a.

Gravitation acts in no time. Laplace calculated that, in order to keep the solar system together, the gravitational pull must propagate with a velocity at least

fifty million times greater than the velocity of light. A physical agent requires time to cover distance. Gravitation defies time.

b.

Matter acts where it is not, or *in abstentia*, through no physical agent. This is a defiance of space. Newton was aware of this difficulty when he wrote in a letter to Bentley: “That gravity should be innate, inherent, and essential to matter, so that one body can act upon another at a distance through a vacuum without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity that I believe no man, who has in philosophical matters a competent faculty of thinking, can ever fall into it.” Leibnitz opposed the theory of gravitation for this very reason.

c.

Gravitational force is unchangeable by any and all agents or by any medium through which it passes, always propagating as the inverse square of the distances. “Gravitation is entirely independent of everything that influences other natural phenomena” (De Sitter[(28)]). This is a defiance of the principles governing other energies.

d.

Every particle in the universe must be under a tendency to be pulled apart because of the infinite mass in the universe: it is pulled to all sides by all the matter in space.

A few additional remarks about the motion of bodies in the universe which bear upon the theory of gravitation are added here:

1.

The notion of the tangential escape or inertia of the primary motion of the planets and satellites, being adopted by all cosmogonical theories of post-Newtonian days, led all of them into insurmountable difficulties. The retrograde motion of some satellites is one of these difficulties.

2.

The principle of gravitation demands an ultimate balling of all matter in the cosmos. This is not in harmony with spectral observations, which suggest even an “expanding universe”

3.

> “An atom differs from the solar system by the fact that it is not gravitation that makes the electrons go round the nucleus, but electricity.” (B. Russell). Different principles are supposed to govern the motion of the planetary bodies in the macrocosm and microcosm.[(29)]

* * *

Newton explained the principle underlying the motion of the planets and the satellites by the example of a stone thrown horizontally from a mountain with such force that gravitation bends its flight so that it revolves around the earth, coming back to exactly the same place, once again to repeat the course of its flight. But he admits “It is not to be conceived that mere mechanical causes could give birth to so many regular motions,” and invokes an act of Providence in providing each satellite with a tangential push of a strength which, together with the pull of the primary, creates an orbit. (General Scholium to Book III of the *Principia*) The inertia of the tangential (instantaneous) push has not exhausted itself in all the eons despite the tidal friction between a satellite and its primary, or the sun pulling the satellite away from the primary, or the resistance of matter (meteorites) in space, though all these forces act permanently and therefore with acceleration.

* * *

Newton’s gravitational theory is regarded as proved by the action of the tides. But studying the tides, Newton came to the conclusion that the moon has a mass equal to one fortieth of the earth. Modern calculations, based on the theory of gravitation (but not on the action of the tides), ascribe to the moon a mass equal to 1/81 of the earth’s mass.[(30)]

The greatest triumph of the theory of gravitation was the discovery of the planet Neptune, the position of which was calculated simultaneously by Adams and Leverrier from the perturbations experienced by Uranus. But in the controversy which ensued concerning the priority in announcing the existence of Neptune, it was stressed that neither of the two scholars was the real discoverer, as both of them calculated very erroneously the distance of Neptune from the orbit of Uranus.[(31)] Yet, even if the computations were correct, there would be no proof that gravitation and not another energy acts between Uranus and Neptune. The gravitational pull decreases as the square of the distance. Electricity and magnetism act in the same way. Newton was mistaken when he ascribed to magnetism a decrease that follows the cube of the distance.[(32)]

Building his System of the World, Newton put before his readers “Rules of Reasoning in Philosophy.” The First Rule is: “We are to admit no more causes of

natural things than such as are both true and sufficient to explain their appearances." Rule II is : "Therefore, to the same natural effects we must, as far as possible, assign the same causes."

II

Thorough theoretical and experimental investigations will be necessary to build a new theory in place of the now accepted theory of gravitation. For the present we shall offer only general suggestions.

1.

