

The
Descent
of the
Atom

A LAYMAN'S
★ CREATION

Anonymous



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THE DESCENT OF THE ATOM

A Layman's Creation

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OF
THE
ATOM

A LAYMAN'S CREATION



ANONYMOUS



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THE DESCENT OF THE ATOM

A Layman's Creation

*And Booz commanded his servants, saying:
If she would even reap with you, hinder her
not. . . . And let fall some of your hand-
fuls of purpose, and leave them, that she may
gather them without shame, and let no man
rebuke her when she gathereth them. . . .*

THE DESCENT OF THE ATOM

Science, Have Mercy!

What are they getting at, these hired men of Science?

To-day they build and to-morrow they tear down and there is no end to their extravagances.

These superfeature cinema cosmoses without a beginning, a middle, or an end. These rococo astral Great White Ways. These glittering galaxies, watch-shaped but with no pointing hands to tell a standard celestial time. These contracting, expanding, exploding, collapsing universes, now a million times older, now a thousand times younger than this errant planet particle, the earth. These pyramided supergalaxies on the Wall Street plan. These island universes trembling in their sleep while werewolves howl from the graveyard of prehuman nights.

Meanwhile Creation, gray old mist mumbling in its beard of some mystical infinity, teems with legends of the atom, psychic construct, mathematical abstraction, microcosmic avatar of negation, ghost dance of electron and proton, of neutron and deuteron, of photon and positron and negatron and whatnotron, schizophrenetic company of wavelike corpuscles and corpuscular waves, of indivisible quanta of energy which is likewise matter,

motion, everything that can be imagined, nothing that can be proved.

Out come the builders. In go the wreckers. One follows modestly behind. All one wants is a few unregarded scraps with which to build a rude shelter of one's own. It is hard not to have a homeplace.

The Heavens Are One

On a frosty night I look at the heavens and am obscurely troubled in my mind. This press of stars so near, so watchful is an old familiar concourse; and yet there is to-night a difference. This sky seems more heavily compact of stars than I have ever seen it. It is almost as if . . . old words drift into my mind . . .

"The heavens are one." Now what did old Xenophanes mean by that?

I walk on. I cannot see my path for the darkness. Not all the light of all the stars will light me one step on my way. How countless many millions of millions of these stars there are! How then, I ask myself, can the heavens be one? A queer kind of oneness that.

The Things Above

I sit at my desk and wonder. I listen to my fingertips knocking, knocking on hard mahogany, on the tight-closed door of "matter." How solid this wood seems! And yet I know this "solidness" is an illusion. I know it for an all but vacuum with only an occasional hard point of substance. And these infrequent points, these atoms,

are in their turn a kind of interrupted emptiness. If an atom were as big as a cathedral, the planetary electrons would be but pinheads and the protons only dust specks. The wise men have told me all about this. Now suppose, I muse idly on, I am a humunculous perched on the surface of one of these invincibly tiny planet-electrons. Will light shine on me from the faraway nucleus my sun? And when my electron in its perpetual rotation turns its face away from the nucleus, will it be night then for me? And will it be all dark? Or shall I see neighboring atoms shining as stars in the distant heavens of my atomic universe? And shall I see all these shining points as mutually disassociated bodies? Or will it occur to me, ignorant homunculous that I am, that all these stars, these heavens, are one, one wood, one desk, with an unimaginable monster living, sitting at the desk wondering?

I shift my place from below to above. Now I am a very large anthropomorphic eye staring sunward from a good many light years away. What shall I, this distant staring eye, make of the fragment of the heavens that this earthly I saw an hour ago to-night? Shall I see, not scattered points of light but a solid mass, or if not solid, then liquid or gas, of which the minute constituent points, the individual stars, will be lost to sight in smallness? I cannot see the heavens for the stars; is that how it is with me, the me sitting at my desk wondering?

This fiction of a "solid" desk, this legendary celestial void pinpricked by chance-driven hordes of unrelated stars, are they simply the obverse and reverse sides of

the same illusion? Are the heavens true "matter", at least to the extent that the wood of my desk is pseudo matter? Does truth lie beyond both, or somewhere in between?

"The things above," is it not written in the Talmud, "are as the things below."?

The Star As Atom

In the only kind of "matter" I can imagine, the ultimate primary particle is the atom. But it is visually evident that the ultimate primary unit of the heavens is the star. It must follow that of the new and higher order of "matter" composing the heavens the star is the atom.

The star as atom? But an atom of what? What kind of atom?

Atom is as atom does. If the stars are true atoms, then they must, on however vastly enlarged a scale, conform precisely to the terrestrial atom in structure and behavior. I turn back to my earthly model.

The terrestrial atom? But there are ninety-two different kinds of terrestrial atom, are there not? Hydrogen, simplest and lightest. Uranium, heaviest and most complex. And ninety others in an ascending scale of "atomic numbers" and "atomic weights" between. Ninety-two "elements" of terrestrial "matter", and a special form of atom at the root of each element. But to which of the ninety-two known and distinct forms of the terrestrial atom does the star-as-atom belong? To answer this I must explore the nature of the atom and discover what in the structure and behavior of a given atom labels it as

hydrogen or uranium or oxygen or something else. I find my first clue in the law of "atomic number."

Every atom on the terrestrial plane of "matter" has from one to ninety-two exterior planetary electrons, and the number of these electrons determines the place of the atom in the table of elements. Thus an atom with one planetary electron is an atom of hydrogen. Eight little "planets" spell oxygen; nine, fluorin; ten, neon; and so on up to uranium with its ninety-two electrons-as-planets.

It appears at once from this law of atomic number that the stars, to be true atoms on their own astral plane of "matter", must in their normal state have planets-as-electrons, one or more, by the same atomic law which ordains that every terrestrial atom must have one or more exterior planetary electrons in its natural state. All the stars in my universe must have planets or I cannot use them. But stars, it seems, are not wearing planets this season by edict of the fashion authorities in astrophysics.

Our sunstar, I am told, is the only star, or at least one of the very, very few, to be equipped with planets. It got them by accident. It seems two stars either ran head-on into each other, or at least passed very close, and as a result of this brush, or collision, certain portions of one star, or perhaps both, were knocked or pulled out of the main mass, or masses, and into planetary orbits. This accident, as is clearly shown mathematically, cannot have happened more than once in every so many millions, or is it billions, of years. So a planeted star is not only a mon-

ster, but a very, very rare one, and life, possible only on a planet, a much more rare and valuable find than I might have supposed from my meager reading of war and industrial statistics. Now all this may be true as stated, but I am going ahead on the assumption that this fashion in astrophysical thought will also pass, and then the stars will be given back their planets without which they cannot be the atoms that I am going to try to show myself they are. The only stars without planets are those which had planets once and lost them, the same as some terrestrial atoms are known to lose some or all of their planetary electrons in the give-and-take of nature or the laboratory and in the process become ions. Opinion to the contrary, however distinguished the sources, has no visible exhibit to offer in evidence, and I have only one, the sunstar. In a game which tallies in batches of astronomical units and light years, 1 to 0 in the first inning is not a decisive score. I shall have to do better than that. Much better.

I do not deny the mathematical possibility of a planet as the by-product of collision or tidal disturbance, I do not know enough about it to say yes or no; what I doubt is the necessity. On the contrary, I think I can show reasons to accept the necessity of natural-born planets in fundamental star economy. But to do this, to show the star as structurally, and behavioristically, an atom in the authentic manner of the terrestrial atom, I shall need more evidence than that of certain bodies called planets revolving round the star I call the sun. Earth has its

moon, other planets have their nine satellites, or ten; but the earth system is no atom, nor is Saturn or Jupiter an atom, not by any means. What I must do is to explore the economy of the star and establish, if I can, a fundamental resemblance between it and a terrestrial atom imaginatively enlarged to the star order of magnitude. Now the only star at my disposal with respect to which I have the requisite empirical data is that of the solar system, the sunstar.

If the sunstar were an atom, what kind of atom would it be, atom of what element? Obviously, of the element of which the atomic number is nine. Nine planets, nine exterior electrons, atomic number nine. A few years ago I should have said eight planets, and that would have made my sunstar an atom of the element oxygen. Another planet may be found, and this would make the sunstar neon, atomic number ten. But nine it is, as my data stand, and my sunstar is an atom of fluorin, atomic number nine. Now what is this fluorin like, on the earth plane of atomony? In the mass, a pale-greenish gas. But that does not help much. What is a fluorin atom like, inside?

I turn to my table of atomic weights. Fluorin, atomic weight nineteen. In other words, a synthesis of nineteen hydrogen atoms. This means nineteen protons in the nucleus, with ten nuclear electrons serving, along with the nine exterior electrons, to keep the atom electrically neutral. Nineteen positive charges, or positively charged particles, as the case may be; nineteen negative charges, or negatively charged particles; that is all there

is to an atom of fluorin, thirty-eight charged particles of — what? What is a proton really? What is an electron? What is the difference between them? Let me break down my fluorin atom into its nineteen constituent hydrogen atoms, and then take a hydrogen atom and break it into its two parts, proton and electron, and see what I can see.

Some Toy Weights and Measures

Those indefatigable fellows who spend their lives chasing atoms about, weighing and measuring their parts, provide me with interesting dimensions of the hydrogen atom and its parts, electron and proton. Here, for example, are the respective diameters, in fractions of an inch:

| (<i>a</i>)tom | (<i>e</i>)lectron | (<i>p</i>)roton |
|-----------------|----------------------|--------------------------|
| 1/250,000,000 | 1/25,000,000,000,000 | 1/45,000,000,000,000,000 |

I find that *p* into *e* goes 1800 times. But real mathematicians, presumably quoting logarithms to their purpose, place the ratio at 1830 to 1. Myself, I like 1845 the best, and this is the number I am going to use in my very rude calculations. It can make no material difference in the results, and I think I can see a significance in this particular number which would make it good news if I were to hear that the atom chasers had made in new findings the very slight revisions needed to give this ratio of 1845 to 1.

What I think I see in the number 1845 is a very plain intention of nature. The proton mass is to the electron

mass as 1845 to 1. Now if this ratio can be inverted and applied to the respective diameters, I find an amusing set-up. I find that the number 1845 expresses at one and the same time the number of electron masses in one proton mass and the number of proton diameters in one electron diameter. In other words, the proton is exactly as much heavier than the electron as its diameter is shorter than the electron's diameter. This does not at first seem very startling, but let me put it to myself in plainer terms.

Volumes of similar bodies, such as spheres, vary as the cubes of their dimensions, so the volume of the electron is to the volume of the proton as the cube of 1845 to the cube of 1, which is 1. Therefore, if the masses of the two were equal, their relative densities would be as 1 to 6,280,426,125. But the mass of the electron is to the mass of the proton as 1 to 1845, increasing the above ratio by that factor and producing the ratio to 1845 raised to the 4th power. This gives the relative densities 1 to 11,587,386,200,625 (a figure which applied to linear distance in miles would express very nearly two light years). Now to a physics dealing with terrestrial elemental densities of which the most extreme range can be bracketed in the ratio 1 to less than 200,000, any such relation as the one just shown must seem preposterous, all but metaphysical. Mathematically it may make sense, but pragmatically it leads exactly nowhere. Not even the delicate fingers of imagination can make a pattern of it.

Between these two invisibly minute bodies of such disparate density coefficients as apparently to place them

upon two distinct and unrelated planes of being, what bond can there be? To call the electron an electric charge is merely to beg the question. Electricity, whatever it may be in theory, is corpuscular in effect. A corpuscle is by definition a "body", that is to say it has mass, extension, and inertia. It is some arrangement of "matter." And no flimsy arrangement, either, by terrestrial standards. I don't need to argue from my premise and allege, without having yet produced any decent evidence, that the electron is a planet in little with all the materiality of "solid" earth itself. I only need to remind myself that the terrestrial electron is the bullet of various forms of radiation, and a bullet which does not fall in pieces, or even flatten itself out, upon hitting a hard target even at the speed of light. Science has no empirical record, none at least that it has shared with me, of one single electron annihilated. The electron is "matter", all right. It is made of something, but of what? And what is "matter"?

Is there only one "matter"? Or is there a proton "matter" and an electron "matter", a positive and a negative "matter", each separate and distinct from the other, a duality of essence? I have never heard this proposed by acceptable authority; it is contrary to the little all I know of physics. It is, till shown to be otherwise, absurd. It follows that proton is a primary form, electron a secondary form, of the one substance which from now on I shall call matter, without inverted commas. This matter has different forms but only one essence. In other words, there are degrees of matter, and the electron substance

must be some diffuse arrangement of the proton substance which is primary, and perhaps pure, matter. But what arrangement? A proton dust, a gas, or what?

I know of, can imagine, but one arrangement by which matter can exist in a dilute state and yet conform to the law of gravitation. This arrangement is some organization of the atomic process. The electron, I conclude, is a closed system of matter suspended in the atomic process. It is a minute world composed of atoms of an order of magnitude inferior to that of the terrestrial atom. I am not afraid of this new smallness. If I can accept an atom so small that I can never hope to see it, I can easily take the next step and accept an atom too small for me to imagine outside of mathematics.

No, it is not the smallness that troubles me. It is the inconclusiveness. For what have I now? Merely a system of atoms inferior in magnitude to the terrestrial atom but otherwise indistinguishable from it. I have simply shifted my problem to a point more remote in smallness without nearing a solution.

Call the terrestrial atom a . Within and composing the electron e of the atom a , I now have an atom of inferior magnitude, which I will call aa . But the electron of hydrogen atom aa must also, by my previous reasoning, be composed of matter organized by the atomic process, and so I must admit atom aaa and likewise atoms $aaaa$, $aaaaa$, and so on down into new abysses of tininess of which I cannot now foresee an end. I cannot descend so far in the scale of magnitudes but I find facing me a new and smaller

electron composed in turn of newer and yet smaller atoms. Each time I think I have matter resolved into its ultimate minuteness I find it slipping away again through my fingers in a smaller smallness. I have nothing to hold on to but the form, the form of the atom.

