RADIANT ENERGY

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For Beyond the Light Rays Lies the Secret of the Universe

The Evolution of Energy and Matter

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Originally compiled for the Layman
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Writings of
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In the study of these pages one should consider that both matter and radiations have corpuscular properties as well as wave properties. The corpuscular properties are evident when recognized as highly localized events of very short duration with specific values of electric charge, energy and mass. The wave properties can be proven in different ways which have been proven and taught for so many years.

Atomic energy (nuclear energy) is a technological development of the highest "political" significance. That may be considered almost an understatement, it is certainly not an overstatement, but the so-called "Atomic energy" with its accompanying hysteria and the wild claims for its use as a source of generating light, power and heat by nuclear fission ceases to be an understatement and is a gross oversatement of its value.

It is rightly claimed that in nuclear physics lies still ahead untold furthur scientific advances. Just what the advantages will accrue from the new discoveries is problematical. In the treatment of the human body by the radiation products obtained from the "atomic pile", will its therapy value be greater than radium or X-ray and any less dangerous? The final cost for such therapy may be less if the original billions of the peoples' tax dollars in first costs is forgotten. But, as with radium and X-ray, will the damage to healthy tissues offset much of the final benefit and value?

As far as nuclear energy (atomic energy) is concerned for heat, light and power, it is and always will be nothing more or less than an expensive, dangerous, glorified steam plant or an equaly dangerous thermo electric device or a breaking into the radiation lines of force of the radiation field that surrounds the reactor to capture energy. Such a plant, no matter how effecient, can never be the complete answer to the world's energy problems. Costs, weight, danger will always be a great problem.

In the first few weeks after the so-called "atomic bomb" became known to the public it was excusable to make unwarranted claims. In the heated imagination of enthusiasm it was only natural that the majority of the people and a great number of scientists would feel that the question to all political and econominal energy troubles that lead to war through the need of energy had now been ... solved; all the heat, light and power problems were about to be answered. It has been rightly said that whoever controls the energy of the world controls the world. THE NATION THAT CONTROLS THE COSMIC ENERGY CONTROLS THE WORLD FOR GOOD OR EVIL. "To be attached to the very wheel work of nature", as Tesla put it years ago, what an advantage. What are the nations fighting for but power? Oil, coal, and now fission material, all these things will lose their incentive to be fought for with cosmic power development. Think of being able to get one's power at any point in the universe.

Any nuclear fuel, even to the most "super nuclear pile reactor", or what have you, is, and always will be, just another source of fuel to operate an energy plant from any heat, light and powr viewpoint. When I say radioactive material is just another fuel to operate a prime move power plant, I mean just that. Nothing will be changed from our present method of generating' and transmitting electrical power except the furnace and the fuel. Will the cost of the fuel and its danger from radiation and weight of shielding make it practical? The Life of the radio-active or"atomic pile" is also a serious problem in the way of its practical application. There will be no change in the method of

power transmission, still expensive power lines and power plants. If a method is found to generate or capture electrical energy direct from the pile's radiations that will change little of the costs and none of the other problems.

When it comes to energy for automobiles, trains, airplanes and all forms of transportation, the fuel cost will be greater than can be practical; the cost of shielding and weight involved impractical.

Today the Federal Government is spending billions of tax dollars each year on scientific research and development, much of that money being for atomic energy research. Investigation shows, we are not getting full value from these expenditures.

Power from the Cosmos and the Earth

Nickola Tesla said over sixty years ago, "Ere many generations pass our machinery will be driven by power obtainable at any point in the universe. Is this energy static or kinetic? If static, our hopes are in vain; if kinetic, and this we know it is for certain, then it is a mere question of time when men will suceeed in attaching their machinery to the very wheel-work of nature." Nickola Tesla was not referring to so-called "atomic energy" or nuclear energy but to the energy which is continually bombarding the earth from outer space.

Enough energy is coming to the Earth to light one million, one hundred ninety-three thousand, six hundred one hundred-watt lamps or 119,360,000 watts of energy for every human being on the earth today. Does that sound like a practical amount of commercial heat, light and power worth going after which is coming to us continually day and night in a useable form with no danger from radion-active radiation? No danger from nuclear fission and it can be transformed into electrical energy without the use of any "glorified energy" set-up. No fuel of any kind will be taken on as a dead load for the energy can be "picked-up" direct by the great ocean liner, railroad, airplane automobile or any form of transportation, to say nothing of the heat, light and power available for use in all kinds of buildings; to pump water on the desert lands with equipment of only a fraction of the weight of any steam plant or any kind of engine in use today and at a fraction of the cost. A wild dream? Not at all. A proven, practical reality as hundreds of people know who have witnessed the MORAY Radiant Energy equipment. Power from the cosmos!

The total energies involved in "cosmic" radiations are individually and collectively very large. The methods or processes of their generation involve a basic relation to the total structure of the action of the universe.

Physicists today believe that cosmic radiation consist primarily of protons and some heavier nuclei. At times they pack a maximum wallop of around 100 quadrillion electron volts. Coming continuously, with slight variations in time, their radiation have a uniform directional isotropy. The earth is therefore surrounded in an atmosphere of radiations with the cosmic rays coming continually to the earth from all directions. There may be a slight deflection of the weaker rays by the earth's magnetic field. There is every indication that our sun in not the source of any appreciable amount of these radiations. Their origin, therefore, is from the universe as a whole. The total energy of cosmic radiation is more than the entire luminous output of all the stars and nebulae of the universe combined. Unlimited power is being delivered to everyone's doorstep.

The M^{O}ray radiant energy discoveries give the greatest amount of energy per pound of equipment of any system known to man. Electric power through an electric motor or an electric jet far exceed any form of engine in the delivery of power as there is no dead center, or lost motion, in an electric motor nor loss of push in an electric jet. A much higher starting torque is had than in any type of combustion engine.

Cosmic power is the most practical form of "energy harnessing" yet put to use by man whereby it is possible to utilize the vast source of energy of the universe without a prime mover at any point on the land, in the air, on the water or under the water, using the energy which exists in the universe and transforming it into useful purposes. An electrical generator is, inthe true sense, not a generator, as it does not create electric energy. Electricity is not made by the generator, it is merely pumped. From that standpoint, an electric ganerator might be referred to as an electric pump and the M_{O}ray radiant energy device as a high-speed oscillating turbine energy device.

To account for the propagation of heat and light--that is, of radiant energy--man has postulated the existence of a medium filling all space. But the transference of the energy of radiant heat and light is not the only evidence in favor of the existence of such a medium. Electric, magnetic, and electro-magnetic phenomena (and gravitation itself) point in the same direction.

It is a matter of common observation that attractions and repulsions take place between electrified bodies, magnets, and circuits conveying electric currents. Large masses may be set in motion in this manner and acquire kinetic energy. If an electric current be started in any circuit, corresponding induced currents spring up in all very close neighboring conductors; yet, there is no visible conection between the circuit and the conductors. To originate a current in any conductor requires the expenditure of energy. How then is the energy propagated from the circuit to the conductors? If we believe in the continuity of the propagation of energy--that is, if we believe that when it disappears at one place and reappears at another, it must have passed through

the intervening space, and therefore have existed there somehow in the meantime--we are forced to postulate a vehicle for its conveyance from place to place, and this vehicle has been called the ether.

When a body is electrified, what we must first observe is that a certain amount of energy has been spent; work has been done, and the result is the electrified state of the body. The process of electrifying a conductor is therefore the storing of energy in some way in, or around the conductor, in some medium (the ether). The work is spent in altering the state of the medium, and when the body is discharged the medium returns to its original state, and the store of energy is evolved. Similarly a supply of energy is required to maintain an electric current, and the phenomena arising from the current are manifestations of the presence of this energy in the ether around the circuit. Formerly an electrified body was supposed to have something called electricity residing upon it which caused the electrical phenomena, and an electric current was regarded as a flow of electricity traveling along the wire, while the energy which appeared at any part of the circuit (if considered at all) was supposed to have been conveyed along the wiwre by the current. The existence of induction, however, and electromagnetic actions between bodies situated at a distance from each other, lead us to look upon the medium around the conductors as playing a very important part in the development of the phenomena. It is, in fact, the storehouse of the energy.

Upon this basis Maxwell founded his theory of electricity and magnetism, and determined the distribution of the energy in the various parts of the field in terms of the electric and magnetic forces. The ether around an electrified body is charged with energy, and the electrical phenomena are manifestations of this energy, and not of an imaginary electric fluid distributed over the conductor. When we speak of the charge of an electrified conductor we refer to the charge of energy in the ether around it, and when we talk of the electric flow or current in the circuit we refer to the only flow we know of, viz. the flow of energy through the electric field into the wire.

The work spent in producing the electrification of a conductor is spent on the medium and stored there, probably as energy of motion. To denote this we shall say that the ether around the conductor is polarized, this word being employed to denote that its state or some of its properties have been altered in some manner by the work done on it--that is, by the energy stored in it. In the case of a conductor possessing what is termed a positive charge, the ether around it is polarized in a certain manner and to a certain extent depending on the intensity of the charge. If the charge be negative the polarization is in the opposite sense, the two being related, perhaps, like right-handed and left-handed twists or rotations.

Now consider the case of a body charged alternately, positively and negatively, in rapid succession. The positive charge means a positive polarization of the ether, which begins at the conductor and travels out through space. When the body is discharged the ether is once more set free and resumes its former condition. The negative charge now entails a modification of the ether or polarization in the oPposite sense. The result of alternate charges of opposite sign is that the ether at any point becomes polarized alternately in opposite directions, while waves of opposite polarizations are propagated through space, each carrying energy derived from the source or agent supplying the electrification. Here, then, we have a periodic disturbance of some kind occuring at each point, accompanied by waves of energy traveling outwards from the conductor.

The phenomena of interference lead to the conclusion that light is the result of a periodic disturbance, or vibration, of the ether, but as to the nature of the vibration--that is, as to the exact nature of the periodic change--or what it is that changes we possess no knowledge. We know that alternating electric charges are accompanied by corresponding changes of state, of vibrations, of the ether, and if the charge be varied periodica ly and with sufficient rapidity, we have a vibration at each point analogous to, and perhaps identical with, that which occurs in the propagation of light; a combination of wave and corpuscular properties.

This, then, is the electromagnetic theory of the luminous vibration. In the older or elastic-solid theory, the light vibrations were supposed to be actual oscillations of the elements or molecules of the ether about their positions of rest, such as takes place when waves of transverse disturbance are propagated through an elastic solid. Such a limitation is, however, unwarranted to some extent although we cannot afford to entirely disregard the corpuscular theory of light. A combination of the theories have merit. We know that the change, disturbance, vibration, polarization, or whatever we wish to term it, is periodic and transverse to the direction of propagation.
The electromagnetic theory teaches us nothing further as to its nature, but rather asserts that whatever the change may be, it is the same in kind as that which occurs in the ether when the charge of an electrified body is altered or reversed. It reduces light and heat waves to the same category as waves of electric polarization; the only quality of the latter required to constitute the former is sufficient rapidity of alternation. These speculations were given the strongest confirmation by important experiments of Professor Hertz many years ago.

When an elastic substance is subjected to strain and then set free, one of two things may happen. The substance may slowly recover from the strain and gradually attain its natural state, or the elastic recoil may carry it past its position of equilibrium, and cause it to execute a series of oscillations. Something of the same sort may also occur when an electrified capacitor is discharged. In ordinary language there may be a continuous flow of electricity in one direction till the discharge is completed, or an oscillating discharge may occur--that is, the first flow may be succeeded by a back-rush, as if the first discharge had overrun itself and somethlng like recoil had set in. The

capacitor thus becomes more or less charged again in the opposite sense, and a second discharge occurs, accompanied by a second back-rush, the oscillation going on till all the energy is either radiated or used up in heating the conductors or performing other work.

In the vibrations of the forces of the Universe we find the key to the sources of all energy. The real key in securing the energy needed in modern industry is the utilization of the energy resources of the Universe without being limited to crude prime movers. The answer may lie in the balancing of an energy generator that will oscillate because of the oscillations of the Universe. Some claim it will be found by a collapsing of the earth's magnetic field. Others seek it in the creation of an electron drag. Dr. Gunn, who was a civilian scientist for the U.S. Navy, stated years ago that the earth is a huge generator, generating over 200 millions amperes of electric current continuously. Earth = 5.6×10^9 Ft^2 → $\frac{2 \times 10^8}{5.6 \times 10^9} = 3.5$ amps/Ft^2

The aurora borealis is considered to be very definitely an electrical phenomenon produced by the passage of electric charges through the rarified gases of the higher atmosphere.

The conversion of matter to energy in the stars is now generally accepted as demonstrated, and reasoning from what occurs in radioactive disintegration, during which energy waves are radiated, we may conclude that energy waves of very high frequency are sent out from the stars, one of which is our sun.

It is well known that air conducts electricity away from charged objects. This being true how does the earth, a charged object exposed as it is to the surrounding atmosphere, maintain its charge? Dr. Gunn and others have proven the earth has this charge. Physicists have shown that the earth has a negative charge which amounts to 400,000 columbs, yet six feet above the ground the air is charged with more than 200 volts positive in respect to the ground. Therefore, if the air conducts electricity the earth's charge must be constantly passing into the atmosphere. It has been calculated that the earth has a continuous discharge into the atmosphere of 1800 amperes. At the rate the earth would lose 90% of its charge into the air in an hour, yet the earth's charge does not diminish but persists and has done so since the earliest of geological time. Where does the earth's source of energy come from? It has been found that the higher the altitude from the earth, ionization, which could be the media for the flow of energy, increases instead of decreasing. Many names have been given to the sources of energy which we may feel are different sources of energy. We carry on a great deal of research on cosmic ray--the universal electromagnetic field, earth's magnetic field and the energy being received on the earth from the sun's rays. Could it be all energy is from one source--vibrations? Since the source of energy is the universe, the generation of energy by rotary action and all prime movers is an effect and not a cause. Would it be going too far to suggest that there is no such thing as heat, light, sound or even electricity; but all things are merely effects manifesting themselves in various forms because of

the effect of vibrations on various media ? Oscillatory energy action, be it in a leyden jar or another capacitor, man-made or in what we may call natural capacitors, all act the same. The oscillations will continue until they have reached their cycle of height and then there will be a back-rush returning to where the oscillations originated. Every oscillation, whether large or small, is completed during the same interval of time. The beat note of time, the heart beats of life, the oscillations of the universe all prove the same great fact that oscillations are governed by the same cycle of time, completed during the same inteval of time. Waves of energy have a regular beat note of interval, coming and going as the waves of the sea, but in a very definite mathematical order, coming to the earth from every direction with a regular rhythm that might be referred to as the Father of Time, the Sire of Gravitation.

We repeat, "Energy has a definite elastic rigidity and density, which is subject to displacemt. and ~~and~~ strain." When a strain is removed, the medium will spring back to its old position and beyond, surging back and forth as the waves of the sea, and will continue to oscillate until the original pressure is used up. If the internal impedance is too great, there will be no oscillations, but it will merely slide back in a dead beat to its unrestrained state. Cutting down the resistance to the minimum and by synchronous ionic actions of the device with the ionic actions of the universe, recovery will be quicker and quicker until inertia will assert itself and lengthen out the time of final recovery by carrying the recoil beyond the natural oscillation and thus prolonging the vibrations by oscillations. When the recovery is distinctly oscillatory and harmonics set in, the oscillations will continue because of the oscillations of the universe. These oscillations will be surgings with a definite beat note of the evolution of matter and the evolution of energy.

"In the far-off stellar crucibles of the universe we see the same laws being obeyed as in our laboratories. As we trace down to the almost infinitesimal constituents of the extremely minute atom, we find apparantly it does not exist at all as the realistic matter which we have supposed it to be. W There at its very foundation it seems to consist of energy charges which probably stimulate the motions of celestial bodies. It is becoming more and more certain that the apparent complexity of nature is due to our lack of knowledge, as the picture unfolds it promises a marvelous simplicity. Energy is emitted at various wavelengths or frequencies which must be taken into account in laws of radiation... How the physicist uses quanta as commonly as he does electron and atoms and molecules. Bodies are built of molecules, the molecules of atoms, and the atoms of electrons protons and high energy photons. Here we see the atomistic principle applied to "material" (matter) and then to electricity (What shall we call it?) Finally, a physical process--the radiation emitted by the electrons--is divided into quanta. With such pictures of the universe being constructed we may cease to be surprised at anything, and our interest and admiration will grow. Will we ever get to the final foundation?"

"One of the most marvelous relationships that has ever been revealed in the entire science of physics is that between light and electricity. What we do at the present time in regard to the [illegible] tionship is not quite so surprising. However, considering the total [illegible] knowledge about a half century ago, pertaining to the existence of electrons in atoms of matter, the sudden revelation that light (and radiation in general) are an electrical phenomena was very startling and revolutionary. Even today these persons who are unfamiliar with fundamental physics find it difficult to believe that energy traveling from yonder star to the earth is electromagnetic waves of many wave lengths or frequencies, with different effects depending on the media.

"Radiant here means proceeding from a center in straight lines in every direction. Energy is internal and inherent. "Energy" is defined as a condition of matter in virtue of which any definite portions may effect changes in any other definite portion. This was written in 1892, and discoveries since confirm it. Energy then, is a state of matter, or, rather, the result of a particular state or condition inwhich matter may be when any observed phase of energy appears."