Attraction between two neutral atoms. Each atom is made up of positive and negative electricity and, though neutral as a whole, may form an electric dipole when subjected to an electric force. Thus, in the theory presented here, this attraction is not due to "inherent gravitational" properties of mass, but instead to the well known electrical properties of attraction. Two dipoles arrange themselves so that the attraction is stronger than their mutual repulsion.

2.

Inertia, or the passive property of matter. "The equality of active and passive, or gravitational and inertial mass was in Newton's system a most remarkable accidental coincidence, something like a miracle. Newton himself decidedly felt it as such" (W. DeSitter).[(33)]

In Einstein's explanation, inertia and gravitation are not two different properties, but one and the same property viewed from different points in space. According to his illustration, a man in an elevator that is being continuously pulled up by a rope invisible to the man will feel his feet pressed against the bottom of the elevator and will think that he gravitates toward the floor. But someone else observing the situation from the outside in space will judge that there is a fact of inertia; the pulled elevator has to overcome the inertia of the man standing on its floor. If the man in the elevator lets an object fall from his hand, it will approach the floor at an accelerated speed because the elevator is being continuously pulled upward; to the observer on the outside it rises with acceleration.

By this illustration Einstein tried to explain the equivalence of inertia and gravitation. But it is impossible to adopt this explanation for the gravitational effect of the globe: the observer from outside cannot perceive the globe as moving simultaneously in all directions. Einstein sees the difficulty and says: "It is, for instance, impossible to choose a body of reference such that, as judged from it, the gravitational field of the earth (in its entirety) vanishes." [(34)]

In our explanation the active property is due to one kind of charge in the atom - the attracting (attracted) charge; the passive property, to the opposite charge, which repels (is repelled). Both exist in equal quantities in a neutral atom; this explains the equality of the gravitating and inertial properties of matter.

However, the charges must arrange themselves in such a manner that attraction proceeds: the attracting force overcomes the repelling force because the attracting poles of the dipoles are closer to one another than the repelling poles; when the repelling poles are closer, the atoms (or their combinations in molecules) repel each other, as is the case with gases.

A charged body attracts more strongly than a neutral body because of the presence of free electrons; in dipoles the charges rearrange themselves only a little, but free electrons can rearrange themselves much more.

3.

Attraction of bodies toward the earth. The ionosphere is strongly charged with respect to the "neutral" earth; a potential difference of 100 volts per meter altitude exists near the ground, or a difference in potentials which forces the current through the electric lamps. Does any relation exist between the difference in voltage in the lower atmosphere and the difference in weight ("at the ceiling of a room 3 meters high a kilogram weighs about one milligram less than at the floor")?

With the altitude a voltage difference per meter is not the same as near the ground, but it accumulates to a high figure: "Between a point ten miles high and the surface of the earth there is an electrical pressure difference of about a hundred and fifty thousand volts." (35)

Neutral bodies consist of both positive and negative charges. Neutral atoms form dipoles along the lines of force of the electric field with poles turned toward the earth and the ionosphere. Is the fall of objects due to their "dipole attraction" and to their movement in an electrical field as dipoles? The proximity to the ground gives its action preference over that of the ionosphere as far as the attracting force is concerned, since the distance between the opposite electric poles of the atomic dipole is much smaller in comparison to its total distance from the ionosphere than from the ground. This means, however, that when objects reach a certain altitude, they would be attracted upward. Meteorites, repelled into space, are apparently charged identically with the upper layer of the ionosphere.

This part of the theory (concerning falling bodies) requires experimentation and exact calculation. It is probable that besides carrying a charge, the ground

turns all of its atoms as dipoles toward the ionosphere.[(36)]

4.