Nature has performed perhaps her choicest marvel here. She has given me endless variety of form and behavior in one supremely simple essence. For everything, I begin to see at last, is proton. In the hydrogen atom nucleus proton exists in the state of absolute density. In the electron this same proton becomes diffuse and aëriiform. But from the top to the bottom stair of creation it is always proton. All is proton and there is no other. All empirically known and imaginable substance is but a variety of effects produced by diverse arrangements of proton suspended in the atomic process, which process in turn is but a series of divisions and subdivisions of this selfsame proton into progressively diminishing magnitudes of itself, the whole organization being no doubt conditioned by a corresponding series of progressively weaker and weaker and perhaps interpenetrative magnetic fields.

So much for the electron, enlarged wraith of the proton, but material enough all the same. What more is there to say of the proton itself? More to ask than to say, I am afraid. I ask myself, is the proton invincible? Is it everlasting? Is it indestructible? Is it as it was in the beginning, unchanged and unchangeable? And I do not know how to answer.

On The Frontier Of Matter

I mistrust big words. Almost invariably they lead the user eventually to the biggest word of all, biggest and emptiest, most arrogant and at the same time cringing, the word of intellectual surrender: "infinity." I must admit that proton is unique, but that is not the same as saying it is "infinitely" anything. On the contrary, it establishes very definitely a boundary for matter, a point in density beyond which matter shall not pass on pain of becoming something else. But what else? Energy? I suppose so.

One thing seems to me certain. These scientist-sharpshooters, who think they are going to reduce proton to energy to run their little engines, are fooling themselves badly. For there is this distinction to be made between proton and any other arrangement of matter in creation, that proton alone is independent of the atomic process. In dense, uniquely compact proton there is no place for the relatively vast emptinesses of intra- and interatomic space. Proton must be perfectly opaque, nonporous, each part contacting other parts at every point. It must be a perfect reflector, absolutely nonabsorbent. No heat, light, radiation, or chemical reagent whatsoever, can enter it. The only thing that conceivably could annihilate the proton would be some pressure far, far beyond the power of man to exert, beyond the power even of any natural agency that I know, some literally irresistible shock or fundamental process of nature, the diastole, in short, to the systole of the periodic beat of creation which once

made matter out of energy and shall at the expiration of the appointed interval show it over the same road back to the beginning. Meanwhile the popguns of science will pop and pop in vain. They will never bring down the proton, as I believe a competent ballistician could demonstrate convincingly from my premises.

It is safe I believe to assert that proton substance is not annihilable, in the sense of being reducible to pure energy, by any human means thus far developed or by any natural process now known to man, not excluding the extremes of temperature and pressure alleged to prevail at the center of a star. Whether an individual proton can by known processes be so altered as to lose its character as the nucleus of a hydrogen atom of a given order in the atomic scale is another matter. No such alteration can be empirically shown at the present stage of science, but a less decisive alteration, involving diminution of mass of certain protons seems clearly to be indicated by reported observations. I have been hearing rumors of an experiment said to have resulted in the production of one helium atom by synthesis of four hydrogen atoms.

The atomic weight of the hydrogen atom is known to be about 1.0077, as against 4 even, the atomic weight of helium. It appears that in the synthesis each hydrogen atom lost the fraction 0.0077 of its mass, presumably accounted for by an expenditure of "energy" liberated in the synthesizing process. That is the theory, I believe: that every expenditure of "energy" is accompanied by a loss of mass. I suspect that the theory thus

baldly stated may some day turn out to be a half-truth or oversimplification, but meanwhile this much at least is clear: that most if not all of the loss of mass noted in the experiment must have been levied upon the hydrogen atom nuclei, the protons. For look, the total mass of an electron is at most some 0.0005 of the atom's total mass, or only 1/15th of the mass observed to be lost by each hydrogen atom involved in the synthesis.

Here I think is classic evidence that the proton as a primary unit of the atom is subject in certain conditions to a diminution of mass. But (and it is a big "but", or rather pair of "buts") no such substantial loss has been recorded as might impair the integrity of a proton in its character of hydrogen atom nucleus, much less destroy it utterly; and, moreover, even this relatively trifling loss of mass said to be converted into "energy" is not known ever to have been brought about by human means except in a laboratory imitation of what is doubtless a common and spontaneous phenomenon of nature. But I fail to see in this experiment any convincing evidence or strong implication that matter is either being made out of or turned into energy. And if I seem to be rushing straight into a head-on collision with either the First or the Second Law of thermodynamics I am sorry, but I do not think I am placing myself in that predicament.

One thing about this experiment puzzles me. The experimenters appear to have observed manifestations of radiant energy liberated in the synthesizing process. The radiation, it seems, was found to be of a hardness corre-

sponding to thirty million volts, and that is very hard in comparison with any known terrestrial radiation, though softer than cosmic rays, of which the hardest indicate a much higher voltage. Now this energy cannot have been at one and the same time both radiant energy, which is corporeal, corpuscular in content, and "pure" energy, which is of necessity intangible, imponderable, and of itself incalculable. It must have been one or the other and the evidence seems to be all for some form of radiant energy, even though a somewhat unfamiliar form of it. I see no evidence of liberation of "pure" energy in this experiment. There was a loss of mass, yes, but I think this loss should be interpreted not in terms of annihilation, or conversion of matter into "pure" energy, but merely as dislocation and transference of matter. The difficulty lies, I am convinced, in trying to name a manifestation of radiant energy composed of corpuscles very much more minute than any with which science has as yet had to deal. A second problem is to account for the energy generating the radiation without conceding a compensatory "annihilation" of matter and yet without offense to the sacred Second Law. I believe I have a reasonable explanation.

In the forcible union of four hydrogen atoms to form one atom of helium the Coulomb forces resident in each hydrogen atom were disturbed. In consequence of this disturbance and ensuing readjustment to the new arrangement, there was a magnetic or electrical discharge. Each proton (hydrogen nucleus), and possibly each electron as

well, evacuated some portion of its primeval charge. Thus the energy known to have been expended in the synthesis was no new energy freshly manufactured out of matter, but an old energy drawn from the antique well of electromagnetism. It was, in short, the unwanted excess of a primeval deposit of static energy over and above the reduced capacity of the original four hydrogen atoms to accommodate in their new helium atom partnership. But the only kind of energetic discharge I know is corpuscular in content. What was the nature of the corpuscles composing the hard radiation observed by the experimenters? Simply protons and electrons and possibly some alpha particles, helium nuclei, though all I can be sure about in the premises are the protons.

Reason tells me, and for all I know it may be mathematically demonstrable, that an ideally compact, perfectly nonporous, mass of nonatomic substance would be composed of homogeneous equal similar particles of the same density as the inclusive mass; that each such particle would be composed of equal similar subparticles, and so on in inverse geometrical progression of magnitudes; and that each particle of any order of magnitude would be equal to any other particle of its own or any other order in density and in the number of its constituent primary subparticles, and would bear to them each the same fixed ratio with respect to mass and volume.

The proton is just such a particle and at the same time nest of lesser nests of particles as the hypothetical sort just now described, but whether to satisfy my conditions

it must be a sphere, or a crystal, or something else in shape, I cannot say. A bee might know or a crystallographist. What I must hold to is that any two protons are alike in shape, density and composition and differ only in magnitude and mass, and that the proton substance occurs only in a rhythmic progression of magnitudes, each magnitude bearing to any other magnitude a definite and calculable relation. I hope a little further on to define this relation by a constant and put these related magnitudes in a formula. Meanwhile I have my clue to the nature of the corpuscles composing the radiation emitted by the helium atom in the making.

Radiant Energy In Little

Of electromagnetism, Coulomb forces, and the whole profound scheme which binds electron to proton in the hydrogen atom and gathers hydrogen atoms into bands to form the more complex atoms, I know next to nothing. But this much I may take for self-evident, that the surface of the proton is coated with something in the nature of a positive charge of electricity, and that the surface of the electron is similarly covered with a negative charge. If this be true it is not too difficult to surmise what happens when, in the convulsion of helium atom synthesis, each proton of the original four hydrogen atoms releases some portion of its charge.

This, I remind myself, is not free energy but static energy confined presumably to the surfaces of the surface subparticles of the terrestrial proton, and the discharge

when it occurs carries along with it a certain number of subprotons. Thus, the ensuing radiation, if observed by robots much more delicate of perception than any existing apparatus, would be found to consist in part at least of protons of an order of magnitude lesser in a calculable degree than the familiar terrestrial proton. Such observations as may have been made must, I suppose, have been set down in terms of wave effects, but the time may come when these smaller than small particles will be weighed and measured by a new physics and accorded the dignity of genuine protonship.

As to the discharge, if any, from the surface of the electrons, it is clear that the discharged corpuscles would be electrons alone or electrons and protons, and possibly some alpha particles, helium nuclei, each of the order of magnitude next below the terrestrial order.

I dare not follow this line further for fear of being caught up in complexities past my understanding. I feel safe only when dealing with simple things. And, anyhow, I have got what I wanted out of it. But before facing back to the sun and stars, I am going to make a little plastic image of the atom to take along in my pocket, to remind me.

The Atom As Teacup

I am trying now to reproduce the atom not pictorially as an all-seeing artist would perceive it in a hypothetical state of rest, but pragmatically as a physicist might note its response to his gestures of "annihilation." Let me

start off with a complex atom, any one of the ninety-two will do.

The atom in my imagination assumes the likeness of a cluster of teacups on a tray. For every hydrogen atom embodied in the complex atom there is a teacup on the tray. Say it is a fluorin atom. Then there are nineteen teacups on the tray. Let the tray itself be the little known forces which bind the nineteen hydrogen atoms into a single atom of fluorin.

I withdraw the tray, which thereupon turns to nothing in my hand. The nineteen teacups fall to the floor and lie there. In place of the original cluster, I now see smaller clusters (less complex atoms), a few separate single teacups intact (hydrogen atoms), one or two of which have lost their handles in the fall. I select one of the mutilated cups, bowl and severed handle. All the rest I sweep away.

I examine the damaged cup. The bowl (electron) is of a serviceable-looking gray substance, rather light in weight. The dissevered knob, or handle (proton), is dazzling white, perfectly opaque, reflecting rays of sunlight blindingly. Its hardness and heaviness constitute a challenge to the inquiring spirit of the amateur. I try to smash the white knob with a hammer, to dissolve it with acids, to melt it in a crucible. No use. Nothing I can do leaves so much as a dent or scratch on the contemptuously smooth hard surface. I give it up. Now let me try the bowl.

My luck improves. I smash the bowl to pieces with

my hammer, and with heat and acid reduce the fragments to granules, which I then place under the microscope. A surprise. These grains which I expected to find all alike are found to present a great diversity, on their tiny scale, of weights and sizes. Not only that. They are all shaped like little trays of teacups, on one tray a single cup, as many as ninety-two cups on other trays, with here and there a dissevered handle, a dishandled bowl. And now I see that the plain gray bowl of my original teacup was in reality a whole little world of smaller teacups. I withdraw all the tiny trays, smash off the minute white handles and put them to one side. I try to pulverize the tiny bowls, but when I examine the supposed powder through stronger lenses I find that all I have produced is a third and still tinier order of teacups, all arranged in groups of one to ninety-two on trays. Of teacups, I begin to understand, there is no end, no end at least that I can hope to reach.

I desist. But I have noted certain things. The second pile of *débris*, for instance, is smaller than the first. As the number of teacups grows, the aggregate volume shrinks. The present number is all but inexpressible and yet the pile of them seems less than a point compared to the volume of gray stuff composing the bowl of the original cup. Where has all the gray stuff gone? I have only this insignificant pile of innumerable teacups, this and the hard white handle of the original cup and the numerous smaller hard white handles of the second order

of cups which but for their handles have now disappeared, all these lesser handles in a neat little pile beside the single original handle, the primary proton. Surely there was more matter than this in the first place. Where has the main mass gone?

The answer is at hand. That first main mass was no such solid matter as it seemed. It was nothing but space pinpricked with "holes" of proton widely scattered in the atomic process. If I weigh the primary proton and the little pile of secondary protons along with the yet littler pile of tertiary teacups I shall find the weight of the whole exactly equal to the weight of the original teacup. Nothing has been lost. No matter has been turned into energy. All the protons remain and the whole mass was proton. The teacup was only the form and all the lesser teacups are no more than forms except only as they contain a rare and minute dust of proton.

So much for scientists' dreams of "annihilating" matter to produce "pure energy" to run their little engines of the future. "Pure energy" is safely beyond the reach of man, of nature too for that matter, in this my creation. "Pure energy" appeared once in the beginning. It will appear a second time and that will be the end.

Meanwhile I have a whole creation to build and I have not as yet made a single star of it. I must hurry back to the sun. I carry along with me my image of the atom and the thought that if a lot of lesser teacups compose the teacup of the terrestrial hydrogen atom, then it may well be worth considering whether the terrestrial atom

itself is not one of many teacups united in a very much larger teacup of which the bowl is called a planet.

I have seen how the proton occurs in a periodicity of magnitudes. For all I know, there may be slight departures from the norm in the masses of individual protons of a given order of atomicity, for nature is no purist. They are claiming now that there is a "heavy" hydrogen atom twice the weight of the normal, but what of it? The essential thing I fasten on is the unique and uniform density of the proton substance, a density which like the supposedly uniform speed of light I now strongly suspect to be an absolute. And he who thinks there is no matter reckons without his proton, without which there could be neither thought nor thinker.

