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NEW THEORIES
OF THE
GREAT PHYSICAL FORCES.

ROGERS.



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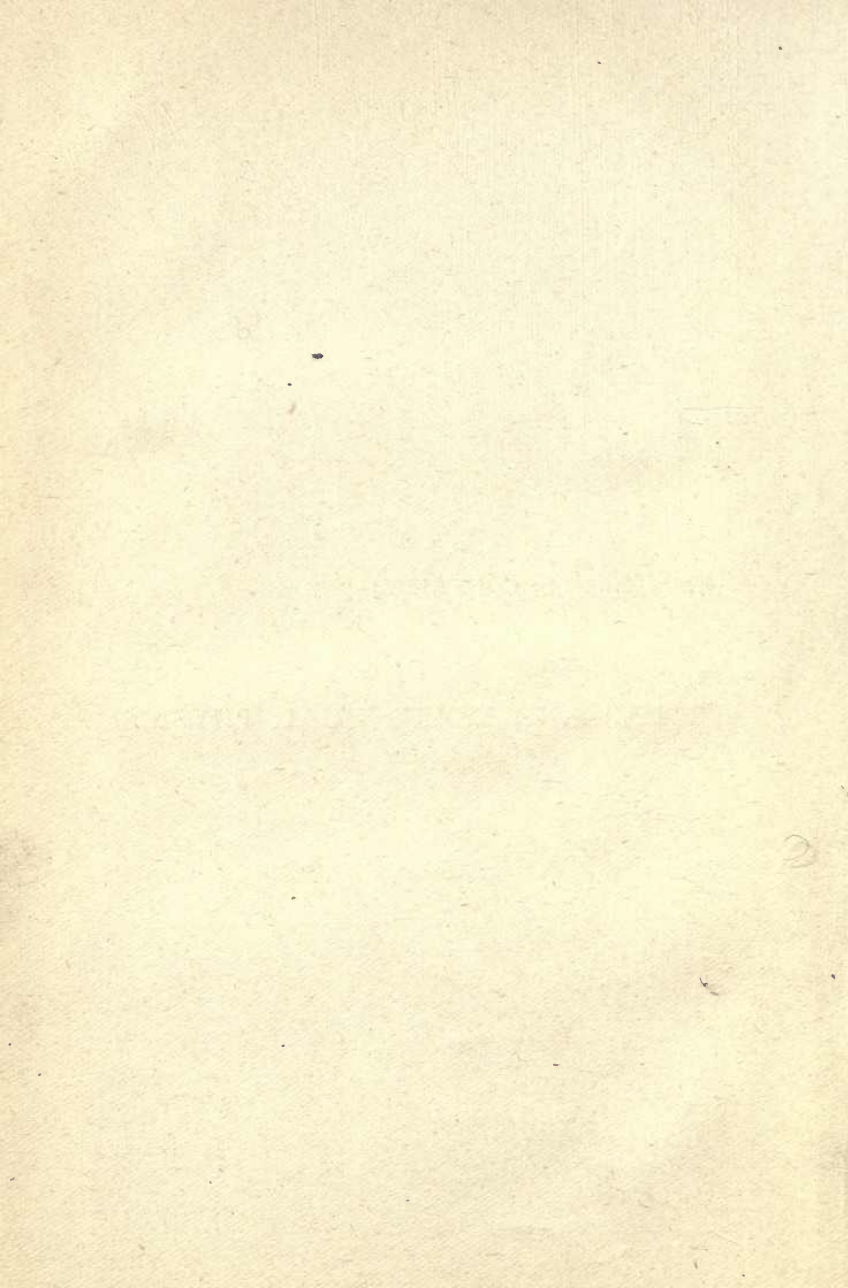
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CONTRIBUTIONS
TO
SOLAR AND TERRESTRIAL PHYSICS.



“In knowledge, that man only is to be contemned and despised who is not in a state of transition.”

“— nor is there anything more adverse to accuracy than fixity of opinion.”—FARADAY.

“Science must grow. Its development is as necessary, and as irresistible as the motion of the tides, or the flowing of the Gulf Stream.”—TYNDALL.

“The cry of science is still onward, and its goal of yesterday will ever be its starting-point to-morrow.”—DAWSON.

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NEW AND ORIGINAL
THEORIES
OF THE
GREAT PHYSICAL FORCES.

BY
HENRY RAYMOND ROGERS, M.D.

"Every time
Serves for the matter then born in it."
SHAKSPERE.

PUBLISHED BY THE AUTHOR.

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By HENRY RAYMOND ROGERS.

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PREFACE.

“ Show me a man who makes no mistakes, and I will show you a man who has done nothing.”—LIEBIG.

IN this little volume the author gives but his own personal opinions upon the subjects discussed, and although the sentiments are expressed with an assurance born of conviction, yet he claims not infallibility.

He has ever been unable to accept the usual explanations of the great physical forces ; and the inadequacies of mooted theories have impelled him to efforts for more philosophical interpretations. If in his investigations he has been forced to strange and unusual conclusions, he has been actuated only by an honest desire to promote the advancement of science.

He is not insensible to the responsibility of the position which he thus voluntarily assumes, in asserting his opinions upon problems so vast and momentous.

It is no enviable position to occupy, that of

antagonism to so large a proportion of the scientific world and, too, upon subjects of strictly scientific import. That he does thus find himself placed in such relations at the present time, has not been a matter of his own seeking. No other consideration than the profoundest sense of duty and responsibility could have influenced him in the course pursued. Perhaps some apology is yet due for so boldly trespassing upon hypotheses which were very generally thought to be well established, and certainly secure from such treatment.

The attempt, in a measure, to develop so extended a field of research, in so few pages, has led to much crudeness in the presentation. For this a reasonable indulgence may be claimed.

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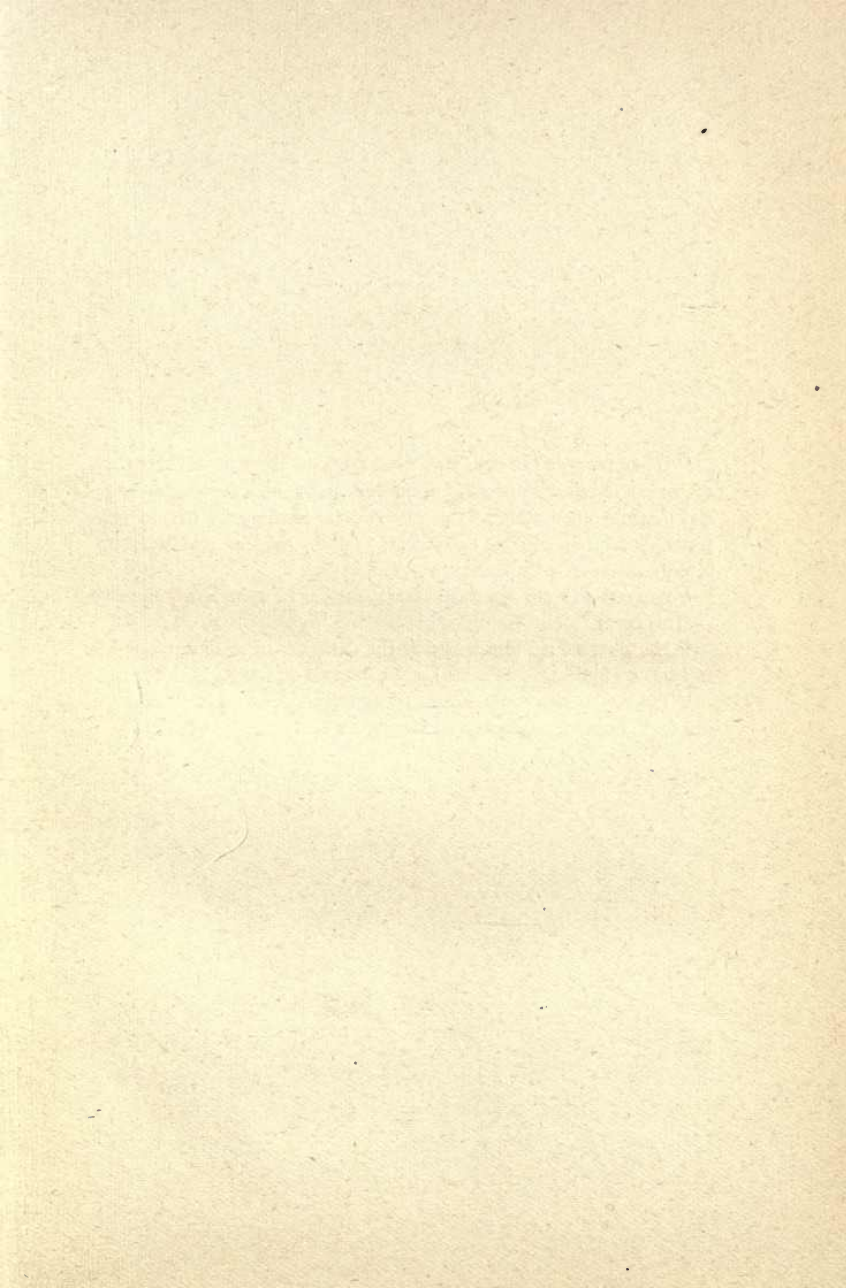
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“If we suppose the sun and fixed stars to be gigantic fountains of magnetic influence, acting upon our globe and its atmosphere, and likewise upon all the other planets, the phenomena of the universe would then become susceptible of the grandest and simplest interpretations.”—CROSSLAND.

“Are not the sun and fixed stars great earths vehemently hot?”
—NEWTON.

“Herschel’s fixed idea was that the darkness of a spot upon the sun was an indication of a cool and habitable globe.”—HUMBOLDT.

“The sun as the main source of light and heat must be able to call forth and animate magnetic forces on our planet.”—*Ibid.*

THE
GREAT PHYSICAL FORCES.

CHAPTER I.

INTRODUCTORY.

The Sun.

THE sun's position in the great field of energy is daily becoming more exalted in the estimation of philosophic minds. His labors are being revealed to us with a distinctness never before conceived. He it is that stored the coal in the bosom of the earth, and piled up the polar ice. He it is that aids the chemist, drives the engine, ripens the harvest, dispenses life and health.

The study of the sun and solar physics, therefore, must be essential to the right understanding of whatever we observe to take place at the earth. Sun and earth are united in indissoluble bonds. In philosophic minds

the conviction of a most perfect *inter-dependence* is rapidly gaining ground.

All this has been known and appreciated to a degree, yet this great source of universal operations is shrouded in mystery. Still, our curiosity has been kindled, and men are eagerly looking for further developments.

Natural Science, in all her branches, is fully awake, and is on her watch-tower of observation. Ignorance of the sun, of its character, and of the methods by which its functions are performed, must be confessed; notwithstanding all the more recent unfoldings and imaginings of scientists, regarding the great orb. But yet we are very hopeful of vast increase in our solar knowledge; not alone, or chiefly, by new observations, or discoveries, but quite as much by new interpretations of old, long observed phenomena. The ground of hopefulness lies in the belief that a *grand unity* underlies, and binds together in one, all Physical Forces, as well in earth and sun.

While regarding the sun as all, and more than all that has ever been claimed for it, still we are impressed most strongly that the sun has *social relations* with his planets, which have never been duly considered by the masters in science. The sun *acts*, but it must

also be that the earth and planets *react*. The sun gives and dispenses favors, but science has too much overlooked the great fact that the sun receives and sympathizes.

Let our philosophy but accept the idea that *the sun rouses the earth into action through their mutual relationships ; that the two interchange good offices and essential services, rather than that the sun is wholly independent, and simply gives outright, as philosophy has hitherto conceived, and we think that the dawn of a better day has come.*

The new philosophy, in our opinion, will teach that the sun gives in such a way that he will not be impoverished ; that though bountiful, he is not wasteful ; that though he freely gives, yet that he also as freely receives in return.

The new philosophy will be true to correlation, and it will be true to conservation as well.

CHAPTER II.

WHAT IS PROPOSED.

IN the following pages I shall endeavor to set forth, in a simple and orderly manner, certain of my own theories of the Great Physical Forces.

In these theories will be comprised the identity of those forces, the intimate and essential nature of sunlight, sun-heat, gravity, sun-spots, winds and sounds, also the intimate nature of the atmosphere.

In treating these subjects my opinions will not be found in accord with those which receive universal assent at the present time, and I may thus unintentionally offend. I shall therefore claim exceeding indulgence.

If I differ from high authority, I have not a thought of detraction. None can venerate the NESTORS in science who have enriched its annals, more than I, and though we reverse their judgments, their errors are confessedly our indispensable helps and guides.

The Great Problem.

The problem of the great physical forces has engaged the profoundest attention of mankind from the earliest historic period down to the present time, yet it remains practically unsolved.

Before the Christian era the opinion was entertained that all of the phenomena of nature might be reduced to one principle of explanation ; that there was more than a connection between the imponderable agents—more than a relationship even,—that there was an actual identity.

No substantial progress was thereafter made in the direction of verifying this theory until along into the present century, when the development of electrical science presented a tangible basis for successful investigation.