"In contrast to electric and magnetic fields, the gravitational field exhibits a most remarkable property, which is of fundamental importance ... Bodies which are moving under the sole influence of a gravitational field receive an acceleration, which does not in the least depend either on the material or the physical state of the body." (Einstein)[(37)]

This law is supposed to hold with great accuracy. The velocity of the fall is generally explored with the help of a pendulum; it appears to us that a charged object must fall with a different velocity than a neutral object. This is generally denied. But the denial is based on the observation that there is no difference in the number of swings of a pendulum in a unit of time, in the case where a charged or neutral bob is used. This method may produce inaccurate results. *In an accurate method, the falling time and the time of ascent of the pendulum must be measured separately.* In the case of a charged body, the increase in the velocity of descent of the pendulum may be accompanied by a decrease in the velocity of ascent, and thus the number of swings in a unit of time would remain the same for charged and non-charged bobs.

In a charged body the attracting and the inertial properties are not equal. It appears also that the weight of a body increases after it is charged. An experiment made with a piece of hard rubber (ten grams), neutral and again charged by rubbing, on a scale with a sensitivity of one-tenth of a milligram, showed a change in weight of over ten milligrams. This appears to be the result of an induced charge in the bottom (ebony) of the balance (placed on a thick plate of glass). A grounded wire held over the scale with the charged rubber raises the scale. If "gravitation" is an electrical phenomenon, attraction by induced electricity is not an entirely different phenomenon. Nevertheless, this experiment cannot be regarded as conclusive for the present problem.

In the oil-drop experiment the action of the charges may be made equal to the "gravitational" pull: One and the same action is ascribed to two fundamentally different principles.

A photograph may provide the answer to the question of how much a charged drop revolving around a pole of a magnet is influenced by the terrestrial pull.

Would a metal container filled with gas fall (in a vacuum) with the same velocity as a solid piece of metal?

III

Attraction, repulsion, and electromagnetic circumduction act in the solar system. Sun, planets, satellites, comets are charged bodies. As charged bodies they are interdependent.

The solar surface is charged negatively in relation to the charge of the earth, as the spectral lines (with the dominant red line in the spectrum of hydrogen) reveal. The sun carries a charge and rotates: it is an electromagnet.

The spots of the sun are magnetic, and the filaments of hydrogen on the sun's surface arrange themselves as iron particles in a magnetic field.[(38)] Besides the spots, the sun as a whole is a magnet. "The form of the corona and the motion of the prominences suggest that it is a magnet," wrote G.E. Hale when he undertook to detect the Zeeman effect.[(39)] The Zeeman effect proved to be most pronounced at 45° in both hemispheres of the sun; Hale found the displacement of lines decreases to zero at the equator and near the poles of rotation; and also that "a first approximate value for the vertical intensity of the sun's general field at the poles is 50 gausses." Thus, it was confirmed that the sun is a magnet, but the magnetic field was found not to be strong.

This result is questioned here. The lines of the corona suggested the existence of a magnetic field on the sun to the scholar who discovered it. But the form of the corona suggests a powerful magnetic field.[(40)] Visible coronal bands and streamers reach a distance equal to ten and more diameters from the disc of the sun—Mercury is only forty solar diameters from the sun and Earth 108 solar diameters. More recent investigation by Stevens, who photographed the streamers from 25,000 feet, disclose a globular corona more extensive than any known from ground photographs.

Disturbances in filaments and vortices of the sun affect the ionosphere of the earth and prove the existence of a powerful charge on the sun; rotating at the speed of the solar rotation, a strong charge must produce a strong magnetic field.

A revised investigation of the magnetic power of the field around the sun is here suggested. It should be kept in mind that the observations have been made from the solar magnetic field, in which the earth is embedded, if our concept is correct. It is possible also that the strongest Zeeman effect will show itself in latitudes higher than 45°. As is well known, the angle of observation must be taken into consideration in observing the Zeeman effect.

The sun is a rotating charged body, and it creates a magnetic field. We assume the solar charge to be large enough to produce a magnetic field with lines of force reaching the orbit of Pluto. The charged planets move at right angles to the sun's magnetic lines of force and describe the usual circular motion to which moving charged bodies are subjected in a magnetic field. Satellites, in turn, revolve in smaller magnetic fields produced by the rotation of the charged planets. The non-rotating planets have no satellites, for they do not produce magnetic fields. If there are rotating satellites, they may be able to revolve trabants around them.