The Planet As Electron

I believe the sunstar to be a true fluorin atom of the star order A of which the mass and dimensions bear to the mass and dimensions of the terrestrial order of atom a the same ratios as those existing between a and the subterrestrial order of atom aa , primary constituent unit of the terrestrial electron e . That is to say the solar system and the terrestrial fluorin atom, and the mutually corresponding primary parts of each, are similar objects.

The terrestrial fluorin atom, composed as I have seen of nineteen hydrogen atoms, is of the atomic weight 19 and, thanks to its nine exterior planetary electrons, bears the atomic number 9. The laws of atomic number and atomic weight are absolute. If the solar system is a true

atom it can be no other, provided the astronomers have at last called the full roster of the planets, than fluorin. It must consist of nineteen hydrogen atoms-as-stars and its empirically known mass must demonstrably express the atomic number 19 in terms of established intra-atomic quantities.

Now, I know from empirical sources that practically the whole mass of the solar system resides in the sun proper and this accords with the dictum of atomic physics which says that atomic weight is disposed almost entirely in the nucleus of the atom, or, more specifically, in the proton content of the nucleus. So, I must locate the bulk of atomic weight of my fluorin atom-as-solar-system in nineteen nuclear, or solar, protons of the order P and distribute the very small remaining fraction among the ten nuclear electrons E and the nine exterior electrons E visible as planets of the solar system. Although the weight of an electron is insignificant compared to the weight of an atom, it bears nevertheless a known fixed ratio (1 to 1845) to the weight of an individual proton. By application of this known relation I should be able to translate the atomic weight of the fluorin atom into the sun's mass expressed in terrestrial terms. But first I must determine approximately the mass of a typical electron of the order E and in this respect my data are limited strictly to the nine known planet masses.

I have tables giving the masses of the planets in terms of the earth's mass, also their diameters in miles. In both respects they are far from uniform. I ask myself, Can

it be that terrestrial electrons show such wide diversity of weight and measure? My answer is, Why not? If, as science seems to have shown with its "heavy" hydrogen atoms, one proton can be twice as heavy as another proton, who am I, to say that the electron alone of all known things must wear the chains of perfect sameness? If nature fills her species with genera and trims each variety with sports and mutations, how can poor I hope to attain perfection in every detail of my private little creation? There is doubtless a norm for the electron, as for every other created thing, and prescribed limits of magnitude and mass within each order; but the limits however impassable are not so narrow in fact as in the eye of the alien beholder. No, nature is no martinet and neither will I be.

One more thought before I place my planets on the scales. I think I have some grounds for suspecting that each electron of any order whatsoever may be a primeval unit of creation, older than any atom of its order except only the hydrogen atom and surely older than the physical system of which the atom is a primary unit. If this belief be sound, and I shall review the evidence of its soundness in the proper place, the terrestrial electron is older than the terrestrial fluorin atom and the planet earth, and any planet may be older than the solar system and the universe of stars, a proposition which has been demonstrated mathematically and hailed, perhaps overhastily, as the newest and most choice absurdity of modern science.

This much is known, that the terrestrial electron frequently transfers its allegiance from one atom to another. Only the creator knows, or could find out if he tried, how many distinct and dissimilar atoms any given electron has served in its time, or how many and how distant stars have known our own earth, or Mercury, or Jupiter as an attendant planet or familiar habitant of their fiery interiors. Considered in this light, the life of a planet is not an easy one nor uniform in its hardships. Naturally, no planet is now exactly as it was in the beginning. To each its own individual loss, perhaps alternating with occasional gains, of mass and volume. So, the difference between one electron and another, the inequality of this planet to that, once perhaps indistinguishably slight, has widened with time and the vicissitudes of the cosmic adventure. This variety of masses and sizes, so marked in the planets as to cause wonder at the thought that once they may all have been almost if not quite equal, may in time and in turn be manifest in terrestrial electrons under the scrutiny of sharper eyes than any with which science has as yet peered into the invisible. Or may already have been glimpsed, for all I know.

Meanwhile, in my effort to strike a happy mean of mass and dimension, I must take my planets as I find them. With a million planets to work with I could look for a nicer average. With only nine known planets I can at least do my best.

Here is a table giving the masses in terms of earth's mass and the diameters in miles of some

MEMBERS OF THE SOLAR SYSTEM

| | MASS (<i>Earth equals 1</i>) | DIAMETER (<i>In Miles</i>) |
|---------|-----------------------------------|---------------------------------|
| Sun | 331,950.00 | 864,400 |
| Mercury | .04 | 3,030 |
| Venus | .81 | 7,700 |
| Earth | 1.00 | 7,918 |
| Moon | .012 | 2,160 |
| Mars | .108 | 4,230 |
| Jupiter | 316.94 | 86,500 |
| Saturn | 94.90 | 70,000 |
| Uranus | 14.66 | 31,500 |
| Neptune | 17.16 | 34,800 |
| Pluto | ? | ? |

Now, this is as hopeless a set of irreconcilables as I may decide to let it be. Here is a Mercury with only three times the mass of earth's moon and, on the heavy end, a Jupiter of which three would have a mass equal to a thousand earths. I have a Mars with only twice the moon's diameter and a Saturn the diameter of which is twenty-three times Mercury's. And by taking account of comparative densities and a few more incompatibles, I could quickly wind myself in a maze to delight the soul of a professional indeterminist. But I remind myself that I am not trying to take precision measurements, that all I hope to establish are certain fundamental relations, and that simple reasonableness, not manipulated subtleties, is my cue. So, I shall simply discard those planets which are patently untypical and confine my averaging to the two middle groups, earth-Venus, of the

order of 1, and Uranus-Neptune, of the order of 14-17 earth masses. Averaging these four, I derive a tentative hypothetical planet with a mass of 8.5 earth masses and a diameter of 20480, or call it 20500, miles. Now I can proceed with my sun-weighing.

The Sun On Atomic Scales

First, I have to find the mass of a proton P , and while I am about it I may as well get its diameter also. I multiply my tentative average planet mass, 8.5 earth masses, by 1845, and then divide the planet diameter, 20500 miles, by 1845, and derive a proton P measuring 11.1 miles in diameter and having 15682.5 earth masses. I multiply this product by 19, the number of protons P in the assumed fluorin atom-as-star, and derive, for a sun mass corresponding to the atomic weight 19, the product 297967.5 earth masses, which falls short by ten per cent of the observed sun mass, given in my table as 331950 earth masses. If I had the correct mass for Pluto I might perhaps have come closer. But a ten per cent miss is not too bad. It is close enough, surely, to show an essential correspondence between the empirically known sun's mass and the atomic weight 19.

With this established it will now be an easy matter, simply by reversing the foregoing process to ascertain almost exactly what the mass of the average planet ought to be. I divide the known mass of the sun, 331950 earth masses, by 19 to correct my previous calculation for the mass of a proton P , and for the correct mass I get 17471 earth masses, which divided by 1845 gives, for the

corrected mass of the ideal average planet, 9.5 earth masses.

As a byproduct of this lisping in numbers I find I have the dimensions and masses of the two primary units of a hydrogen atom-as-star, both of the one-proton nucleus, or sun, and of the solitary planet; for I am assuming a virgin hydrogen atom-as-star with ideal undamaged parts. True, to be perfectly consistent I suppose I ought to add to the mass of the proton-nucleus the fractional 0.0077 which I have seen is lost in the syntheses of more complex atoms, but I do not expect to have occasion to use the quantity, so why put too fine a point upon it? But I shall need to know the diameter of the star, which I can work out from a comparative use of the dimensions of the terrestrial hydrogen atom set down above. I note that the diameter of the atom is 100,000 times the diameter of the electron, so I multiply by this figure the diameter of my ideal planet and get the result 2,050,000,000 miles. This, then, is the diameter of the hydrogen atom-as-star and the half of it is the mean orbital radius, or astronomical unit, of the planet. So here is my ideal hydrogen atom-as-star complete.

HYDROGEN ATOM-AS-STAR

| | THE STAR | THE PLANET | THE SUN |
|---|---------------|------------|---------|
| DIAMETER (<i>In Miles</i>) | 2,050,000,000 | 20,500 | 11.1 |
| MASS (<i>Earth equals 1</i>) | 17,480.5 | 9.5 | 17,471 |
| Astronomical Unit of Planet: 1,025,000,000 miles. | | | |

Now, in a mechanistic creation arranged in successive orders of the atomic process it is necessary to assume some fixed periodicity of magnitudes and this implies an ordinal constant of dimensional discontinuity. This constant I determine by calculating the ratio of the diameter of the terrestrial electron to the diameter of the ideal planet, which proves to be of the order of

$$1 \text{ to } 32472 \times 10^{18}$$

And the volumes will vary as the cubes of the diameters, or as

$$1 \text{ to } 34 \times 10^{66}$$

Fuel For Astral Furnaces

Of the doles, many and various, meted out to the lay public by the governing minds of organizational science, that which enriches me least in understanding is the coin current with respect to the internal economy of the stars. It is, I know, wholly proper for the specialist to fill in empirical vacua (so abhorrent to custodians of natural law) with hypothetical origins of observed phenomena in his special field. But the prevailing hypothetical tender, however sound the credit of the illustrious sponsors, seems at times to depart somewhat from the gold standard of fundamental reasonableness. To one accustomed all one's life to "buy tellurian", the much advertised "lucid" matter of the stars seems slightly inflated, faintly foreign, almost disturbingly exotic.

It was Newton himself, no less, who some two hundred

years ago first proposed "lucid" matter for star substance. And to-day this same "lucid" matter is being put forward as the be-all and do-all of stellar radiation. The same name, but the stuff itself brought strictly up to date. For Newton (poor Sir Isaac!) had not heard about the atom form, never dreamed that his dimly and tentatively conjectured "lucid" matter would, in my day, be procrusteanized into a type of radioactive atom "a bit heavier and more complex" than any known to exist on earth, or anywhere else, for that matter, except only in the wonderland of academic surmise. Had he discovered the fairy continent of the atom I wonder if he might not, for a time at least if not for ever, have left the stars of the heavens in peace and devoted himself with eagerness and delight to the exploration of this incomparable starlet so vastly littler than he ever dared to imagine littleness and yet holding in store for the inquiring mind greater riches than all of intergalactic space had yielded up to human knowledge before or during his lifetime or would yield for many lifetimes after.

Had Sir Isaac been made aware of the very simplest atom in the table of the elements, so easily taken for granted by the modern infant of the species, would he not gladly have exchanged a thousand merely speculative "lucid" matters for this one microcosm of assured reality? Once the steel of that inflexibly just mind had met the flint (I always think of it as a highly concentrated quartz crystal in little) of the one true matter, proton, what sparks of universal truth must not have been struck out to light

the long darkness of man's mumbling and hagridden night. But the primitive artist, I am told, was, often as not, compelled to greatness by the poverty of the palette. Might not Newton too have yielded to the mordant spell of that cankered specimen of atom life, the radioactive atom, and offered it, if not as the very stuff, then as the next of kin of astral "lucid" matter, primeval substance of creation? Maybe so, but somehow I doubt it. It is my guess that he would have chosen instead some quite simple atom, the simpler the better because more truly atom, as his portal to the mystery of the stars. But enough of guessing. I beg pardon of my instructors and get back to the lesson.

"Lucid" matter, then, is in its latest incarnation composed of superradioactive atoms. The history of a star's decline is the story of the gradual reduction of its "lucid" matter to "pure energy" which emerges into interstellar space as light, heat, and highly penetrating radiation. The "lucid" matter falls by its own superior weight to the center of the star and in course of the ensuing radiation there is generated a temperature of some fifty million degrees. Now, fifty million degrees is so hot that a pin-head as hot would consume an army corps of robots I don't know how many hundred miles away, or something of that sort. In such a temperature the "lucid" atoms lose one ring after another of their outer electrons. Particles charge about with great abandon to produce the theoretical condition assumed by modern speculative science to exist in the hypothetical "liquid" star.

Now, I am to understand that the proton and the electron are bottles of "pure energy." The bottles fall into one another and are broken. Proton and electron are "annihilated", vanish in a splash of "pure energy", most of which is swallowed up in space though some small portion comes to earth as light, heat and other radiation. It is all very simple. Too simple perhaps.

The notion of "pure energy" in breakable bottles is, I am afraid, more picturesque than persuasive. I like my teacups better, the material of each cup being composed of lesser cups, the lesser of still lesser ones, and so on down to an approaching nothingness which I shall try to deal with when I get there. If my scheme of matter be a just one there is no conceivable temperature so high, no pressure so extreme, as ever possibly to transform a minim of matter into "pure energy." For look. When I break the first cup I produce not energy but more millions than I can count of little cups, and if I break each of the millions of lesser cups one by one I find I have simply multiplied the millions and reduced the size of cups still to be broken. But I have gone into all that at some length above and know how vastly more difficult it would be to "annihilate" an atom than to catch and demolish each separate molecule of a gas escaping from a ruptured container.

I do not dwell on the extreme unlikelihood of a proton ever being "annihilated" by collision at whatever speed with an electron of a density twelve million million times less than its own. To pile up new highs of temperature

and pressure and what not in pad and pencil assaults upon the integrity of matter is, I am convinced, a waste of zeros. What is more, there is no need of it, as I shall try to show.

In Defense Of The Creator

In the assumption however arbitrary of an astral matter composed of atoms "a bit heavier and more complex than uranium", there is nothing intrinsically repulsive to reason; though I doubt that the sponsors of the trans-terrestrial stuff have strengthened their case by sicklying it o'er with the pale cast of a supernal nomenclature. For if this postulated "lucid" matter is but a continuation of a terrestrially familiar series, simply one or several more radioactive gradients than man happens to know about, why not let it go at that? Why try to give it the character of a distinct and quasi-magical "type" and thus widen the already yawning gulf between neoscientific imagism and the patient faith of common men in the residual unity of creation?