The correlation of nearly all of those forces is now assured, leaving little to be added besides gravity to complete the unity. Yet notwithstanding the satisfactory progress which has been made in solving the grand problem of their correlation, little has been learned of their intimate nature, and the method of their operation. This is due, in the highest degree, to certain theories which

were developed, and which made their way, *pari passu*, with the advancements of electrical and electro-magnetic science. These theories, specious, inconsistent, illogical, yet withal plausible, and even fascinating, served to blind the mental vision so that mankind might not appreciate the truth.¹

The hypothesis promulgated by BRUNO, KANT and LAPLACE, of the nebular origin of the spheres, and the deductions consequent thereupon, in regard to the progressive stages through which the earth in its developments has passed, was pernicious in its influence in diverting the minds of investigators from other and truer channels. To the blind confidence with which that hypothesis has been universally accepted and perpetuated, and to the fallacious theories thus directly and indirectly engendered, we owe our false position at the present day.

The present theories of the transmission of light and sound; of the production of winds, and sun-spots, and of the method of development and dissemination of heat, are in point of fact, unphilosophical and incomprehensible.

¹ Appendix, p. 97.

It is quite remarkable that in the present century, excelling as it does any period in the world's history in exact and reliable scientific knowledge, such unsatisfactory opinions should obtain. The failure is still more inexplicable when we reflect that these subjects are in importance the highest which can engage our attention as scientists.

We have at the present time sufficient reliable data whereon to found satisfactory hypotheses. We have but to utilize the means which the true scientists of the century have so wonderfully developed, and with which they have so prodigally surrounded us, in order to complete the consummation of the great and crowning achievement in physical science.

CHAPTER III.

THE GREAT FORCES, THEIR CHARACTER AND OPERATIONS.

I NOW ask, What is the intimate and inherent nature of those forces? Do they, or either of them, belong to the domain of the supernatural? Are they the products of some supreme force, or forces, heretofore unappreciated? The reply is clear and unquestionable. The supernatural must necessarily be a part of the Divine Essence, and consequently intangible. Not so the subjects of our inquiry. They are *natural products*, therefore, and *the result of the operation of some power commensurate with the stupendousness of their manifestations.*

Sunlight and Sun-heat.

In the forces, light, and heat, what immensity of power is represented! Strangely enough we have ever imagined these forces to be the unaided work of the sun, as though that luminary could be capable of sending

forth in undiminished exuberance, such marvels of force, during all the ages, and remain itself unexhausted !

The Great Law of Conservation of Force.

But how speaks the law of conservation, that law most enduring, and most inexorable? According to the decrees of that law, whatever is received by the earth from the sun, an equivalent for the same must again be returned from the earth to the sun, to the uttermost fraction.² Such being the conditions, how may this retro-acting process that all analogy and the profoundest scientific axiom prove to be in constant operation—how, I ask, may this retro-acting process be explained? What equivalent may the earth give back as compensation for such enormous benefits, for such stupendous powers? The laws of conservation may not be violated: *the earth will respond.*

How are the Spheres constructed?

The constitution of these two retro-acting spheres, and consequently of all the others of

² Appendix, p. 98.

the heavenly host,³ at this point demands our attention. How are the spheres made up? How speaks the earth? The earth with which we are familiar—our sample—is formed of a slight crust, a core, to a greater or less extent and degree incandescent, and measuring 250,000 millions of cubic miles in dimensions, also an envelope which we call the atmosphere.

Now, from the presence of the vast mass of incandescent material within the enclosure of each sphere-crust, it may reasonably be inferred, nay the very nature of human reason *compels* the decision, that *they are placed there for some specific purpose*, and that *their operations are commensurate with their immensity*.

We may not neglect to make account of so vast an element, and so vital and preponderating, in all globes.*

We are thus compelled to answer the question, What part in the economy of nature is this great central core particularly fitted to perform? What its function among the great forces?

³ Appendix, p. 99.

* The earth's core constitutes nearly $\frac{98}{100}$ of its entire mass.

The great problem of the age, which scientists are intently engaged in solving, is the correlation of the leading forces already adverted to. Thus far light, heat, electricity, magnetism, chemical action, vital action, cohesion, etc., have been proved to be parts of one great whole. Now, since the especial characteristic of the great earth-core is heat, it comes directly into relationship with the forces mentioned. How then are its forces expended? Through what channels do they manifest their presence? The philosophical mind would most naturally associate with it the idea of stupendous magnetic power. We may well suppose such a power extending its influence through and beyond the earth-crust, reaching out towards the moon, and retro-acting with that body in preserving their mutual relations.

Does not this mighty influence reach out toward the sun also, and act conjointly with that great central orb in producing results, which to us, have ever been great mysteries.⁴

The Grand Magnetic Circuit.

In the retro-acting influence in operation

⁴ Appendix, p. 99.

between these great bodies, may be found *A Grand Magnetic Circuit*. In this grand magnetic circuit is found the *key* to the whole subject of the correlation and identity of all the forces.

And now, as preparatory to using this *key* that we may enter in and consider the intimate nature of the physical forces, we would be impressed with the clear and full idea of this mighty *current*, which bears upon its tide, *as one*, all manner of forces with which we have to do.

It remains for us to tell what this great current *is*, and what it *does*. To the child, to the savage, and to the civilized man alike, it comes first and pre-eminently as light.

CHAPTER IV.

SUNLIGHT.

Its Source and Nature.

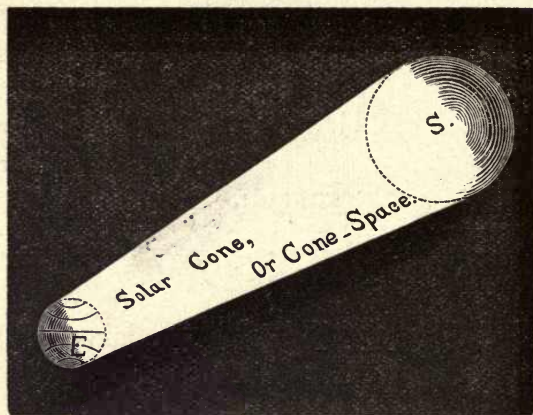
SUNLIGHT is one of the products of that grand retro-action which is incessantly in operation between sun and earth, and is, in its intimate and essential nature, a vito-magnetic *fluid** (or so-called magnetic). Subtle, and apparently intangible, manifesting itself rather as a presence than a real substance, it fills all the space between the sun and earth—which space may, with sufficient accuracy, be termed the solar cone or cone-space.

Its Limits.

Beyond the boundaries of the solar cone,
no light is.

* This term is employed as being most exact and comprehensive, as this fluid is now known to be the source of all life and all attractions.

SOLAR CONE.



Pl. I.

The Sun not Incandescent.

The apparent brightness of the sun is owing to the aggregation of the 93,000,000 of miles of this fluid which is present between the sun and earth, ~~or to~~ our presence in the great current of activity of the vitomagnetic force. It is therefore not due to a condition of incandescence *at* or *near*. that body. It is cool and habitable, and emits no light. The brightness of the intervening fluid intercepts the view, and thus no one may behold its body. Dark spots upon its face disclose its true character.⁵

⁵ Appendix, p. 99.

*To be attached to page 31, "New
and Original Theories of the Great
Physical Forces."*

To be attached to page 81. "New
and Original Theories of the Great
Physical Forces."

Light and Heat.

BY HENRY RAYMOND ROGERS, M. D.

From the Buffalo Courier.

Scientists have practically ignored the existence in nature of two distinct forms of light and heat. This two-fold division is clear and demonstrable, yet investigators in these fields have made too little account of it in their reckoning. The failure to recognize this fact has been the source of errors and confusion in our philosophy of these forces. The two forms while possessing certain properties in common, have yet other properties quite dissimilar. Different in the manner of their production and in their effects, it is a question whether they are not essentially different in their nature.

The first form, that of *combustion* light and heat, is dependent for its production upon the combustive destruction of inflammable materials due to the action of oxygen. Examples of this form are the lights and fires of our homes.

The second form we term *magnetic*—in the production of which oxygen has no part. Examples of this form are the magneto-electric and the dynamo-electric processes—the latter of which is pre-eminently the topic of the day. The peculiarity of this form is that light and heat are not necessarily manifested at or near the seat of production, but exist potentially, their development as light and heat being effected wherever the proper conditions are provided. This magnetic force, while permitted to flow freely through a perfect conductor is never developed into light and heat, but

is only converted into these forces as the current encounters and overcomes resistance.

The operations of these two forms are characteristically different. The former are feeble in power and are transmissible to but short distances. They act by continuity, and speedily diminish in intensity as the square of the distance increases. The latter are transmissible in any direction, and by any pathway, and have scarcely any terrestrial limits. They are transported by wires over continents and beneath oceans, and many miles of *space* have been traversed by them without visible means of conduction. But, unlike the former, they do not pass as sensible light and heat.

Their functions differ. The magnetic form of light may be employed in photography, and by it the various shades of color may be discerned in the night season. In strength and brilliancy the magnetic light alone resembles that of the sun.

In our studies of these forces we have been greatly impressed with the similarity between the operations of the magnetic class and the productions of the sun. This similarity naturally suggests the question whether there is not good reason to suppose that sunlight and sun heat, as to their production, follow the analogy of the superior process, rather than the inferior,—that its action is magnetic, rather than combusive.

This suggestion affords immense relief. If light and heat are regarded as magnetic, we are apparently eased of the great burden of finding adequate supplies of material to keep up, and to keep uniform, the vast conflagration sup-

posed to rage at the sun. Unquestionably this has been a tax upon ingenuity which neither we nor our scientific fathers have been able to bear. If the magnetic process be admitted, the loss and waste involved in the combustive process,—enormous beyond computation, may possibly be relieved, and the great law of conservation of force thus jeopardized, even in the house of its friends, may still be maintained in its integrity.

The demonstrations of our senses, as well as the teachings of all the ages based upon these demonstrations, lead us to attribute to the sun the possession of a most dazzling brilliancy, and an unlimited amount of heat. So it certainly appears; and every hypothesis that has ever had a hold upon the scientific mind has been based upon that conception. Yet the simple fact that the earth receives its heat through the agency of the sun is not conclusive evidence that the sun is itself hot. On the contrary it is well known that heat rapidly diminishes in the direction of the sun; and at the altitude of considerably less than two miles lies the line of perpetual frost, the temperature of space progressively lowering beyond that point.

Standing as diametrically opposed to the old methods of thought is the fact that the sun is not inherently brilliant. Beyond the lower portions of the atmospheric mass there is no dazzle. Only a short distance upwards from the earth at a point where respiration, by reason of the rarity of the atmosphere, becomes impeded, the human eye may behold that great orb undazed.

Thus sun light and sun heat are shown to resemble the light and heat which we are able to develop through the aid of our magnetic machines. The fact of the actual production of the intensest heat yet reached, through the agency of mere motion, opens up to us a new view of these great forces. As motion applied to our dynamo-electric machines is *changed* or *converted* into light and heat, so also may sun light and sun heat be the products of mere *change*, of simple conversion of force instead of the products of a measureless and ceaseless destruction. The element out of which they are developed passes, as we may suppose, through all space without visible form or manifestation, as electricity through wires, and without visible means of transportation; as for example, Prof. Loomis sent the magnetic current from kite to kite, flown from Virginia mountain-tops, twenty miles apart. Moreover, as the "carbon point" or the "platinum coil" is the necessary resistance, the encountering of which develops the electric light out of our little electric current, so may this earth's atmosphere furnish the required resistance out of the encounter with which the great current of force from sun to earth, invisible while passing through vacant space, becomes *manifest* light and heat. The analogy, to say the least, is very striking.

Science at the present time admits of four different explanations of the production of sun-light and sun-heat, viz:

- (1). Combustion of cosmical substances falling into the sun;
- (2) arrest of motion of such cosmical substances;
- (3)

contraction of the solar mass ; (4) dissociation of compound bodies in the sun's substance.

It will be observed that there is no recognition here of the two forms of light and heat; the sun is by all of them made the manufacturing place of light and heat, as well as the distributing reservoir, whence the whole solar system is supplied; not with the invisible, insensible, potential, light and heat, *to be developed where required*, but with these actual forces.

The first hypothesis, that of "combustion," is virtually given up by scientists on account of its insuperable difficulties. The fuel problem is too intricate for the finite mind.

The second, the so-called *mechanical hypothesis*, is held in greatest favor by scientists to-day as best accounting for the phenomena; or as being least vulnerable to objections. This hypothesis pre-supposes the presence in space of an incalculable supply of ponderable masses, all roving loosely and by chance, until falling under the influence of the sun they are drawn thereto with such momentum that the concussion gives rise to inconceivable light and heat. We may, however, be allowed to question whether the doctrine of chance can account for our exact and definite supply of light and heat without excess or deficiency. But such existence of ponderable matter, away from the influence of gravity, moving about in the universe, and assumed to follow the attraction of the nearest stellar system, can hardly be credited by philosophic minds.

It is incredible that such matter has ever by any agencies escaped from the

power of gravity after having once been under its influence. It may reasonably be supposed that any body or substance which would be capable of floating loose in space must have its origin in some sphere. It could not otherwise have an existence; and having once formed the part of some sphere, no power could detach it from its surrounding and project it into space, other than through disruption of the parent body. But the history of science has furnished no evidence of such disruption.