"It is recognized that in addition to possessing kinetic energy, the atom is capable of absorbing energy internally. This internal energy would seem to be associated with the configuration of the particles of which the atom is composed. While under ordinary conditions an atom is in what is known as the normal state, or the state in which we find matter apparently neither giving off, nor absorbing energy. However, the internal energy of the atom can be altered. When the internal energy of the atom exceeds that of its normal state it is said to be excited. Excitations may be caused in several ways, among which is the collision of the atom with rapidly moving positive or negative particles, or as in the breaking of lines of force in the modern electromagnetic generator, which is nothing more than an electric pump, for the electric generator does not create the electrical energy any more than the water pump creates water. Kinetic energy is given up when excitation causes rapidly moving particles to give up some or all of their kinetic energy to the atom during collisions. This is taking place in the Universe all the time. The electric [illegible] tor would never have been discovered except a dielectric (insulation) had been discovered. Discover a dielectric (a valve) for the energy of the Universe and a means of making a device oscillate with the oscillating energy of the Universe and one has the answer to harnessing the energy of the Universe. A limiting case of excitation is ionization, in which energy is absorbed by the atom sufficiently to allow a loosely bound electron to leave the atom against the electrostatic force which tends to hold it within the atom. An atom which has given up one or more electron s is said to be ionized. It is possible that ionization, or in other words excitation, may take place in successive steps through absorption of quanta energy, or, in other words, through the evolution of matter and evolution of forces. The return of an ionized atom to a state of lower energy is associated with electromagnetic radiation. So also from the process of ionization which may result from a number of causes, and the one we are interested in is through cosmic radiation, electric energy becoming associated with the oscillation

or vibration of the universe. The higher the frequency, the greater the ionization or excitation. All energy appertains either to matter or excitation of energy and continually passes from ont to the other, or in other words, continually possessing kinetic energy. There, at its very foundation, matter consists of an energy charge which governs the very motion of the planets and suns.

Matter is susceptible to motion, and stress. All atoms appertain either to matter or energy, and continually pass from one to the other, thus producing kinetic energy. There at its very foundation matter consists of energy charges which govern the very motion of celestial bodies...

Multidimensional worlds of the kind beloved by mystics, dating back to the days of the Indian philosopher Pantanjali do not appeal to me. However, I do fear this theory may come in the same field to some lacking a proper background. To introduce a new way of using an old source of energy, be it called the collapsing of earth's magnetism or any hypothesis of a source of energy can only be justified by the necessity of explaining the insistent fact that a battery of vibratory units can be made to produce 50 KW of energy per unit of 50 pounds. Therefore, some hypothesis of theory must be sound to attempt an explanation of the discovery of a device whereby energy can be obtained by oscillatory means in harmony with the vibrations (oscillations) of the Universe. On the other hand the hypothesis may be taken that the oscillations are out of harmony with the harmonies of the Universe cutting lines of force of energy oscillations by oscillations. The viewpoint on the harmonics of the Universe depending on what yardstick is used in the valuation of the hypothesis used to explain the results. It all sums down to the fundamentals of electromagnetism or whatever name one has chosen to apply to the original source of energy which in the final analysis must be accepted as vibration or oscillation. The focus of our attention in any field of energy has the same dimensions as has that foci of attention in all the higher fields of vibratory energy. It also must be conceded that all energy is vibratory in its final ahalysis and therefore exists throughout all the Universe. It might be well not to throw this theory out of the window as some former theories have gone and later had to be brought back through the door because they refused to die but were kept alive by the fact that they may have best explained the reason why a modality which existed did perform as claimed.

For centuries before the development of chemistry, as a science, the alchemists strove to carry out the transmutation of elements. Then as scientific chemistry developed and success in transmutation eluded the investigators the opinion gained firm hold that conversion of one element into another was impossible, that atoms were immutable and indestructible. The definitions of element and elementary substances accepted during the 19th Centry were based upon this belief.

Soon after the discovery of radioactivity it was recognized that radioactive changes involve the spontaneous conversion of atoms of one element to those of another. It then became necessary to change the definition of element. This was done by saying one element could not be converted into another by artificial means. It has now become necessary to make another change in the definition of element, because it has been found possible to change nearly every element into other elements by bombardment with particles moving at high speed from the Cyclotron and other devices. These developments necessitated another change in our theory on elements and it is now said that an element cannot be transmuted into another by ordinary chemical methods. How soon will another change have to be made in this theory?

No one can say that in all space, including that of the Earth"s atmosphere, all matter is not being bombarded by high speed particles. Therefore is it too far wrong to say that throughoutspace there is energy and this energy is kinetic in nature and can be harnessed and used by man by oscillatory means without a mechanical prime mover? Not alone on the earth but in all the Universe.

It has been proven that this oscillatory energy will drive special constructed electric motors at a speed heretofore never dreamed possible. Tesla had a glimpse of the idea in his one wire motor. Also by this means of oscillatory action the clockwise vortex of the pull of gravity in the Northern Hemisphere can be made to rotate counter-clockwise andthe counterclockwise pull of gravity in the Southern Hemisphere can be made to rotate clockwise. This is a complete reversal of the vortex of theearth's magnetic pull, or call it what you will

It was, no doubt, by this law that Nickola Tesla discovered how to create fire balls which may have greater destruction than the missile of our greatest cannons included "atomic".

Watson Davis, director of Science Service, Washington, D.C. in his book "The Advance of Science", 1934 writes "Cosmic Rays bombard the earth from outer space every second of the day and night. They penetrate everything including our own bodies. They carry the mightiest packet of energy yet known to science. They give rise to burst of material particles. ------"

"The immense energies of the cosmic rays discourage the hopes of scientists that artificial cosmic radiation can be produced----some cosmic rays have energies of the order of 100 million volts." Dr. Anderson, at The California Institite of Technology, discovers "The Cosmic-ray energies deduced, range from a 100 million to 3 billion volts. "-----the figure of a 100 million volts is a result of Dr. W. Kilhorster's measurement of penetrating radiation in the depths of the Strassfurt salt mines."

"Of all radiant energy rushing about the universe, the Cosmic Rays are thought to be by far the most important. Science deduces with astronomical accuracy that the universe's total radiant energy in the form of cosmic rays is from 30 to 300 times greater than that existing in heat, light, and all other forms combined. Of the imports of energy received by the earth, the cosmic rays equal approximately one-half of the total energy coming in from the stars, excepting the sun."

The important purpose for the quotations which have been given is to arouse attention to the fact that there are tremendous energies coming to the earth from outer space. These energies are only different manifestations of the energies we see in operation all around us. In many cases we are not even consciously aware of their existence. As Mr. Davis states, "They penetrate everything including our own bodies." Everyone of us is actually alive by virtue of these energies. Every part and particle of the Universe is alive with them. The dynamos that now furnish our electric power do not create or originate any power of electricity; they merely direct "pump" the existing energy or electricity. In other words, so far as this is now concerned, electricity has always existed.

The present method of securing electricity for heat, light, and power is only one of the ways of directing it for human good. As a matter of fact, it is a very crude and expensive method. The very first thing one notices when he reads the history of mechanical development. is the constantly changing appearance of machinery as it is improved for better performances and greater efficiency. For instance, compare the first railroad engine with the ones of today; the first automobile with those of today; the first printing press with the one of today, and so one, and you see how rapidly these changes have taken place. It is not impossible to imagine that, at any time, an entirely different manner of travel will be invented. It isn't much more than half a century since the horse was the best means of short distance travel. In that space of time, the automobile and the airplane have nearly ousted the horse and buggy.

A device has been discovered and designed to secure electricity out of the energies of the Universe and to apply it for power, lighting, heating, and other purposes. When one contemplates the future effect that such a device will have on the light, heat and power used in this world, it staggers the imagination. Speeds in air travel will be possible which have heretofore been unthinkable. What will this mean in all forms of transportation? When people come to comprehend the principles through which this energy secures power from the universe and are willing to use it, what a boon it will be to mankind.

The cruising distance of any Cosmic-Power driven plane will be limited only to the requirements of the crew and passengers. With the Moray bearings even the bearings will need no attention or lubrication for years at a time. Fire hazards from fuels will be eliminated. No exhaust or fumes of any kind. An R.E. plane and even jet will be practically noiseless except for the whirl

of the circular discs by which the plane will be propelled, or in the case of the jet the ions and the energy will be obtainable at any point in the Universe from the oscillations of the Universe. Speed of the R. E. motor, which we first experimented with and which is shown in the pictures, was in excess of 12,000 R. P. M. No reason is indicated why speeds greater than 360,000 RPM will not be obtainable because the motor will be using current at a frequency of 6,000 cycles. Such frequencies are obtainable from R. E. by transposition just as the draft of the current with the R. E. device is adapted to the load, so also can the frequencies be varied as desired. An R. E. powered plane will not be propelled by conventional propeller blades but circular discs will be used which already have shown great promise and some successful experiments made with an experimental motor. The fast rotating circular discs reach their maximum speed in 60 secons. During this period the greatest strain is reached and passed when inertia asserts itself and the strain on the motor is greatly reduced. At full speed there is very little vibration in the plane. In slowing down the propelling discs are again subjected to great strain for about 60 seconds. The size of an R. E. unit capable of delivering 60 K. W. will be about 42" X 26" X 22". This size of cabinet allows for better dielectric conditions over smaller size cabinets. To get greater K. W. output, units are connected in multiple series. Details of connection to motor and suspended plates will not be given here. This motor uses a rotating field while the armature is stationary. The armature is about 50 feet away, in the center of the plane, from the rotary discs of the field. Tesla proved this theory to be sound. A capacity connection between the armature poles and the fielddiscs is used. Naturally many details have been withheld. Cost of such a plane will be less in mass production than standard airliners of today and speeds greater than that of jets will be obtained. It must be remembered R. E. motors are demonstrated realities although theyare still in the experimental stage.

Books could be filled with accounts of the struggles for existence of a new idea or a new way of doing things. You need only read the story of the development of the telephone, the railroad, airplane, and the automobile, yes even the bathtub, and you will begin to appreciate the costs in sacrifice, money and unselfishness to promote a new and revolutionary movement, irrespective of the vast good it accomplishes when established for the use of humanity. (See Ralph Parlett's "Pockets of Paradise".)

The Moray Energy Equipment has been thoroughly, experimentally, tested and it's possibility established. It has been experimented with under all kinds of physical and weather conditions. It has been tested many miles from all power lines before capable and disinterested electrical men and distinguished scientists to their satisfaction and or about which they could find no fault.

The discovery of the natural principles and laws through which energy has been captured and made a part of the great discoveries in electrical science was brought about by years of intensive work with this one phase of

electricity in mind. What particular theory, or set of principles and theories, contributed most to the discovery of this energy equipment is very difficult to determine. The inventor has not been able to say who or what theories or principles were the determining factors. He recognizes that it is from the works of the great scientists that a definite idea of the possibility of his discovery had its origin.

The equipment is so devised as to capture through it the energy from space by oscillating in harmony with the oscillations of the universe as distinguished from the electric generator "pumping" the energy through the breaking of the lines of magnetic force. The energy in space is coming to the earth continuously in the form of oscillations which might be compared to the oscillations of the "waves of the ocean" and the device functions by being able to oscillate in harmony with or because of the oscillations of the universe.

It should be just as easy to accept the fact that a receiving set or electrical device has been constructed for the purpose of receiving the energy waves from the universe as it is to accept a radio receiving set that receives "sound waves" transformed from electrical impulses as the radio does. Whether these energies waves are electrical or otherwise should not matter. One transposes electrical waves to sound while the other transposes energy waves into heat, light, and power. The facts involved are the same in both the radio receiving set and this device. The nature of the mechanism, however, in one differs greatly from the other. The radio receiving set receives man transmitted energy waves out of the air and transposes them into "sound waves"; the R. E. device receives oscillations from the universe and transposes them into electricity.

The device can be built in various sizes to meet the requirments. Adaptation of present equipment of various kinds for use with the device can be easily made although motors will be less expensive than the present A. C. aor D. C. motors and will obtain tremendous speeds for air travel. While the ordinary light globes now on the market can be used, the inventor has in mind a globe which will be more efficient. One of the peculiarities of this current is that the glass globe itself does not get hot except at one small point and its lights is as white as snow. Study the pictures and the reports of photographic experts.

Nickola Tesla worked out an idea of vibrations for National Defense. Moray, in some instances, has gone as far as Nickola Tesla.

Vibrational waves of frequencies above the normal range of human ear perceptions are catalogued as ultrasonics. These are waves of frequencies of over 20 k.c. up to 500 m.c. Vibrations above and below these ranges act essentially the same.

Motion is manifest in everything in the universe. In other words, as in a musical note of a high or low C the vibrational rate, the frequency, is different but all "C" notes are essentially thesame, differing only in harmonic and range frequency. This is the foundation upon which much of Yarom's investigation of vibration is based. All matter possesses a natural rate of vibration. Yarom's research in ultrasonics did not end at 500 m.c. but it took the harmonic of certain frequencies and utilized them for various results from breaking objects by vibrations to bringing down birds out of the air, from throwing the natural vibratory rate of living cells out of balance to the shearing off of animal, mineral and vegetable matter. Sometime it has required several frequencies to be transmitted over a media at the same time. What do we mean by "media" when Yarom research is being considered? Any material that has elasticity can propagate this type of ultrasonics research. The propagation takes the form of a displacement of oscillations. As said before when any elastic substance is subject to strain and then set free, one of two things may happen. The substance may slowly recover from the strain and gradually attain its natural state or the oscillating recoil may carry it past its position of equilibrium and cause the medium to execute a series of oscillations. If these oscillations become violent enough a shattering may take place because the first flow of oscillations is succeeded by a back-rush and the first discharge will overrun itself and severe recoil sets in. This is exactly the same phenomena that takes place in an electrified condenser or capacitor. This was fully covered in the book "Beyond the Light Rays" written in 1926 by Dr. Moray. This means nothing more or less than the Harmonics of Ultra Vibrations may be transmitted many thousands of miles. One may say, "Hold on there!" Not at all. The physicists of 75 years ago said, and rightly, "It was impossible to transmit the human voice over a copper wire." That statement was true then as today, but the telephone still operates and in no violation of any law of physics, so also with the abovestatement.

No law of physics is violated when Yarom claims it is possible to shatter matter many thousands of miles away with vibrations. Ammunition may be exploded, buildings destroyed and human beings either killed or shocked into coma, depending on the degree of intensity and frequency of the vibration oscillator violence or frequency. Each individual type of matter has its own particular rate of vibration or frequency and this is equally true of individuals. Each individual's frequency is as distinctive as are the individual's finger prints.

The universe is singing and this symphony or frequency is what keeps every part of the universe and every atom in its proper orbit. We can see this instudies beyond the microsoope or beyond the telescope, either instrument telling us the same story. Science agrees that all forms of matter is vibrating at its particular rate of frequency and so it is with the various forms of energy, heat, light, magnetism and electricity, these are but forms of vibratory motion connected with and emanating from the same source, the great generator of the universe; or, in other words, all matter, energy or force in the evolution

of matter and the evolution of forces manifests a rate and degree of vibration entirely of its own. Matter, vibrating at a certain rate of its individual character, maybe transmuted into other substances by lowering or raising its rate of frequency. If the frequency is raised high enough its molecules will separate and the atoms are freed. Raise the vibration of the atoms still higher and higher and they will resolve themselves into the original elements of which all matter is constituted. Matter then beoomes a form of energy. Yarom has, by these means, disassociated matter into energy just as nature is doing and by a reversal of the process energy may be made to evolve back again into matter. Frequencies may be developed which will balance the pull of gravity to a certain degree of neutralization of the forces of gravity. One then goes beyond those of gravitation. The understanding then of the principle of vibration or frequency is to grasp the secret of energy, i.e. vibrations, in which lies the secret of all things.

Most businessmen say they are keen for research, but they do not know the first thing about it. Some businessmen believe if you build a beautiful laboratory and fill it with expensive equipment and hire a number of high-salaried men with a lot of scientific degrees you will have a fine scientific organization. Maybe. But, it reminds me of the artist who decided to be like MIchael Angelo, so he spent years studying every detail of the great artist's life. He got himself the same kind of studio, same paints and brushes and canvas and clothes. Then he settled down to paint. "I can't understand", he said, "why the pictures turned out so rotten." No, facilities are all right in a laboratory, but it's the men that count. Just as in a studio, as it is the artist who counts. And the good research man ,by the way, is an artist. Work in a laboratory may be weeks, months, years of drudgery. Some of that can be done by ordinary workers. But, when one breaks through into new territory, enters an unknown door, goes down that lonesome road (and, no one, who has not walked that road, can know how lonesome it is), it is the artist's powers of creative imagination which carries him. That is why it is so hard to pick good men for a research laboratory. You may pick the top men from the finest engineering and scientific schools, but if they haven't that inner spark, the curiosity, the wonder, the feel of things, they are no good.

In research you need a lot of intelligent ignorance. Whenever you begin to think you know all about any subject, it stops your progress dead in that subject. As the old colored fellow said: "It ain't the things you don't know that hurts you, it's the things you think you know for sure that ain't so."

The main things we should do is quit being afraid of the future. Change is the law of life. We should work with change instead of being forced into it. If you refuse to change, if you just want to sit down and be satisfied with your business, the best place to do it is in front of the undertaker's office.

All our education teaches is finality. Business clamors for stability. We are teaching and demanding what the world "ain't".

If we had a library containing books describing all the things we do not know, that building would be bigger than all the libraries of the world put together containing the books of the things we think we know.

A great majority of the works in America today are employed in industries which were mere infants or did not exist at all in 1900.

Laboratories turn out ideas which develop into new industries. Therefore if a few more million were spent on inventing and scientific research for labor creating discoveries we would stave off depressions.