"The origin of the earth's main magnetic field has so far defied all attempts of solution." [(41)] The cause of the earth's magnetic field is in (1) the magnetic field of the sun, and (2) the rotation of the charged earth around its axis.

It has been calculated[(42)] that if the earth is a magnet because of the rotating charge on its surface, the charge must be so great as to "enter as a serious factor in planetary perturbations," and therefore the theory was dropped.[(43)] But this is exactly what happens: the electromagnetic fields of the earth and of other planets are the causes of the planetary perturbations.

We have constructed a theory according to which the members of the solar system are charged bodies; electric attraction and repulsion, and electromagnetic circumduction act in the system; the origin of the magnetic field around the sun is in its charge—the sun is an electromagnet; planetary motion is due to the electromagnetic force exerted on the planets by the sun. The planets as charged bodies create magnetic fields by their rotation. It follows that (a) gravity, depending on electrical charge, varies with the charge, (b) the masses of the planets are inaccurately calculated, (c) the positive and negative charges are manifested only in relation to the charge of the earth.

One of the differences between the conception of celestial mechanism expounded here and the theories of gravitation of Newton and Einstein is that in our understanding the revolution of the moon is a process of a different order from that of the falling of objects near the terrestrial ground. The revolution of the moon is a phenomenon of circumduction of a charge by a magnetic field and is not a fall combined with inertia; the primary motion of planets and satellites along a straight line is a fallacious notion. At the distance of the moon the electromagnetic field of the earth causes circumduction while in the terrestrial atmosphere the electric field between the earth and the ionosphere causes the movement of the dipoles. Like the moon, the earth and other planets and satellites are subject to electromagnetic circumduction.

IV

"Universal gravitation" is an electromagnetic phenomenon, in which the charges in the atoms, the free charges, the magnetic fields of the sun and the planets play their parts.

In the frame of this theory the following phenomena become explainable:

1.

   All planets revolve in approximately one plane. They revolve in a plane perpendicular to the lines of force of the sun's magnetic field.

2.

The planets have a greater aggregate energy of motion than the sun. The revolution of the planets did not originate in the angular velocity of rotation of the sun; the magnetic field of the sun effected their revolution. Also, the fact that one of the satellites of Mars revolves with an angular speed greater than that of the rotation of this planet is explained here by electromagnetic circumduction.

3.

The retrograde revolution of a number of satellites. It is due either to retrograde rotation of the primary with inversed magnetic poles or to a difference of charges. The fact that the retrograde satellites of Jupiter and Saturn are the most remote from their primaries poses the problem whether their remoteness from the primaries and their relative closeness to the sun play a role in their being of a presumably different charge than the other satellites of Jupiter and Saturn.[(44)]

In the case of Uranus, the retrograde revolution of its satellites follows the retrograde rotation of the planet and its magnetic field. (One of the magnetic poles of Uranus can be readily investigated because it faces the ecliptic.)

4.

The rotation of the earth. The tidal theory fails to account for the rotation of the planets. The position of the magnetic poles of the earth at a distance of about 20 degrees from the geographical poles may be related to the rotation of the earth. Once each day the magnetic poles of the earth occupy the southernmost and the northernmost positions in the lines of the magnetic field of the sun.

5.

Perturbations among the members of the solar system are actions of attraction as well as of repulsion and depend on the charges of the planets and satellites and their magnetic properties. The fact that after perturbations, the planets resume their normal courses is due to the regulating action of the sun’s magnetic field. Similarly, the satellites are regulated in their motion by the electromagnetic fields of the primaries.

6.

The anomalies in the motion of Mercury and other planets. The velocities of

revolution of the planets depend on their charges. A strongly charged body is carried across the lines of the magnetic field more swiftly than a weakly charged body. If the charge of a planet increases, the velocity of revolution of such a planet must increase too. Positive as well as negative charges arrive from the sun in an uninterrupted flow.