The insignificant manifestations, such as ærolites, meteorites and meteors, which bring with them nothing foreign, should not be received as evidence in the establishment of a philosophy. The tame uniformity of those bodies, and the slight inclination of their pathways earthward, preclude their being classed with external forces. Ærolites of immense size are not unfrequently observed to pass in a direction almost horizontal to the earth and in close proximity to it, for hundreds of miles. This fact is very damaging to the philosophy which the phenomenon is claimed to sustain.

In view of all the facts which physical science presents, we are forced to the conclusion that there are no foreign bodies or substances existing in space; that none may be found within the range of our atmosphere, or which may come within its range, which are not of purely terrestrial origin.

The supposition that old useless worlds, comets, meteors, etc., are attracted to the sun to be utilized for the production of its light and heat, is contrary to every principle of reason and

sound philosophy, and is therefore unworthy of consideration.

The inevitable enlargement of the sun's dimensions which would occur from the accretions resulting from this method, would also prove fatal to this hypothesis. An exact knowledge of the sun for centuries has not in the slightest degree disclosed a change of radius in the earth's orbit; a necessary consequence of any change in the sun's bulk.

The third hypothesis, "the contraction of the solar mass," implying a progressive diminution of that body, finds the same objections which lie against its progressive augmentation.

The fourth, "the dissociation of compound bodies in the sun's substance," depends upon the process of combustion, (SECCHI, "*Le Soleil*,") and is therefore open to the objections already named.

Each of the foregoing hypotheses stands in direct opposition to the inexorable law of conservation of force. According to the decree of that law, whatever is received by the earth from the sun, an equivalent for the same must again be returned from the earth to the sun to the uttermost fraction. Each recognizes the presence of a vast flood of light, heat and magnetic force, (*gravity*) incessantly issuing from the great solar mass, and proceeding therefrom with inconceivable velocity to the earth. Yet neither makes provision for the retro-acting, or returning force, which under that law becomes indispensable.

No hypothesis based upon any other foundation can stand.

Each assumes the actual and indispensable presence of light and heat at

the surface of the sun, or in its envelope, as elements in the solar economy. But, inasmuch as heat does not come from the sun as actual heat, and we may suppose also that light does not come as actual light, then there really exists at the sun no necessity for the enormous production there, such as these hypotheses demand.

Again, the prodigious destruction of material claimed to be involved in the production of light and heat at the sun, and the expenditure of an inconceivable amount of force in projecting the same in all directions, and to all distances into space, are thus shown to be uncalled for and therefore irrational.

The analogy between our little magnetic batteries and the great sun battery has a yet deeper significance. Our magnetic battery, in the process of developing light and heat, develops also another *force*, that of attraction. Magnetic light, heat and attraction, are thus known to be products of one process. Analogy suggests that *attraction*, or *gravity*, in like manner is developed by the great sun-battery, and is likewise an integral constituent with sunlight and sun heat. These great sun forces, therefore, may not be regarded as three distinct entities, but rather as different effects of one and the same action.

Thus the fact that the sun and earth are gigantic fountains of magnetic influence, continually acting and reacting upon each other, as is claimed by the highest authorities in physical science, gives to the phenomena now being considered their clearest and fullest interpretations.

Dunkirk, N. Y., August, 1879.

COLD.

Its Relations with the So-called Physical Forces.

BY HENRY RAYMOND ROGERS, M. D.

That cold is simply "*the absence of heat,*" is apparently unquestioned by the scientific world. Physical Science consequently gives it no position as a positive force. Yet the manifestations of the power of cold are many, and plain; taking on forms of exquisite delicacy, as well as of stupendous magnitude and power. It has, moreover, as distinctive operations, and as clearly defined laws. Cold should therefore take rank with light, heat, electricity, magnetism, gravity, etc. The recognition of this force must introduce great light into science in many of its branches.

The powers of cold are unquestioned. The almost fabulous polar ice-fields show its might, and the delicate fern-like frost pictures upon our window-panes, attest the presence of a real force.

To compare it with heat it is not less active. Heat expands, cold contracts;

heat drives the needle of the galvanometer in one direction, cold drives it in the opposite. Cold equally affects the senses. Cold is subject to the same laws of reflection. Surely the *absence* of something cannot be *reflected* from a polished surface. Applied to water confined within strong vessels, cold causes the walls of the vessels to burst asunder by the expansive force of crystalization. The marvelous power thus exercised may not be attributed simply to the absence of heat,—a mere negative condition. The particles of water which compose the icy crystals are arranged in due order, and perform their functions through the operation of a power not less real than that of either of the great forces.

Cold is generated by the solution of certain bodies, as heat is, by the solution of others.

The power capable of disrupting and disintegrating the earth's solid crust, and of bridging a mighty river in a single night,—the power which topples down massive walls of masonry, can hardly be regarded as a slight thing, or a figment of the imagination.

Heat and cold, so opposite in their effects, are, we believe, correlated as truly as are the negative and positive conditions in electricity. One may not presume to say that either is mightier, or more real, than the other.

The physical changes that give rise to this phenomenon are not appreciated; hence cold is assigned a false character. But heat is necessarily involved with it in misunderstanding. The rectification of the latter waits upon the recognition of the nature of cold.

The sun is represented as an incandescent mass, inconceivably hot, with a temperature rated at millions of degrees ; yet heat *diminishes* in the direction of the sun, and at a short distance from the earth the temperature becomes inconceivably cold. Thus no particle of heat reaches the earth, from that body, *as heat*.

In like manner sun light, which is subject to the same creative cause, and the same method of transmission as sun-heat, rapidly diminishes in the direction of the sun ;—so rapidly that the sun, at the elevation of a few miles, looses its brilliancy, and may be viewed with undazed eye.

The sun is therefore presumably cool and dark,—not differing from the earth in its physical conditions and in its habitability.

The vastly important inference therefore,—an inference that must lie at the bottom of all true physical philosophy, is, that there is some great primordial principle *acting through* the sun, and which is so fitted to operate upon our atmosphere as that it causes all necessary forms of activity in air and earth.

These varied forms of activity,—though we call them “the physical forces” as if they were really distinct and independent, and not but correlated *forms*,—embrace certain peculiar activities which we term *cold*, as truly as others which we call light, heat, electricity, etc.

It is the constant recognition everywhere, of the great primordial principle operating differently according as it is differently conditioned, that must set us into the right understanding of all phys-

ical changes taking place upon the earth.

The mere *absence* of a force (*i. e. nothing*) accounts for nothing.

In the new interpretations of the great forces which must surely come, and at an early day, cold will be awarded a position more in accordance with its deserts,—equal place among the recognized forces.

When the immutable law of conservation shall be applied to the investigation of those great forces, and shall be made the criterion by which to judge each one of them, its character, and mode of operation; a new era in the history of science, and in the development of human knowledge will have been attained.

Dunkirk, N. Y., December, 1879.

If, therefore, the sun be truly dark, the brightness of its satellites cannot be caused by light projected from its surface or surroundings. How, then, may we account for the light of the moon and planets, which do not possess a light *sui generis*? A new hypothesis is requisite. To frame this hypothesis is not difficult.

The New Hypothesis.

Analogy teaches us that the earth is seen from the moon and planets, even as they are seen from the earth. Yet there is nothing upon the face of the whole earth which is capable of reflecting the slightest amount of the sun's rays to those spheres. The fields, forests, rocks, and seas, only absorb light, they do not reflect it. In this phenomenon, therefore, there is no element of specular reflection. It consists rather of the lighting up of the static vito-magnetic fluid of our atmosphere, by the great solar current. The atmosphere, thus vivified, discloses our presence to those orbs, and in like manner, their presence to the inhabitants of the earth.

No Borrowed Light.

The light of the planets is therefore in no sense a borrowed light, since the action which generates and transmits it, is purely co-operative. Otherwise there could be no light at the earth, or planets.

The Sun Dependent for His own Supply.

And, indeed, the sun possesses within himself alone no element of supply of his own needed light and heat; and in his immensity and power is even *dependent* upon the circling orbs, for the quantity of each which is indispensable to a condition of habitation.

The bodies of the planets are in like manner invisible; we behold but the illumined atmosphere of each sphere. Thus the moon and planets, to be visible, must possess atmospheres.

Light as a Substance.

That the thunderbolt is a substance may not be questioned. That the aurora borealis, or polaris, another form of vito-magnetic

fluid, is a substance is not questioned. The so-called heat-lightning, though apparently intangible, must therefore be regarded as a substance. Yet further in the remove we find the zodiacal light. Sunlight is but the same, in form of extreme tenuity. The thunderbolt passes from earth to cloud, and instantaneously changes its *substantial* form to one as tenuous as light; yet, in the transformation, this fluid has not lost its identity. Though unseen, it continues to exist as matter.

Velocity of Light.

While ever present, light is being incessantly replenished; its action being instantaneous. The calculations of ROËMER, founded upon observations made through spaces of 382 and 568 millions of miles of distance, should not be too confidently accepted, especially as the results of such conclusions are so vitally important. When we consider that with our best telescopes directed towards the moon, less than a quarter of a million of miles distant, nothing really satisfactory may be discerned, what value, therefore, may be attached to statements founded upon such thoroughly unreliable data?

BRADLEY'S estimate of the velocity of light, founded upon his study of "the aberration of light," is even less worthy of consideration.

Any effort to measure such an inconceivable velocity as that claimed for light, by any means or appliances which may be devised by human ingenuity, must be regarded as futile. DESCARTES says: "Light reaches us *instantaneously* from the sun, and would do so, even if the intervening distance were greater than that between the earth and heaven."

CHAPTER V.

SUN-HEAT.

Its Source and Limits.

SUN-HEAT is another product of the same retro-action between the sun and earth ; consequently it has the same range and the same boundaries as when it is viewed as light.

Tendencies to unsettle in Science.

The scientists of to-day may well look after the soundness of their favorite theories of the great physical forces ; for the uncertain tenure of old theories, by reason of recent discoveries, is becoming but too manifest. New phenomena are now observed which require solutions not met by present hypotheses. The nebular hypothesis which has so long possessed the scientific mind has, by the discovery of the moons of Mars, become a thing of the past. According to M. MAICHE, water is found to be no longer the old-fashioned conventional oxygen and hy-

drogen, but essentially a new element must be considered in estimating its composition.⁶ Light is ascertained to be as veritable a substance as water. The sun is recognized to be dark, cool, and habitable. Messages go through the air from kite to kite ten miles apart without visible agency. Telephonic sounds leap from wire to wire through quite ten feet of space.

Present theories of Supply of Sun-heat.

The present theories of the production and dissemination of sun-heat, are simply accepted for want of better, and not because they account satisfactorily for the phenomena.

The first and most prominent is the combustion theory, which, though bearing the seal of ages, is obnoxious both to common and philosophic reasoning. This theory presupposes a consumption of material beyond all conception, and the supply of which has been no small tax upon the scientific imagination. The source of this supply has been claimed to be the subsidence of useless worlds, and of asteroids, and meteors, show-

⁶ Appendix, p. 99.

ered down upon its surface. Estimates have been carefully made, and we are gravely informed of the probable amount of combustive material required to supply the sun's demands for given periods. It is said that the coal-fields of Pennsylvania, which would supply the world's consumption for centuries, would keep the sun's rate of emission for considerably less than $\frac{1}{1,000}$ part of a second. POUILLET estimated the quantity of heat emitted by the sun per hour to be equal to the supply of a layer of anthracite coal ten feet thick, spread over the whole surface of the sun.

The theory advocated by HELMHOLTZ, and by many other scientists, of "the gradual contraction of the solar orb," and that of SECCHI, "the dissociation of compound bodies in the sun's substance," are attempts after a more consistent philosophy.

The foregoing theories pre-suppose the sun to be a glowing fiery mass, from which, in all directions, issue radiations of heat and light into space. Of this enormous quantity of radiated heat, the earth is supposed to receive but $\frac{1}{2,000,000,000}$ part.

MEYER observes: "*A general law of nature which knows no exception is the fol-*

lowing: *In order to obtain heat, something must be expended.*"

This combustion theory therefore calls for an enormous expenditure of material for generating heat and light, together with a still further expenditure of force for projecting these into all space, at all distances. All these theories are therefore inconsistent with the immutable law of the Conservation of Force.

The true Source of Supply.

In seeking the source of supply of heat and light, we are compelled to look for a philosophy more consistent than any hitherto advanced. Controlled too much by the literal evidence of the senses and the superficial appearance of things, we have ever regarded the sun as ALL ALONE in developing and exercising these great forces.

The law of conservation compels us to look to the *earth*, a heretofore neglected factor in this problem. This factor being introduced we shall find the problem to be wonderfully simplified.

All space may rationally be regarded as complete vacuum, thus presenting no resistance nor obstacles to the free progress of

the retro-acting elements. Distance is then virtually annihilated, and Mercury, 37,000,000 of miles from the sun, and Neptune, 2,800,000,000 of miles, stand alike in their relations with the great central orb.

The Earth's part in the Process.

The earth may no longer be regarded as having a merely passive part to play. The forces in operation as between the earth and sun, are purely co-operative, and the one precisely counterbalances the other. The earth, therefore, must have a *vis viva* within itself, capable of reciprocating in the organic functions of the great vito-magnetic circuit. We certainly know that it possesses a marvellous wealth of resources. The following are the most important of its sources of *vis viva*.