Whether a substance composed of superradioactive elements would in fact accomplish what is claimed for "lucid" matter I am not competent to say. But one suspects that the creator of creation may be viewing the creators of "lucid" matter with a faint amusement, unflattering to himself though he may find the business. For he must see himself categorized with those who think they have to burn their houses to the ground in order to enjoy a dinner of roast pig. Is it not pathetically human, this

constant readiness to deny the creator the wit to organize his stars with some modicum of the economy demanded of any journeyman electrician? To nature they yield perforce with respect to resources of magnitudes and masses of raw materials, but any suspicion that the maker of the stars may be a tolerably good engineer seems never to have entered their heads.

Very well. Grant "lucid" matter, for the moment, and all its works, even its end result of reducing astral particles to "splashes of intangible pure energy." By what miracle of physics is this "pure energy" to be conceived of as transmuting itself into the tangible and admittedly corpuscular rays of heat and sunlight in passage? I do not know, I cannot ever guess.

On the whole, I find myself ill at ease in the presence of this "lucid" matter. There is no modesty about it, no give and take as between its august self and lesser elements. It is not only the all-doer of the present, but the all-beer of the past. It is, in a word, the primeval substance of creation. It is older than the hydrogen atoms of which it is composed. Its progress is from the complex to the simple. If I apply this principle to biological evolution I find myself wondering whether the first life form may not have been the spitting cobra.

In The Basement Of Matter

Of the raw materials which biological evolution has to work with on the terrestrial plane, and of the mixtures, compounds, syntheses and agglomerates entering into the

composition of a planet, I have fairly coherent, if unspecialized and imperfect, impressions. But of one thing I am sure, that at the bottom of each mass, synthesis, compound, and mixture appears the simple hydrogen atom. It is the one form of matter without which I cannot imagine a planet, or any important part of it, in being. Nor is there any ambiguity as to the stages of the hydrogen atom's march to its objectives, or as to the lines of march.

By one line of march, the hydrogen atom advances straight to its appointed place in the final scheme of the planet, arriving in the same form as it started out, namely, as hydrogen atom. Or it turns to the left and unites with other hydrogen atoms in a more or less extensive progression of complex atoms, of which there are eighty-two permanent and nine radioactive forms, the latter stopping short of the imaginary line separating terrestrial matter from the hypothetical so-called "lucid" matter of the stars. Or again, it turns to the right and, along with other hydrogen atoms or with complex atoms, forms molecules. And the hydrogen atom, and the complex atom both permanent and radioactive, and the molecule enter into any number of chemical and physical relations resulting in organic and inorganic bodies and eventually producing the agglomerate mass that is the planet.

Now, is it not clear that to allow precedence in time to any other matter, "lucid" or nonlucid, terrestrial or astral, over the hydrogen atom is to assert the precedence of form over substance, of arrangement over content? But enough of that.

Concerning the governing forces responsible for the economy of the planet, I know a little and am left to guess the rest. Electromagnetism has something to do with the atom, holding its parts together somehow. Atom holds to atom in the molecule, and certain molecules to certain other molecules in certain formations, by virtue of the chemical bond. Masses tend to sink centerward, lighter masses rising above heavier masses, by the law of gravitation. And that is about all I have been taught. If poverty of the palette were all, I should be able to turn out a pretty good picture of creation on the planet plane. Anyhow, I will assemble my slim fagot of certainties and see what kind of hydrogen atom I can make out of them.

Matter and energy are opposite and presumably alternating states of the same thing, a thing which I will not attempt to name.

All matter is proton at bottom. The proton proper, nucleus of the hydrogen atom, is primeval inertial mass. The electron, planetary particle of the hydrogen atom, is matter solely by virtue of its proton content, its component subprotons suspended in the atomic process. But that does not tell the whole story of the electron, or of the proton either. I have still to deal with the charges of which they are the carriers.

The Pursuit Of Energy

The proton carries a positive charge of something which I hear called variously electricity, magnetism, electro-

magnetism. The charges are equal, but the electron's charge is "negative" while the proton's charge is "positive." What this means, I do not know.

I have been taught that "two electrified particles attract or repel each other with a force which is directly proportional to the product of their charges and inversely proportional to the square of the distance between them." Thus is stated the law of Coulomb forces. The statement is, in my perhaps worthless opinion, ambiguous in one respect and false in a second.

Consider the falsehood. Inertial masses (and the proton and electron are inertial masses as truly as is a cannonball) as such obey but one law of attraction, the law of gravitation. The attraction and repulsion noted in the quoted statement are not of the "electrified" particles but of the "electrification" alone. The particles themselves are but burdens on the charges, in the Coulomb reference.

This distinction, not possible in Coulomb's time, when particles were not allowed the dignity of mass, is to-day as important as it should be clear. It is mistaken identification of the charge with the carrier that leads to such palpable errors as that by which I am supposed to believe that inertial mass and energy are essentially identical. Quantum physics ought to know better and perhaps does.

The ambiguity in the above quotation is of the same general order of confusion. To call a proton or an electron an "electrified particle" is I believe a solecism in the atomic rhetoric. Electricity is not a behavior but a material agency, a concourse of electrons which have been

withdrawn from the atomic process. The electron is not "electrified", it is electricity itself, a particle of light, once it attains the speed of light. Call it a photon, call it anything you like. A particle of mass by any other name continues to be matter.

What is so easily called electric or radiant "energy" is not in fact energy at all but energy-propelled matter. The logic behind the new terminology is the brand of logic that would confound an acrobat with the ball upon which perched he rolls across the stage. Energy has but one reality, as matter has but the one reality of proton. Neither can be the other, or any other, than itself.

Real energy is the intangible, imponderable something that clings to the surface of proton and electron and, without altering their essence, conditions their behavior, their movements in space. Catch this impalpable something and you have in your hand the currently much touted "free will" of the new schoolmen's electron. Yes, try and catch it, Chase it off its little rolling ball and watch it slip away, fade away on a decillion or so of littler spinning, rolling balls.

What keeps this slippery something on the ball? What is the nature of the affinity by which this immaterial essence holds fast to its particular proton or electron and packs its material host about wherever it goes. I do not know, I cannot even guess. The essence itself I know only, as used to be said of electricity, by its manifestations. But I know its right name. It is energy, magnetic energy, real energy.

The Mechanistic Atom

Here is a hydrogen atom, invisibly tiny spinning electron revolving round the tinier, much heavier proton at a mean distance of $1/500$ millionth of an inch. (In my hydrogen atom-as-star, the mean orbital radius assumes the order of one billion miles, but the one distance is in cosmic terms every bit as real as the other, just as one order of the atom is no less real than the preceding order. The values lie in the relations wholly.) Across this minute but actual stretch of intra-atomic space reaches the magnetic force that attracts the electron's negative charge to the proton's positive charge. At the same time, gravity asserts its force to increase the mutually attractive impulse. But to what am I to look for a countervailing repulsion? I see what holds the atom's parts together. But what resistance intervenes to prevent collapse?

Must I credit gravitation from without, the combined pull of all the neighboring atoms in the gravitational field, the pull which presumably gives the orbit an elliptical not circular shape? I do not think so. Everybody's business is nobody's business and I will not tolerate a system that stakes the individual atom's existence on the group caprice. I want an atom that I could lift out of the general gravitational field altogether without disturbance to its fundamental integrity. Besides, I think it can be shown mathematically that the general composite gravity from without would be insufficient to equalize the combined magnetic and gravitational impulses within the atom's special field.

Field. What do I mean by field? Do I mean ether, that dim spacious god out of the machine invoked by my forefathers to rescue the brave new wave theory of light? But ether was never more than a word, a handle to nothing, a verbal anesthetic to put painful uncertainties to sleep. It is a word not used by our smarter contemporary practitioners. They talk of the field instead.

Of the need for a field there is no question. One does not have to be a Faraday to reject the notion of forces acting directly at a distance. For mass to attract mass, for energy to attract or repel energy, a gravitational field and a magnetic field are required; and if the two fields can be fused into a practical identity, so much the better. The electric field is supererogatory now that reason and relativity unite to show the equality of inertial mass and gravitational mass; though relativity might have done better to stop there and not try to establish an impossible identity between inertial mass and energy. A photon speeding through an electric field is one and the same thing as an electron traversing a gravitational field, and in my opinion the energy-photon and the special electric field will eventually find their way to the same intellectual ash heap.

My need for a field is special and personal. I need it to keep my atom from collapsing. To keep the electron from falling into the proton-nucleus under the combined magnetic and gravitational pulls, I must interpose some substance in which it may, in effect, float. That this substance is identical with the substance composing the magnetogravitational field, I cannot doubt.

What can the field stuff be? Not energy; energy is immaterial and a body is precisely what my field must have; in a magnetic field made of energy there would be exactly as much sense as in a gravitational field made of gravity, the terms cancel each other out. But if not energy then what? Nothing remains but matter.

Matter is proton and a field of unprocessed proton is unthinkable. But the only process in which I know proton to be capable of discontinuous suspension is the atomic process and I already have that.

So, in my effort to fill the gaps left by the atomic process, I am reduced to this very atomic process. It must be this or nothing and it looks very much like nothing. How can I squeeze atoms into the empty places of an atom? It would be like trying to cram teacups of equal size and shape into one of their number.

Teacups. There I have my cue.

The Field

The field, within a given hydrogen atom, is that than which it can be no other. It is a system of lesser atoms.

I have seen how the terrestrial electron e contains atoms of the next lower order aa , which by applying the constant of ordinal dimensional increment to the known diameter of the terrestrial hydrogen atom a I find to be of the order of

$$\frac{1}{8 \times 10^{30}} \text{ inches in diameter}$$

Now I must conceive of these inferior atoms aa as

occupying not only the sphere of the electron but all of the hitherto presumed empty space within the atom *a*. But I do not think of these inferior field atoms as overflowing from the electron. On the contrary.

In my progress thus far it has been increasingly necessary to look to the proton-nucleus of the hydrogen atom as the ineluctable source of the material electron and its immaterial magnetic charge. I shall not stop here to develop the thought, but I shall return to it below in discussing my concept of creation not as an arbitrary special act, but as a purely causal phenomenon in due process of natural law. Meanwhile I think I have good reason to regard the electron as a negatively charged concentration of the field. This is the order of precedence in time:

1. Proton 2. Field 3. Concentration of field as electron.

If the electron is the creature of the field, then it becomes clear that the field is the fundamental reality of effective matter, outside of the proton. I use the word outside in its literal extensive sense. The field does not in fact enter the proton but surrounds it. It follows that lines of magnetic or gravitational force can never pass through any proton. The proton must always remain a hole in exact field physics and its acceptance on this basis should cast light on a number of troublesome anomalies in current orthodoxy. For one thing, it should dispose for ever of any lingering belief that the field is "in some sense identical with space itself", or "something necessarily

given with space." Once given its precise atomic character, as I am now giving it, I think for the first time, the field becomes a material and at least theoretically portable substance, as much so as the terrestrial atom or its parent star. But the point to emphasize here is the substantial identity of the material electron with its material field, the patent truth that the terrestrial electron e is a secondary state of the field f , that is to say, a modification of a primary state imposed upon space which must otherwise be empty within the atom a . All this without prejudice to the necessary and important part played by the electron's magnetic charge.

So, my conceptual field f , considered from the terrestrial atom a as the point of departure, is some arrangement of atoms of the order aa . But the terrestrial atom within the sphere of the planet earth, itself an electron of the order E , assumes at least ninety-two more or less distinct forms, and I have no reason to deny that the subterrestrial atom aa may assume all or at least some of these variant forms within the sphere of the terrestrial electron e . But I must remember that the electron is a sophistication of the field proper and subject to special conditions not necessarily prevalent throughout the field. So, to postulate a general distortion of the atom form from its pristine form (undoubtedly the hydrogen atom form) into complex atom forms throughout the whole field would be unwarranted.

This then is my conception of a magnetogravitational field f within the terrestrial atom a . It is a gas, fluid,

or some other congregation of hydrogen atoms of the order aa occupying the space within the orbit of the electron and penetrating the sphere of the electron and in general occupying and composing the material atom entire except only the proton, which it does not penetrate and which is to be considered as within, but not of, the field.

In this material field conditioned by the natural forces made operative by and within it, I think of the terrestrial electron as a microship pursuing its own wake round and round a miniature rounded ocean, pitting buoyancy against the composite magnetogravitational attractive force tending to pull it to the bottom, or center, of the atom. I see also in this field the long postulated medium in which the fundamental impulses of magnetism and gravitation are enabled to act between discontinuous particles, thus removing the necessity of assuming direct action between particles or bodies at a distance. What could be simpler or more reasonable? My only criticism of it is that it will not, as it now stands, do the work of a magnetogravitational field.

A field to be effective must provide actual or at least functional contacts among discontinuous gravitational masses and magnetic charges. This my system of inferior atoms as thus far developed does not but only seems to do. Across the chasms between particles it flings not a bridge but only a stipple of lesser particles. Even when I grant, as indeed I must, that each atom aa of the field f of the terrestrial atom a is provided in turn with a sub-

field *ff* composed of atoms *aaa* yet more minute, and that the supply of fields is in exact measure to the descent of the atom from ineptual macrocosm to ultimate conceptual smallness, even then the discontinuity remains unbridged. The stepping-stones draw closer, but they never meet.