Power is to the world what lubrication is to an automobile. It is the stuff the world "runs on". We cannot produce energy in a strict sense of the word; we can only transform it from one place to another. Man creates nothing. He can only change the things he finds on earth. Now, in changing energy from one kind to another we are like a child trying to pour milk from one bottle to another, we spilling most of it. Since energy is the most needed and the most fundamental thing in civilazation today, the most needed invention is the one which will allow us to transform the energy of the Universe into power with the least amount of waste.

Each year over $280,000,000 is paid to independent American inventors. Invention today is a more robust industry than it has ever been in the history of mankind.

Technological development has reached a point where civilization as we know it cannot exist without new ideas, new inventions. Industry and civilations would "starve" in a few years, and we would be thrown back a thousand years in our progress, if our great factories could not find and make new things with which to stimulate new buying and trade. Civilazation cannot stand still without going backwards and perishing; and, with no inventing there can be no progress. No class of men have such staggering responsibility as those who are forwarding inventions.

One of the best ways to get security is to take risks; and, one of the worst ways to lose security is to sit back and ask that everything be done for you. Today's pioneers have an unlimited future before them. They won't make history with six shooters and covered wagons, but they will be searching into and producing from a greater unknown than the wild West ever was, the fields in scientific research as ye t not tapped by man.

The words, Scientific Research, frighten most people, but, if we treat it as one does most any problem in life--reduce it down into its constituent

parts--Scientific Research means nothing but progress. It is simply a way of trying to find new knowledge and ways of improving our "way-of-life". How many stop to think where the world would be if it were not for the pioneers--pioneers of the unknown on the land, on the sea, in the air and in the unknown of science and invention in the laboratory.

A research laboratory, with instruments many times powerful as a pile-driver or with instruments more delicate than a breath of air, may seem a weird place to some, but it's just another place to get things done without which the world would be a poor one indeed. The things done in these laboratories soon become a part of our everyday life. Because of these things we have better food, better care when sick and better chances of living, and in the living we do so in better homes and in the places we work. If you want a change of a life-time (a chance very seldom offered) get into research at least by getting close enough to it by becoming associated with it. Why is it a chance of a lifetime? Because it is a means towards great personal satisfaction for those who like to do things or see things done, and in the doing, life is made more desirable for yourselves, your loved ones and your fellowmen. While still having a personal part in such things you will be in a business that has been, is and always will be, where the great values and returns are to be found financially and otherwise.

Scientific research is the foundation upon which all wealth has been built in every walk of life and upon which it still stands. Have you ever stopped to think about it? Name one business that would be where it is today if it were not for invention and discovery. Well-run scientific research is the best insurance against another depression.

The Sale of the earth is energy and the evolution of matter and the evolution of forces in the processes of the creation of all things. By the proper uses of these natural laws of energy and matter, matter is turned into energy.

As in the reception of radio waves, so in the case of the MOray device the circuit is a tuned arrangement to respond to the particular wave frequency "oscillations" which it is desired to intercept. A "valve" to prevent return of the energy to the outer circuit and force it to go through the power application circuit is a part of the discovery.

Experiments have been made at different places many miles away from all power lines, and 26 miles from even a farmer's telephone. The places for these experiments were selected by the members of the parties making the tests and not by the inventor; and the places were not prearranged but selected by them as they drove along in their own car--not the car of the inventor--looking for a place to make the test.

The device on an endurance test was operated under standard R. R. seals for a total of 157 hours and 55 minutes, when the seals were broken and the device put under severe strain and tests made about an hour longer and then shut off.

Close examination of the device disclosed that all parts were in perfect shape and could have run much longer. During the entire test the lights burned evenly and brightly without flickering and there was no change in the brilliancy from day to day.

The quantity of current passing through the secondary of the transformer is sufficient to burn up wire of that size if ordinary current were used, yet there is no heating of the transformer even though there is no circulation of air through it to cool it, as it is completely enclosed. All parts of the machine run absolutely cool, regardless of the length of time operated.

It makes no difference whether one fifty-watt lamp is used or whether 50 are connected to the machine, the draft of current is adapted to the load.

There is not a sound from the machine when it is in operating, there being no moving parts.

An experimental demonstration was made in the presence of a nationally known physicist, a professor in one of the greatest universities of the country, at which time he noted and mentioned the following:

"That when the oscillators are connected in the circuit, the condensers fill slowly, and the longer the current is applied to charge them, the greater the charge they take, up to their maximum for the applied voltage, much as in filling a bucket by pouring the water into it, instead of taking the charge practically instantaneously, as is ordinarily the case with capacitors.

"That the lights at one spot are much hotter than is ever the case with any current used at the present time, dur to the incandescence of the gas in the globes under the influence of the very high frequency, but the rest of the globe remained cool.

"That the size of wire in the transformer could not carry the amperage passing through it without burning up, if ordinary current were used, yet the wires remained absolutely cool, no matter how long the machine operated."

The above points show that there is developed something which is entirely out of the ordinary, and cannot be accounted for on the basis on induction from existing power lines or current from batteries.

In later experiments tests were made successfully while the device was set up in a moving automobile and airplaine.

Beginning many years ago men of science have come from foreign countries and from the East and West and have witnessed experimental demonstrations and not one of them has been able to find any fault with what they have seen and heard. Names of these men of Science will be furnished upon request. These men have had the device opened for their inspection and have pronounced the experiments wonderful, that the current is high frequency, the color of the light

different, that the device carries many times as much current without even getting slighly warm than any other electrical device of like construction known to science today. The theory has been pronounced by leading men of science as scientifically, electrically and meachanically sound and correct.

If we reverse our imaginations on what the telescope has taught us of the stellar universe, we will find that beyond the microscope we have found the particles of which everything about us consists obeying every law that is found everywhere from stellar space to atomic space. We find bodies in motion and when we think how small the photon, the proton and electron are, and yet obeying the same laws of the universe, we may see the economical uselessness of science trying to "crack" the atom, when nature, or call it what you will, is accomplishing the same thing for us in stellar and inter-stellar spaces. Why do something nature is already doing for us? Let's use what nature offers as Moray suggested in 1926 and again in 1931. In the great laboratories of the universe we are having done for us something that far exceeds in its performance anything that we may hope to accomplish in our laboratories. Why try in a small way something which nature is already doing for us? From this conception we might see that Democritus came close to a great scientific truth in his bold statement, when he declared thatall physical phenomena reduced itself to one signle item--motion, or, as we might repeat, the vibration of the universe. Let us not forget the atom is but a counterpart of the universe itself, and that light and other radiations exert a mechanical pressure upon every object they strike, and that all these radiations are vibratory material in their character. There is a breaking down and a building up of the atom continuously, and it is the evolution of matter and of forces which is producing, eternally, unlimited power.

May it not yet be shown that the dissipated energy which results from so much transformation of matter which has heretofore been unavailable--or we should say unused by us where it has only appeared to be unavtilable--should now become available to us, an unlimited source of power through the discoveries of application of these forces.

In the Gamma Rays we find potentials which are equivalent to as much as 2,000,000 volts, yet their wavelengths are not the shortest known to the physicists. In octaves still higher lies rays which are known as Co smic Rays. Who can draw a definite line and say how much higher other octaves exist than those known as th e Cosmic Rays? Our starting point from the discovery of these different rays--vibrations--was electrical conductivity of the air. It has been discovered that conductivity is just as strong by night as by day, so that radiations emitted by the sun can scarecely be the cause of this energy. May we not , then, accept the theory that the sun, in and of itself, has no energy, but is merely a rebroadcaster of the great generator--the sonic of the universe itself; that these two, then--matter and energy--are possible one? Is the sum total of all that has been found out during the centuries of constant research to be judged by that small portion of the universe which is visible to man, who is only armed with his infinitesimal telescopes, or with the most powerful microscopes and spectroscopes ever made by man?

All space is saturated with energies which are doubtless what we may call electrical in their ultimate character or very closely allied to electrical action. The relation of matter to energy and energy to matter then becomes the potential of the universe, one continuous series of oscillations, oscillating to and fro like a great pendulum across the universe. One might ask, "How can one get a steady source of energy from such surges?" Could not a steady flow of water be obtained from the waves of the sea?

The history of every major scientific discovery has proven that argumentation on the merits of a discovery, when judged by private interpretation of the scientific facts in question, has proven them all impossible and their discoverer a charlatan.

Another difficulty which has hindered man in forming a true picture of the objective world is that mixed blessing--egotism. In early centuries he could not escape from the false assumption of his own preeminent importance, and these same shackles are still prejudicing the observations of some persons.

In reference to electronic, neutrons, protons, photons, and ions: It is our theory in using these terms that they are the energy of the universe, which have become disassociated here and there, and these innumerable infinitesimal particles of electrified particles constitute (by forces they exert and the disturbances they originate) the substratum of what our senses term as matter, and by nature splitting matter the energy of the universe is born.

Matter is susceptible to motion. EITHER is susceptible to stress. All atoms appertain either to matter or energy, and continually pass from one to the other, thus producing kinetic energy. There at its very foundation matter consists of electrical charges which govern the very motion of celestial bodies--i.e. radiactive radiations of energy and matter. The evolution of matter and the evolution of forces (energy).

There are ample writings which acknowledge that there is unlimited energy in the universe, but to say one is able to tap this supplyis another matter. If I tell you there is water, good cold water, in a glass on your table, but you cannot drink it for a million years, what would you think? You know how to get the water out of a glass. Well, it is as easy to tap this energy now out in space as it will be in a million years from now. If it can be done then, it can be done now.

Let us review the statement made before when anelastic substance is subjected to strain and then set free, one of two things happens. The substance may slowly recover from the strain and gradually attain its natural state, or the elastic recoil may carry it past its position of equilibrium and cause it to execute a series of oscillations. In ordinary language there may be a continuous flow of energy in one direction until the discharge is completed, or an oscillating discharge may occur. That is, the first flow may be succeeded by a back-rush, as if the first discharge had overrun itself and something like a recoil set in. The device thus becomes more or less charged again in the

opposite direction, and a second discharge occurs accompanied by a second back-rush, the oscillations going on until the energy is either radiated or used up in the heating of the conductors or in doing other work and the device will oscillate in harmony with the oscillations of the universe, or in other words, if the device is capable of synchronization with the vibrations of that energy through space, then the oscillations will go on forever. The device oscillates because of the oscillations of the universe.

We fully realize the difficulties of discovering new truths but there are still greater difficulties in getting them recognized, for as Mark Twain said: "It takes twenty years to get a new idea fixed in the human mind", and we should be armed with scant philosophy if we remain for long surprised at the attacks of some, and at the silence of others who have heard of our experiments.

Heat, light, sound etc. are not things in themselves, but effects of vibrations on a media produced by energy directly or indirectly.

We speak of generating electricity: To be exact, we only transfer it from one place to another (pump it, if you please). We cannot generate it because we can neither destroy or create it. After we have used it to light our homes or do other work, it is like water over the wheel--no less water, only the lowering of potential. The electricity has "sunk back" from whence it came, ready and waiting for nature or man to raise its potential, when it again is ready to do man's bidding, or in other words in the evolution of energy it "sinks back" to its source. It is naturally very slowly but steadily being liberated from the universe only to return again.

Elements maintain an equilibrium by oscillations, rotations, attractions and repulsions, but this does not interfere with a transformation of equilibrium, which when the transformations of equilibrium are rapid enough become heat, light and electricity, i.e., matter is turning into energy and energy into matter.

There can be no "production" of current electricity, there will be no kinetic energy if there is no disturbance of equilibrium, that is to say change of potential of energy level. When one thinks of the oxygen and nitrogen molecules of the air all about us moving with the speed of bullets and striking us and everything with this speed, one can form some idea of the agitation taking place in the universe. The oscillations of the universe are part of this agitation.

The oscillations of these electrons, ions, photons, protons, etc. out in space are emitting electromagnetic waves of many wavelengths and frequency. In the Moray device it is so constructed that the frequency is very much lower on the secondary side than on the primary side.

All radiant energy is now believed to possess mass or something equivalent to it. Mass and radiant energy are even considered to be interchangeable.

We are convinced it is active radiations produced in "nature;s cyclotrons" by the evolution of matter into energy and energy into matter.

"Scientific American" (1930)--"The earth itself is a huge electric dynamo generating enough current to supply light, heat, and other electrical needs to the 10 laragest cities in the U. S. for at least a millions years." Researches on thermal reactions inside the earth, conducted by Dr. Ross Gunn, indicates that the earth is a great generator.

"Science Service"--"Nature of the World and of Man" (Printed by the Univ. of CHicago Press, 1925) "The amount of light and heat (radiant energy) received by the earth from the sun is enormous. On the square yard exposed perpendicularly to the sun's rays radiant energy is received at the rate of one and one-half horsepower. The average rate for the earth through the periods of darkness as well as of light is three-eights of a horsepower per square yard. This means that 300 horsepower are received on a building 50 x 150 feet in dimensions. Our planet is receiving energy at the rate of 160,000 horsepower per inhabitant of the earth at the present time.

"The earth receives but an insignificant fraction of the energy the sun radiates: only about one-two-billionth." "The Advance of Science", by Watson Davis, Director, Science Service, Washington, 1934.

Cosmic Rays bombard the earth from outer space every second of the day and night. They penetrate everything including our own bodies. They carry the mightiest packet of energy yet known to science. They give rise to bursts of material particles.

Hundred Billion Volt Wallops.

No other radiations "pack such a wallop" as Cosmic Rays. Compared with other energies here on earth, they rate thousands and millions of times as powerful. Cosmic Rays energies seem to lie between 100 million and more than 100 billion volts. It is not possible to be any too definite and positive, because estimates necessarily change with additional experiments. Comprehension becomes difficult when energies reach billions of volts. The highest electrical pressure on high-tension power lines is 240,000 volts. The peak of artificial electricity production for experimental purposes is 10 million volts. Lightning is rated at about 1 billion volts

The immense energies of the cosmic rays discourage the hopes of scientists that artificial cosmic radiation can be produced. Dr. Millikan estimated in his early work that cosmic rays had energies of the order of 10 million volts, and it is understandable that plans were then being laid to make synthetic Cosmic Radiation. These aspirations vanish with the increasing realization of the higher energies involved.

Dr. Anderson's cloud chamber at California Institute of Technology in which the positron was discovered has furnished much information about cosmic ray energies. He found that some positrons are born of cosmic rays smashing into matter. The cosmic-ray energies deduced from the tracks left in the Anderson cloud chamber range from 100 to 3 billion volts. The Lemaitre-Vallart theiry together with Dr. Johnson's asymmetry measurements, gives definite values for the energy of half of the cosmic radiation, and shows it continuously distributed between 5 billion and 50 billion volts.

The figure of 100 billion volts is a result of Dr. W. Kolhorster's measurement of penetrating radiated in the depths of the Strassfurt salt mines. He found that the minimum energy of these rays had a penetration which was greater than ever before demonstrated. Dr. Axel Corlin of Sweden's Lund Observatory found radiation that still had energy after passing through somewhat greater depths and, therefore, the voltage figures can be made even higher. And energie of 100 billion volts or more are indicated by the great bursts set off by cosmic ray collisions, called the stosse, which have been observed particularly in Germany.

We are now living in what we call the atomic age, but our civilization is still largely based on coal and oil. Such a foundation was not established nor was progress made without passionate resistance from people with hardened opinions. In the days of King Edward I, it was a capital offense to burn coal in London. In 1819 the growing scarcity of wood in England led Dudley to attempt the substitution of coal for charcoal in his blast furnace. A riot organized and the furnance wrecked. Only 170 years ago it was illegal to sell coal in the city of Philadelphia.

Our gigantic petroleum industry came into being because a man had faith in an idea at which his neighbors scoffed. Edwin L. Drake of Titusville, Pennsylvania believed that large quantities of petroleum existed in subterranean cavities. In 1859 he started drilling and his efforts became the laughing stock of all western Pennsylvania. When his well filled with oil, Drake's folly became, overnight, the envy of the countryside.

In 1802 William Murdock made gas from coal, and with it lighted his house in Cornwall. Furious opposition was aroused when Murdock and his associates attempted to extend the use of gas. Scott, Byron, and Napoleon were among those who ridiculed the crazy notion. Scott wrote: "There is a mad man proposing to light the streets with--what do you suppose--smoke."

Don't let the arteries of your opinion harden. The world moves irresistibly on. Move with it.

One hears a great deal about the work being done by the cyclotron or atom smasher, from the first one constructed by Dr. C. E. Lawrence at the Univ. of California to the 16th American cyclotron constructed at the Univ. of Illinois; and now, many others.

Hundreds of thousands of dollars are being spent for apparatus with which to effect transformations and many of the greatest scientists are givin their entire time to this work. All this time and money could be saved if we would but realize the fact that nature is splitting atoms all the time for us. That is the source of energy of the universe and it is being given to us free c charge.

The Carnegie Institution of Washington, D. C. has its Atomic Physics Laboratory. At Harvard Univ. mercury has apparently been turned into gold by the cyclotron. This experiment was reported in Washington to the Americ Physical society by Dr. Scherr and Prof. Bainbridge.

The report shows, however, that the amount of gold obtained was so exceedingly minute that its presence was shown only by a indirect method. Further, it is in a for m of gold that vanishes rapidly. It decays like radium. With one form detected, after 48 minutes half of a given amount was gone; afte another 48 minutes half of what remained was gone and so on. Other forms lasted but a few days. Small amounts of platinum were also formed by transmutation of mercury.

A tiny amount of gold was mixed with about a pound of the bombarded me cury as a bait to draw the transmuted gold atoms together. One can see, there fore, that transmutation of metals is an accomplished fact, something which 20 years ago would have been called impossible by the name institutions that are spending so much time and money today on this research. By the same toke lead has been turned into gold in a laboratory in Utah.