1st. The great reservoir of vito-magnetic fluid, the vast incandescent earth-core. The presence and activity therein of mighty force, —of heat, and motion, in the highest degree, are abundantly shown by various terrestrial phenomena. These phenomena, while perfectly familiar to observers, seem never to have received any fitting interpretation.

2d. Motions and frictions of every kind ; * the motions of the waters of the earth, the great oceans, with their rolling tides sweeping the whole circumference of the earth twice in twenty-four hours, at a speed of one thousand miles per hour ; with its frictions upon itself, the bottom, and the shores ; its great storms lashing it into fury, and its gentler motions from lesser winds ; also the motions of all seas, rivers, and rain-falls.

3d. So all motions of the air, in form of hurricanes, lesser winds, or zephyrs ; tearing their way through forests, and hills, and through space ; or causing gentlest flutter of leaflet. We have witnessed their goings forth, but have neglected to calculate their mission.

4th. All chemical actions.

5th. All combustions.

6th. All evaporations.

The *earth* is thus elaborating in all her gigantic processes, the materials and forces, which *she* furnishes in the great interchange. How strangely have these great sources of

* In the motions of the spheres through space, unlike all other forms of motion, there is no element of resistance. This form of motion is therefore incapable of developing *vis viva*.

vis viva remained practically unheeded until the present time.

The Sun's part in the Process.

The part performed by the sun may but feebly be conceived.⁷ Within its vast proportions (being 1,000 times as large as all the planets combined) may be found every element suited to all requirements.

We seek a new Philosophy.

The construction of a true philosophy of the physical forces must depend now upon our rightly understanding the *modus operandi* of the conveyance, and utilization, of these sun-elements, and the workings of this sun-power.

The presence of a veritable flood of light, heat, and magnetic force, as in motion from the sun to the earth, has ever been recognized. *The line of greatest intensity of this solar, or vito-magnetic current, is found along the line of greatest diameters of those bodies.* The centre of this current reaches the earth at, or near the equator.

⁷ Appendix, p. 100.

It is a well-established fact that from the equator to the poles a continuous magnetic flood is ever in motion.⁸

In thus tracing the course of the magnetic current from the sun to the equator, and thence to the poles, a physical necessity, made imperative by the inexorable law of conservation, indicates that a *retro-current* from the earth back to the sun, must now have part in the process. Should such be the case, as all reason and philosophy affirm, we have a completed "*Grand Magnetic Circuit,*" *in and through which all physical phenomena have their origin.* But aside from the logical necessity, we hold that there are terrestrial phenomena, which, rightly interpreted, point to just such a retro-acting inter-communication.

Old Phenomena, and new Interpretations.

The phenomenon, the aurora borealis, or polaris, has never been satisfactorily explained. It is acknowledged as purely magnetic in character, and to be due to the passage of currents upward from the earth. It

⁸ Appendix, p. 100.

has received the regard due to a mere negative though brilliant exhibition, whereas the character, extent, and significance of its manifestations should have caused it to be greeted, and studied, as the index of the operation of very positive cosmical functions.

HUMBOLDT regarded this process as "the restoration of a disturbed equilibrium;" and so indeed it is, but it is an equilibrium, not simply as between the earth, and atmosphere. Various observers have estimated the altitude to which the aurora sometimes reaches, at from 80 to 265 miles. The fact that the *bulk* of the atmosphere reaches but *three miles* above the earth's surface, forbids it to be regarded as purely a terrestro-atmospheric phenomenon.

While viewing the more striking and brilliant exhibitions of the aurora, the more undemonstrative and by far the most important and vital operations have been disregarded. The former may not be observed, except occasionally, and fitfully, *can* only be present when favoring meteorological conditions admit of its disclosure. The latter, more unobtrusive and even invisible to the naked eye, are incessantly, and at all seasons,

in action, by day as well as by night.⁹ May not this auroral display then be regarded in a measure as confirmatory of what the law of conservation had already suggested to us; the existence of a *retro-current*?

Well understood Processes in Confirmation.

The suggestion of a simple, adequate, and perfect theory is given us by an ordinary electro-magnetic battery. Let the conducting wire from such a battery extend half around the circumference of this globe. It is apparently as quiet and dormant as is our earth; yet in those cold plates, solutions, and wire, there lie the hidden elements of heat, light, and power. At the distant extremity of the wire, when not connected with the earth, we may have none of the manifestations of heat, light, or attraction—even though the plates are put into the solution. But let us now make the connection between the extremity of the wire and the earth, *then* the circuit is complete, and heat, light, and attraction are disclosed in highest degree.

Now from the *Great Sun Battery*,¹⁰ in which we locate the one *Great Universal*

⁹ Appendix, p. 101.

¹⁰ Appendix, p. 102.

Force: Newton's "Higher and Still Unknown Force," every one recognizes a current constantly present, setting towards the earth. That current is recognized as bringing us our light and heat. But without a *retro-current*, should we have a circuit complete? Should we have any of these phenomena?

Heat without Combustion.

Neither *in* the battery nor *near* the battery do the phenomena manifest themselves. Though the developer of light, heat, and power, the battery itself is neither luminous, hot, nor magnetic. "To explain the effects of the sun, therefore, there is not the least reason to infer that it is itself luminous, or even warm. Potential action generated in a dark, cold body, may produce great heat and light, at a distance from the seat of activity; and *what is thus wrought artificially in a small way may surely be done naturally in a tremendous fashion by the grand forces of the sun.*"

Inter-currents.

It is now well known that a number of currents may pass in each direction, at the

same time, over one and the same telegraph wire; and in like manner, great solar currents may pass to and fro without interference.

Solution of the Problem.

Sun-heat, therefore, like sunlight and gravity, is a veritable production, yet it is not due to the process of combustion. It is not dependent for its creation upon the destruction of fabulous quantities of substantial materials. *The rather does it originate in, and is it disseminated through the vast energies of spheres retro-acting upon spheres throughout the whole universe of matter.*

CHAPTER VI.

THE SEASONS.

Why their varying Temperature?

THE usual explanation of these phenomena, *i. e.*, the influence of direct and oblique sun-rays, has ever seemed insufficient and unsatisfactory; especially in view of the *fact* that the heat comes not from the sun by continuity after the manner of progression as from a heated body.

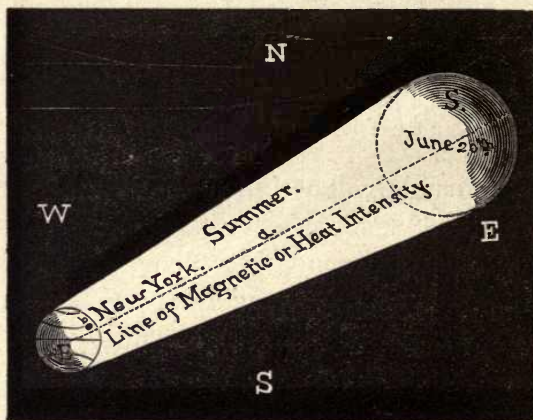
A philosophy more exact and consistent may be found in the development of the theory already advanced, and which is illustrated in the following plates.

The maximum of heat at the surface of the earth bears a very constant and intimate relation to the line of greatest diameters of the sun and earth.—Pl. II. a.

Through this line the heat-producing functions of these great spheres are in operation in the highest degree.

This line of magnetic, or heat activity, consequently varies with the earth's movements. On the 20th of June the flood of

SEASONS.—SUMMER.

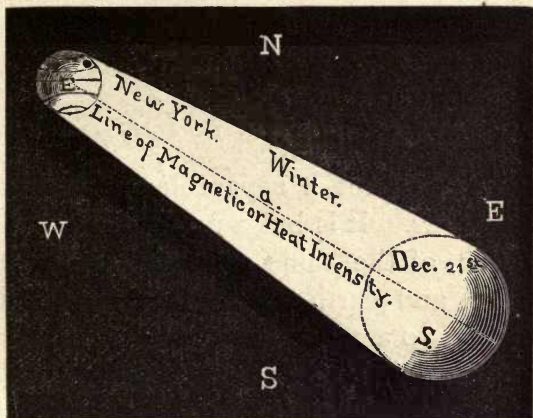


Pl. II.

summer heat overspreads the northern portions of the earth; the sun thence apparently turns southward, and with its departure the relations of the line of heat activity change. The city of New York, which on the 20th of June is found nearest the centre of the solar current (Plate II. b), is, on the 21st of December, located at its greatest distance from the line of magnetic or heat intensity

(Plate III. b), where the heat-producing forces are in operation in but low degree.

SEASONS.—WINTER.



Pl. III.

CHAPTER VII.

GRAVITY.

Its Essential Nature, and its Source.

GRAVITY is not a separable entity, not a power *per se*. It is but a production, and an operation, of the same retro-action between sun-core, and earth-core. This retro-action gives rise to a stupendous magnetic circuit, as described, in which both sun and earth become the embodiments of magnetic force, or, in other words, great magnets.¹¹

The power thus developed is exercised in preserving the relative positions of the two bodies, and, on the part of the earth, as we know, in drawing unto itself all objects within its influence.

The same current, therefore, which lights up our earth, and which gives to it its requisite supply of heat, at the same time induces it with the power of attraction.

¹¹ Appendix, p. 102.

Thus is engendered that power known as gravity, which has ever been acknowledged a profound mystery beyond the comprehension of man.

CHAPTER VIII.

THE ATMOSPHERE.

A Veritable Ocean.

THE great aërial ocean which we call the atmosphere (at the bottom of which we live, and move, and have our being), is even more vitally important than has ever been dreamed of in human philosophy.

How Constituted.

Its tangible constituents, such as clouds, vapors, gases, are well understood; as well as the modifying influence of those atmospheric elements upon what we call sunlight, and sun-heat. But the intangible and vital principle, or basis of the atmosphere, has in a measure escaped recognition. This principle is vito-magnetic in its character, and may be designated as *static*,¹² from its habit when

¹² Appendix, p. 104.

in equilibrium, and also in contradistinction from that vast flood of *active* fluid which fills the solar cone-space.

Extent and Character of this Influence.

The whole globe and its surrounding atmosphere are vast reservoirs of this static fluid. These, interacting freely through continuity, virtually become one in their operations. As a constituent of the atmosphere this fluid is nearly uniform in its proportions. Its varying conditions, as positive, negative, and neutral, form a marked peculiarity. Changes from one to another of these conditions, over larger or smaller areas, are affected with marvellous rapidity, and with varying and sometimes with striking results.

In the extremes of atmospheric temperature, this fluid is found to exist in the extremes of its positive and negative conditions. The contrast is by some supposed to exist in the seasons of winter and summer, in proportions as 13 to 1, (heretofore regarded as quantitative).

Note the Functions of this Ocean.

This fluid is indeed *the vital principle*, upon which *all life*, animate and inanimate, depends. The necessity for frequent respirations is occasioned by the imperative demands of the system for this agent. As before intimated, the mild and steady light which illumines the earth in its day-season is owing to the action of the *active* fluid of the cone-space upon the *static* fluid of the atmosphere. The untempered force of the former might not be endured. The pale and steady light of the moon and planets is due to a like reaction through the same agencies.

The relations which the present known constituents of the atmosphere sustain to this fluid may not at the present time be estimated.

Not yet fully Comprehended.

“Air,” said SIR LYON PLAYFAIR, “is the most familiar of substances; the first with which an infant becomes acquainted on entrance into the world, and in death, the last to be given up; yet, strange to say, its nature and constitution have only become partially understood within the past century, and even

now scientific knowledge can only be regarded as on the threshold of the subject."

The novelty and the assurance of the concluding lines of the above quotation would, at a comparatively recent date, have excited in the reader a great astonishment. We had supposed that the constituents, and the functions of our atmosphere were very well understood, that little, if anything, could be learned by further investigation. Yet the revelations which are now being made show the assertion of SIR LYON PLAYFAIR to be almost prophetic.

The vito-magnetic, the most important ingredient, has scarcely been referred to in any formula of its constitution. This constituent as previously stated, forms the bulk of the atmosphere, and upon *it* depends the principal performance of its varied functions. More vital than oxygen, without it life could not be sustained for an hour.

Have we been Mistaken?

The experiments of M. PASTEUR have demonstrated that oxygen and light are not essentials of life, as he developed life in the dark, in an atmosphere of carbonic acid.

New Light.

More recent discoveries verify the presence of this comparatively unappreciated constituent.

The process of induction has ever been a great mystery in electrical science. Magnetic currents are known to act upon bodies in close proximity without the intervention of a spark, and to induce such bodies with magnetic force. This action, called induction, has been supposed to be limited to short distances. This we believe to be erroneous. In order that the inductive process take place, it is only necessary to suppose some impulse to be superinduced upon some pervading medium. This medium we recognize in the static vito-magnetic constituent of the atmosphere. Magnetic or electrical induction is therefore nature's effort towards an equilibrium. Newly-discovered phenomena show that this process is carried on even at considerable distances. To Prof. LOOMIS of New Haven, Conn., we are indebted for experiments which illustrate this fact. These experiments show that magnetic communications may be made through ten miles of space without the intervention of visible

means of conduction. The employment of wires is rendered unnecessary by reason of the presence of the vito-magnetic fluid which operates in restoring the disturbed equilibrium. Magnetic *currents* are therefore not essential to this phenomenon.