The difficulty lies in the nature of the very device by which alone the field is made possible at all, that is, in the atomic process itself. No matter how minute my field atoms eventually become, and even though I place them actually touching end to end, the empty space between electron and proton-nucleus of the smallest of small atoms remains. Mere proximity is cold comfort, in this my dilemma. I have no more right to assume direct action between particles separated by these fantastically minute emptinesses than I have to assume a like direct action across absolutely empty interstellar space.

Here arises another question which will have to be faced soon or late. If the atomic form persists to the very bottom of matter, what then is the last electron made of, since than the smallest atom there can be no smaller?

It begins to appear that the problem of the field is the fundamental problem of all matter. It becomes increasingly clear, and on more grounds than one, that I must look for light to some eventual failure of the atomic process. But what can be the nature of this failure? What sign have I anywhere of lapses in the incomparable mechanism of the atom? Let me search once more

through my little hoard of crumbs and scraps of laboratory backdoor alms.

Search For A Final State

Here is the positron, positively charged electron, to show that the magnetic charge is not fixed absolutely by its sign in the selection of a host. And what is this "sign", anyway? They tell me that the electron's negative charge is "equal" to the proton's positive charge, and yet the charges are different, one being "plus", the other "minus." What is the quality of this difference? I wonder. All I know is that the atom has a way of drawing many and various effects out of a common primary source.

And here is the deuteron, hydrogen atom nucleus twice as heavy as the normal proton-nucleus. Can it be that "heavy" hydrogen (occurring in minute traces in any given quantity of ordinary hydrogen) is the true primitive hydrogen nucleus? Can it be that the norm of hydrogen atom mass has dwindled by one-half in postcreational time, owing perhaps to progressive losses incurred in uncounted syntheses of hydrogen into complex atoms and consequent disruptions into the original hydrogen? Is this the Second Law at work sapping the life of the particle as it is said to levy its inexorable toll on all gross matter? Is every particle subject to this gradual loss of mass in some exact correspondence with a concurrent reduction in the quantum of the magnetic charge it carries?

Where you find the deuteron, you are more likely than

not to find also the neutron, a particle of the same mass as the proton, or possibly the deuteron, but carrying, as the saying is, a "zero" charge, which is to say that it is neither positive nor negative but magnetically neutral. What am I to make of it?

This much at least seems certain, that individual particles can on occasion depart from the ordinal norm of mass, and quanta of magnetic energy can do likewise. Now, if individual particles can vary one from another, however slightly by any present scheme of measures, within a given order of the atomic dynasty, is it inconceivable that a whole order may vary somewhat, *mutatis mutandis*, from a preceding or succeeding order? If I can catch individual atoms in the act of straying from the beaten path of atomic habit, must I not admit the possibility of a final state distinguished by the complete absence of the atomic process?

And, finally, if I may recognize the possibility of all this occurring in present time, may I not with equal fairness consider the likelihood of its taking place in, and as, a necessary part of the creative process?

My conclusions in respect of a final state must necessarily be conditioned by my ideas however inchoate of a first state. I cannot hope to see beyond the atomic system without first having caught some significant glimpse of the way the atom came into being.

To catch this gleam I must work back from effect to cause, from phenomenon to essence; and if I seem at moments to be growing mildly theomorphous it will be

in fact the ways of insects not of gods that I am trying to follow. Somewhere along this road I have left my original intention of making a personal creation for my private pleasure and comfort. It happened like this. Whenever I strained to create out of my imagination some element that had not been before, I found that the resulting "creation" lacked that something by which reason recognizes infallibly the shape and color of truth. But whenever I built instinctively and let my hands dispose convenient bits of nature in ingenuous arrangements such as might delight a child, and whenever I found myself delighted with these childlike arrangements and perhaps a little proud of their naïve and unquestionable rightness, then I discovered invariably that nature had been there before me and that after all I had created nothing and invented nothing but had only for once in a way seen nature's work through child's eyes; for a child, or an insect, or nature sees no end of amusing and important acts to be performed with a very few very simple things, and the evident fact that a thousand acts are but one act performed a thousand times does not mar the zest of the business at all, for repetition is the fundamental diversity and variety without repetition is anarchy.

First there was energy, then matter. Somewhere in between I must look for a first state. It would be neither energy nor matter, or perhaps more truly it would be a subjunctive mode of both. Given this first state I should not find it too difficult to reconstruct the atom. I can draw a little on quantum mechanics, but more on the in-

fusorium, the bee and the spider, though most of all on the crystal, which is closest to the atom and almost an eye-witness of the transaction in question.

Matter At The Source

I imagine energy as arranged in opposite spirals one of which I will call plus, the other minus. The spirals gyrate and engage each other in an interpenetrating operation which has the effect of amalgamating the original plus and minus dynamic energy in the form of neutral static energy.

Thus, what began as a pair of distinct centrifugal impulses (the flight of plus from plus, of minus from minus free energy) resolves into one composite centripetal movement (the search as it were of both signs of energy for a common center), the first significant result of which is a perfect union of what undoubtedly are two complementary though incorrigibly distinct parts of the same whole energy. All that ensues from the completion of this union to the eventual appearance of real matter is brought about by this centripetal movement, which does not cease with the achievement of unity but goes on as though from some inner necessity to a process of condensation.

Out of the condensation process emerges a new something which is neither energy nor matter but a modification of the first in the direction of the second. The difference between this new form and the form of static energy from which it derives is inexpressible in material

terms but may be imagined as a figurative equivalent of the difference between viscous and fluid.

This new quasi-viscous something is my conception of the first state of creation. If not matter it contains the whole essence of matter. If not energy it is permeated with the energy from which it derives. It is, in short, the material principle of energy.

The condensing process goes on. In the dark depths of the sphere of the plasma of the first state minute concentrations are ingenerated. These are nodules of raw matter, as little as possible more than mathematical points. Each nodule is immured as in a honeycomb cell, being separated from its neighbor nodules by a round wall of the first state plasma, which itself, the portion of it remaining over and above the portion incorporated in the incubating matter, shows no disposition to participate in the materializing process on its own account but only as an agent.

The foregoing outline of the creative procedure in its prematerial stages is wholly imaginative and necessarily so because I have had only unknowns with which to work. Whether in any detail or altogether I have guessed right or wrong is a localized question without decisive bearing on the general scheme of a material creation resting on a dynastic system of discontinuous atomic orders. What is vital to the scheme is the series of dynamic phenomena which alone, given some such first state immaterial plasma as I have suggested above, could produce such a system and of which the system is a necessary consequence. These

phenomena I shall now try to reconstruct to the best of my limited understanding of respectable dynamic law.

The Proton-Nucleus Of Creation

What I have now is a concourse of infant material particles incubating each within its separate cell throughout the extent of the sphere of the first state plasma. These will be the ultimate, indivisible corpuscles of matter, the only true "atoms" by strict etymology, but I will not argue about that now. The absolute quantitative measure of any mass in creation, of creation itself, will be the number of these finally small particles it contains. All other measures will be relative and contingent.

Most significant is the separatedness of each nodule of raw matter in the general matrix of the first state. It is almost as though the creative agency were endowing the nascent particle with individuality in order to make it complete and self-sufficient, a kind of separate creation. This is the first sign I find in nature of a schematic discontinuity, a discontinuity, in this instance, in space. This device of spacial discontinuity will recur in another form as the permanent principle of the atomic process, but its use in the proton of creation is temporary and preliminary to the exactly opposite principle of perfect continuity in space by which the condition of absolute density will be effected.

I picture each nodule in its cell as a spherical or bean-shaped droplet. The cells are arranged in a regular pattern within a spherical, or beanshaped, system which

itself is but a unit in a larger sphere, or bean, composed of the lesser systems and containing exactly as many of them as there are separate nodules in each lesser system. So many nodules to a system. So many systems to a supersystem. So many supersystems to a still greater system, and so on to a system supreme within the general sphere of the first state plasma, which contains as many of these primary systems as there are nodules in each system of the lowest order. Always the "so many" is the same throughout the general sphere, or bean, itself, of which there is only one.

They tell me the creator is a mathematician. I wonder. I think of a young child playing with his little tin pail and spade in the lee of a fisherman's dory drawn up in the shadow of an old hulk of a schooner rotting high and dry on a beach. He fills his pail with beach sand and then empties it, fills and empties, fills and empties, sometimes running the sand through his fingers and trying to count its grains, and so he falls asleep and dreams. In a dream the work goes on but on a greatly enlarged scale and with a clairvoyant particularity.

Now it seems that he can count the grains of sand as they sift through his fingers into the pail. It is not a classroom count but a kind of rhythmic knowing in numbers without arithmetic names. He fills the pail to the brim and knows to a grain how many grains it holds. He finds other pails and fills them one by one and the number of grains in each filled pail is the same as the number in any other pail. When the number of filled pails equals

the number of grains in each he stows them in the dory, exactly filling it. Then he sees that the schooner is surrounded by dories just like this one, an enormous fleet of dories with tin pails in piles around each dory, and so he starts all over again, so many grains to a pail, the same rhythmic unarithmic number of pails to each dory. When there are as many filled dories as there are pails to each dory he begins to stow the dories in the schooner and finds that they exactly fill it.

He sees the whole beach now filled with empty schooners, each schooner surrounded by empty dories, each dory surrounded by empty pails. So he starts to work afresh, filling the pails with sand, the dories with pails, the schooners with dories, until he has filled as many schooners as there are dories in each filled schooner, using up all the schooners and all the sand on the beach. But beyond he sees another beach with a dory lying in the lee of a dismantled schooner and with an empty tin pail beside it in the sand. On this second beach he has the same experience as on the first, both here and on a great many other beaches also. When he has finished working on them he knows there are as many beaches in all as there are schooners on each beach, dories stowed in each schooner, filled pails in each dory, grains of sand in each filled pail. Then all the beaches heave up to form a solid ball which begins to contract, closing on the dreamer, slowly choking him, and he wakes up with his mouth full of sand.

That is all the mathematics I can find in the proton of

creation. And the dynamics of it is just as elementary. The whole business is never deep in anything but simplicities deep enough for professional philosophers to drown in.

Here then is the bean (to call it so) of creation, the general plasma of the first state in which are embedded lesser beans composed of beanlets and inferior beanlets in a finite series of diminishing discontinuous magnitudes terminating at the small, or bottom, end in the nodules enclosing the material essence of the indivisibly small proton-to-be. It now remains for the nodules to contract into perfectly dense protons, which is the same as saying particles of continuous, nonporous matter, and for all of the above mentioned systems to fuse into one another in such manner as to compose one continuous, perfectly dense master proton, the proton of creation. But how am I to explain this particular and general contraction toward a common center? What is the cause of it? What is the law?

The law, certainly, is the law of gravity. But where does gravity begin? What is gravity, anyhow, and what is its relation to the primeval impulses of free energy which I have indicated somewhere above?

Let me refresh my memory concerning those impulses.

Inklings Of Unity

I saw free energy in separate spirals of the two opposite signs to the nature of which I have no clue. Then I saw the two signs of energy in flight as it were from sep-

aratedness. They met, interpenetrated, engaged in a combined centripetal movement towards a common center. The first significant result was a perfect union of energy of the two opposed signs in what I have likened to a fluid neither plus nor minus but energetically neutral everywhere.

This fluid, having first achieved a perfect fusion, proceeded to condense into the first state plasma from which it was to go on to its final metamorphosis and emergence as real matter, proton, as I have seen above.

The question is, at what point before, during, or after the materializing action did the primeval motility of free energy leave off and yield to the attractive impulse of gravity? And to this I can find but one reasonable answer. There was no leaving off, no yielding. What I call gravity is but a projection into the material creation of the primeval movement of free energy towards a center. Even in the frozen state of energy called matter the tendency persists and that is all there is to gravity. Magnetism is the static equivalent of the primitive flight impulse (plus from plus to minus, minus from minus to plus) of free energy. Gravity is the persistence in matter of the centripetal (condensing) impulse of fused plus and minus energy. Gravity is primitive magnetism at work in a new environment of its own creating. The impulse is continuous and unchanged. There is only one absolute thing, energy-matter; one absolute impulse, magnetogravity. This reasonable view is obscured in the popular mind, perhaps, by the universal acceptance of grav-

ity as an arbitrary pulling together of dead masses by a mathematical fiction called a "force." The Newtonian mathematic would carry a larger meaning, I believe, if applied to the earlier and saner Aristotelian concept of gravity as the quasi-spontaneous impulse of a body to return to its own proper place ("the center"), given the opportunity to do so.

Given the opportunity. Given a field, in other words. What I should have asked myself above is not where gravity sets in but, where does the field begin? Not only gravitational mass but energy, in a material creation at least, requires a field the search for which has put me to so much trouble on the atomic plane of matter. I suspect the necessity of a field at a very early point in the creative process. I doubt that energy could have been converted into matter without a field in which to function freely.

In the first movement of free energy assumed above I can conceive of inertial energy as propelled by some dynamic impulse either spontaneous or else induced by a fortuitous meeting of the two opposite spirals in space. The ensuing concerted movement of the signs is undoubtedly a projection of the original movement, that is to say, a necessary consequence of it, the flight impulse turning towards a common center; and this secondary movement is like the first a transference of the inertial content of free energy and so requires no field but empty space.

I am not unaware that I cannot give energy inertia without at the same time giving it mass and I see no reason to

deny it either. I know of nothing in nature to justify the assumption of mass (or of extension or inertia for that matter) as a property especially devised to distinguish the particular condition of the universal essence which happens to bear the name of matter. No state is specially privileged in its fundamental possessions (though each state has its own peculiar behavior patterns), and I cannot escape the conviction that mass is as fundamental as energy itself. Mass is not a special creation for the benefit of matter but, with respect to any given unit of matter, is the sum of mass inherent in the quantity of energy of which the given unit of matter is a concentration. But I must take care not to confuse the mass of real energy with the mass of what is commonly and erroneously called energy, and which is not energy at all but inertial mass in the form of electricity or the like. Undoubtedly this fictitious energy has mass, but so too does real energy and it is as inertial mass rather than some pale metaphysical abstraction that I first conceive of energy moving in obedience to some unknown impulse on the scene of creation.