It is less than 100 years since science began to consider light, heat, magnetism, galvanism and electricity as natural forces. In the early part of the 19th Centnny school books termed these things imponderable substances. The corpuscle theory of light was taught and the sun was supposed to contain a never failing supply of these corpuscles. After the corpuscles had about faded man turned to the wave theory, but even the wave theory was based on a crude concept of a movement of the ultimate principles or atoms of matter. The electronic theory superceced the old theory and while the electron theory surpasses all former theories, could it be, as greater light leads us on, the electron theiry will be found to lack "absolute" knowledge, and the Einstein Theory stand some revision, amendments, or even undoing?

Si r Humphrey Davy had a definition for heat, he said, "The immediate cause of the phenomenon is motion". Man naturally thought of mechanical motion, the vibration of the "corpuscles" of bodies tending to separate them. The theory of heat has changed some since Sir Davy's Day, but in his day who would have dared disagree with Sir Davy? Who dares to disagree with established theory of today? Who dares disagree with the theory of the Conversation of energy to the slightest degree? The manifestation of a primary force of anything is not necessarily the thing itself. Man can form only a theory, but not a full

conception of it except such as we derive from its phenomena, which may be an effect of the primary force and not the primary force itself, which is quite another story.

CHEMICAL REACTIONS BY MEANS OF ELECTRONIC EXCITATION

If two molecules were beyond each other's Molecular range and if the neighboring surfaces could, by any means as by the supply of electricity from without, be oppositely electrified, the forces of cohesion would be intensified momentarily by something akin to chemical affinity and cohesion would set in over Ultra-molecular distances. The opposite charges cannot be maintained electrostatically between two neighboring metallic surfaces, but they can be momentarily imparted by a sudden jerk or disruptive discharge or receive electric impulses, these are the things which are effective in promoting chemical cohesion. It is not to be supposed that the electronis in a polarized atom need to be disturbed in any great amount in order to produce chemical cohesion, polarization converts ordinary molecular force in cohesion into incipient but real chemical affinity.

It has long been known that electrical forces between charges are of the inverse square law type. The interactions of two moving charbed particles free in space can be easily computed by our analogy to our well-known astronomical problems with due regard to the signs. Coulomb's Law states, "The forces exerted upon each other by two small charged bodies varies directly as the product of the charges and inversely as the square of the distance beween their centers". The force also depends on the kind of medium in which the charged bodies are placed

$$f = \frac{Q_1 \; Q_2}{4 \pi p r^2}$$ p is the permittivity of the medium

As an illustration of the force given by the Coulombs Law, if we have two small bodies each charaged with one coulomb of electricity and these are placed in a vacuum with a distance of one meter between centers the force of repulsion will be 8.9 x 10^9 neutons or 2.25 x 10^9 lbs.

It is obvious that if chemical molecules could be made to obey Coulomb's Law and may be subjected to the interactions of the electrical forces, the impact, or inter-molecular pressure, between the reacting molecules must be very large.

We know from proven experimental facts that at 10^{-2} cm. and even down to 10^{-5} cm. apart, gaseous ions at atmospheric pressure exert very feeble forces on each other. As the ions are being knocked around randomly by molecular impacts, Brownian movement whose impact forces are larger than the attractive forces. Only until they are within molecular distances to each other is the coulombic potential energy equal to or exceeding the average of translation.

$$\frac{ge^2}{4 \pi pro}$$ equal to or greater than $$\frac{3}{2}$$ kt

ro is the molecular distance

Inside this molecular distance the ions are actively drawn together; outside this sphere of radius ro has an electric field given by the equation:

$$X = \frac{e}{r^2}$$

at 10^{-8} cm. X is 10^{8} volts/cm., even at 10^{-6} cm. it is 10^{4} volts cm. It is apparent that the coulombic force within such molecular distances between oppositely charged ions must be very great. The effect is analogous to the entrapping of comets when they pass near a planet, thereby rendering them permanent members of the solar system. Since the stoppage of commet like ions in an encounter with oppositely charged ions occurs well within the limits of atomic magnitude, 10^{-8} cm., so that the acceleration will be of the order of $u^2/2b = 10^{24}$ egs., and the force needed to drop even a single electron will be 1/10 dyne. The power to stop and neutralize such electron s flying with 1/30 of the speed of light inside a molecular thickness can be estimated.

$$\frac{\text{energy}}{\text{time}} = 1/2\, mu^2 \frac{u}{2b} \sim 10^{-27}(10^{9})^{3}\ 10^{8} = 10^{8} \text{ erg/sec}$$

Reaction of excited atoms or molecules is of importance only under conditions of high electric densities, in view of the short time intervals involved, ' that is 10^{-8} sec. Some atoms can, however have electron s in metastic state of excitation lasting some 10^{-4} sec. However, at lower electron densities second impacts can change the phenomena, and such atoms in impact with neutral atoms or molecules of an appropriate sort can lose energy by inelastic impacts causing excitation, ionization or dissociation of the molecules.

In any collision between a charged particle and a neutral molecule ionization takes place because of theelectric force exerted on the planetary electrons in the molecules.

The Bohr Theory of spectral lines indicates that an electron should be able to lose energy to an electron in an atom or molecule as soon as it possesses an energy equal to $hv \sim 1/2\, mv^2$; v is the frequency of the light radiated. When the disturbed electron returns from its orbit or state, it was suspected that the first inelastic impact at increasing energies should correspond to these excitations losses, leading to light emission, and not to ionization, the ionization potential being higher. It was found in complete conformity with Bohr's theory, the first inelastic impacts of electrons with atoms or molecules at lower energies, in general gives rise to the emission of light of the first line of a series of these atoms and that as the electrons' energies increase, the separate higher lines of appropriate frequency appear as the energy reaches a proper value.

At an appropriate energy of the impacting electron, the atomic or molecular electronis are completely removed from the atoms or molecules leaving behind them positively ionized atomic ions or molecular ions.

When an electron possesses more than an ionizing amount of energy, any

superfluous energy which it has after causing ionization is distributed between itself and some electrons removed from the atoms or molecules.

A single electron of appropriately high energy can liberate as many as 4 to 5 electrons at once from an atom in the outer electrons of mercury. The work on dissaciation and the mechanism of ionization in certain gases such as the rare gases, nitrogen and hydrogen, has shown the possibility of the simultaneous excitation and ionization of the same atom by a single electron impact of appropriate energy.

It is found with few exceptions that the larger the diameter of the atoms and the larger the number of external electrons the smaller the excitation and ionization potential will be.

The probability of resonance or ionization is greatest at the precise ionization or resonance potential and falls off exponentially from what value on only to rise again as the next potential is reached. In any case it can be definitely stated that the probability of ionization and excitation calculated on the basis of the electron free path in a given gas the number ions formed are a maximum at the ionization or excitation potential; thereafter, they drop rapidly to lower values as the electron velocity increases.

Experimentally found the number of ionizing collisions per meter made by an electron, is approx. proportional to the excess of energy of the electron above the ionizing energy;

$$n = C(E-E_1)$$

E is the actual energy of the electrons
E_1 is the ionization potential of the gas
C is a constant

The energy an electron must have before it can produce an appreciable amoun' of ionization is always considerably larger than the ionization potential. The ionization potential determines only the energy at which ionization by collision starts. The greatest amount of ionization occurs when the electron has an energy 5 to 10 times that given by the ionizing potential.

The minimum value of the potential at which definitely inelastic impacts of electrons with atoms or molecules set in and where the electrons lose all, or a large fraction of their energy at a single impact, is called the critical potential. It was first observed that the conductivity of gas was increased at the critical potential, or first ionization potential, that is, when an electron acquired an energy of equivalent volt V_o, characteristic of a given gas, it was able on impact, to remove an electron from an atom which has an ionization potential of V_o. This is expressed in electron volts.

The second ionization potential corresponds to the work required to remove a second electron from the atom or molecule, when the atom or molecule has already been ionized.

Unless ionization occurs, atoms and molecules can absorb only discreet amounts of energy, this energy has the effect of moving the most loosely held orbital electron or electrons in an atom to some larger orbit. Thus at normal temperature 27°C., the average kinetic energy of the gas molecules corresponds to less than 0.04 e.v., that is, the fraction of the total number of molecules which has energies greater than that necessary for ionization of the gas is extremely small.

Because the mass of the electron is so very small the energy it loses in an elastic collision is only a small fraction of its total kinetic energy. The fraction f is given by the following equations:

$$f = 2.66 \frac{mM}{(m-M)^2} \; ? \; \frac{(1 \; ? \; WM)}{WM}$$

W_M average mass of the molecules

W_m average mass of the electrons

f is approximately equal to m/M even when the average energy of the electrons is only 20% or 30% larger than the average energy of the molecules. Thus with a comparatively small electric field, if the electrons can make a sufficient number of collisions the average energy of the electron can become many times of the molecules.

If the electric intensity were only 100 volts/ampere the average energy of the electrons in oxygen would be about 4.5 e.v. at 1 mm. Hg. This corresponds to a temperature of 35,000°k. Under conditions such as these the actual kinetic energy of a fairly large fraction of the electrons would thus be larger than the ionization energy of the molecules and ionization could occur owing to the collions of the electrons with neutral molecules.

The forces acting between an electron and a molecule varies much more than the inverse square law coulomb. This is represented by the following equation;

$$f = \frac{(D-1) \quad O^2}{2 \times 3.1416 \; N_r^5}$$

this assumes spherical elastic molecules and ions, these attract each other at a distance r with a force f. Thus an electron can approach very closely to a neutral molecule before experiencing any force due to the neuclei and the orbital electrons. If then, the electron has made a series of collisions and its energy or velocity is sufficiently low it can attach itself easily to the neutral molecule to form a negative ion. However, at too low pressures, the electron mean free path is increased and collisions are few thus insufficient to bring about the

formation of negative molecular ions.

Electrons of low velocity approaching an ionized atom or atomic ion or molecular ion, must be able to interchange velocities so that while one electron neutralizes the ionized atom, the other electron escapes with the total energy resulting from the process. Another example would be a free slow-moving electron approaching an excited atom, the energy of excitation is given to the slow electron while the excited electron returns to its normal orbit without radiation or to some intermediate orbit with radiation of lower frequency. A classical example for illustration is the irradiation of mercury vapor by the line 2537 Å; the mercury vapor becomes activated, is then in a metastable state; if these atoms collide with Thallium atoms while in this state, a thallium-electron would be raised to a higher level so that it emits the green thallium line. The difference between the energy of the 2537 Å line and the low-energy thallium line, is converted into kinetic energy of the separating mercury and thallium atoms after impact. If the activated mercury atom strikes hydrogen molecules in the excited state the energy is converted into the work is dissociation of these molecules into atoms or molecular hydrogen fragments. If the excited mercury atom collides with an atom of lower ionizing energy, this may remove an electron from the neutral atom ionizing it, and itself returns to the normal state.

Methods of electronic excitation:

A. Processes in the gas itself;

1. Rapidly moving electrons, and beta rays from radioactive changes.
2. Rapidly moving positive charges, protons and alpha particles.
3. Rapidly moving positive ions in high electrostatic fields.
4. Photo electric ionization by ultraviolet light, X-Ray and othe rays beyond the light rays as coming from the Cosmos.
5. Through chemical reactions in the gas, e.g.e. oxidation of NO--NO_2 P-----P_2O_3, P_2O_5, etc.
6. Possibly ionization and excitation of thegas may be caused by temperature alone without action of the walls, or by impact of rapidly moving neutral atoms or molecules from other sources, for example neutralized alpha rays, etc.

B. Processes due to solid or liquid surfaces in contact with the gas.

1. Bombardment of metal by fast electron s, alpha particles, positive ions or recoil atoms giving secondary atoms.
2. Action of metasable atoms on solid surfaces giving secondary atoms.
3. Action of gamma rays, X-rays and light on solid or liquid surfaces giving electrons photo-electric effect.
4. Incandescent metals in general emitting large numbers of electrons called thermo-ionic emissions.
5. Incandescent surfaces having salts, phosphates, oxides, chlorides, or complex metal salts of mixed composition, at lower temperatures give positive ions such as sodium ions potassium ions, barium ions, etc.

6. C hemical reactions at surfaces, oxidation of moist phosphorus, potassium, sodium, etc. give ions of both signs, but more negative ions.
7. The atomizing of liquids into minute droplets by high velocity air currents tangential to the surface causes the smallest droplets to become negatively charged. If water is used which contains ions. the larger droplets have ions in them and are predominately positive. The source of conductivity of the gas is the source of the charges on rain clouds and thunderstorms.
8. Frictional effects between solid particles suspended in gases, as typified by electron in s and storms.
9. Ionization of a gas can occur when the average energy of the molecules becomes so great that the energy transferred ina collision bew een two neutral molecules is sufficient to ionize one of them.
10. The collision of free electrons with neutral atoms or molecules. Ionization by collision between molecules and electrons in thermal ionization may involve several processes:
    a. The electrons may ionize directly in colliding with a neutral molecule.
    b. The electron may excite a molecule and a subsequent electron may ionize it.
    c. An electron might excite a neutral atom which subsequently in returning to its normal state would give off radiation and cause photo-ionization either in the gas or at the walls of the discharge.
11. The electric field is then one of the most important ionization agents.

An ion moving under the influences of the forces of the electric field is given by the following equations:

$$F \pm XAned$$

legend F -- force; X--field strength; A--base area volume; n--ions/cc; e--charge; d--length parallel to field

This force acts on each ion between its 10^9 collisions/sec. with molecules to give it momentum in the field direction. At each of the 10^9 impacts some of this momentum is yielded to the neutral molecules with which the ion collides. As a result the molecules are set into a motion along X.

When a molecule captures a charge to become a molecular ion it moves in the electric field according to the following equation:

$$K = e / 6 \times 3.1416 - a(1 - AL/a)$$

e charge; coefficient of viscosity;
a-radius of particles; A constant, (.874)
L Mean free path.

The distance a molecule moves between impacts is called a free path, the mean free path is dependent on the velocities of the ions.

Now an ion that has fallen through a potential difference of one volt will have a kinetic energy of 1.6×10^{-19} joule. That is,

$$q\,E \text{ ----- } 1 \times 1.6 \times 10^{-19} \text{ ------- } 1.6 \times 10^{-19} \text{ jould}$$

According to the equation: $q\,E = \frac{1}{2} mv^2$

we find that the velocity of the particle after falling through a difference of potential of E volts is entirely independent of the length of the path the particle has traversed and also entirely independent of the form or shape of the electric field. The electric field intensity may be distorted in any way we please. That is, it may be at a high at one point, low at another, but still if the total difference in potential is E volts, the velocity of the particle will be:

$$V = \sqrt{2q/m(E)}$$

E. g. an electron with the kinetic energy of one electron has a velocity of: $V = 5.93 \times 10^5$ meters/sec.

A hydrogen ion having a kinetic energy of one electron volt would have a velocity of 9.85×10^3 meters/sec. Or nearly 6.1 miles per second. Hence the mobility of charged particles, positvely charged molecular ions and negatively charged molecular ions or atomic ions in the electric field may be controlled by simply controlling the difference of potential through which the particles are falling. Further, since the molecules are to react with one another the rate of reaction and the intensity of said reaction may be controlled at will.

A specific case in which the electric field performs the double function of molecular excitation and the creation of inter-molecular and atomic ions is being given by the system used by the inventor.

It is a system utilizing the principles of the wire corona with concentric cylinder at different pressures. The system is modified in conformity to the concept that chemical reactions must take place when the two oppositely charged molecular ions from an appropriate activated catalyst are accelerated against one another in the wire corona, it consists of a cylinder made of a suitable catalyst (nickel, platinum, iron, vanadium, etc.) from which positive atomic ions are emitted. The reactants (gases) streaming through the chamber parallel to the length of the wire attain the polarity of the negative molecular ions by the high electric field close to the wire. As these negative molecular ions are accelerated at the right angles to the wire in the direction of the electric field toward the positively charged catalyst cyclinder, they are met by an avalanche of onrushing atomic ions from the catalyst. A certain amount of reaction takes plac in that instant. (10^{-8} sec.) However, some of the negatave molecular ions outside the mean free path of the positive atomic ions are free to rush headlong toward the positive cylindrical field where they are neutralized, and instantly given a positive charge by the avalanche of outrushing positive ions. These positive molecular ions are accelerated back o into the field and collide against the negative molecular ions coming from the direction of the negative electrode corona. This melee continues until the reaction has come to a point when the individual participants are either all gone or the mixture is outside of the electric field; backrus oscillations.

The MOray apparatus combined with other equipment, consists of a combination of specially constructed tubes which we will refer to as valves, "pressure transmitters", interceptors and oscillators. The valves are not rectifiers in the sense that they operate as readio valves in changing A. C. or H. F. to D. C. They have an actual valve action in stopping the "flow" of energy which may be thought of as oscillatory action similar to the waves of the sea, without rectification, from returning to the outer circuit, much as a retaining wall could stop the waves of the sea from returning. The other modalities and "tubes" of the device are equally unique in their performance. Although no new laws of energy are being advanced or claimed as having been discovered, the application in the method of utilization of the energy throughout space is unique in that "Generation" is accomplished by oscillatory utilization rather than by the conventional prime mover. These detector tubes have a synchronized pull with the specially developed oscillators of high faradic capacity and provide a means through which oscillating energy may pass to specially constructed valve oscillators whose relation to the first stage valve is such as to permit oscillations to come in from but not to return to the outer circuit with an automatic variable relation to the oscillations from the universe, and capable of setting up within their circuits initial oscillations which coincide with the oscillations of the universe.