A wonderful exhibition of this power was recently observed at Rochester, N. Y. In a telephonic exhibition in this city, the musicians were located in Buffalo, sixty-eight miles distant. While PROF. JOHNSON was engaged in preparatory practice during the afternoon, the notes from Buffalo were distinctly heard at the same time, in a city business office, at some distance from the hall of exhibition. Yet the wire used by the Professor, and that employed in the private telephone, were at no point less than ten feet apart. The same phenomenon was observed during the progress of the exhibition in another locality, the two lines still being no nearer than ten feet to each other.

*The Character and Virtue of this Element
may not be Mistaken.*

It is this vito-magnetic element, and not some other ingredient, that renders the atmosphere so sympathetic, and responsive, to

the governing Force resident in the sun, and in the earth-core. The atmosphere thus not only furnishes the field of operation for the manifold Force, co-operating between the sun and earth, but is itself the medium and instrument of the operations.

The vito-magnetic power under its Protean forms, styled "Vital Forces," and "The Physical Forces," works in the atmosphere and is the source of nearly all its phenomena. It causes and directs movements in every province of nature. Nothing else has so intimate relations with animal and vegetable life and growth. It may be considered as constituting the inherent *virtue* of the atmosphere.

Among the varying manifestations in which this agent is disclosed to us, within and beyond the atmosphere, may be enumerated the following, viz.: 1, Linear lightning; 2, Ball lightning; 3, The flash with reverberations; 4, Heat lightning; 5, Aurora; 6, Frictional or mechanical; 7, Magnetic; 8, Vital; 9, St. Elmo's Fires; 10, The exaggerated wave which bears destruction in its pathway; 11, That disclosed by rain, hail, snow, and fog; 12, Sunlight, and sun-heat; 13, Static, or atmospheric; 14, Zodiacal light; 15, Corona, etc., etc.

CHAPTER IX.

WINDS.

Entertained theories Erroneous.

THE mere mechanical theory which regards the atmosphere as a loose mixture of gaseous materials, and the winds as mere mechanical disturbances within it, misses its real intimate nature and is insufficient. But once conceive the atmosphere as arranged like a perfectly adjusted instrument for the meeting-place and co-operation of sun-force, and earth-force, where are elaborated all the benefits designed for our mundane creation, and we begin to look for better explanations.

Their true Character.

What we call the wind is mediately the air moving but causatively, and immediately, and more profoundly, it is the action of the vitomagnetic fluid. *It is therefore a purely mag-*

netic phenomenon. In the interplay of that subtle, all-pervasive fluid, is found the key to the theory of the winds. Hurricanes, cyclones, tornadoes, zephyrs, etc., are manifestations of its operations. These phenomena imply the existence of a force at times stupendous, and at times so gentle as simply to move a leaflet.

This power in full magnitude may spring instantaneously into action; and it may, too, as instantaneously cease. It may suddenly drive a body of air at the rate of one hundred miles per hour, and as suddenly arrest its progress. The air having no inherent propulsive powers, that originate and control its directions, velocities, and varied forms of movement, is yet subject to definite laws. What these laws are has never been divulged.—“The wind bloweth where it listeth.” Yet in viewing earth and atmosphere as vast reservoirs of vito-magnetic fluid, shifting back and forth to maintain an, equilibrium, we believe we see the workings of the very force which moves and sways the atmosphere; which causes its currents, both general and special; and which gives rise to all its more extraordinary and unaccountable phenomena.

What gives rise to the Currents.

The changes in the magnetism of the earth and atmosphere give rise to these currents. They are developed in various forms. The following may be mentioned as the most important.

1st. The general and widespread perturbations, occurring within the body of the earth, and implicating immense areas, even whole continents.

2d. The interruptions of continuity of the *solar currents* as in the phenomena called sun-spots. These changes, to whatever cause due, are capable of disturbing the terrestrial magnetic equilibrium over varying areas, and of working instantaneously.

3d. The effects of the interruptions of the sun's rays through the medium of clouds.

4th. Purely local vito-magnetic, or electrical, actions occupying smaller or larger areas.¹³

That the origination, suspension, and continuation of these movements, in all their forms are due to purely vito-magnetic force, we think demonstrable. Thus, no other can

¹³ Appendix, p. 105.

act so instantaneously, none with such varied exhibitions of power, and none so widespread in their development.

In the movement of a body of air, the space previously occupied by that body must be resupplied by another of equal volume. This resupply may not necessarily be derived from the circumambient atmosphere as heretofore supposed. In some instances the resupply is derived *in but slight degree* from that source, but rather from that great reservoir, the earth; as in the instances of whirlwinds and tornadoes.

Philosophical Considerations drawn from Observation.

FLAMMARIAN says:—“ We know that a whirlwind is a column of air which turns upon its own axis, and which advances comparatively slowly, for, as a rule, a person can keep up with it at a walking pace. This whirling column of air is both caused and set in motion by electricity.”

If whirlwinds are caused and set in motion by electricity, why may not all other forms of wind be productions of the same force? PELTIER has established both by numerous facts

and by a series of ingenious experiments, that the waterspouts of the land and sea are electrical phenomena.

This had been suspected by BECCARIA a hundred years before.

The hurricane which occurred in the Barbadoes in 1831, was the most remarkable on record. In the actions of the hurricane and the electrical displays, there was abundant evidence of cause and effect.

The lightning for hours played in flashes and forked darts, and moved frightfully between the clouds and the earth, with a most surprising action, and the earth was felt to tremble. The moment this singular alternation of the lightning passing to and fro ceased, the hurricane burst forth with a violence which exceeded all that had yet been experienced. The winds blowing with appalling velocity, changed their course frequently and almost instantaneously, occasionally abating but only to return in gusts from S. W.-W. and N. W. with accumulated fury.

These alternations of wind and violent electrical phenomena, were something more than coincident, more than a casual connection. Here we observe a manifest interdependence.

In another hurricane, "the wind blew about twelve hours with the utmost fury from the N. E. and then, in an instant, perfect calm ensued for an hour, then, quick as thought, the hurricane sprang up with tremendous force from the S. W." No other power known can suspend and put in motion, in opposite directions, such marvellous velocities and so instantaneously.

A remarkable phenomenon was exhibited by a hurricane in 1837, and described by CAPT. SEYMOUR of Cork. "For nearly an hour we could not see each other nor anything else, but merely the light, and most astonishing, every one of our finger-nails turned quite black and remained so nearly five weeks afterwards. This fact may be classed among other proofs of the agency of electricity in the production of hurricanes."

The following facts are entirely inconsistent with usual methods of explanation of the cause of winds: "The entire atmosphere, to the altitude of many thousand feet, is constantly traversed by numerous horizontal currents of air, flowing in different directions and at different heights."

"The course of a balloonist was altered no

less than five times in the space of fourteen hours. "The aëronaut GREEN, at the height of 14,000 feet, encountered a current that bore him along at the rate of five miles per hour, but upon descending to the altitude of 12,000 feet he met a contrary wind blowing with a velocity of eighty miles an hour."

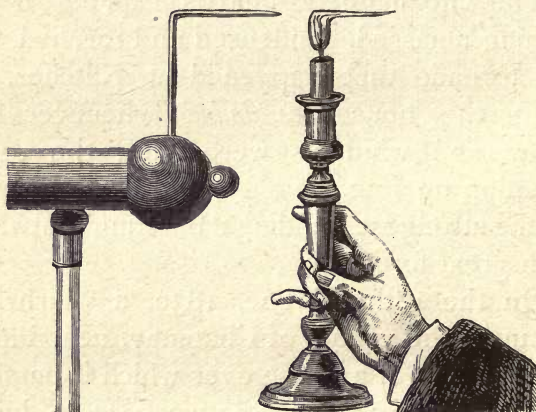
The vito-magnetic fluid is capable of becoming amassed, condensed and rarefied. In the tornado that happened at Natchez, in 1840, the houses *exploded* whenever the doors and windows were shut, the roofs shooting up into the air, and the walls even of the strongest buildings bursting outward with great force.

On the 18th of June, 1839, a whirlwind fell upon the village of Chatenay, near Paris. In the room of a house over which it passed, several articles of needle-work were lying upon a table. The next day some of them were found in a field at a distance from the house, together with a pillow-case taken from another room. They must have been carried up the chimney by the rush of air outwards, as every other means of exit was closed.

It is a fact well-known to miners that during and before violent tempests, strong ascending currents are observed.

If a metallic rod terminating in a point be attached to the conductor of an electrical machine, electricity escapes in large quantities from the point. A continuous current is thus kept up and the flame of a taper, if placed in front of the current, is blown in a horizontal

MANUFACTURED WIND.



Pl. IV.

direction. Wind is thus *manufactured* on a small scale. Pl. IV.

At a recent meeting of a Meteorological Society in England, a paper was read by the REV. JOSEPH CROMPTON, M.A., F.M.S. "The author, when walking close to the Cathedral of Norwich, was struck with the unusual fluttering of the flags on the top of

the spire, which was 300 feet high. They were streaming with a strained, quivering motion perpendicularly upwards. A heavy cloud was passing overhead at the moment and as it passed, the flags followed the cloud and then gradually dropped into comparative quietness. The same phenomenon was noticed several times. As the cloud approached, the upper banner began to feel its influence and streamed towards it, *against the direction of the wind*, which still blew as before, steadily on all below. As the cloud came nearer, the vehement quivering and streaming motion of the flags increased; they began to take an upward perpendicular direction into the cloud and seemed almost tearing themselves from the staves to which they were fastened. Again as the cloud passed, they followed it as they had previously streamed to meet its approach, and then dropped away as before, one or two actually folding over their staves. All the other flags at the lower elevation did not show the least symptom of disturbance." In this phenomenon we observe the operation of two of the wind-producing causes just mentioned, viz. :—a wind arising from purely local causes, and of limited extent, occurring

within the boundaries of a wind produced by the action of more general, and widespread causes—*A wind within a wind.*

The above instances plainly carry a suggestion of magnetic origin and power.

Winds may not arise from Presumed Causes.

If winds are due to such a simple mechanical causation as the production by the sun, of a rarefied atmosphere, the colder air rushing in from all sides into the empty spaces, we should hardly expect to find any definite currents bounded by well-defined limits; much less should we look for transverse and opposite currents going like messengers at varying rates of speed, some slow, and others exceedingly swift. Nor may stronger gales suddenly cease, as though stopped by some mighty invisible wall. And in no wise can they, from mere calorific agencies, leap out of perfect calmness into hurricane velocity, or subside into silence as by magic. On no such principle can they shift back upon their own track, going either way with terrific velocity.

A Great Cosmical System.

We have seen the marks of electrical action in the cases cited, and since we know something of the subtlety of the agent; that it may be "amassed, condensed and rarefied," that it is not loose and wandering, and the mere plaything of fortuitous forces, as the atmosphere is supposed to be; but, on the contrary, has close and most sympathetic adjustment with the earth-force; and that *it* is the invisible hand that holds and manages the grosser atmospheric matter; since we know this, we are now brought to the study of a great cosmical system.

CHAPTER X.

SUN-SPOTS.

Grave Doubts.

HERBERT SPENCER says: "At present none of the interpretations of the sun-spots can be regarded as established."

How numerous and how strange have been the theories promulgated as to the character of the manifestations called sun-spots. The dark spots in the sun have been supposed to be "solid bodies revolving very near its surface," "Smoke of volcanoes;" "Scum floating upon an ocean of fluid matter;" "Clouds;" "Opaque masses floating in the fluid matter of the sun, dipping down occasionally," "Fiery liquid surrounding the sun which, by its ebbing and flowing, the highest parts of it were occasionally uncovered, and appeared under the shape of dark spots, and by the return of the fiery liquid, they were again covered, and in a manner successively assumed different phases;" "In-

terruptions of continuity in the bright envelopes immediately surrounding the sun," "Cavities" etc.

Overestimate of the Degree of Spot-shadow.

Public sentiment in regard to the degree of darkness which is disclosed in sun-spots is exceedingly erroneous. It is believed that the spots are really dark. ZÖLLNER, however, states that "The black umbra of a spot emits four thousand times as much light as that derived from an equal area of the moon." "The blackest part of the spot is intrinsically bright."

What They are not, and what They are.

These phenomena may not arise from disruptions taking place on the sun's surface, neither from violent agitations near that surface. The essential and intimate character of the so-called sun-spots may be found in the interruptions of continuity in the fluid occupying the solar cone-space. This fluid which we call sunlight intercommunicates between the entire opposing surface of sun and earth, unless interrupted by some temporary cause. Any cause which is capable of

producing results of such character and magnitude can only act by more or less completely interrupting the development or transmission of this fluid.

The result of such action would be disclosed to us by a decreased brilliancy in the direction of the sun. The so-called sun-spot would be in character, magnitude, form, and shade proportionate to the extent and character of the disturbing force. The permanence or evanescence of the spot would indicate the sun or earth as being the locality of such derangement. The more permanent form being developed at the sun, and the more ephemeral at the earth.

Any forces in operation at the earth which might interfere with the intercommunication of light, would lessen the brilliancy of the light, at the earth-extremity of the cone-space; and the deficiency thus produced would disclose to an observer at the earth all the appearances of a spot upon the surface of the sun. The so-called spot, thus produced, might therefore not be regarded as a veritable spot upon the sun's disc, but rather as an optical illusion.