I have never felt the desire to impute a purpose to the creator, but I should be void of intuition and untouched by all the evidence of right thinking did I not see in the foregoing one definite and supreme motivation on the part of the creative agency. This motivation I can sum up in a phrase which I have used several times above and for which I can find no exact substitute: "the search for a center." I doubt that it is possible to gain even an ap-

proximate understanding of the creative process without recognizing the dominant place of this search for a center in the general scheme. In this as in all expeditions of pure reason it is necessary to go the whole distance or else remain at home. All the evidence points to the conclusion that the translation of energy into matter and material structures was not an end but a necessary means of prospering energy's primary concern, its search for a center. Matter's sole reason for being lies in the truth that only in the complete continuity of perfectly dense proton could energy find an absolute and final center.

There could be no fixed center for energy short of proton. But energy's very need of proton is the measure of its inability to resolve itself directly into proton. To perform so highly constructive an act as the creation of proton the imperative requirement was direction. But the movement of inertial energy in space was a blind movement, directionless. Order had to be somehow provided, order and directed organization. Ordered operations in an organized field, in short.

The first field, which is to say the medium in which discontinuous energy was first able to undertake a common organized enterprise, was the plasma of what I have been calling the first state. I am going to change its name now and call it *matrix* in token of its twofold function as the mother and mold of matter. Its third function, that of field, will appear below. Meanwhile I must look a little more closely than I have looked into the nature of this matrix.

Matrix And The Field

I have now to deal with the great spiral cloud of inertial neutral energy which at a given pass constitutes the sum of creation. Taken as a whole this energy may be likened very roughly to an inchoate spider suspended webless in a nongravitational vacuum. It has no place to stand. So the search for a center must for the time being resolve itself into an attempt at equilibrium. Before it can organize itself and order its actions the spider energy must spin itself a web. This it proceeds to do.

How energy contrives to spin its web as it were out of its own entrails I am far too dull to deduce, too uninformed to guess. But this I can safely assume, that first it must have established lines of continuity, which is the same as saying lines of gravity. I conceive of these lines of continuity, at some advanced stage of their development, as tenuous threads of energy somehow conditioned by the rudimentary play of gravity which holds them together and in consequence transformed into a state other than that of the parent energy. I think of these incomparably fine filaments as reaching out in all directions, crossing and recrossing in all directions to form a three-dimensional meshwork, or net, in which is snared all that portion of the original energy which has not undergone the metamorphosis. I see the residual neutral static energy running quicksilverlike (as electric current through wires) along the strands of this close network stretching out everywhere to the extreme limits of the scene of creation and formed of the substance of the

first state which I have already decided to call matrix.

In this first near view of matrix, mother- and mold-to-be of proton and, besides, the field in which energy finds the equipoise essential to an organized search for the center, I see more clearly the urgency of Newton's need for an intermediate state between "light" and "gross" matter. The tragic flaw in his hypothesis reveals itself starkly in the name he chose for his assumed transitional substance. In calling it "lucid" matter he epitomized his fatal identification of energy with light. He was doomed to failure on this line because the river he tried to bridge was inexistent. Between "gross" matter and light there is no crossing for the final reason that they are one and the same inertial matter. To confuse light with energy was a natural and perhaps inevitable error in the state of knowledge during Newton's lifetime. But for modern scientists, rich in the knowledge of atomic physics, to persist complacently and unanimously in a solecism that should be self-evident is a curious example of atavism at the heart of progress.

Energy is not light. It is not heat. It is fundamentally independent of and anterior to both. Both are exclusively atomic phenomena. Without the atomic process, an afterthought as it were of energy on the rebound, light and heat can be neither produced nor entertained. Can I imagine friction producing light or heat in a body innocent of carbon or oxygen atoms or indeed of any atom at all? Can I conceive of combustion (oxidation), or chemical reaction of any sort, in a world void of atoms?

Can there be light where there are no electrons to provide the body itself of light?

Energy is dark and cold and so also is matrix (which I lay respectfully on the honored grave of "lucid" matter). Light and heat are postprotonic phenomena. On the scene of primeval creation which I have now reached there is no light, no heat, no sound, only an ominous thickening in the universal darkness.

I have seen that energy has mass, extension, inertia. So too has matrix. In what respect then is matrix not matter? Simply in this, that it has not achieved the absolute condensation, the substantial continuity at all points and in all directions, which distinguishes proton-matter and makes it unique.

Now energy, that part of it not converted into matrix, has reached a kind of equilibrium. I think of it as flashing at an absolute velocity and in all directions along the strands of the great meshwork of matrix, seeking, never for a moment pausing in its search for, the center. The search will end, I know, in one general and perfectly fused mass of proton. This proton of creation is "the center", but it is to be taken not in a single rush but only at the end of an ordered march of systematically organized subsidiary centers.

In the outer parts of creation energy traverses the network of matrix with comparative freedom, but deeper in I conceive of a state of congestion caused by the crossing of multiple lines of energy at focal points. At these strategic points the field of matrix is caught up in minute

whorls in which the matrix undergoes an induced condensation which is to result in the beanshaped nodules of raw matter out of which ultimately small and indivisible particles of proton will materialize. Only in these minimal nodules will be seen a direct metamorphosis of matrix into proton, and all greater proton masses will be multiples of these least protons and not direct conversions of matrix into matter. In these smallest proton particles energy will find the local centers which are to be massed for an orderly march on "the center."

The order of march is inherent in the formation of the battalions, regiments and divisions composed exclusively of minimal proton particles. I have seen above how these particles fall into clusters, the clusters into systems, the systems into supersystems, the whole constituting a series of discontinuous orders of magnitude, each order containing, in the aggregate, fewer and larger prime members, and how at length all the parts become one whole in the unique and all-inclusive proton of creation. I can find but one explanation for these periodic divisions. It seems clear to me that the business follows a definite schematic pattern etched in the matrix in advance of the materializing operations.

I feel some assurance in identifying this prefiguration with the residue of the composite movement set up at the meeting of the original plus and minus spirals of free energy. If I may judge from the resultants of comparable geophysical phenomena, this movement would assume some such form as that of a cyclone or water-

spout, and so the design forms in my imagination of a system of discontinuously larger and smaller whorls of energy, or rather a concourse of such systems. Some portion of the original impetus would discharge itself into the process of amalgamation of the two opposite signs and a comparative calm would ensue in the outer parts of the scene of creation. But in the more central parts the "cyclones" would persist in strength and the lines of continuity which I have seen forming into filaments of matrix as a field for energy would necessarily, in these more central parts, assume the exact pattern of these residual movements. Here are located the points of multiple crossings, the minute whorls in which matrix is congested and conditioned and processed into raw proton-matter; and surrounding these smallest whorls are the ascending series of discontinuously greater whorls from which will emerge the clusters, systems of clusters and supersystems, and, finally, the whorl of whorls, the envelope as it were of the whole movement, the cocoon of the proton of creation. All this as a necessary consequence of the free shifting of the spider energy to attain equilibrium in its tridimensional web of matrix.

Now I must not fall into the error of attributing the actual metamorphosis of matrix into matter to the pressure of energy at points of congestion. True, the focused activity of energy at strategic points contributes to the shaping and mixing of matrix in minute cylinders or bean-shaped nodules, thus providing the material upon which gravity may operate. But it is gravity itself and

nothing else that resolves matrix into the perfectly continuous and absolutely condensed state which I call proton-matter, and it is this same gravity which alone fuses the clusters, systems of clusters, and supersystems together into superior proton masses and finally into the proton of creation. But gravity must have a field in which to function. It finds this field in unprocessed matrix.

Not all of the matrix contained in a given nodule undergoes the materializing process at this stage, but only so much of it as is defined by the miniature local reproduction of the general pattern, the signature as it were, of a residual movement of energy. Within the interstices of the pattern, the same as outside of it altogether, I conceive of the matrix as untouched by the protonizing operation. This inner pulp of unprocessed matrix provides the gravitational field in which bits of raw matter draw together, excreting the field at the point of fusion where gravity becomes operative by actual contact at every point, a condition only possible in proton. In precisely the same manner the individual particles of each cluster move and condense to a common center, the clusters of each system do likewise, as do the systems of each supersystem and ultimately the secondary proton masses which fuse into the proton of creation. Within and between all these aggregations, the same as within the smallest nodule, matrix provides the gravitational field, oozing away into the common mass of unprocessed matrix once its function, somewhat of a kind of catalysis in reverse, is performed.

Creometric Dead Reckoning

Thus energy finds "the center", by the device of forming and massing a great quantity of subsidiary centers. In this dead reckoning, so to speak, by systematized and discontinuous orders of magnitude the creative agency hints rather broadly, or so it seems to me, at a strange but very real dimension over and above the everyday dimensions of length, breadth and thickness and relativity's newly minted time dimension. I will look at the possibilities of this somewhere below.

The precise manner in which ultimate fusion is attained between the indivisible smallest particles and between the various systems is a question for the specializing crystallographer. I can only hint at the problem and make a crude suggestion or two. What is required is an absolute spacial economy expressed in perfect continuity of the fused parts and this consideration will determine the form in which the separate particles and unified systems will finally "set" and permanently condense. I believe there are only three known possible figures which these particles and systems can assume and remain similar throughout and equal according to their order, and these three are the square, the triangle and the hexagon. The most likely form, in my judgment, is a bipyramidal one with each base containing six triangular planes, a familiar form of the quartz crystal, I am told.

So I imagine each indivisible smallest particle assuming under pressure of its neighbors at the point of fusion

the shape of a hexagonal bipyramid. I conceive of each cluster of particles taking the same form, and each system of clusters, and each supersystem; and, finally, I see the proton of creation itself as a hexagonal bipyramid. All these large and minute protons are now being fused into an impenetrable unity and I shall never see one of them in exterior creation, but the form remains and I know that if the proton of creation were ever to be blasted apart it would separate into hexagonal bipyramids composed of lesser hexagonal bipyramids, or whatever the true form is, for I am only guessing at this particular form, of course. But if my guess be true I know that any proton anywhere in creation is a larger or smaller hexagonal bipyramid.

Before the proton of creation fuses in all its particles and parts and seals itself away from all but the most impudent imagination for the duration of this particular creation, let me try roundly to calculate the numbers of these parts and particles. I have seen how the indivisible smallest particles are the only direct creation of proton out of matrix and how every proton mass is some multiple of these smallest particles. I think I can indicate how many particles there are in each cluster, which will be the number of clusters in each system, and so forth, and the number of secondary systems within the proton of creation. This number is no other than that which I adduced somewhere above as the constant of ordinal discontinuity according to volume, which in this instance is

the same as saying according to mass. It is the same both within and outside the proton of creation :

$$moC = 34 \times 10^{68}$$

and this is the number of protons of any order contained in any proton of the next higher order, as for example, the number of terrestrial protons contained as primary component particles in the proton-nucleus of a hydrogen atom-as-star. And it is at the same time the number by which, in the proton of creation, the total number of members of any given order must be multiplied to give the total number of members of the next lower order according to magnitude. The formulas write themselves. To simplify, let me dispense with literal quantities and all that and assume arbitrarily that there are six orders of magnitude, including the proton of creation at the top and the indivisible least particle at the bottom.

TABLE OF NUMBERS AND MASSES IN SIX CONSECUTIVE ORDERS OF PROTON

| | <i>Proton of Creation</i> | | | <i>Indivisible Least Particle</i> | | |
|---|-------------------------------|------------------|------------------|---------------------------------------|------------------|------------------|
| <i>Magnitude</i> | 1 | 2 | 3 | 4 | 5 | 6 |
| <i>Number of Members in Order</i> | 1 | moC | moC ² | moC ³ | moC ⁴ | moC ⁵ |
| <i>Number of Least Particles in Each Member</i> | moC ⁵ | moC ⁴ | moC ³ | moC ² | moC | 1 |

And this table can be applied to any given number of orders, not only with respect to numbers and masses of protons but equally to determine the quantity of energy carried by a proton of any given order in terms of the charge carried by the indivisible least particle, as I will now try to show.

The attainment of equilibrium of energy in the matrix web of creation implied an equal distribution of energy in any given quantity of matrix. Now that I have seen some unknown but very substantial fraction of the whole matrix transformed into proton, I ask myself what has become of the concomitant energy of the protonized portion. I can find but one answer.

Energy, like matrix and proton-matter, has mass and extension and so cannot occupy a space already occupied by either. And inasmuch as proton is absolutely continuous within itself there can be no room in it for energy. Therefore each proton must as a necessary incident to final condensation discharge its energy surplus, that is the quantity of static energy previously associated with the quantity of matrix incorporated in the given proton. And this is what happens. At the point of perfect fusion the surplus energy is lodged not in but on the surface of the proton. This happens with every indivisible least proton particle.

This evacuated energy is no longer neutral. Its enforced flight from a center preëmpted by energy in the concentrated proton state has at the same time and perhaps as a necessary consequence of its reversed direction

set it down a rung on the ladder of evolution. The bond uniting the two opposite signs relaxes and this energy splits into its plus and minus components, the plus charge gathering at the north pole, the minus charge at the south pole of the proton particle. I will call each of these charges a quantum of the *n*th order of magnetic energy.