Special provision is provided to stop R. E. tubes from becoming blocked in their disipation of the charges created by the oscillations that continually accumulate based on the oscillatory capacity back rush effect common to capacitors and herein applied to vacuum tubes. This action of these devices has the effect of enlarging and proponging the time of charge and discharge of the capacitors and the capacity energy in the circuit to an appreciable interval in perfect harmony with the natural energy wave through the intercepter's valves and oscillators in the circuit which set up in the circuit electrical pulsations corresponding to the energy waves captured by the intercepter and again kept from returning to the second outer circuit by multi-walled valves. The final tubes act as energy pressure transmitters with a means to prevent "shunting" condensation by a special form of "getter". This stops condensation accumulating at the base of the tubes which would block their ionic action.

One must split the energy discharge band into lines of variation, call this what you will, lines of energy or lines of light beyond the "light rays". The oscillations, therefore, do not become simple oscillations but through the action of the Universe set up an energy flow which might be referred to as the assertion of inertia. When inertia sets in the action will continue because of the oscillations of the Cosmos, otherwise one would have a complete dissipation of energy andno oscillations. The oscillations will vibrate during the same period of time regardless of the potential, but the rate of vibration of the device depends on the "capacity" of its modalities, i.e., condensers, etc.

Let us go from the known to the unknown. We have referred to a form of sonic action in place of the common electronic liberation accomplished in radio

tubes. It is an accepted fact when various substances are bombarded with alpha rays they are found to give off electrons. This is the principle involved in various vacuum tubes. Tomson gave a similar action of liberation the name of Delta Rays. These Delta Rays or electrons are thought by some to originate in a type of ionization which might be referred to a "thermions", give off when the alpha particles strike the bombbarded substance. Is it, therefore, possible some "particle" from the Cosmos, with greater penetrating power than Alpha Rays, would penetrate quartz or various substances and set up a decided ionic action? I am only asking questions to put a point over without further disclosures on the idea. One maybe could learn much froma glorified "monochromator".

Just as sodium, potassium, caesium, rubidium, barium, strentium, react to visible light, or let us say wavelengths, within a certain range, might not certain other substances or substance react to oscillations from the Cosmos?

The universe is analogous to a radio transmitting station. It is continually emitting energy, only of a greater range of wavelength. Wavelengths and frequencies are truly the answer to all vibrant worlds of living things. The stellar laboratories providing environments as yet unproducible by man or perhaps only unrecognized. The terms cosmic energy, radiant energy (as used by Dr. Moray) can be thought of as synonymous terms of frequencies of unknown and undefined limits. In fact,limits of arbitrarily named ranges of the spectrum, which the spectrum has not defined so that the terms should be recognized, as meaning a locality in the wavelength scale without being definitely "fenced". Energy must be absorbed to be utilized. Absorption converts energy into heat, chemical energy, mechanical energy, electrical energy and perhaps into forms unknown at the present time. "Vibrant with life" is more than a poetical phrase.

In its simplest form an ion consists of a molecule of air that has either one or more or one less than the quota of electrons for the electrically neutral molecule. The former is a negatively charged, the later a positively charged ion. Positive ions are attracted toward negatively charged bodies while negative ions drift away from them. This process goes on and the body loses its electrical charge at a rate that is proportional to the abundance of ions, to the velocity at which the ions move towards the attracting body. The velocity is less or greater if the ion is not the simple type but consists of a variable aggregate of molecules. Much could be written on this but the above should suffice for the present purpose. Let us go on from, not stop at, the Ultra Violet Light THeory of Aurorea.

In many electronic tubes the electrons are not emitted directly from the filament but from an indirect Cathode which does not enter into the direct electrical function of the tube. DOes this teach us anything toward an indirect generation of ions and ionic action? Could the opposite deflection of alpha and beta rays and the undeflected course of the gamma rays teach us anything about cosmic energy or radiant energy valves and oscillators?

The more perfect the ionic action the greater the velocity. The greater the maan free path and the greater the collecting voltage the greater the ionic gain of energy will be between collisions and the greater the amount of kinetic energy will be conserved. The collision will be "perfectly elastic".

The little we know about "space" and what it contains or may contain is so limited that we are forced to acknowledge anything is possible beyond our experiences. The actual material of space consisting of the matter of celestial bodies is a very small part of the whole. There may be many all pervading energies or matter that are more important than those we have detected. The very fact of our inability heretofore to detect them may make them all the more important in the cycles of our life and the things we know.

There is a multiplicity of phenomena which occurs at the same time in gas conduction, the known laws are largely empirical and approximate. Ohm's law is valid in only a few limited cases, conductivity changes markedly with the variety of gas and the gas pressure. In the detector and intercepter circuits it becomes more important to maintain oscillatory action than frequency stability.

The combination of natural vibration and forced vibration is particularly important. It must be remembered that a point of resonance will be reached at some frequency and the charge will reach a magnitude depending on the impressed force which, in the case of the universe, is immense--the effect of resonance, pure resonance.

Science claims complete resonance is not producible. Science also, at one time, said it was impossible to transmit the human voice over a copper wire. That is and will always be a fact, but the same results are obtained. Science also said it was impossible for a heavier than air device to "fly".

Resonance has been obtained where a return wire in an electric circuit is not necessary. Pure resonance offers many dangers to the inexperienced investigator. The walls of Jericho are an example of pure resonance. Marching feet, running dogs and some music comes within the danger zone for bridges and the other mechanical structures, as also the breaking of a water glass. Every substance has a natural vibratory resonance and a point of dissociation.

The theory is that in perfect resonance the oscillations will become more and more vigorous until the vibration or oscillation will go on forever, or to the dissociation of the matter. However, while this will be true in theory, it is only partly true. In fact, if one can obtain resonance with the "great generator", the universe with its multiplicity of vibrations corresponding to the natural vibration and pure resonance of the different substances--each substance has a different pure sonic, pure vibration, pure resonance, call it what you will--buildings may be made to fall, glass to break, matter to explode, but only such things as come within the certain vibratory ranges of that resonance will be affected. The vibratory rate and the resonance of water is not exactly the same as

that of oil. Find the proper resonance of certain "kinds" of matter and the constructive results will far outweigh the destructive. Gasoline and fire each have their place which must be honored and feared as also appreciated. Man can destroy himself now, so where will a pure controlled resonance make too great a difference? There are enough things which, in the hands of babes, ignorance or knaves can snuff out nearly everything now; so, where need pure resonance be feared? The writerhas, as Tesla did, come very close to pure resonance with certain substances. Being in resonance to one substance as compared to another is not being in resonance to all substances.

Put together in pure resonance certain electrical responding modalities which synchronize with the resonance of certain vibrations of the universe and what have you? Usable energy from the universe. This energy may come to the planets as oscillations similar to the oscillations and the tides of the sea. The R. E. tubes received this energy in surges which may last only a few microseconds but the pressure and the current in those surges are so large that sufficient energy is delivered to the equipment in resonance as to be unlimited and usable in multiples of flashes and a magnitude which will compete with the light of day. Remember resonance and pressure can do a lot of amplifying of energy. Also remember the vibrations going out from the sources in the universe must also return to its sources. Nothing is lost only a lowering of potential like water over the wheel.

The R. E. tubes present no new laws of physics. It may be a case of advancing further in the law and thereby obtaining results not at first deemed possible. This is the history of science. R. E. tubes possess greater ability' to obtain "saturation" and thus charge the accompanying capacitors or condensers at a more steady rate which, when a certain voltage is reached, ionization occurs in the gases of the discharged tube and causes the condensers of the valve circuit to discharge into other condensers of the oscillators and other modalities of the circuit.

When ionization in the preceding tubes is no longer possible because of the reduced voltage, the process starts all over agin. The first valve passes vibrations of energy into an oscillatory circuit, ionization sets in, a discharge occurs and energy passes through another valve into other oscillators. The process is repeated from the first stage on to the second on to the third and so on, much like a bucket bridge. That is why I asked years ago, "cannot a steady flow of water be obtained from the waves of the sea or energy from the vibrations of the Cosmos?"

Many phenomena, especially those occurring in certain frequencies, are still unexplained and there are numerous places where the classic theory and observed facts do not agree.

When a vibration of any kind strikes a boundary between two media of different vibratory impedances at an angle of other than 90 degress, a transformation of the vibratory rate may be changed into another vibratory rate. The R. E.

Device, therefore will continue to capture energy by resonance, or call it what you will, as long as the "keep alive" vibration of the Cosmos continues to oscillate the various stages of valves and oscillators in the circuit. Simple is it not? Just a case of the trapping of energy which is everywhere present in the primary circuit and causing it to oscillate through the secondary circuits through a blocked circuit of no return.

Our experiments have proved that there is an energy which exists in the universe which, by proper development of equipment can be made available for commercial use.

One may say all "energy" comes from the sun. Can one prove the sun is the foundation of all "energy"? Or is the sun a transmitter of energy? That light is an electrical phenomena has been amply proved. The atoms in those distant stellar crucibles have moving electrons which are emitting electromagnetic waves of many lengths and many frequencies, which can be tuned to certain ranges of wavelengths. Our eyes and other senses respond to some of these frequencies but there are many beyond those which we loosely term light. The photographic plate records some of these and also invisible radiations of shorter wavelengths or higher frequencies known as ultra violet radiations. There are radiations measured by their heating effect of longer wavelengths or lower frequencies which we call infra-red radiations. There are electromagnetic radiations of still shorter wavelengths. These are gnerally known as "Roentgen Rays". There are rays of still shorter wavelengths; these are of unlimited power. These are born and put into locomotion from the very "Source of Foundation of Energy". What is a man to do with such a picture of the universe other than let our interest and admiration grow? But will we ever get to the final foundation? Anything is possible beyond our experiences. And as Tennyson said:

"One God, one law, one element
And one far-off divine event
To which the whole creation moves"

Where does the electric generator get the electricity which we say it generates? Does the generator create it? We might as well say the air pump creates the air or the water pump creates the water. Everywhere from stellar space to atomic space we find what? Motion--vibration--we study much about the evolution of matter and the evolution of forces but we learn little in proportion to what there is to learn.

Electricity if vibrations. Where ether (or if you do not like that name, call it what you will) is quiescent, we see nothing. Light causes vibrations of this ether and it is these vibrations which our eyes detect. All substances are really combinations of one primordial substance i.e. vibrations, or in other words, electricity is specifically modified ether. Electrons in motion go to constitute an electric current. What electricity is to matter, so is electric force to common mechanical force, and electrical inertia to mechanical inertia. By inertia, we mean the ratio of force to acceleration.

Here on earth we have many "receiving stations" which are tuned to certain ranges of wavelengths.

Energy was defined in 1892 as a condition of matter, in virtue of which, any definite portion may effect changes in any other of definite portion. Later discoveries have since confirmed this. Energy then, is a state of matter, or rather, the result of a particular state or condition in which matter may be, when any observed phase of energy appears.

Cosmic rays, cosmic vibrations and matter may appear to consist of two entirely different things, but the fact is, these two subjects are actually joined together. Those highly penetrating rays which we call cosmic rays, originate somewhere in the remote spaces of the universe and continually bombard our earth with almost continuous vigor day and night, year after year.

We must not think of cosmic rays, ultraviolet, X-ray, gamma or any ray, as simple in character. None of them in any sense of the word consist of a single type of ray. Ultraviolet rays, X-ray, gamma rays, cosmic rays and so on all consist of various wavelengths or frequencies. That is all ultraviolet rays are not of the same frequency, all X-rays are not of the same frequency any more than all radio waves (hertzian waves) are the same frequency. All are exceedingly complex in their make-up. This complexity is what has given them such an important place in the study of the physical sciences.

The great study of matter and cosmic rays so closely tied together, will open up greater and greater fields of science for the practical good of the human race.

A few years ago before the Wright Brothers' first flight, an Indian farm boy, Frances Jenkins, came to Washington to take a Govt. post. But after a few years, he gave up his job to devote his life to inventions. This was the period when Marconi wireless waves were first being heralded, and soon all over America, amateurs were communicating by dots and dashes. In those days, radio broadcasting was unknown. But already young Jenkins cherished a fantastic dream of sending sight, as well as sound, "through the air".

In order to raise money to build his elaborate experimental devices, Jenkins began to invent things. One of these was the self-starter for automobiles. Also he helped to develop the projector which has made possible the modern motion picture. All told, he secured patents on 400 inventions. By the year 1922 he had carried his experiments to the point of sending the first still photograph by radio. But the dream of sending the first living, moving pictures through the air still haunted him. And, he needed money so badly!.

Turning aside temporarily from his television, he invented the paper ice-cream cup and the modern milk bottle cap. With the proceeds of these lowly but useful inventions, he turned again to television.

And then, one day after years of tireless effort in the old Naval Radio Station in Washington, Jenkins focused a television camera upon a small model of a windmill. The blades of the windmill were set in motion by the wind from an electric fan. Hurrying back to his laboratory, several miles distant, Jenkins watched the image of the little windmill turning steadily in his receiving set. He rushed to the telephone and called Secy. of the Navy, Wilbur, to come over at once to see his "radiovision" in operation. Secy. Wilbur and other Govt. officials rushed to the inventor's laboratory. The blades of the little windmill were turning in the first successful television demonstration every made. Years of experimenting continued. What might have happend if our Govt. had helped him?

And then a tragedy! Francis Jenkins died. He never lived to see the complete fulfillment of the dreams that had been his through all the years.

What is the connection of the work of Jenkins and Cosmic rays? Just this, everything consists of vibrations, the source of the Universe, the creation of all that exists or ever will exist, nature or man-created, the sonic of "Life ".

We do not need the man-made cyclotron nor static generator. We do not need man-made so-called nuclear generators (atomic pile). The Universe is the only cyclotron, betatron, sychrotron or atomic pile. We need radiant energy from stellar space.

In the laboratories of the universe we find the uranium and radium series changing from uranium to radium, radium into radon A, B, C, C_1, D (radio lead) radium E. & F., and finally into lead, and if we follow the process, lead into gold and so on. In the laboratory lead has been changed into gold and by reversing the process changed lead into polonium or radium F. If this step can be taken either way, is there any reason why further steps cannot be taken?

This is not a case of splitting the atom, but merely of addition, multiplication, division and subtraction of the combinations of the atoms, but not the breaking into of the chain of the universe. It is plain evolution of matter and evolution of forces, and there is no need in highly overestimating the accomplishment under misinterpretation of the facts.

As frequency vibrations or oscillations is the basis of the existence of all animal, vegetable, and mineral matter, one could explode matter from any distance to which the proper oscillation, vibrations could be transmitted.

In AMerica and abroad, scientists have devised the thermal diffusion method which has proven to be one of the most efficientmethods of separating the different forms of isotopes of the elements. With this method scientist have separaed not only the isotopes of chlorine, but those of neon, krypton and other.

Experiments have also satisfied us that gravity is akin to, if not an "electrical" oscillation, so well balan ed that we might, for the lack of a better name, almost call it a "Wattless energy" until some force is exerted to oppose its potential and then gravity opposes such force. This means gravity can be

controlled and unlimited advancement made in air navigation, with the only concern left being air speed and momentum.

There is much of value to be developed in fields that have not even been touced and about which very little is known in research on the atomic nucleus. SOme astounding discoveries in artificial radioactivity have been set up, not by the usual expensive method with the cyclotron, but by new tubes and oscillators. A new world is to be entered through ultrasonics, hyper and ultra high frequen currents created through the use of certain tube discoveries working in ionic as well as electronic action.

Whatever frequency of current used and whatever ray or rays used, the frequency of the current and the wavelength of the ray or rays used must harmonize so as to blend or synchronize with the natural frequency or wavelength of the substance treated so as to produce the synchronous action that will set up a vibration for which we might "coin" an expression and call this action a "super-ultra sonic reaction" between the frequency of current, the wavelength of the ray, and the vibratory rate of the substance treated to cause the desired catalystic reaction.

Where can be find the source of energy to open to us the "Key to the Universe"? From the cyclotron, the synchrotron, betatron or from the "electrostatic generator"? All of these are highly prized by the physicists although the latter has been rather obscured in the public mind by the glory of the cyclotron an synchrotron. But these wonderful devices are the not answer. They are too expensive and too small when compared to the real source of energy, for, as Benjamin Franklin said, "One is paying too much for his whistle". The great cyclotron of the universe is doing the same thing much moreefficiently and at far less cost to us. Reapeating again: "In far-off cosmic space the same laws are being obeyed as in our laboratories. There matter does not exist at all as the realistic substance which we had supposed it had to be. There at its very foundation it consists of electric charges which stimulate the motions of celestial bodies." Is nuclear or atomic energy the answer?No!!

No matter how one looks at the so-called "atomic pile" it is absolutely wrong to refer to its action as "atom-smashing". No atoms have been smashed or destroyed. They have only taken advantage of new found momentary freedom. Let me emphasize again, this is not a case of splitting or smashing the atom, but merely of addition, multiplication, division and subtraction of the combinations of the atoms, not a breaking into the "chain of the universe" but plain evolution of matter and evolution of forces and there is no need in highly overestimating the accomplishment under wrong interpretation of the facts.

The atomic arrangement may have been changed, but the atom still remains in the form of matter as we understand matter or as energy which is also a form of matter in the evolution of the universe.

We asked the question over 35 years ago, we repeat that question now: "Why should man waste his time and efforts in trying to get energy out of the

atom when nature is doing it all the time for us out in space?" Why not use the energy offered us in place of worrying about "why grass is green", or"atom splitting" or what have you, in the hope these will discover for us a new source of energy which has been sitting on our doorsteps since the world began?

The salt of the earth is energy and the evolution of matter and theevolution of forces is the process of the creation of all things. By proper uses of these natural laws of energy and matter, matter is turned into energy. That is something we all agree can be done but do we understand that man can, by proper use of these same laws take energy and reverse the process and change energy into matter? In the light of present day science the dream of the alchemis is not so foolish now.