They are Caused by Magnetic Perturbations.

What may be the forces in operation on the part of the sun, and earth alike, which may so interfere with the development or transmission of light through the solar cone-space?

The condition of the contents contained within the enclosure of the sun-crust and earth-crust, is presumably one of unrest; its actions varying from repose to the most violent agitation, with a tendency to the cyclonic in its motions. Although the earth-core may not be presumed to be an entire moving mass, yet it is known to be in a measure incandescent, and molten. Magnetic storms occur within our earth-crust which sway the needle without, and almost instantaneously manifest their presence over areas of more than half the globe. The same phenomena are undoubtedly present in increased development at the sun.

We may therefore with reason suppose that perturbations, however produced, occur within those spheres, of such an extent and character as might be a sufficient cause of

the interruption of development, or of transmission of that fluid.

Inconsistency of the Present Accepted Philosophy.

The ephemeral or evanescent character of many of the so-called sun-spots, removes them from the domain of sun-phenomena, otherwise than in appearance.

Figures that are Deceptive.

Some of these spots even of large dimensions come into the field of view almost instantaneously; and as suddenly disappear. Thus KRONE "observed a spot of no inconsiderable dimensions which sprang into existence in less than a minute of time." DR. WOLLASTON says:—"I once saw with a two-inch reflector a spot which burst in pieces as I was looking at it." BIELA also notes that "spots disappear sometimes in a single moment." SIR WILLIAM HERSCHEL "turned away his eyes from a group of spots he was observing, and when he looked again the group had vanished."

Of those who attempt to make an estimate of these phenomena by mathematical formu-

læ, we would ask, What velocities must these sudden and apparently widespread outbursts represent, if they take place at the sun?

Effects of these Wonderful Phenomena.

That this phenomenon is a result of an interruption of the solar current is rational to suppose. It is indisputable that the interruptions which produce these manifestations have an important bearing upon terrestrial phenomena. Winds, storms, vegetation, healthfulness, are manifestly influenced, and in a measure controlled by these perturbations.

Mistaken Conceptions.

The claim of many scientists that spot periods may be calculated, and classified, possesses no element even of probability, much less of fact, to sustain the supposition. The evanescent character of many of these spots places them beyond the sphere of statistical calculation.

May not be Tabulated.

Not even concerted and systematic investigation can insure reliable conclusions, for

persons separated by even inconsiderable distances would not always observe precisely the same spot manifestations. Moreover, the spots appear and vanish so quickly that no correct estimate can be made at any single locality. As well attempt to map and chart the aurora borealis.

Unbiased Estimate of their Character and Location.

SCHEINER was one of the first who ever observed these spots through a telescope, and was therefore uncontrolled by theories in his estimate of their character and location. He held it "impossible that they could be on the sun itself," and imagined some of them to be "as far from the sun, as the moon, Venus, or Mercury."

CHAPTER XI.

SOUND.

Essential Character and Medium of Transmission.

SOUNDS are products of vito-magnetic conditions and changes. They result from action or force expended upon the vito-magnetic element of the atmosphere. If such action or force be directly expended upon the air, or, more accurately, upon this vito-magnetic constituent of the air, it is propagated in accordance with the laws that govern the transmission of the vito-magnetic or electrical fluid through the air. If it be expended upon a lengthened wire, then, as sound, it is transmitted according to the laws of magnetic transmission through wire.

The recent experiments in connection with the telephone have demonstrated the fact that sound may be communicated through hundreds of miles of space without occupying any appreciable length of time—in this respect being precisely like the ordinary action of the magnetic current. It is most

philosophical therefore to conclude that it is the same element that is concerned in both instances. If we were to distinguish between the actions of the telephonic wire and the telegraphic wire we should say that there is no difference in the medium of communication, which is in either case the vito-magnetic fluid ; but that in the former the normal fluid is affected simply, while in the latter an artificial and extraordinary amount of fluid is induced so as to produce strong magnetic effects. In the telephone wire we have an *affection* of the fluid ; in the telegraphic wire a *pulsation*, so to speak.

In the production of sound, *vibrations* (erroneously called *waves*), have an important agency, but *they have no act or part in its conveyance.*

The varying intensities of sound, and the distance to which it reaches, are in direct ratio with the kind of force applied in its production, the character of the resistance offered and the medium of communication employed.

CHAPTER XII.

SOME OF THE RESULTS OF THE FOREGOING THEORIES.

THE theories thus asserted may be regarded as exceedingly radical in their character. Their influence may not be fully estimated. Marvellous in extent are the ramifications which proceed from these sources, and few are the subjects of human thought and investigation which will not be, to a greater or less degree, affected by their influence.

New channels of thought and investigation will be opened, and old theories which now have the confidence of great minds and great numbers, will quietly sink into oblivion.

The blank astonishment and incredulity with which these theories will be received, will soon be followed by acceptance, and the world will wonder why these things have been so long delayed.

If these theories be true, among the foremost and withal the most mischievous of the

old theories which will fall, will be that figment of the imagination—the *Nebular Hypothesis*.¹⁴ How strangely, and how strongly, has that hypothesis maintained its ground, *even after nebulous masses have been resolved into clusters of stars*. If gravity be the result of retro-acting forces, there could be no element of attraction in the flimsy gaseous particles whereby they might be drawn together. If gravity be the result of retro-acting forces, then must those forces have their existence somewhere. But where could there be found in flimsy gases any such special centres of force—any nuclei—from which attraction might proceed in its work of forming the spheres? A starting-point is lacking.

If these theories be true, the sun is formed like unto the earth, and is cool, non-luminous, and habitable. Incandescence not being the condition of the sun or its surroundings; exhausted worlds, worn out asteroids, and stray comets and meteors are not required to keep up external fires.

If, therefore, incandescence be *not* a condition of the sun's surroundings, then surely

¹⁴ Appendix, p. 106.97

there may be *no* glowing metallic vapors, *no* hydrogen, *no* iron, *no* sodium, *no* magnesium, *no* oxygen; those constituents of the sun envelope, so graphically described by the spectroscopists of the present day.

The origin of *celestial* spectroscopy was as vague and unphilosophical as was that of the nebular hypothesis. FRAUENHOFER and KIRCHHOFF *imagined* certain things, and straightway a great theory sprang into existence.¹⁵

Verily the "Scientific use of the Imagination" too often leads men into the grossest errors.

If these theories be true, we may hereafter ignore all undulatory processes. Time may no longer be estimated in noting the transmission of light and heat, since, like gravity, each acts instantaneously. *If the most distant fixed star which is visible could be annihilated to-night, its light would be seen no more forever.*

If these theories be true, the recent marvels of the age, the telephone, phonograph, and their fast-multiplying brood find a satisfactory and philosophical explanation.

¹⁵ Appendix, p. 106.

If these theories be true, the boast of the Atheist, that God is wasteful and a bungler, in that he wastefully scatters his sunlight, and sun-heat, in all directions into space, is set at naught. Nature has been misinterpreted. *No sunlight nor sun-heat is disclosed, except in the direction of other spheres.*

These theories throw new light upon the character and extent of the atmosphere of the moon and planets, and the consequent availability of those and other spheres for sustaining life. The extent of the atmosphere of each celestial body may be presumed to be proportionate to our own. Analogy would therefore teach us that those bodies, also our sun, and other suns, are the abodes of intelligent beings.

If these theories be true, heat may no longer be regarded as actual motion among the particles of heated matter, neither may we longer imagine the existence of hypothetical upper trade winds.

If these theories be true, the part which has ever been attributed to the sun as originator and dispenser of light and heat, has been overestimated. Every sphere contains within its enclosure the source from which its own supply is derived;—a veritable storehouse,

which at one and the same time yields and governs its requisite supply. *The earth receives what is due to it, in the interchange constantly taking place; and not an amount which the sun may fitfully dole out.*

In the character of the winds, and atmosphere as disclosed, what revelations! What floods of light will thus be thrown upon subjects now mysterious!

CHAPTER XIII.

THE DIRECT INFLUENCE OF THESE FORCES AS CAUSATION OF DISEASE.

IN its bearings upon the systemic conditions which we term health and disease, this mysterious vito-magnetic fluid is of the highest import. This great principle which fills the earth and all spheres, and governs and binds them together—this great principle which is the source of all life, animate and inanimate—this principle dominates in every vital system, from man down through and beyond the microscopic forms of existence.

The normal action of this principle in every part of the human system constitutes *health*; its abnormal action, *disease*; its interruption, *death*.

The human system is thus a delicately organized and exceedingly sensitive vito-magnetic machine, and is virtually kept in action

through the operation of this principle. Any condition, therefore, which may directly or indirectly influence or disturb this principle, may influence or disturb the actions of every human organization.

In the search for causes of disease throughout the ages, this field, so fruitful in material, has been left almost unexplored. The disclosures of the early future will wonderfully change the sentiments entertained in regard to the cause of a large proportion of our diseases. Meteorological influence, although now comparatively ignored as a disease-producing power, will ere long be recognized not only as *a* power, but as *the* power, far overshadowing all other influences combined.

The character and extent of these influences are scarcely imagined. In estimating them the attention of the profession is now mainly directed to thermometric and hygrometric changes and conditions. These form not the largest proportion of the perturbing influences constantly in operation around us.

With the verification of the meteorological theory of causation, more positive and rational ideas will prevail ;—obscurity will, in a

measure, give place to clearer and more exact perceptions of the character and relations of diseases, and a corresponding efficiency in treatment may be expected.

CHAPTER XIV.

THE ARTIFICIAL PRODUCTION OF LIGHT, HEAT, AND POWER, AND THEIR UTILIZATION.

THE practical procurement of necessary light and heat for our dwellings, as well as of necessary mechanical power for the world's work in mills and factories, *in some less expensive and laborious manner* than through vast consumption of wood, coal, and oil, is believed to be now so close upon realization that we may even call it *un fait accompli*.

The conversion of the momentum of rivers, and of the power of cataracts, tides, and winds, into vito-magnetic or electrical fluid; the transportation of this fluid to any locality through wire or cable; and its final transmutation into light, heat, or mechanical force sufficient for all work, are already demonstrated as practicable.

There is no reason then why the Mississippi should not be made to roll, and Niagara to fall through our workshops, or even to im-

pel our street-cars. They may as well work as to be idle as they go.

But in all this, startling as it seems, man is only imitating Nature in her every-day operations through sun and earth. Even the order is similar. The sun is the *river* giving its constant impulse through the vito-magnetic cable of the solar cone. The *earth* end of the cable is adjusted by means of the atmosphere, for the production of light and heat for this earthly habitation.

It induces the globe with magnetic influence which we have called gravity. And in its workshop, its mechanical and vital forces are keeping up all motions in animal and plant, earth, ocean, and air.

And thus light, heat, gravity, mechanical power, electricity, magnetism, vital force and universal motion, are but one principle variously expressed. This principle we have designated vito-magnetic fluid. But have we reached a climax and an end? No. This vito-magnetic river or current flows on. Its flood is never stayed. But yet we find no accumulation. Light and heat have neither been piled up to the sky, nor have they become annihilated. Their essential element has only changed form, and proceeded on its

busy way, turning earth into a magnet, vivifying and operating all organisms, travelling upon all currents, gathering up and utilizing all the fragments and waste of its workshop, transmitting and conserving its energy *en route* to the poles. And finally, *the same element that signalized its entrance at the earth's more central regions AS HEAT, now signalizes its departure along earth's polar extremities AS COLD.**

Nothing is lost. Such a mighty flowing current cannot be stopped. If it rolls *in* we may be assured that *somewhere* it will roll *out*. And this is but THE GRAND COSMICAL CIRCUIT, already made mention of.

* We would not define cold as "absence of heat." Cold is rather the opposite electrical condition to heat.

CHAPTER XV.

WHY WAS NOT THIS DISCOVERY SOONER MADE?

IT may be asked, why should the discovery of this great source of all the forces, vital and physical, have been delayed to the present time? Master minds have been engaged for ages in efforts to solve the wonderful problem.

HERSCHEL, NEWTON, HUMBOLDT, FARADAY, MOSSOTTI, and many others have held the *key* almost within their control, and the consummation has only failed of being realized at an earlier day by reason of the tenacity with which the minds of men are held by preconceived and pre-existing opinions.

SIR WILLIAM HERSCHEL regarded solar and stellar light as the effects of an *electromagnetic* process.

NEWTON recognized all movements of the cosmical bodies to be the result of one and the same force; "*of some higher and still unknown power,*" but luminiferous ether

shaded his mental vision, and he failed to discern that power. In his investigations of those great subjects he is led to ask, "Are not the sun, and fixed stars, great earths, vehemently hot?"

HUMBOLDT said: "It is indeed a brilliant effort, worthy of the human mind, to comprise in one organic whole, the entire science of nature, from the laws of gravity to the formative impulse in animated bodies;" but the preoccupation of his vast mind, and the hold of pre-existing ideas, offered difficulties to the solution of the problem. But, note the approximation of his ideas to those herein expressed, he said: "The sun, as the main source of light and heat, must be able to call forth and animate magnetic forces on our planet." Unfortunately, however, he continues thus: "and more especially in the gaseous strata of our atmosphere."