Its stay on the surface of its proton is limited. Simultaneously with the fusion of the individual proton within itself there is in progress the larger fusion by which all the indivisible least protons of a given cluster unite to form a proton of the order n minus 1. By this fusion all the plus and minus charges of the *n*th order are disturbed a second time and lodged on the surface of this new and larger proton where all the minimal plus quanta unite in a single larger plus quantum and all the minimal minus quanta unite in a single minus quantum of magnetic energy. The retreat continues until eventually all the surplus energy is lodged on the surface of the proton of creation, all the lesser minus quanta being combined in a single minus quantum at the south pole, and all the lesser plus quanta in a single plus quantum at the north pole, a permanent condition of the cosmic process.

It follows from the foregoing that the energy quantum of a proton of any given order bears a fixed quantitative relation to the quantum of a proton of any given higher or lower order. This relation is identical with the relation between the corresponding proton masses as given in the lower line of the above table of numbers and masses.

Flight Of Proton

Now the scene of creation assumes this setup:

1. The proton of creation. A (perhaps bipyramidal) crystal composed of similar lesser crystals arranged in an unknown number of discontinuous orders of magnitude, each member of each order (excepting only the particles of the *n*th order, which are ultimately small and indivisible) containing a known uniform number of prime subcrystals, and each order bearing to any other given order calculable fixed relations as to number of members and magnitude of individual members.
2. Matrix. The outlying mass of unused matrix is reinforced by the unprocessed matrix which served as an energogravitational field for the protonizing process and which was consequently evacuated into the general matrix mass assembled on the surface of the completed proton of creation.
3. Polarized static (magnetic) energy. A charge of plus magnetic energy at the north pole, an equal charge of minus magnetic energy at the south pole, of the proton of creation. The energy content of either sign is the sum of quanta of like sign evacuated from all the indivisible least particles of proton at the point of fusion. The sum of these two ultimate quanta of static magnetic energy is the total quantity of primeval energy given with the total quantity of matrix now concentrated and incorporated in the proton of creation. I conceive of

this magnetic energy as fastened to the outer primary subcrystals of the proton of creation by a gravitational pressure so tenacious that no portion of it can be forcibly dislodged without carrying along with it that quantity of proton corresponding to the fraction of magnetic energy withdrawn.

4. Residual neutral energy. This is the fused primitive energy given with and bearing a fixed though unknown quantitative relation to the remaining (unprotonized) matrix which serves it as a field.

It must be plain by now that by no natural dynamic process could a given quantity of matrix be converted into proton without the intervention of a reserve of matrix to act as a field and thereafter to be cast aside. I do not know what fraction of the whole original matrix is embodied in this unused reserve of matrix and that is too bad, for if I knew this and also the number of discontinuous orders of crystals incorporated in the proton of creation I should have an exact method for determining all of the fundamental quantities in creation, as will appear below. But I can at least deduce the manner in which this reserve of matrix was finally disposed of.

I think of the proton of creation as a kernel of absolute density at the center of gravity of a greatly larger, extremely rarefied mass of matrix. I think of primitive neutral energy as traversing this great mass at absolute speed in search of equilibrium and "the center." Again I see congestion at points of multiple crossings, little whorls within greater whorls. I see nodules forming and

within them indivisible least proton particles in process of incubation. I see emerging clusters, systems of clusters, supersystems, all in the old pattern traced by centripetal primeval energy, protons crystalizing within protons which are themselves component crystals of larger protons. But the highest order of these protons is not of the order of the proton of creation but of its primary component protons. And these secondary protons do not fuse to a common center, but at a given point are projected separately into space from the spinning mass of which the proton of creation is the gravitational center. One by one they are thrown off at a tangent until at length the proton of creation is left spinning naked and alone.

These protons moving off each by itself from the proton of creation are, as I have seen, of the second order of proton magnitude. Each is the absolutely dense kernel of a mass of unprocessed matrix (a necessary condition to protonization as I have seen above) and within this mass is incubating a new set of protons, this time of the third order of proton magnitude, all of which will presently move off at a tangent into space, some in the direction of the proton of creation, some into remoter reaches, depending on the direction of the initial impulse which parts them from their parent proton of the second order. All these wandering bodies are inertial masses in a fieldless space.

Are the movements of these inertial bodies wholly uncontrolled from without? Or does each body in leaving its parent draw out strands of matrix as elastic tethers

to reduce the centrifugal impulse to an approximation of inertial rest? I cannot answer. I prefer not to guess.

Nor can I determine the number of protons of the second order produced from the reserve of matrix remaining over and above that portion of matrix which I saw converted into the proton of creation. I can only say that this number depends upon the quantity of matrix available. Thus, if one-half of all the original matrix remained and all of this one-half could be turned directly into proton, the number of protons of the second order loosed in space would equal the number of their compeer primary component protons of the proton of creation. But this one-half must be halved in turn to allow for the reserve quantity of matrix to be used as a field for the protonizing process and then to be withdrawn and turned into protons of the third order; and so on down the scale. This means that on the assumed one-half basis the number of protons of the second order exterior to the proton of creation would be half the number of secondary protons incorporated in the proton of creation, a number which I know to be identical with the number expressing the constant of ordinal discontinuity according to mass. And the number of tertiary protons emanating from the reserve left over from the production of each secondary proton would be the same as the above, and this index would govern every step of the protonizing operation to the very bottom of matter. But I dare not assert that the reserve quantity of matrix is exactly one-half the original quantity in the first instance or thereafter. All I can say

with confidence is that the reserve, if not one-half the original quantity, must be either some substantial fraction or else some very small multiple of it. This is equivalent to saying (as I shall see below) that the aggregate mass of primary subprotons (or subatoms) constituting the as yet inchoate field of any given proton equals, if not the full mass of the given proton, then some substantial fraction or small multiple of it. I note this for later reference.

The flight of proton continues, each order owing its existence to the necessary reserve store of matrix over and above the quantity turned into protons of the next higher order. And so I come to the lowest order, the indivisible least particle of proton, the particle than which the creative agency can make no matter smaller.

The Birth Of An Atom

In the mass of surplus matrix gathered on the surface of a given completed proton of the order n minus 1, protons of the final (n th) order form as absolutely dense (perhaps bipyramidal) crystals buried in turn each in its thick overlay of surplus and unprocessed matrix. But in these ultimate surpluses of matrix will form no new and smaller order of protons, for the limit of smallness has at last been reached.

As these ultimate particles are projected off into space from the surface of the penultimate proton I conceive of the swaddling matrix of each as trailing behind and spinning light elastic tethers by which it retains contact with

the parent proton (n minus 1). I think of all these spun wakes as crossing to form a fine web of matrix in three dimensions with the penultimate proton at the center of gravity and all the n th order protons scattered at fairly regular intervals and constituting subsidiary centers throughout the extent of the web. All over the web flashes at absolute speed primeval neutral energy (given as I have seen with all matrix) in its unwearied pursuit of equilibrium and "the center." Whorls within whorls appear in somewhat the pattern originally traced by primitive centripetal energy before the time of proton. Though no new proton particles and orders will emerge from these centers of activity, these cyclonic disturbances have at least the effect of stiffening the matrix web, and these patterned stiffenings, together with the reinforcement provided by the subsidiary hard centers that are n th order protons, contribute to the production of a "field" more rugged and coherent than any I have seen heretofore on the site of creation.

What I have so crudely and incompletely reconstructed is the field of an individual proton of the order n minus 1. Since I conceive of all protons as in a state of rotation (in consequence of the conditions producing them) I must think of all the n th order protons as being projected away from their parent proton on approximately parallel planes. So I imagine the field not as a sphere, but roughly watchshaped and with indeterminate edges "bleeding off" into space under the persisting inertial movement of the vanguard of evacuated n th order protons, trailers

of matrix streaming behind as lines of communication with the inner field and central parent proton-nucleus.

The penultimate proton itself I think of as a magnetically neutral (perhaps bipyramidal) crystal, the plus charge at its north pole exactly equalizing the minus charge at its south pole. The *n*th order proton also is polarized and magnetically neutral. It can never be an atom. It is an *interrupted* atom with no field of its own, merely one of a great number of proton specks suspended in the field of its parent atom, which latter I can at least call a demiatom because it has a rudimentary likeness to the "modern" atom and the likeness grows.

The demiatom's field is no such field as I have earlier considered in relation to the higher atomic orders. It is composed not of separate and clearcut subatoms, but is continuously one, not with the absolute continuity of proton mass, but with the continuity of lines crossing and recrossing and leaving interstices between. But continuous it is, in its fashion, and it is this continuity that completes the incompleteness of a field composed wholly of specially discontinuous subatoms. I can see now how this web of matrix stuffs the nooks and crannies of the higher fields, takes very fine stitches as it were in the rents which otherwise would be fatal to the effective performance of the more highly developed fields I am coming to.

A last word about the field of the penultimate proton, the demiatom. I have seen how the web of matrix is traversed unceasingly by currents of primitive neutral energy seeking equilibrium and "the center." These cur-

rents serve to amplify the impulse of gravity between the parent and subsidiary protons and between one suspended *nth* order particle and another. All these polarized protons, both the parent and its subsidiaries, are in effect magnetically neutral, so it is to gravity and not gravity's other self, magnetism, that I must look for an attractive or collapsive influence tending to offset the original inertial flight impulse of the subsidiary protons and to draw them and their webbed envelope into some more or less orderly arrangement in relation to their parent proton. Against this collapsive influence I must set the stiffening effect which I have noted above as resulting from the cyclonic patterns consequent upon the unflagging movement of primitive magnetically neutral energy coursing through the matrix web in search of equilibrium and "the center." I merely note the nature of these collapsive and repulsive influences. No man but a fool or a sage would venture, in the present state of terrestrial empirical knowledge, to strike an exact balance between them. But I think it reasonable to assume a point at which some working degree of unity is established, a point at which the central parent proton may be said to form one body with its surrounding field of matrix web shot through with protons of the *nth* order. Then, and not before, I imagine a shifting of poles. The negative charge leaves the south pole of the penultimate proton and passes through the surrounding substance, now a feasible magnetic as well as gravitational field. At or near the outer limit of the

effective field this negative charge catches up some portion of the proton-ridden matrix of which the field is composed and adopts it as a host.

Thus the first rudimentary atom, a magnet with positively charged proton-nucleus and negatively charged "electron." Under the magnetic impulse the electron assumes a spinning motion. Under the gravitational impulse, conveyed through the medium of the same magnetogravitational field of matrix, the electron begins to revolve about the proton-nucleus at the center of gravity of this demiatom of the order n minus 1, tracing for itself an orbit in the outer field.

All this within the roughly watchshaped continuum of one penultimate proton transformed as I have seen into a demiatom. But the original repulsive influence implicit in the inertial flight of n th order protons is still at work. The indeterminate outer edges of the exceedingly elastic and extensible matrix field reaches out into space until at length it meets the similarly outreaching "bleeds" of other demiation fields, and gravity supervenes between one atom and its fellows. In this fashion all the demiatoms derived from a given proton of the order n minus 2 are welded into a common field.

This new field is more on the order of the field which I tried many pages back to rationalize into being and failed by reason of the persistent discontinuity of the atomic process as commonly accepted. It has its horde of separate atoms (demiatoms), but these separate atoms

are not spacially discontinuous, but are stuffed with and connected by an omnipresent and sufficiently continuous web of matrix so organized as to permit the free and practically uninterrupted conveyance of magnetic and gravitational impulses from and to all points within it. Across this field passes the negative magnetic charge from the south pole of the proton n minus 2 to some point in the outer parts of the field, and here it gathers up some portion of the stuff of the field and makes of it a host for itself, an electron. This antepenultimate atom may, for all I know, be of the order composing the field of the terrestrial atom, though the process may be more gradual, with some unknown number of intermediate orders employed. But in either case I now perceive the underlying properties of the atom and that its composition is not so simple as at first I tried to make it. It was a slight oversight by which I failed to make allowance in my terrestrial atom for a substratum of some such primitive stuff as matrix. It is still true enough for any mortal purpose that the entire mass of the atom resides in its proton content, for the matrix content of a given terrestrial atom is almost too slight for words and possibly too imponderable for physical apprehension by my generation of mankind. And yet it is only by such fantastically slight incalculable traces of a substance which may never be seen or weighed or in any sense "felt" by man or man's machines that the flight of proton was halted, the atomic process made feasible, and the whole vast structure of star-studded creation resolved into a present and actual thing.

And I believe it came about in some such manner as I have tried to describe.

Now I can take up my terrestrial hydrogen atom where I left it when I set out on my long and somewhat fumbling expedition into first causes in search of a cement, or filler, for the field.

Fall Of The Atom

It may be fanciful, but I cannot resist the idea that in the hydrogen atom creation achieves its most esthetic expression. All that follows is destructive in detail and decadent in effect and if these later manifestations hold beauty for the conditioned sensory apparatus of the mundane beholder reason must admit that from a cosmic viewpoint it is the beauty and bloom of corruption.

Taken as a whole, the terrestrial hydrogen atom is perhaps the nearest approach to absolute beauty in the whole epic of creation. Greatly extensible, greatly compressible, protean paragon of springs constituted of lesser springs in an exquisite harmony of mutual accommodation, the hydrogen atom in a state of freedom makes all else in nature look gross and artificial by comparison. The evolution of the atom from its pure hydrogen state to the more complex forms which for the sake of custom I must call atoms, though they are not true atoms at all but only syntheses of the one true atom, hydrogen, is a progress in expedient ugliness. Now the spontaneous equipoise of the hydrogen atom gives way to coercive violence, brutal compulsions of all kinds and descriptions.

The emergence of the conditions by which life is made possible signalizes in a truly esthetic sense the *fall* of the atom.

But, as though the creative agency was strictly limited in its store of absolutes, the hydrogen atom owes its own existence, in part, to the very form of decadence to which itself is foredoomed to fall a prey. Its absolute perfection is denied by the sophisticating process inseparable from the making of an electron. For I must assume within the terrestrial electron the same kinds of syntheses and combinations on the part of its constituent subatoms (field atoms) as I must now examine in their known relations to the terrestrial atom proper.