It is not a question of finding new elements, but of being able to use energy and matter in whatever wavelengths one finds them and of changing them to any desired wavelength or frequency by letting nature do our "atom splitting" for us. It is merely cheaper, faster, more sure and the potential possibilities far exceed any puny efforts of man. I say, "puny" for, while man may discover new means of causing explosions and of creating explosives, he has not and cannot destroy the atom. It is merely a question of a change in form, no less matter and no less energy. We separate matter or energy only to have them join elsewhere. If we can split the atom, actually we will have split the chain that holds the cycle of the universe together and like one drop of gasoline exploding all the other drops of gasoline near it, so will the chains of atoms go right on destroying every other atom of the universe into total destruction of all matter.

The opinion that atomic energy is a discovery of the 1940's, a scientific creation of the War years, is not correct. All one needs to do to upset such an idea is to study the research work of a score of scientists of 50 years or more ago. We will learn there are no so-called atomic secrets. A few of these scientists were Gustave Le Bon, Davy, Ampere, Faraday, Fleming, Galileo, Kalahne, David Henry, and others. Of such scientists as these M. Lucien Poincare wrote, "The most profound discoveries, those which will suddenly reveal regions entirely unknown and open up perfectly fresh horizons will be made by a few men of genius who will pursue in solitary meditation their stubborn labor, to verify their boldest conceptions." To substantiate the above statements we can quote Gustave Le Bon.

Facts prove that matter is capable of a dissociation fitted to lead it into forms in which it loses all its material qualities. Among the most important Dr. Le Bon noted the emission by all bodies of particles endowed with immense speed, capable of making the air a conductor of electricity, of passing through obstacles, and of being thrown out of their course by a magnetic field. None of the forces then known were able to produce such effects, particularly the emission of particles with a speed almost or equaling that of light; it was evident that science then found itself in the presence of absolutely unknown facts. Several theories were put forth in explanation of them. One only--that the dissociation of atoms, which Dr. Le Bon advanced at the commencement of these researches has resisted all criticism and on this account is now almost universally adopted.

It is now many years since Dr.. Le Bon proved by experiment for the first time, that the phenomena observed in substances termined radioactive--such as uranium--could be observed in all substances in nature, and could only be explained by the dissociation of their atoms.

The action of light on any substance, a lighted lamp, chemical reactions of very different kinds. an electric discharge, etc., cause these effluxes to appear. SUbstances termed radio-active such as uranium or radium, simply present in a high degree a phenomena which all matter possesses to some extent. When Dr. Le Bon formulated for the first time this generalization, though it wassupported by very precise experiments, it attracted hardly any attention. In the whole world one physicist, the learned Prof. de Heen, alone grasped its import and adopted it after having verified its perfect correctness. But the experiments being too convincing to permit of long challenge, the doctrine of the universal dissociation of matter at last triumphed. The atmosphere was then cleared, and physicists no longer denied that this dissociation of matter--this radioactivity as it is now called--is a universal phenomenon widely spread throughout the universe; and, as Prof. J. J. Thomson demonstrated, exists in most substances--water, sand, clay, brick, etc.

What becomes of matter when it dissociates? Can it be supposed that when atoms dissaggregate they only divide into smaller parts and thus form a simple dust of atoms? We shall see that nothing of the sort takes place, and that matter which dissociates dematerializes itself by passing through successive phases which gradually deprive it of its material qualities until it finally returns to the rate of vibrations whence it seems to have issued as energy.

When the fact is once recognized that atoms can dissociate and reappear as energy and then from energy back to matter then the question arises as to whence they obtain the immense quantity of energy necessary to launch into space, particles with a speed of a same order as light or greater.

The explanation in reality is simple enough, since it is verified that far from being an inert thing only capable of giving up the energy artificially supplied to it, matter is an enormous reservoir of energy, intra cosmic energy.

Parts of such a doctrine years ago assailed too many fundamental scientific principles accepted for centuries to be at once admitted. Accustomed to regard the rights, the rigid principles of thermodynamics as absolute truths, and persuaded that an isolatedmaterial system could possess no other energy than supplied from without, a majority of physicists long persisted in seeking outside of it the sources of the energy manifesteddurin the dissociation, not disintegration of matter. Gradually we are coming to see the facts.

The reality of this form of energy is proven by experimental facts. Cosmic energy is the most powerful of known forces, and is the origin of most others including intra atomic energy.

Mater, formerly regarded as inert and only able to give back the energy originally supplied to it, is, on the other hand, a colossal reservoir of energy intra-atomic and intra-cosmic energy which can be expended without borrowing anything from without.

It is from the intra-sonic energy manifested during the dissociation of matter that most of the forces in the universe are derived, notably electricity and solar heat.

Force and matter are two different forms of one and the same thing. Matter represents a stable form of intra-atomic energy; heat, light, electricity, etc. represent instable forms of it (cosmic energy).

By the dissociation of atoms, the stable form of energy termed matter is simply changed into those unstable forms known by the names of electricity, light, heat, etc.

For the examination of these several propositions let us, as a basis of presentation, take them as proved and seek at once the changes they bring about in a general conception of the mechanism of the universe.

The problem of the nature of matter and of force is one of those which have most exercised the sagacity of scientists. Its complete solution has escaped us because it really implies the knowledge, still inaccessible, of the first cause of things. Scientific theories heretofore set forth have not allowed us to completely solve this great question. They lead, however, to a conception of matter and energy far different from that in use at the present day, cosmic energy.

We can arrive at the conclusion that matter is an immense reservoir of energy solely constituted by a system of vibrating atoms maintained in equilibrium by the rotations, attractions and repulsions of matter's component parts. From this equilibrium result the material properties of bodies such as weight, form, and apparent permance. Matter also represents movement, but the movements of its component elements are confined within a very restricted space. This conception leads us to view matter as a variety of energy. To the known forms of energy--heat light, etc. --there must be added another--energy from the cosmos which embraces but surpasses intra-atomic energy. This energy is characterized by its colossal greatness and its unlimited accumulation within everything in the universe.

It follows from the preceding statements that by dissociation of matter one is simply giving to the variety of energy which fills all space in a different form--such as, for example, what we call electricity or light but in reality are radiations or forms of vibrations.

We will endeavour to give an account of the forms under which this energy of the universe may be condensed within the atom, and the cosmos, but the

existence of the fact itself has a far greater importance than the theories it gives rise to of simple atomic energy. Without pretending to give the definition so vainly sought for of energy, we will content ourselves with stating that allphenomenality is nothing but a transformation of equilibrium. When the transformations of equilibrium are rapid, we call them electricity, heat, light, all forms of vibration. When the changes of equilibrium are slower, we give them the name of matter. To go beyond this we must wander into the region of hypothesis and admit that the elements of which the aggregate is represented by forces in equilibrium, are constituted by vortices formed in the midst of the universe. These vortices posses an individuality, supposed by some to be ephemeral but which the evolution of matter and of energy prove to be eternal. The individuality dissappears, and the vortex dissolves as soon as the forces which maintain their existence cease to act but others from elsewhere, i.e. eternal creation, eternal evolution.

The equilibriums of these elements, of which the aggregate constitutes an atom, may be compared to those which keep the planets in their orbits. So soon as they are disturbed considerable energies manifest themselves, as they would were the earth or any other planet stayed in its course.

SUch disturbances in planetary systems may be realized, either without apparent reason, as in very radioactive bodies when, for diverse reasons, they reached a certain degree of instabilitiey, or artificiality, as in ordinary bodies when brought under the influence of various excitants--heat, light, or other forms of vibration.

These excitants act in such cases like the detonator of an explosive--that is to say, by freeing quantities of energy greatly in excess of the very slight cause which has determined their liberation. And as the energy condensed in the universe is immense in quantity, it results from this that to an extremely slight loss in matter there corresponds the creation of an enormous quantity of energy.

From this standpoint we may say of the various forms of energy resulting from dissociation of matter, forms of energy such as heat, electricity, light (all vibrations), represent the last stages of matter before it returns into the cosmos from whence it came.

IF, extending these ideas, we wish to apply them to the differences presented by the various simple bodies studied, we should say that one simple body only differs from another in rate of vibration. If we could deprive any element of a sufficient quantity of the energy it contains, we should succeed in completely transforming it.

As to the necessarily hypothetical origin of the energies condensed within the atom, we will seek for it in a phenomenon analogous to that invoked by astronomers to explain the formation of the sun, and of the energies it stores up. To their minds this formation is the necessary consequence of the

condensation of the primitive nebula. If this theory be valid for the solar system, an analogous explanation is equally so for all matter.

Such a theory clears away the classical duality of matter and energy. These are two identical things under different aspects. There is no separation between matter and energy, since matter is simply a stable form of energy and nothing else and continually changes from one to the other in the cosmos.

We can only understand things by fitting them into the common frame of our thoughts The essence of energy being unknown, we are compelled to materialize it in order to enable us to reason about it. We thus arrive--but only for the purposes of demonstration--at the following definitions: Energy and matter represent entities of the same order. The various forms of energy--electricity heat, light, etc. --are manifestations of matter in action. They only differ in the nature and the stability of the equilibrium formed in the heart of the cosmos. It is through these manifestations that the universe is known to us.

The illustrious Faraday endeavored to clear away the duality existing between matter and energy. Others made the same attempt, by pointing out that matter was only brought home to us by the intermediary of forces acting on our senses. But all arguments of this order were considered as having a purely metaphysical bearing. It was objected to in Faraday*s time that it had not been possible to transform matter into energy, and that this latter was necessary to animate the former. Scientific principles, considered assured, taught that nature as a kind of inert reservoir could create the liquid it holds. Everything seemed then to point out that nature and energy were irreducible thin as independent one of the other as weight is of color. It was therefore not without reason that they were taken as belonging to different worlds.

The transformation of matter into energy having been demonstrated, it follows that energy may be transformed into matter.

The facts summed up in the preceding pages show that matter in a set form is not eternal but as a rate of vibration or energy is eternal, that it constitutes an enormous reservoir of vibrations, and that it disappears by transforming itself into other forms of energy or matter before returning to its source, being in reality just another cycle in the process of creation.

It can therefore be said that if matter cannot be created, it cannot be destroyed but returning to its source begins a cycle again. The elements of a substance which is burned or sought to be annihilated by any other means are transformed and are but a change of vibration. They may lose every quality of matter, including the most fundamental of them all--weight--but that only shows gravity lost its power over such elements because of a change in vibration. The theoretical importance of these principles is considerable but self-evident.

It is easy to deprive matter of all its attributes, save one. Solidity, shape, color, chemical properties, maydisappear but there remains a rate of vibration. The very hardest body can be transformed into an invisible vapor. But, in spite of every one of these changes, the mass of the body, as measured by its weight, remains invariable, and by changing or restoring rates of

vibrations can be made to reappear; this constituted the one fixed point in the mobile ocean of phenomena, vibration . It enables the chemist, as well as the physicist, to follow matter through its perpetual transformations, and this is why matter remains something mobile and eternal.

The importance of permanence and, therefore, the indestructibility of vibration which one recognizes throughout the changes in matter, being the only characteristic by which this great unknown conception can be grasped, necesaarily became preponderant.

These fundamental dogmas, the bases of modern science, the researches detailed in this work tend to destroy. If the principle of the conservation of energy--which is simply a bold generalization of experiments made in very simple cases--likewise succumbs to the blows which are already attacking it, the conclusion must be arrived at that nothing in the world is eternal in a set form but subject to changes of rate of vibration. The great divinities of science could also be condemned to submit to that invariable cycle which rules all things.

On the ruins of former doctrines and after centuries of persistent efforts, there sprang up two sovereign powers which seemed eternal--matter as the fundamental woof of things and energy to animate it, the two being one in a different rate of vibration. With the equations connecting them, modern science thought it could explain all phenomena In its learned formulas all the secrets of the universe were enclosed. The divinities of old time were replaced by ingenious systems of differential equations.

Discovery is rarely spontantous; it only appears so because the difficulties and the hesitations which most often surround its inception are generally unnotice

The public troubles itself very little with the way in which inventions are made, but psychologists should certainly be interested in certain sides of the problems of inventions. In fact, they will find therein valuable documents on the birth of beliefs, on the part played, even in laboratories, aby suggestions and illusions, and finally on the preponderant influence of prestige considered as a principal element of demonstration which much of the time surplant facts.

Radiations of the same family as the gamma rays are incapable of refraction or of polarization, and have small kinship with light. These are the radiations which the so-called radioactive substances, such as uranium, constantly emit abundantly and ordinary substances emit to a lesser degrees

Infra-red radiations of great wavelength pass through black paper, ebonite wood, stone, and in fact, most non-conducting substances. They are naturally capable of refraction and polarization. So also in the study of various rays, certain characteristics will always be found but rates of vibrations can be filtered to effect a change.

The generality of the phenomenon of the dissociation of matter would have been noticed much sooner if a number of known facts had been closely examined, but this was not done. So also is this true of the law of oscillations by vibrations of the universe. These facts were spread over very different chapters of physics For example, the loss of an electric charge occasioned by ultra-violet light has long been known, but not one little thought connecting the fact with cathode rays. More than 75 years ago Niepce de Saint-Victor saw that, in the dark, salts of uranium caused photographic impressions for several months; but as this phenomenon did not seem to be connected with any known fact, it was put to one side as the oscillations of the cosmos are now. For 100 years the gases of the oscillations or vibrations of the universe have gone unappreciated. The common link which connects them appeared clearly when we established that the dissociati of matter and the forms of energy which result from it are to be ranked among the most widely spread natural phenomena. Flames had been observed to dischar electrified bodies without any one determining the exact cause of this phenomenon/. The loss of electric charges through the influence of light had been kno for many years but it was regarded as a fact peculiar to a few metals with no suspicion of how general and important this law was.

All this phenomena and many others, such as electricity and solar heat, are very dissimilar in appearance, but are the consequences of the same fact-- namely, the dissociation of matter.

The discovery of the dissociation of matter by radiation has allowed us to penetrate into an unknown world ruled by new forces, where matter losing its properties as we had known it, becomes a form which passes without difficulty through obstacles, and possesses a whole series of unforseen properties, the far-reaching effect of which we have yet a great deal to learn about.

With the discovery of the universal dissociation of matter is linked to that of intra-atomic energy and energy of the cosmos by which science has succeeded in explaining some radioactive phenomena.

The origin of intra-atomic energy is not difficult to elucidate, if one supposes, as do the astronomers, that the condensation of our nebula sufficies by itself to explain the constitution of our solar system. It is conceivable that an analogous condensation of the cosmos may have begotten the energies contained in the atom. The latter may be roughly compared to a sphere in which a non-liquefiable gas was compressed to the degree of thousands of atmospheres at the beginning of the world.

The reason this force (the most widespread and the mightiest of all those of nature) has remained unrecognized so long is in the first place because man lacked the reagents necessary for the proof of its existence and then, because the theory and atomic edifice erected by science were so stable, so solidly fixed in our minds that its dissociation and connection with the cosmos remained extremely slight. Had it been otherwise the world would long ago have utilized cosmic energy.

But how is it that a demonstration so simple as that of the existence of cosmic radiatnt energy has not been made since the discovery of radioactivity, and especially since the demonstration of the generality of this phenomenon? This can only be explained by bearing in mind that it was contrary to all accepted principles to recognize that matter or the energy of the universe could by itself produce energy. Scientific dogmas inspire the same superstitious fear as did the gods of old, though they have at times permitted all their liability to be broken.

The fact of the existence of a considerable condensation of energy within the atoms of the universe only seems to annoy us because it is outside the range of things formerly taught us by experience; it should however be remarked that, even leaving on one side the facts revealed by radioactivity, analogous concentrations are daily observable. Is it not strikingly evident, in fact that electricity must exist at an enormous degree of accumulation in all substances of the universe since it is found by the electrolysis of water that one gramme of hydrogen possesses an electric charge of 96,000 coulombs? One gets an idea of the degree of condensation at which electricity existed before its liberation in all the universe. Elementary treatises have long since pointed out that barely a twentieth part of the above quantity would suffice to charge a globe the size of the earth to a potential of many thousands of volts. The best static machines in our laboratories hardly give forth $\frac{1}{10,000}$ of a coulomb per second. They would have, consequently, to work unceasingly for a little over 30 years to give the quantity of electricity contained within the atoms of one gramme of hydrogen.

As electricity exists in a state of considerable concentration in all matter, it is evident that the atoms of the universe should have been regarded many years ago as a veritable capacitor of energy. One should have recognized the quantity of this energy must be enormous; it was only necessary to appreciate the magnitude of the attractions and repulsions which are produced by electric charges before us. It is curious to note that several physicists years ago have touced the fringe of this question without perceiving its consequences. For example, Cornu pointed out that if it were possible to concentrate a charge of another sphere also having a charge of one coulomb, the force created by this repulsion would equal 918 dynes, or about 9 billions of kilogrammes.

What about the stars and planets of the universe? We know that by the dissociation of water we can obtain from one gramme of hydrogen an electric charge of 96,000 coulombs. This energy would be enough (and this is exactly the hypothesis enunciated by J. J. Thomson) to dispose the electric particles at suitable distances within the universe to obtain through their attractions, repulsions, and rotations, extremely powerful energies in an extremely small space. The difficulty was not, therefore, in conceiving that a great deal of energy could remain within any atom, not just a radioactive one, but that nature was supplying us from the universe usable energy if we but reached out to harness it. It is surprising that a notion so evident was not recognized long ag

Calculation of radioactive energy has been made within those limits of speed at which experiments show that the inertia of matter does not greatly vary

Science formerly established a complete separation between matter and energy. The classic ideas on this decision will be shown in the following passage of a work by Prof. Janet:

"The world we live in is, in reality, a double world; or, rather it is composed of two distinct worlds--one the world of matter, the other the world of energy. Copper, iron, and coal are forms of matter, mechanical labor and heat are forms of energy. These a two worlds are each ruled by one and the same law. Matter can neither be created nor destroyed. Energy can neither be created nor destroyed.