FARADAY, perhaps the most distinguished man, in the whole of his own field, which the world has ever produced, recognizing the power of this great obstacle to true advancement (*i. e.*, preconceived and pre-existing ideas), once said: "When such a one as myself gets out of the way, then new conditions, new men, new views, new opportunities, may

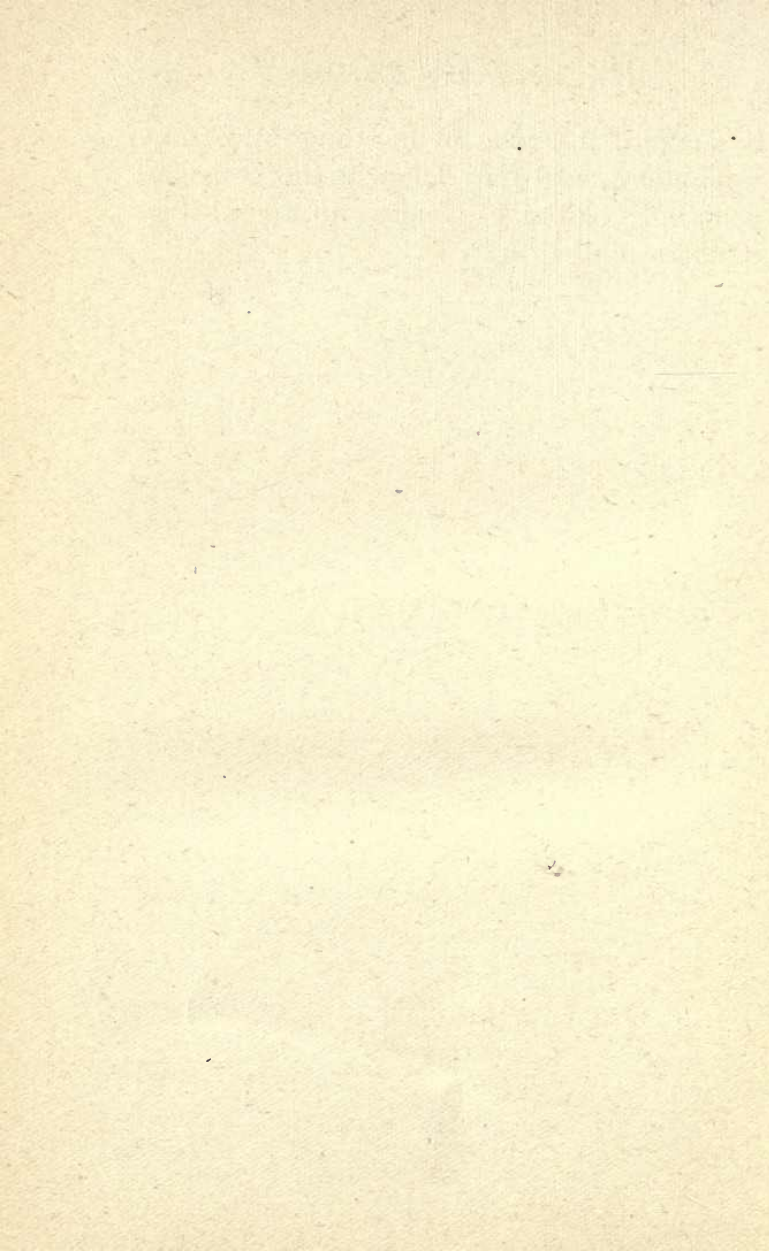
allow of the development of other lines of active operation than those heretofore in service." He believed in the existence of one great universal principle, from which gravity, heat, light, electricity, magnetism, even life itself might come. He spent many of his latest years in efforts to solve this great problem, and on his failure he asked: "Is it all a dream?" He never, however, wavered in his faith, and his last efforts were directed to that end.

With prophetic vision, almost amounting to prescience, he, in speaking of magnetism, said: "When we remember that the earth itself is a magnet, pervaded in every part by this mighty power, universal and strong as gravity itself, we cannot doubt that it is exerting an appointed and essential influence over every particle of matter, and in every place where it is present.

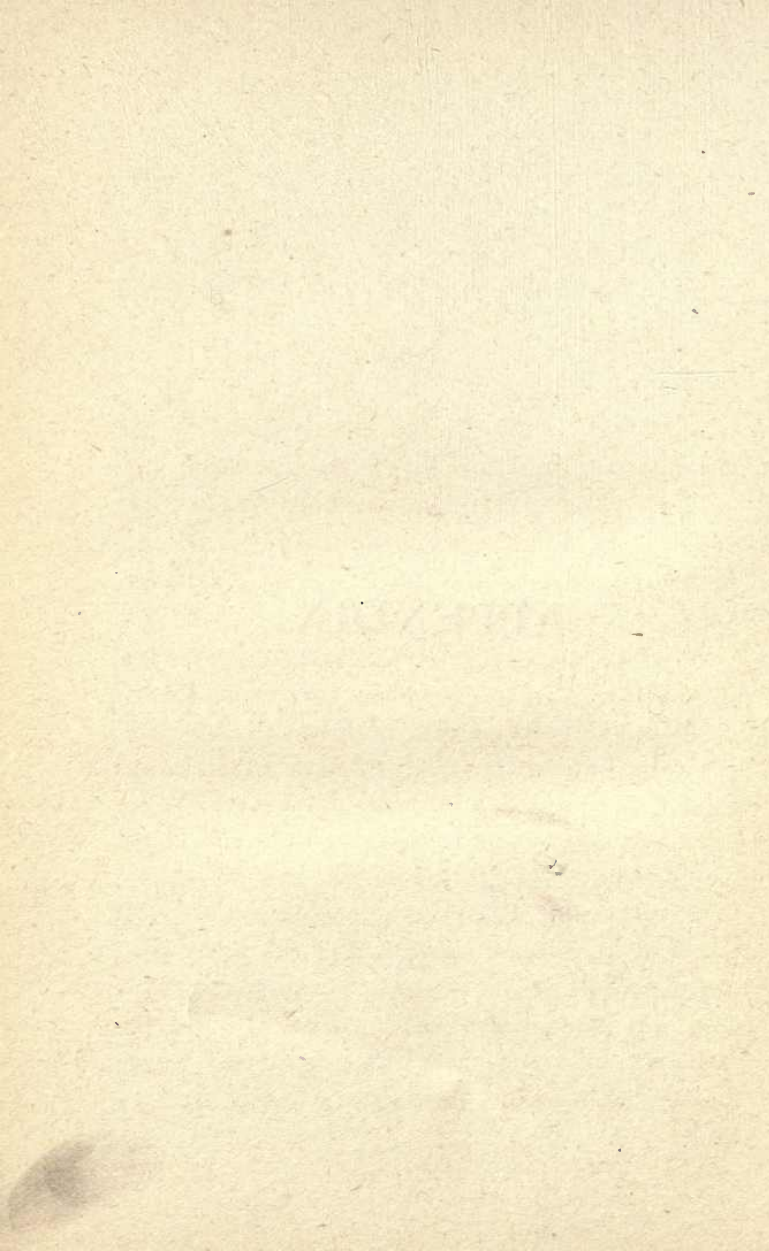
"What its great purpose is, seems to be looming up in the distance before us:—the clouds which obscure our mental sight are daily thinning, and I cannot doubt that a glorious discovery in natural knowledge and in the wisdom and power of God in the creation is awaiting our age."

Thus did those great philosophers so near-

ly attain to the goal of their highest earthly aspirations, and only failed in the consummation by reason of clinging to the existing opinions of their age.



APPENDIX.



APPENDIX.

1. (Page 22.) "BRUNO, about the close of the last century, *guessed* the fundamental fact of the Nebular Hypothesis, and *Kant reasoned out* its foundation idea, and LAPLACE *developed it.*"—CORRELATION AND CONSERVATION OF FORCES.

We have learned to recognize on how very doubtful a basis many of the received axioms of physical science are founded. This hypothesis has been received with much unanimity and has firmly held its sway. Yet, "BRUNO *guessed* the fundamental fact," and this *figment of the imagination* has, for nearly a century, controlled the scientific mind. Its paralyzing influences have affected other departments of physical science, and true progress has been obstructed. The attempt to describe minutely how the spheres were formed millions of years ago is but presumption.

This hypothesis, from such an origin, unverified and unverifiable, is too weak to support the superstructure which has been erected upon it. This hypothesis discarded, it may be presumed that the earth was never in a fluid or *wholly incandescent state*.

“It may be shown that all nebulæ are crowded stellar masses.”—HUMBOLDT.

Action and Retro-action.

2. (Page 25.) “Considering the continued activity of the sun through countless centuries, we may assume, with mathematical certainty, the existence of some compensating influence to make good its enormous loss.”—
COR. AND CON. OF FORCES.

If the earth receives the benefits of this activity, surely the “compensating influence” must, in a like degree, go forth from the earth to the sun. And, furthermore, if this influence (whatever its character) may pass in the *one* direction through space without known or visible means of communication, *retro-action* may be affected through the same channel.

The Earth and all Spheres framed alike.

3. (Page 26.) "The earth belongs to a system of planets analogous to itself, having the same origin, the same destiny, situated around the same centre and governed by the same motive power."—FLAMMARIAN.

Mutual Relations of Earth and Sun.

4. (Page 27.) "A mysterious chain links together the celestial and terrestrial forces. According to the ancient signification of the Titanic myth, the powers of organic life, that is to say, the great order of nature, depend upon the combined action of heaven and earth."—HUMBOLDT.

The Sun's Body Dark.

5. (Page 30.) "HERSCHEL'S fixed idea was that the darkness of a spot was an indication of a cool habitable globe."

A New Theory of the Nature of Water.

6. (Page 36.) M. MAICHE, in *Les Mondes*, propounds the theory, reached after numerous experiments, that water is simply hydrogen plus electricity, or oxygen minus electricity,

or, in other words, that normal electrified hydrogen constitutes water, and that normal diselectrified oxygen produces the same ; or that hydrogen, oxygen, and water are precisely the same, differing only in degree of electrification.

Sun-heat.

7. (Page 41.) “The sun, as the main source of heat and light, must be able to call forth and animate magnetic forces on our planet.”—HUMBOLDT.

“It is an incontestable fact that the sun exercises an action upon the magnetic phenomena which are manifested upon our globe.”—SECCHI.

“What is certain is, that there ought to be, between the sun and planets, a means of communication of force, and the transmission of movement.”—*Ibid.*

“The central body may, as a powerful source of heat, excite magnetic activity on our planet.”—HUMBOLDT.

8. (Page 42.) “It cannot be doubted that electro-magnetic currents exist in the interior of the globe.”—AMPÈRE.

“The internal heat of our planet is con-

nected with the generation of electro-magnetic currents."—HUMBOLDT.

"A large proportion of winter heat of the poles comes through the equatorial current."
—YOUMANS.

Auroræ.

9. (Page 44.) "HOOD heard a noise as of quickly moved musket-balls, and a slight crackling sound during an aurora. He also noticed the same noise on the following day."

"FATHER PERRY of the Stonyhurst Observatory remarked that the green spectroscopic line characteristic of the aurora, could be detected even where the unassisted eye failed to notice any trace of light."

"The fleecy clouds seen in Iceland by THIENEMANN, and which he considered to be the northern light, have been seen in recent times by FRANKLIN and RICHARDSON, near the American north pole, and by ADMIRAL WRANGEL on the Siberian coast. All remarked that the aurora flashed forth in the most vivid beams when masses of cirrus strata were hovering in the upper regions of the air, and when these were so thin that their presence could only be recognized by the formation of a halo around the moon."

These clouds sometimes range themselves *even by day* in a similar manner to the beams of the aurora and then disturb the course of the magnetic needle in the same manner as the latter. On the morning after every distinct nocturnal aurora the same superimposed strata of clouds have still been observed, that had previously been luminous."

PARRY even "saw the great arch of the northern light *continue throughout the day.*"

"ARAGO was of the opinion that each observer saw his own aurora somewhat as each observer of a rainbow sees the luminous arc differently placed."

The Great Sun Battery.

10. (Page 44.) If with a percussion cap and a tear we may develop sufficient power to deflect a magnetic needle 3,000 miles distant, what power may not be expected of the sun, 1,250,000 times larger than the earth; the sun exercising a force of the same character?

Gravity.

11. (Page 50.) "PROF. MOSSOTTI has recently shown, by a very able analysis, that

there are strong grounds for believing that not only the molecular forces which unite the particles of material bodies depend on the electric fluid, but that even gravitation itself, which binds world to world, and sun to sun, can no longer be regarded as an ultimate principle, but the residual portion of a far more powerful force, generated by that energetic agent which pervades creation."—FARADAY.

"If gravitation is made to mean something allied to magnetism, some poorly explained phenomena become easily understood. But what are the circumstances affording proof of the identity of these forces? First, gravitation acts upon all kinds of matter; FARADAY proved the same of magnetism. Second, gravitation is attractive; so is magnetism. Third, gravitation is proportionate to the mass; the force of magnets also depends upon the mass. Fourth, gravitation acts in an inverse ratio to the square of the distance; so does magnetism. Fifth, gravitation does not manifest polarity; magnetism is known not to do so. Sixth, gravitation acts independently of bodies affording a resistance to light and heat; so does magnetism."—CARTWELL.