The planet Mercury moves faster and faster. *This must be the result of an increasing charge of the planet.* Also, the anomalies in the motion of other inner planets may be attributed to a changing charge; other irregularities in the motion of the planets can be attributed to the fact that the electrical charge of the sun is not equally distributed on the solar surface.

7.

The deflection of a ray of light passing close to the sun. Before attributing the deflection to the gravitational field of the sun, the influence of the magnetic field of the sun on the rotation of light should be calculated. (The influence of the moon on a ray of light by creating a ripple in the atmosphere during a solar eclipse must not be overlooked; an investigation of the trajectory of a stellar ray passing close to the moon in a lunar eclipse is suggested here.)

8.

The repulsion of a comet's tail by the sun. The head of a comet and its tail are charged under a great potential difference, accounting for the manifest repulsion of the tail and attraction of the head. The neck of the comet is probably composed of positive and negative elements in equal proportion, thus forming a neutral zone between the head and the tail. Under the influence of the temperature in space the charges change and the comet returns on its orbit.

9.

The displacement of the meteorites in the higher atmosphere. It is caused not by the winds, but by the electromagnetic effect of the ionosphere. The light of the meteorites is caused by electric discharges. Consequently, the passage of meteorites disturbs radio reception.

10.

The influence of the moon on radio reception. The charged moon on its hourly stations exerts an attracting-repelling action on the electrified layers of the atmosphere (ionosphere) to a greater degree than on the "insulating layer" of the earth's atmosphere.

11.

The semi-diurnal variations of the barometric pressure. These variations with maxima at 10 a.m. and 10 p.m. have their cause in the semi-diurnal changes of the charge of the ionosphere at the same hours, 10 a.m. and 10 p.m. The barometric pressure reflects the degree of attraction exerted by the ground and the ionosphere on the gaseous envelope.

12.

The defiance of gravity by water and cloud building. The ground and the ionosphere induce secondary charge-layers in the atmosphere. In such a secondary layer cloud-building takes place. Generation of electricity in clouds is due not to the friction of neutral clouds on mountain ridges, or to the friction of neutral clouds among themselves, or to the friction of droplets by the gravitational pull on them, but to the fact that droplets rise already charged toward the charged layer of the atmosphere, and clouds are further subjected to induction by the ground and the ionosphere. This explains also the segregation of the charges in the upper and lower levels of the clouds.

13.

Defiance of gravity experienced in the cumulo-nimbus clouds. This defiance recorded by airplane pilots is the result of charges and electromagnetic effects prevailing in these clouds.

14.

The direction of the cyclonic and anticyclonic whirls. Their direction on the earth, as well as on the sun, depends on the electromagnetic fields and not on the rotation of these bodies.

15.

Increased gravity over the sea. The increase of gravity over the sea as compared with that over the continent may be explained by the higher charge of salt water.

* * *

There were a few attempts made to unite the electromagnetic and gravitational field theories; but as far as I know nobody has tried to solve the problem of planetary movement around the sun as a motion of charged bodies in a magnetic field; my explanation implies that the measurement of the solar magnetic field by Hale is not correct.

If the sun has a sufficiently strong magnetic field so as to reach the farthest of the planets, the quantitative elements are dictated by the charge of the sun, the strength of its magnetic field, and the charge of the planets.

* * *

The theory of the Cosmos without Gravitation given here in synopsis is written also in a comprehensive form (1941-43). I arrived at this concept early in 1941 as a result of my research in the history of cosmic upheavals as they affected the earth and other members of the solar system. A number of facts proved to me that the sun, the earth and other planets, the satellites, and the comets, are charged bodies, that the planets and their satellites have changed their orbits repeatedly and radically, and that gravitational attraction or the weight of objects has changed during human history. I thus recognized the fact that not gravitation, but electric attraction and repulsion and electromagnetic circumduction govern the solar system.

In construction the electromagnetic theory of the solar system, I am indebted to Miss Shulamith Velikovsky for valuable suggestions on the dipole explanation of attraction between the atoms and the dipole concept of inertia.

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