"Matter and energy can assume various forms without matter transforming itself into energy or energy into matter--We can no more conceive energy without matter than we can conceive matter without energy."

"It is utterly impossible," wrote Lord Kelvin, "that the heat produced can proceed from the stored energy of radium. It therefore seems to me absolutely certain that if the emission of heat continues at the same rate, this heat must be supplied from outside."

Lord Kelvin fell back on the commonplace hypothesis formed at the outset on the origin of the energy of radioactive bodies, which were attributable, as it was then believed, to some mysterious forces from the ambient medium. This supposition had no experimental support. It was simply the theoretical consequence of the idea that matter, being entirely unable to create energy, could only give back what had been supplied to it. The fundamental principles of thermodynamics which Lord Kelvin had helped so much to found, tell us, in fact, that a material system isolated from all external action cannot spontaneously generate energy. Experiment is superior to principles, and when once it has spoken, those scientific laws which appeared to be the most stable are condemned to rejoin in oblivion, the used-up, worn-out dogmas and doctrines of the past.

It would be desirable even in this so-called atomic age to have theory to explain the facts, and to enable science to know whether the energy is borrowed from the atom itself or from external sources from the universe.

Many physicists, like Lord Kelvin, held to the end to the old principles; that is why the phenomena of radioactivity, especially the spontaneous emission of particles animated with great speed and the rise in temperature during radioactivity, seem to them utterly unexplicable, and constitute a scientific enigma, as M. Mascart said. The enigma, however, is very simple with the proper explanation. Today there is an enigma on the use of cosmic power for commercial purposes.

One can hope, whowever, that ideas so opposed to classical dogmas as oscillatory cosmic energy and the transforming of matter into energy and energy into matter will soon be widely acknowledged.

The fact is that the scientific ideas which rule the minds of men at various

epochs have all the solidity of religious dogmas. Very slow to be established, they are very slow likewise to disappear. New scientific truths, although they have experience and reason as a basis, are only propagated by prestige, that is, when they are enunicated by those whose official position gives them prestige in the eyes of the scitnfic public. Truths of such great importance as Ohm's law which governs the whole of electricity, and the law of the conversation of energy which governs all physics, were received, on their first appearance with indifference or contempt and remained without effect until the day when they were enunciated anew by individuals endowed with influence. Now we limit the c onservation of energy without fully understanding what truths it embraces.

It is only by studying the history of sciences that one succeeds in understanding the genesis of beliefs and the laws governing their diffusion. We have just mentioned two discoveries which were among the most important of the 19th Century, and which are summarized in 2 laws, of which one can say that they ought to have appealed to all minds by their marvellous implicity and their imposing grandeur. Now tradition fences them in where we fail to see their magnitude. Not only did they strike no one, but the most eminent scientists of that time did not concern themselves about them except to try and cover them with ridicule. Are we different today?

That the simple enunciation of such doctrines should have appealed to so few shows with what difficulty a new idea is accepted when it does not fit in with former dogmas. Prestige, we repeat, and to a very slight extent, experience are alone the ordinary foundation of our convictions--scientific and otherwise. Even the most convincing experiments have never consituted an immediately demonstrable foundation when they clased with long established accepted ideas that we hate to discard even when the old dogmas have been proven wrong. Galileo learned this when, having brought together all the philosophers of the celebrated University of Pisa, he thought to prove to them by experiment that, on the contrary to the then accepted ideas, bodies of different weights fell with the same velocity. Galileo's demonstration was assuredly very conclusive, since by letting a small leaden ball and a cannon shot of the same metal fall at the same moment from the tope of a tower, he showed that both bodies reached the ground together. The professors contented themselves with appearling to the authority of Aristotle, and would not change or modify their opinions.

That was a long time ago, but the degree of receptivity of minds for new things has not sensibly increased.

When Ohm discovered the law which immortalized his name, and on which the whole science of electrical measurement rests. he published it in a book fille d with experiments so simple and so conclusive that they might have been understood by any child in an elementary school. Not only did he fail to convince anyone, but the most influential scholars of his time treated him in such a way that he lost the berth he occupied, and, to avoid dying of starvation, was only too glad to take a situation in a college at 1,200 francs pe r annum, where he remained for 6 years. Justice was only rendered to him at the close of his life. Robert Mayer, less fortunate, did not even obtain this belated satisfaction. When

he discovered the most important of modern scientific laws, that of the conservation of energy of which the vibrations of the universe is the greatest example, he had great difficulty in finding a publisher who would consent to publish his findings; no scholar bestowed the least attention upon it, no more in fact than on his subsequent publications, among which was the one on the mechanical equivalent of heat, published in 1850. After attempting suicide, Mayer went out of his mind, and remained for a long time unknown, to such a degree that when Helmholtz re-made the same discovery, he was not aware of the work of Mayer. Helmholtz himself did not meet with any greater encouragement to begin with and the most important of the scientific journals of that day, the Annals de Poggendorff, declined to insert his celebrated memoir, "The Conservation of Energy", regarding it as a faciful speculation unworth of the attention of serious readers.

Although matter was formerly considered inert, and only capable of preserving and restoring the energy which had first been given to it, it was necessarily established that there existed within it forces sometimes in considerable amounts, such as cohesion, which forces were independent of all external agents. Other forces, such as radiant heat and electricity, which also issued from matter, might be considered simple restitutions of an energy borrowed from the cosmos.

If the cohesion which makes a rigid block out of the dust of atoms of which bodies are formed, or if that affinity which draws apart or dashes certain elemen one upon the other and creates chemical combinations, or if the osmotic attractions are repulsions which hold in dependency the most important phenomena of life, are visibly forces inhereent to matter itself, then it was, with the old ideas, impos ible to determine the source of this energy. The origin of these forces ceases to be mysterious when it is known that the cosmis is a colossal reservoir of energy that fills all space. Observation has long ago shown that any form of energy whatsoever lends itself to a large number of transformations, and we can conceive how energy from the cosmos may be the source of all the molecular forces--cohesion, affinity, etc. --of matter. We are far from being acquainted with their character, but at least we see the source from which they spring, the universe where matter is born.

Outside the forces plainly inherent to matter that we have considered, there ate two--electricity and solar heat--the origin of which has always remaine unknown, and for which we ca n find an explanation in the theory of intra-atomic energy and inter-cosmic energy, the cradle of the intra-atomic energy.

When we approach in detail the study of the facts on which their theories are abased, we find that electricity is one of the most constant manifestations of the dissociation of matter. Matter being nothing else than cosmic energy itself, it may be said that to dissociate matter is simply to liberate a little intra-atomic energy throughout the universe and to oblige it to take another form. Electricity is precisely one of these forms.

Throughout the years the role of electricity has constantly grown in importance. It is at the base of all chemical reactions; it is a universal foce, and one must connect all other forms with it. That a force with the manifestation importance and universality of electricity should have remained unknown for thousands of years constitutes one of the most striking examples of apathy in the history of science, and is one of those facts we must always bear in mind to unde stand how we may be surrounded with every powerful force without fully realizin their existence. Power from the cosmos radiant energy fs another similar exam

For centuries all that was known about electricity could be reduced to this. that, certain resinous substances when rubbed attract light bodies. Could not other bodies enjoy the same property? By extending the friction to larger surface might not more intense effects be produced? This was the one question of inquiring. However, ages passed b efore a mind arose penetrating enough to ask itself, "The where and whyfor", --one inquisitive enough to verify by experiment whether a body with a large surface when rubbed would not exercise an action superior in energy to that produced by a small fragment of the same body. From this verification which now seems so simple, but which took centuries to accomplish, we saw emerge the frictional electric machine and the phenomena it produces. Why not now let it emerge from the oscillations of the universe and put into the hands of man a power which he one time thought the gods alone posse the secret to.

Electricity was then only produced very laboriously and was considered a very exceptional phenomenon. Now we find it everywhere and know that the simple contact of two heterogeneous bodies suffice to generate it. The difficulty now is not how to produce electricity, but how not to give birth to it during the production of any phenomenon whatever. The falling of a drop of water, the heati of a gaseous mass by the sun, the raising of the temperature of twisted wires, the burning of a match, and any action capable of modifying the nature of a body, are all generators of electricity.

If all chemical reactions are electrical reactions, as is now proven to be the case, if the sun cannot change the temperature of a body without disengaging electticity, if a drop of water cannot fall without its manifestation, it is evident that electricity's role in all forms of life must be preponderant. This, in fact, is what the world isbeginning to admit. Now a single change takes place in the cel of the body, no vital reaction is effected in the tissues without the intervention of electricity. M. Berthelot showed the important roles of the eldctric tensions

to which plants are constantly subjected. The variations in the electric potential of the atmosphere enormous, since they may oscillate between 600 and 800 volts in fine weather, and rise to 15,000 volts at the least fall of rain. This potential increases at the rate of from 20 to 30 volts per metre in height in clear to from 400 to 500 volts in rainy weather for the same elevation. !"These figures", Berthelot said, "give an idea of the potential which exists either between the upper point of a rod of which the other extremity is earthed, or between the top of a plant or a tree, and the layer of air in which that point or that top is bathed.

M. Berthelot also proved that the effluves generated by these differences of tension can provoke numerous chemical reactions --the fixation of nitrogen on hydrates of carbon, the dissociation of carbonic acid into carbonic oxide and oxygen, etc. Why go back to these scientists of yesteryear ? Only to show that much we are doing today does not originate with the Atomic Age! There were thinkers before our day. After having established the phenomenon of the general dissociation of matter, let us ask ourselves if the universal electricity, the origin of which remained unexplained, was not precisely the consequence of the universal displacement of matter. Experiments fully verified this hypothesis, and they proved that electricity is one of the most important forms of intra-atomic energy liberated by the displacement of matter. The various methods employed to obtain electricity, notably friction, only hasten the dissociation of matter. Now let us turn to vibratory oscillations of the universe.

As we study the dissociation of matter, so will the importance of this phenomenon proportionately increase. After recognizing that, electricity may be considered one of the manifestations of the vibration of matter.

To maintain that stars such as the sun can keep up their own temperature by the heat resulting from the dissociation of their component atoms, seems much like saying that a heated body is capable of maintaining its temperature without any contribution from outside. Now, it is well known that an incandescent body such as a heated block of metal when left to itself rapidly cools by radiation, though it be the seat of considerable atomic dissociation.

But it cools, simply because the rise in temperature produced the dissociation of its atoms during incandescence is far too slight to compensate for its loss of heat by radiation. The substances which, like radium, most rapidly dissociate, can hardly maintain their temperature at more than 3^{0} to 4^{0} C. above that of the ambient medium. Suppose, however, that the dissociation of any substance whatever were only one thousand times more rapid than that of radium, then the quantity of energy emitted would more than suffice to keep it in a state of incandesce

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The whole question therefore is whether, at the origin of things, that is to say at the epoch when atoms were formed by condensations, did they not possess such a quantity of energy or rate of vibration that they have been able ever since to maintain the stars in a state of vibration, thanks to their slow dissociation This supposition is supported by various experiments. J. J. Thomson arrived at the conclusion that the energy now concentrated within the atoms is but an insignificant portion of that which they formerly contained and lost by radiation. Independently and at an earlier date, Prof. Filippo R'e arrived at the same conclusion. If, therefore atoms formerly contained a quantity of energy far exceeding the still formidable amount they now possess, they may, by dissociation, have expended during long accumulations of ages a part of the gigantic reserve of forces piled up within them at their source in the universe. They may have been able, and consequently may still be able, to maintain a very high rate of vibration, i.e, stars, like the sun and the heavenly bodies . In the course of time, however, the store of intra-atomic energy within the atoms of certain stars may at length be reduced, and their dissociation and rate of vibration become slower and slower. Finally, they have acquired an increasing stability, have dissociated very slowly, and have become such as one observes them today in the shape of cooled stars like the earth and other planets.

If the theories thus formulated are correct, and the experiments of the Moray Radiant Energy discoveries so indicate, then intra-atomic energy manifested during the dematerialization of matter constitutes the fundamental element from which most other forces are derived. So it is not only electricity which is one of its manifestations, but also solar vibrations, the primary source of life and of the majority of the forces at our disposal. This study, which reveals to us matter in a totally new aspect, permits us to throw unforseen light on the higher mechanics of the universe.

The interest now being shown in spontaneously radioactive substances consists in their emitting, in considerable quantity, elements which other bodies only produce in much smaller quantity. By thus enlarging onthis general phenomenon, we encourage it's study in more detail, as also the rate of vibration in all things.

Rutherford, who studied radioactive substances with great success and, with Curie, discovered facts concerning rays from them, led to the designation of the radiations as Alpha Beta Gamma. The Alpha radiations are composed of positive ions the Beta radiations of electrons identical with those constituting the cathode rays, while the Gamma radiations are similar to the X-rays. Did these pioneers build better than they realized in showing the way?

The Alpha rays are formed of positive ions. They are deviated by an intense magnetic field, but in the opposite direction to the Beta rays. The radius of curvature of their deviation is 1000 times greater than that of the Beta particles. They form 99% of the total radioactivity of radium They render air a conductor of electricity. Their action on a photographic plate is much less than that of the Beta rays, and their force of penetration very slight, since they are stopped by a sheet of paper. Thisfeak power of penetration enables them to be easily differentiated from the other radiations to which paper is no obstacle. Of all the emissions of radioactive bodies, it is the Alpha rays especially which make the air a conductor of electricity, and it is the Beta rays which produce photographic impressions. When a radioactive body is enclosed in a glass tube nearly all the Alpha particles are stopped by the glass walls but inside those glass walls great things take place because of their electrical conducting ability.

It is supposed, from various calculations, that the Alpha particles must have a mass equal or superior to that of the hydrogen atom and a like charge. Their speed, as calculated from the extent of their deviation by a magnetic field of given intensity, is one-tenth that of light.For uranium and thorium it is, for one gramme, 70,000 per second, and for radium a hundred thousand millions. This emission may last without interruption for more than 100 years.

The emission of alpha particles, positive ions, is, together with the production of the emanation, the fundamental phenomenon of radioactivity. The emission of beta particles and that of the gamma rays, which together form hardly 1% of the total emission, should represent a further stage in the dissociation of radioactive atoms. How puny are these compared to the total energy in the cosmos but how close the relationship.

On striking phosphorescent bodies the alpha particles render them luminous It is this property which is the basis for the operation of the spinthariscope, an instrument which renders visible the permanent dissociation of matter. It consists of a screen of suphide of zinc, above which is placed a small metal rod, the end of which has been dipped in a solution of chloride of radium. On examining the screen through a magnifying glass, there can be seen spurting out without cessation a shower of small sparks produced by the impact of the alpha particles, and the emission may last for centuries. This shows the extreme smallness of the particles coming from the disaggregation of atoms. This emission is visible because each particle is made apparent through the enormous degree of lateral perturbation produced by its shock on the sensitive surface, in the same way that raindrops falling into the water produce ripples which exceed their diameter. One may, by using certain varieties of phosphorescent sulphide, succeed in making screens showing the phenomenon of dissociation, now only with salts of radium, but also with other substances. Herein be the door to greater discoveries.

The high speed of the alpha particles seem very difficult to explain. This speed is intelligible enough in the case of the beta rays, which, being compos of atoms of pure electricity, and having a very small inertia, can acquire a very high speed under the influence of limited forces; but the Alpha particles whose dimensions would appear to be identical with that of the hydrogen atom, a velocity of 30,000 kilometres per second seems to be more difficult to explain. It could prove profitable if these experiments of Rutherford and his co-workers were take up again.

These velocities may not be produced instantaneously; they are only comprehensible on the hypothesis that the particles of atoms can be compared to small planetary systems animated with enormous velocities. They would preserve their speed on leaving their orbits as does a stone launched from a sling. The invisible speed of rotation of the elements of matter would therefore be simply transformed into a speed of projection perceptible only by proper instruments.

Beta rays are considered to be composed of electrons identical with those of the cathode rays. They are formed of negative electric atoms freed from all natter. Their mass similar to that of the cathode particles, the thousandth part of that of the hydrogen atom. Their velocity vary between 33% & 96% of that of light.

Beta rays are emitted in a much smaller proportion than that of the alpha particles since they hardly form 1% of the total radiation. It is these rays which produce photographic impressions. Their penetrating power is considerable. While the alpha rays are arrested by a sheet of ordinary paper, the beta rays will penetrate several millimetres of aluminum. It is probably by reason of their great speed that they are much more penetrating than cathode rays (canal rays) which can only pass through sheets of aluminum of a thickness of some thousandths of an inch.

They immediately render luminous by impact bodies capable of phosphorescence, even when separated from them by aluminum foil. The phosphorescence is very bright in platinocyanide of barium and some kinds of diamonds which are rather rare, but are capable of phosphorescence.

In addition to alpha and beta rays, the first charged with positive, and the second with negative electricity, radioactive bodies emit an extremely slight proportion (less than 1%) of gamma rays which are entirely analogous, as to their properties, to X-rays, but possessing a higher power of penetration, since they can penetrate several centimetres of steel. This property enables them to be easily distinguised from alpha and beta rays, which are stopped by a lead plate to a few millimetres thick.