FARADAY'S biographer says :—" He is oppressed with the magnitude and importance of his subject, yet is stimulated by the fact that the discovery which he aims for (the relationship between gravity and electricity) would have a bearing in importance far beyond all conception in elucidating not only the facts connected with these subjects, but also others of a high importance. There being scarcely a limit to the subjects which would be illuminated by it."

" Gravity, surely this force must be capable of an experimental relation to electricity and magnetism and the other forces, so as to bind it up with them in reciprocal action and equivalent effect."—FARADAY.

KEPLER regarded gravity and heat "as being probably derived from one single principle."

" There is every reason for believing that the radiations which constitute heat and light are essentially the same."

" Gravity acts instantaneously."

Static Electricity.

12. (Page 52.) Speaking of static electricity, FARADAY remarks: " What an idea

of the ever-present and ever-ready state of this power is given to us, when we consider that not only every substance, but almost every mode of dealing with substance manifests its presence. It is not accidental at these times, but active and essentially so, and we may, in our endeavors to comprehend it, usefully compare and contrast it with gravity which never changes. There we see that power which in undisturbed and solemn grandeur holds equally the world and the dust of which worlds are formed together, and carries them on in their course through illimitable space through illimitable ages; and in this other power, even in this our first glimpse we see probably the contrasted force which is destined to give all that vivacity and mutual activity to particles that shall fit them as far as matter alone is concerned, for their wonderful office in the phenomena of nature, and enable them to bring forth the ever varying and astonishing changes which earth, air, fire and water present to us; from the motion of the dust in the whirlwind up to the highest conditions of life."

13. (Page 61.) An illustration of this form of wind-production may be found in the following facts related by DR. GISLER, who for

a long time dwelt in the north of Sweden: "The matter of the aurora borealis sometimes descends so low that it touches the ground. At the summit of high mountains it produces upon the face of the traveller an effect analogous to that of wind."

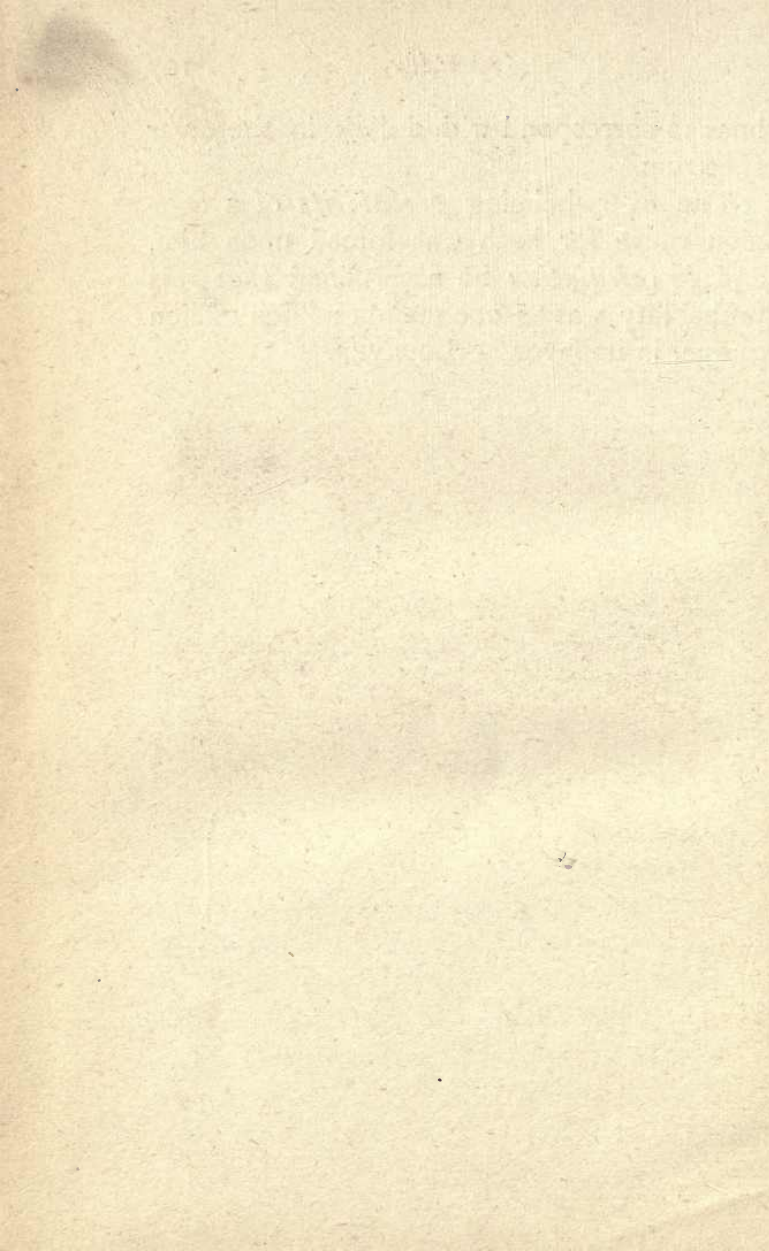
We should pronounce this effect to be the production of a true wind of a circumscribed or local character.

Solar Spectrum, its origin.

14. (Page 80.) PROF. KIRCHHOFF was led to the study of a coincidence between the bright yellow line given in an incandescent sodium vapor, and the solar line "D," which coincidence had already been noticed by FRAUENHOFER. Upon applying a greater dispersive power he noticed that the line "D" was a double one; but so also was the sodium line under these conditions. Moreover, each line of the one coincided with each line of the other. The *suspicion* became strong that it was the sodium in the *sun* which caused the "D" line. He then extended the comparisons to other elements. He carefully measured sixty bright lines in the spectrum of iron; and found every one of these sixty

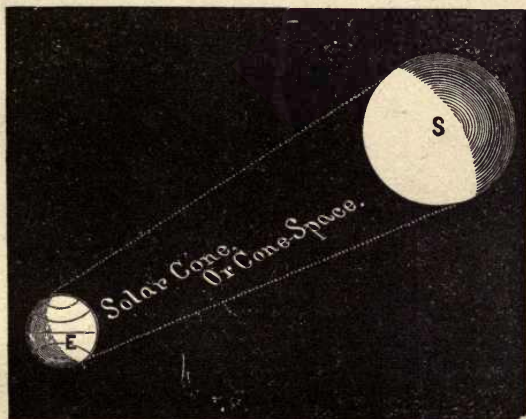
lines to correspond with a dark in the solar spectrum.

The overwhelming *probability* of a common cause for both was forced upon him, and *by calculation* he ascertained that this probability was as one million million million to one, in its favor."—LOCKYER.



ADDENDUM.

The great Solar Cone-space, in order to be clearly marked to the eye, was represented in Plate I, page 30, as white. This to some readers may be misleading; as this space when viewed transversely is not luminous,—it is not even visible. (Pl. V.)

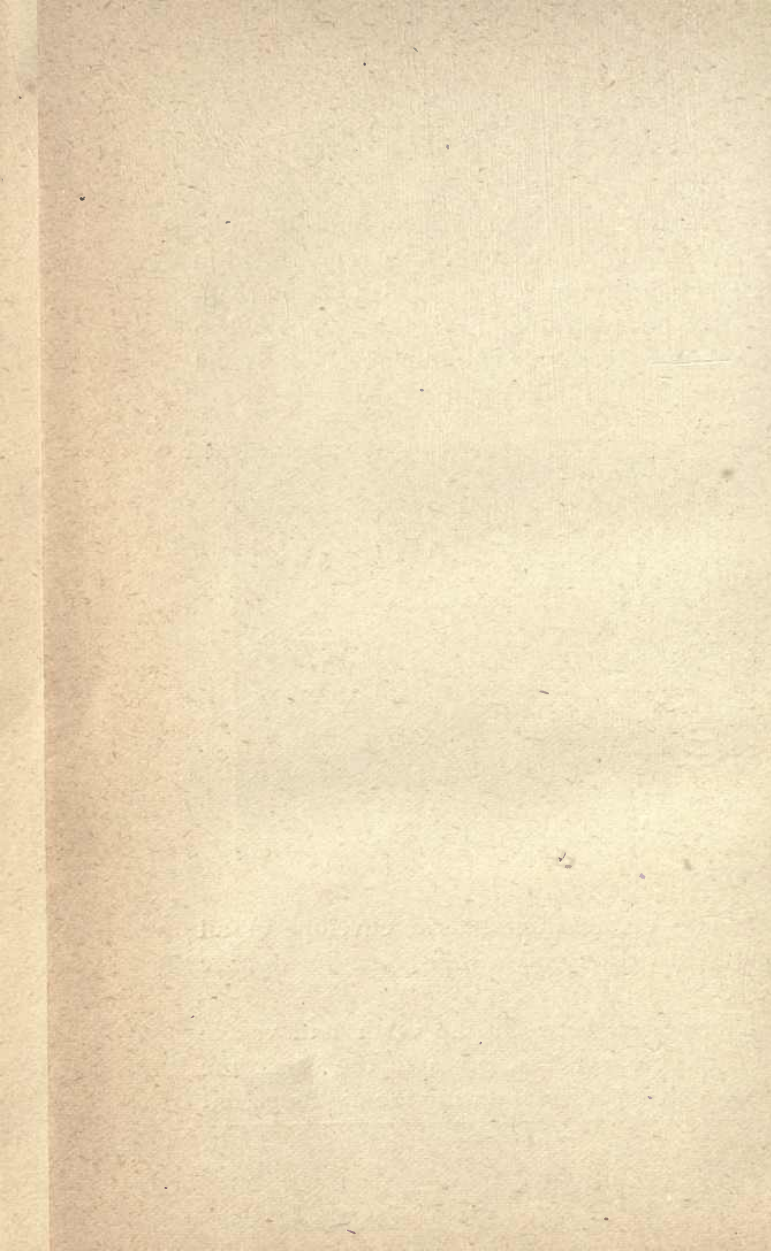


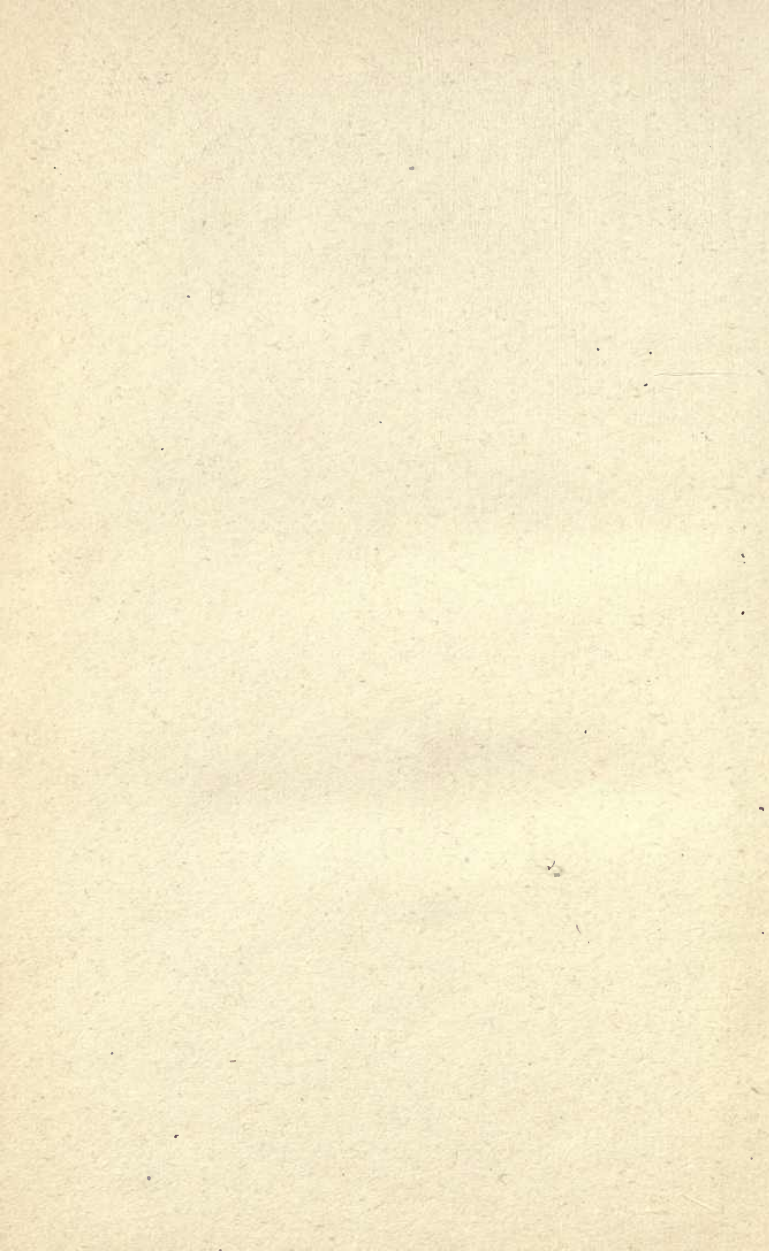
Pl. V.

Outside of the atmospheric envelope of all spheres, there is only "*the black of infinite space.*" *

Retro-action between the earth and visible and invisible spheres, gives to the earth the light which it possesses during the night-season.

* Flammarian.





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