One of the singular properties of alpha-beta-gamma emissions is that none of them can touch a gaseous or solid body without immediately causing, no doubt through the disturbance produced by their endormous velocity, a dissociation resulting in the production of secondary rays, which are similar in their properties to the primary rays, but less intense. These secondary radiations also impress photographic plates, render the air a conductor of electricity, and are deviated by a magnetic field, They are able to produce by their impact tertiary rays having the same properties. It is the secondary rays produced by the gamm rays which are the most active. A photographic impression through a metallic plate is sometimes intensified by the interposition of that plate, because the action of the secondar rays then superposed on the primary rays. Herein may lie a prototype of the action of the universe.

Another curious property of radioactive substances and, for that matter, of all substances is the incessant emitting of a non-electrified product, known as the emanation. These emanations represent the first stages of the dissociation of matter, and by the disaggregation, generates the emission of other particles. It is this emanation by which radium, the atomic pile and other strong sources of radioactivity render radioactive other bodies near them.

Emanations can be cheaply drawn from any highly radioactive body either by dissolving in liquid placed in a receiver communicating with a closed tube and subjecting the radioactive substance to certain ray bombardment or by bringing them to a red heat in a similar apparatus and bombarding them with rays. The emanation drawn into the tube renders it phosphorescent. It can be condensed liquid air. This condensation is revealed by the localization of the phosphorescence.

At ordinary temperature radioactive bodies in a solid state emit the emanation , but only a hundredth part of the quantity omitted in a state of solution and under bombardment of certain rays. By introducing suphide of zinc into a bulb containing a solution of chloride of radium, the disengagement of the emanation renders the sulphide phosphorescent. Radium, when heated, loses the greater part of its activity because of the quantity of emanation it gives off, but it regains it again in about 20 days. The same loss occurs when a solution of this salt is heated to boiling.

When solid chloride of radium has been brought to a red heat, or a solution of it has been boiled for some time, or better still, subjected to special ray bombardment, it still preserves a quarter of its primary activity, but this latter is then solely due to the alpha particles as can be noted by the weak penetrating power of the rays emitted, when can no longer pass through a sheet of paper. It is only after a certain lapse of time that the appearance of the beta rays, capable of passing through metals, again takes place. The activity of the

emanation is lost rather quickly. The rapidity of this loss varies according th the substance. That of actinium is destroyed in a few seconds, that of thorium in a few minutes, that of radium only at the end of three weeks, but is reduced ine one-half in 4 days.

Radium and thorium produce different kinds of emanations, that is, of dissociations which begin with the emission of the emapations. Five or six have been counted. The first engenders the second, and so on. They, no doubt, represent successive stages in the evolution of matter.

To these emanation are due three-fourths of the heat continually produced by radium, which maintains its temperature at 3 or 4 c. above its surroundings. If radium be deprived of its emanation by heating, it gives out about a quarter of the heat it emitted before heating. Almost all of the rise in temperature is due to the alpha particles. If some emanation of radium is left for several days, in a tube, one can observe the spectral lines of helium which were not there before.

Before drawing too many conclusions from this transformation, it must be first remarked that helium is a gas which accompanies all radioactive minerals It was from these bodies that it was first obtained. This gas enters into no chemical combination, it will not liquify and can be kept for indefinite time in the tube in which it is enclosed a catechist of interesting effect.

These derivatives from radium is a special helium since it appears to possess the property of spontaneously vanishing. Its only resemblance to ordinary helium but seems to consist in the momentary prescence of some spectral rays.

The emanation of the radioactive bodies represents one of the intermediate substances. It is partly materials, since it can be condensed and dissolved in certain acids and recovered by evaporation. But it is only incompletely material, since it ends by entirely disappearing and transforming itself into electric particles or of vibratory properties. This transformation, which takes place even in a sealed glass tube, has been proved by experimentation.

Matter and energy!! Where can one draw the line ? The part played by various radiating substances in the phenomena of energy and life is a very preponderant one. Most often it is the indirect reactions which reveal their existence in the phenomena of life and allow them to be isolated. All we know of them in their physiological reactions is that they lose their properties if deprived of the infinitely small quantities of mineral matters which they contain under a form that we suppose to be in the ionic state.

Why go into these raactions? Because they may to a degree help us to understand natural phenomena of the cosmos and of life because there is a parallel of phenomena. Most of the ionic and colloid metals, disastases, ferments, etc.-- possess the property of acting, at least in appearance, by their prescence alone. They do not appear in the products of the reactions which they excite. These actior of presence, also called catalytic, have been used extensively in chemistry. It was known, for example, that oxygen and sulphurous acid, though without action one on the other, unite to form sulphuric acid in presence of platinum black withou this latter taking part in the reaction. N trate of ammonia, though ordinarily

unalterable, also gives a continual disengagement of nitrogen in presence of platinum black. This latter does not combine with oxygen, but it can absorb 800 times its own volume of oxygen. It is supposed, but this is only a hypothesis, that is generally acts by borrowing oxygen from the air and conveying it to the substances with which it is in contact again, an action like those taking place in the planets of the universe and living cells of the human body and some other forms of life.

Among the substances of which one might strictly say act only by their presence is found the vapor of water, which in extremely small amounts play an important part in various reactions. Perfectly dry acetylene is without action on hydride of potassium, but in presence of a trace of humidity the two bodies react one on the other with such violence that the mixture becomes incandescent. Well-dried carbonic acid is also without action of hydride of potassium, but in presence of a slight quantity of steam it pooduces a formate. It is the same with many other bodies--ammonical gas and hydrochoric gas, for example, which ordinarily combine with the emixssion of thick white fumes, but do not do so after having been carefully dried. It will be remembered that by adding to dried salts of quinine traces of water vapor they become phosphorescent and radioactive.

Although catalytic actions were known many years ago it was only in later years that they proved to play a preponderant part in the chemistry of living beings. It is admitted that the disastases and various ferments whose role is so important act only by their presence.

On closely examining the role of bodies acting by their mere presence, we note that they behave as if energy were transported from the catalyzing body to that catalyzed. This fact can hardly be explained unless by acknowledging the catalyzing body is undergoing the commencement of atomic dissociation. We know that, by reason of the enormous velocity possessed by particles of matter during its dissociation, considerable quantities of energy can be produced by the dissociation of a quantity of matter so smallas to elude all attempts to measure it. The catalyzing substances could therefore be simply liberators of energy in matter on the earth and in all the universe. As in the atomic pile the fission material is worn out so also platinum black and the colloid metals are eventually worn out--that is to say, by use they lose a great part of their catalyzing action. The Thebry involved indicates all matter and energy dimply represent a state of equilibrium between the internal elements of which it is formed and the external elements acting upon it. If this connection is not plainly apparent in some bodies, it is because they are so consituted that their equilibriums maintain themselves without perceptible changes within the limits of fairly large variations of the medium. Water can remain liquid in variations of temperature ranging from 0° to 100° C., and most metals do not appear to change their state within still wider limits of heat or of rates of vibration. However, these facts do not answer all the questions.

Succession of changes will be accompanied by the liberation of a certain quantity of the intra-atomic energy contained in matter. This is going on all

the time in the cosmos to such an extent man with his man-made devices can never hope to compete. So why not use "nature's gift" of cosmic reactions? The actions by mere presence which are of such importance in the phenomena of life, may perhaps find an explanation in this theory. It was such studies on phosphorescence which led men to this hypothesis. It will be recollected that pure substances, various sulphides, phosphates of lime, etc., are never phosphorescent normally, and only become so when brought to a red heat for a length of time with traces of other various bodies--such as bismuth, maganese, etc. On the other hand, this elevation of temperature always provokes a dissociation of matter. It is therefore reasonable to suppose that the elements proceeding from this dissociation have an active part in the compounds then formed, which gives to such bodies the capacity for phosphorescence and sometimes other properties.

The combinations so obtained have precisely the characteristics pointed out above as belonging to extreme mobility, that is to say, of disintegrating and then regenerating themselves very rapidly. A fay of blue light falling on a screen of sulphide of zinc, illuminates it in the tenth of a second, and a ray of red light falling on the same screen, disintegrates the phosphorescence in the same space of time, that is it brings the screen back to its original state. These two contrary operations, necessarily implying two converse reactions which may indefinitely repeated.

These facts prove that by reason of the enormous quantity of intra-atomic energy contained in matter, a loss substance too small to be detected by an analytical balance may be accompanied by a very great liberation of energy. We have no need to do this artificially because it is being done for us in the cosmos.

It is possible even without the action of heat to verify in ordinary bodies the existence of a constant emanation from the dissociated matter, though this emanation normally is extremely small in quantity. This all proves that the evolution of creation as going on continually.

To cause it to be apparent, it is necessary to compel it to accumulate in a restricted space. In order to demonstrate this, fold a sheet of metal so as to transform it into a small cylinder similar to the one which encloses the ball of a condensing electroscope. The lower opening is then closed and it is left for 8 days in darkness, and then, still keeping it in darkness so as to avoid any possible influence from light placed the cylinder on the insulating disc of the electroscope or special ray counter instruments to examine its radioactivity. It will then be found, after having charged the whole system, that a definite discharge per minute is obtained. As the metal rapidly loses that which it has accumulated, the discharge soon ceases. Many bodies other than metals such as box-wood cylinder will produce the same effect also certain gas-filled tubes.

The metal, after ceasing to act on the electroscope or counter still has not exhausted its provision of radioactivity. It has simply parted with the quantity it can emit at the particular temperature at which the operation was effected.

As with phosphorescent bodies or radioactive matter, it only has to be slightly heated to cause it to again yield a more considerable emission of active effluves. The only difference between all matter is in the rate of

vibration or wavelength being the difference resulting in transmutation; changing and restoring being a matter of changing from one rate of vibration to another, evolution in its true sense, evolution from one rate of vibration toanother or transmutation, energy changing into matter and matter into energy as we put it back in 1926.

The time is past when transmutation of matter or of energy can be regarded as an illegitimate brain child of research.

It is no longer an insult to the scientific world or the scientific mind to refer to transmutation as a science nor can it be looked upon as an aberration of the human mind. The basic idea of all the transmutation theories was that all metals and all matter came from one origin. Modern science now cannot deny that in the final analysis all things are vibration. The old alchemists reached their conclusions by a theoretical method and then tried to prove their theory by experimentation. Modern science took the opposite method and lost hold of the unity of the physical world for a time until radioactivity and its transmutations again proved the fundamental idea at which the alchemist failed.

Mysticism and transcendentalism can no longer be classed with transmutation. Science now must take and is taking a broad-minded view of the theories of the alchemist and has a sympathetic attitude towards alchemy as a science; a team with chemistry.

The reader by this time may be asking why bring alchemy, transmutation, etc. with the subject of readioactivity, cosmic energy, nuclear energy, radiant energy? Just this, transmutation, radioactivity, cosmic energy, nuclear energy, radiant energy are all based on the same law -- vibration, "The Sonic of the Universe". The research who thinks only of transmutation as a means of changing a base metal into gold and in so doing obtaining untold wealth is not worthy of the science.

Transmutations' true worth and value lies in the great field of research that it opens to the experimental mind and its scientific teaching to be used for good. The fantastic is forgotten and true science, pure science, kept as the yardstick. Chemistry is the grandchild of alchemy. Now science is taking the grandfather and making him a trained scientist and not just a wild old goat born amid the mystical fiery furnance. Whatever the faults of the alchemists, they were the fathers of modern experimental chemical science.

It has long been recognized that all matter liquids, gaseous or solid, are made of atoms and until the electron theory was advanced, the atom was considered to be the smallest unit of matter. Under this belief it was ridiculous to believe, as the medieval alchemist, that one element could be changed into another element. However, science has now found that one element can be

changed into another. The neutron can be changed into the proton, or the proton into the neutron. The work of Sir Rutherford with helium and nitrogen transmutation into oxygen and hydrogen and later experiments with uranium and plutonium prove the alchemists were right in believing one element could be changed into another.

Cosmic rays are constantly creating radioactive carbon and the fusion of small atoms together to make larger ones gives off more energy than so-called "splitting" of the larger uranium or plutonium atoms, the uranium energy release ratio being only 1 to 1000--that is only 1/1000 of the heavy atoms changed in the uranium "atom splitting" process of the "atomic pile".

There is not the slightest reason to doubt that "fission" need be confined to the heavy atoms only. The writer has had success in the "splitting" of the nuclei of paper, of lead, tantalum, mercury, tungsten, gold, copper and aluminum by a method far less expensive than the cyclotron. With a process of electrolysis tritium has been produced in experimental quantities.

"Nuclear fission" action is not confined to highly radioactive substances. "Atom splitting" is taking place naturally on this earth, in the universe, and on other planets and suns, and there is absolutely no need of the unnecessary hysteria that has swept the world over "atom splitting" as it has been going on naturally from the very beginning of time. Energy and matter cannot be considered strangers nor as a science just being introduced to the world. When the evolution of matter and the evolution of forces is considered nothing new is being advanced. When we consider radium giving off 3 distinct forms of energy--alpha, beta, gamma rays--we cannot help but see a relationship between electricity & matter.

Radium also emits an emanation which has the characteristic properties of matter, radon gas (nuclei of helium, ionized helium, another gas generated by alpha rays) from radium which can be condensed into a liquid. Its volume varies inversely with its pressure (Boyles law). Thorium gives off 3 solid substances--mesothorium, radio thorium, and thorium X.

Now, if we turn to vegetable matter, we find energy is also being given off similar as in the case of radium, thorium and other radioactive matter. This time, however, we find direct electrical energy being given off. Various vegetables and fruits will do for the experiment. A "volta pile" can be made of potatoes, grain, apples, onions, etc. Let us consider the apple. In a "volta pile" made of 25 apples (50 halves) one can obtain enough e.m.f. to light a flashlight globe. It will also be found that the living animal cell like the vegetable cell is giving off energy and consuming oxygen and giving off carbon dioxide and an electrical potential.

We find in vegetable and fruit, in metal and animal matter the same relationship and dependence on oxidation and electrical energy--oxidation in stellar space, evolving energy into matter and matter into energy. Here we see energy and matter and matter and energy vibrating together.

Regarding the force of energy from the cosmos, noted experts in photography have found the light produced from this source of energy is much whiter than that obtained from ordinary electrical energy. Also, this light burns into the film when photographed due to the great intensity and pure white light produced yet the light is easy on even weak eyes.

It was also noted that detail from these films could only be obtained by holding back dense areas to about 10 times that of normal exposure even when non-halation film and super flash bulbs were used, but the pictures are sharper. Let us again state, "An electrical generator is in the true sense not a generator. It creates nothing. Electricity is not made by the ganerator, it is merely captured or pumped. From that standpoint an electric generator is an electric pump, and a radiant or cosmic energy divice, a high-speed oscillating energy turbine."

If we reverse our imagination on what the telescope has taught us of the stellar universe, we will find that beyond the microscope we have the particles of which everything about us consists, obeying every law that is found everywhere from stellar space to atomic space. We find bodies in motion and when we think how small the proton and electron are, and yet obeying the same laws of the universe, we may see the economical uselessness of science trying to crack the atom, when nature, or call it what you will, is accomplishing the same thing for us in stellar and inter-stellar spaces. Why do something nature is already doing for us? Let's use what nature offers as I first suggested many years ago. From this conception, we might see that Democritus came close tp a great scientific truth in his bold statement, when he declared that all physical phenomena reduced itself to one single item--motion--or as we might repeat, "vibration", "the sonic of the universe". Let me repeat, "Do not forget the atom is but a counterpart of the universe itself, and that light and other radiations exert a mechanical pressure upon every object they strike, and that all these radiations are essentially electrical in their character. There is a breaking down and a building up of the atom continuously, and it is this evolution which is producing, eternally, unlimited power."

May it not yet be shown that the dissipated energy which results from so much transformation of matter which has heretofore been unavailable--or should we say, unused by us where it has only appeared to be unavailable--should now become available to us, an unlimited source of power through the Moray discoveries of application of these forces? And that matter and energy are possibly one is the sum total of all that has been found during the centuries of constant research, to be judged by that small portion of the universe which is visible to man, who is only armed with his limited yet most powerful telescopes, or with his most powerful microscopes?

As I have said before, I repeat again, "All space is saturated with energies which are vibratory in their ultimated analysis and very closely allied to electrical action. The relation of matter to energy and energy to matter then becomes the potential of the universe, one continuous series of oscillations,

oscillating to and fro like a great pendulum across the universe. A steady flow of energy can be had from the surges of the universe just as a steady flow of water may be obtained from the surgings of the sea."

Electrons are spontaneously being emitted from the nuclei found in nature and every new discovery on the subject bears out the claim that all "space" is filled with energy. Let "A" equal the atomic mass and "N" the nuclear mass. Let "Z e" represent atomic nuclear charge, "M a" mass and a mass number "A". We then have the energy found in nature from a given substance to be:

$$\text{Energy} = Mn\,(Z^a) - MN\,(Z+1)^a - m(e)$$

$$\text{Energy} = Ma\,(Z^a) - Zm\,(e) - Ma\,(Z\ 1)A\quad (Z\quad 1)\,m(e) - M(e)$$

$$\text{Energy} = Mz\,(Z^a) - Ma\,(Z+1)A$$

This is based on the disintegration of radioactive material, natural or artifical; but, the same action is taking place then, the "sonic" (vibrations) of the universe with all matter and energy.

As long as the universe has existed charged particles now called "cosmic rays" have been bombarding every planet or object in the universe, including all living bodies, at the rate of twenty times per second and with a force great enough to penetrate deep into the rocks of the earth.

Cosmic rays have been called "the death cry of the universe" or "by-products of the destruction of matter in the cosmos". In the process of the evolution of matter and evolution of forces there is no "death cry", only the "song of creation". There is no destruction of matter or energy, only the cycle of matter and energy. The creation is going on continually. You subtract in one place only to add in another.

Finis