The terrestrial hydrogen atom, to judge from certain foregoing observations, must have been roughly watch-shaped at first. But in consequence of the "bleed" of its field into surrounding space and the union of this bleed with the bleeds of neighbor atoms, gravitation was set up among the individual atoms and a change of form ensued. The thickness of the "watch" was increased and the circular circumference flattened into an oval, and the atom became roughly eggshaped.

From now on I must regard the terrestrial hydrogen atom as a roughly eggshaped object composed (except only for the minute particle of proton, hardly more than a point, which is the nucleus) of subterrestrial atoms in three or more discontinuously lower orders which in turn are fused with a substratum of indescribably fine webbed matrix the strands of which act so to speak as connective

nerves between the atomic musculatures. A spherical concentration of this amalgam (the electron) revolves around the long way of the egg, describing an ellipse of which the proton-nucleus is at one focus. This revolving motion is caused by gravity acting between the proton-nucleus and the planetary electron. At the same time a spinning motion is imparted to the revolving electron by the magnetic impulse existing between the positive charge of the proton-nucleus and the surface negative charge of the electron, the magnetic impulse operating like a uniformly moving belt on the electron.

All interatomic space is filled by the electromagneto-gravitational field composed of all the combined "bleeds" of individual atomic fields. This general field makes possible the atomic syntheses, chemical combinations and physical agglomerations of which the gross product is a planet.

The terrestrial hydrogen atom is in the most literal sense a miniature star. But its sun is cold and dark and the whole atom is destitute of light and heat except as minute streams of radiation are produced by subterrestrial atoms within the terrestrial and inferior electrons. Let me examine the nature and source of this radiation.

The Atom As Dynamo

The least complex of hydrogen atom syntheses is the helium so-called atom. I must imagine four hydrogen atoms brought together in some combination of external and internal conditions favorable to the synthesis. The

atoms are magnetically neutral, so, apart from some possible external pressure, the controlling impulse must be that of gravity. The proton-nuclei draw together, pulling their fields and planetary electrons along. The several fields contract, setting up an increasing resistance which is highest at the center of gravity and lowest at the outer edges of the composite mass. At the center the combined centripetal impulses of gravity and magnetism (two expressions of the same unique primitive impulse, I must remember) between a given positively charged proton-nucleus and negatively charged electron become all but irresistible. At the same time the resistance of the greatly condensed field is virtually impenetrable. Something must give way. A casualty on one side or the other is inevitable.

Here is the situation. Within a small part of the space normally occupied by a single hydrogen atom are crowded two complete hydrogen atoms and two proton-nuclei of which the planetary electrons are posted at intervals in the outer, less congested portions of the field. Hydrogen atoms, as I have seen, are magnets. With their poles at a normal distance apart the magnetic impulses flowing between the plus and the minus pole are comparatively slight. But brought into such close proximity at the center of the composite field these Coulomb forces become more intense in proportion to their greater nearness, and at the same time and in the same degree the gravitational impulse increases. Now, the gravitational impulse is limited to the attraction existing between the proton-

nucleus at the one end and the proton content of the electron at the other end. But the magnetic attraction is limited strictly to the plus and minus charges of immaterial magnetic energy lodged on the surfaces of the respective bodies. And it is upon these quanta of magnetic energy that the toll is levied by which alone a balance of forces may be struck. A magnetic discharge ensues from each quantum of plus and each quantum of minus magnetic energy, and with the discharge goes into space an exactly measurable fraction of the matter on which each parent quantum is lodged. There is nothing new about all this, it is a number of pages old, or at least the greater part of it. According to prevailing scientific thought this discharge affects all four of the original hydrogen atoms equally, but if the thing happens the way I believe it does I do not see why the two distended hydrogen atoms should suffer precisely the same consequences as the two abnormally constricted ones. But I am not going to argue this.

The highly condensed central part of the completed helium atom is called the nucleus. This nucleus is relatively impervious to penetration from without. This quasi impenetrability is commonly attributed to "electrical high potential." It would be simpler and less magical to credit it to the highly condensed material field. If it were all a matter of "high potential" there would be no resistance to speak of within the simple and "electrically" inactive hydrogen atom, whereas it is common knowledge that such resistance does exist, though to a lesser degree

than in the complex atoms with their more condensed fields. As to this I say no more.

The nucleus of the helium atom is a true sun. It gives light and heat and perhaps all or most of the other known forms of radiation. To understand better the nature and source of radiation let me look at a more complex atom, the fluorin atom, say.

The fluorin atom is as I have seen a synthesis of nineteen hydrogen atoms. On the outside it has nine planetary electrons moving in fixed orbits. Within the nucleus it has ten complete hydrogen atoms and nine protons. The arrangement of these nineteen particles inside the nucleus is unknown. Are they arranged in groups of helium and hydrogen atoms, say, with the nine extra protons wandering unattached? Or are partnerships being continually formed and dissolved? I do not know. All I know is this, that positively charged protons are constantly functioning as magnets with negatively charged electrons. I know this from the manifestations, which take the form of radiation.

A question rises in my mind. As the various electrons draw closer to their partner protons do they retain the same material form as the planetary electrons with which I am familiar? Or does the material electron subside into the field whence it came, leaving its negative magnetic charge unimpeded by a host in its march on the center? Does this charge at a deeper point gorge itself anew on field stuff, forming a new host, a new electron? Does this periodical subsidence and the reëmergence of material

electrons occur not only within the nucleus, but on occasion in the outer field as well? Does this explain the classic phenomenon of quantum mechanics by which an electron is alleged to assume a new orbit without traversing the distance from the old? Is it, in short, a periodical demolition and re-creation of unidentical material electrons and not, as commonly supposed, the episodic expedition of a single given electron into the darkness of absurdities so dear to the heart of modernistic science? All the questions in this paragraph, except only the first, I would answer with one comprehensive yes. And now for radiation.

Faraday was a very great man of science, but he did not invent the dynamo. The creative agency was there before him. Each contracted and distorted hydrogen atom in the nucleus of a complex atom is a true dynamo producing electricity by induction from the hydrogen subatoms of the highly concentrated field substance which constitutes all but a very small fraction of the nucleus by volume. This electricity, or radiation, assumes various wave lengths owing in part at least to variations in the lines of magnetic energy traversing the field between protons and electrons, or more truly between their respective plus and minus charges. In other words, a wave may be longer or shorter according to the location of its point of generation with relation to lines of maximal dynamic impulse. There are other possible contributing factors to the production of a given wave length and I will discuss them below in connection with the nucleus of the atom-as-sunstar.

All true radiation is of atomic origin, a product of the atom nucleus-as-dynamo. Radioactivity is a kind of whole-hog radiation, the radiated particles being of the order not of the field atom, but of the atom producing the radioactivity. A terrestrial electron (or alpha particle or other combination of terrestrial protons and electrons) is caught at a common focus of multiple highly dynamic lines of magnetic impulse projected from some unknown number of pairs of terrestrial protons and electrons functioning as a battery of dynamos. The resultant composite dynamic impulse suffices to detach this primary particle from the nuclear field and launch it in interatomic space, as a photon at the speed of light or (in the case of an alpha particle, or helium nucleus) at about one-fifteenth this speed, or some twelve thousand miles a second. To grasp the essential difference between true radiation and the pseudoradiation known as radioactivity it is only necessary to watch an athlete pitch a baseball and then observe the same athlete toss a medicine ball. It is a difference both of propulsive energy and of propelled mass.

Radioactivity is of common knowledge in connection with the nine most complex known terrestrial atoms. Much else will become clear along with the recognition by science of the actuality of true radiation of field atom parts from every terrestrial atom more complex than hydrogen.

The Field In Chemistry

In the union of nineteen eggshaped hydrogen atoms to form one eggshaped atom of fluorin, what precisely hap-

pens to the nineteen fields? Are they scrambled in a uniform mixture, losing their individuality, and the material electrons, some if not all of the nineteen, reduced to the general field to be reformed and allotted each to its fixed future orbit? Or is the business more orderly? Is the inmost field surrounded by the second and these two by a third, and so on until eighteen successively swallowed fields are enclosed by the nineteenth? This is perhaps a simple problem in physics, but I pass it up. Though one thing seems clear. The ultimate field, whether one or nineteen in number, is surely arranged in nineteen more or less clearly divided layers of density, the inmost being the most dense and the outermost the least dense of the lot. The outer limit of each layer is at least approximately defined by the orbit of a ring electron. These discontinuous fixed orbits are determined by the densities of the field layers they respectively circumscribe and also by the gravitational attraction of the nuclear protons and the magnetic attraction of the protons' positive for the electrons' negative charges. To strike the balance between these several influences is a job for the specialist.

I see no reasonable or evidential grounds for assuming a sharp division and intrinsic differentiation between the so-called nucleus, *qua* nucleus, and the outer field of the atom. Intrinsically the nucleus (I am still using the fluorin atom for illustration of a general truth) is simply the ten innermost and consequently most highly condensed layers of the field. It is differentiated from the nine outer layers of the field by its more central position and con-

sequently higher condensation and by the presence of the nineteen positively charged protons in a relation to the ten negatively charged nuclear electrons favorable to the production of radiation. Apart from its greater nearness to the source of radiation the outermost layer of the nucleus is no more essentially different from the innermost layer of the outer field than one of any two contiguous layers of the outer field is essentially different from its neighbor. But this is not the same as saying the nuclear field layers are not somewhat conditioned by the immediate presence of superabundant radiation and the factors producing it.

The arrangement of the nineteen protons within the nucleus is the atom's final secret. I can only surmise that their respective equal masses are attracted by gravity towards a common center while their equal similar charges mutually repel and prevent contact. At the same time, these positively charged protons attract to themselves by magnetogravity the ten negatively charged nuclear electrons. This attraction is resisted in turn by the field through which the particles would have to pass in order to meet, and the field is densest, most impenetrable, precisely at the place where the attraction between particles is greatest, namely, near the center of gravity of the nucleus and atom. In the nucleus of the complex atom perhaps alone of all places in nature it would seem that the fundamental expressions (gravity and attractorepulsive magnetism) of the unique primeval impulse engage simultaneously in a concerted pattern of dynamic enterprise capable of producing the variant forms of radiation.

Concerning the classic concept of terrestrial matter as all but empty space with only rare and widely separated pinpricks of substance to punctuate the dreary void, only this remains to be said, that it simply is not so. I have seen how the assertedly vacant spaces within and between terrestrial atoms are in fact crowded with subatoms of discontinuously lower orders of magnitude, and how the ultimately small gaps inseparable from the atomic process are bridged by the omnipresent matrix web, and how matrix and lesser fields are fused into the terrestrial hydrogen atom field proper. So much for the consolidating genius of the creative agency as applied to proton in flight.

But now I see how by the arrangement of a given multiple of hydrogen atom fields around a common center, fundamental matter is resolved into a special system with its own peculiar physical and chemical properties. For this is what it inevitably comes to, that the behavior of a given atom in relation to other atoms is determined wholly or to a very large extent by the number and organization of the constituent layers of its field.

Alone of the ninety-two elemental atoms the hydrogen atom has a single and undifferentiated field, being divided neither into layers nor into an outer and nuclear field. What light does this shed on the behavioristic peculiarities of hydrogen? Let a chemist answer. And let him say also whether the fact that helium in certain given conditions behaves thus, while fluorin in the same conditions behaves so, cannot be explained in part at least by the fact that the helium atom has only four field layers while the

fluorin atom has nineteen. And so on through the table of elements.

Now let me consider what happens when these ninety-two distinct and individual arrangements of the same fundamental field come together in pairs and larger multiples to form molecules and the molecules combine and mix and agglomerate in some dizzy number of chemical and physical aggregations, each with its own peculiar properties and behavior. Can I doubt that the deciding factor in by far the greater part of these behaviors is the arrangement of field layers in the constituent atoms?

Mass itself can no longer claim exemption from the field and be placed wholly, or at least all but the small fraction allotted to the electron, in the primary nuclear proton or protons of a given atom. Now a very substantial portion of the atom's mass must be assigned to suborders of protons contained in the field, which constitutes all but a negligible part of the atom by volume.

Now for convenience I am going to divide the terrestrial field into these four parts: 1. The atomic nuclear field. 2. The atomic outer field. 3. The field concentration known as the electron. 4. The extra-atomic field, which as I have indicated above is composed of the combined bleeds of all the original hydrogen atoms in the atom forming process.

These four fields were, and in a sense still are, one and the same field. True, the electron has become distorted and abnormally condensed until superficially it is unrecognizable as veritable field substance. But it is scarcely

more than a point, by volume or mass, in the relatively enormous extent of the general intra-atomic field. The interatomic field does not differ essentially from the outer layers of the atom field, though it is more highly rarefied and unconditioned by the magnetogravitational activities prevailing within the atom. The outer atom field, as I have seen above, is essentially one with that portion of the field contained within the nucleus, though less condensed and free from the conditioning effects of the dynamic impulses at the source of radiation. But of my four arbitrary divisions it is undoubtedly the outer field of the atom to which I must look for the controlling factors in most of the familiar though little understood phenomena of chemistry and physics.

The field outside the atom is comparatively passive, serving primarily as a medium for the free operation of gravity and electromagnetism between one tenant atom and its neighbors, always ready to step aside and make room for some specialized field more important than itself. The electron as field is insignificant except within its own boundaries. The nuclear field is permanently compressed to a point where it is in effect a rigid core. But the outer atom field is a marvel of exquisitely accommodative springs and it is these springs within springs perhaps that make chemicophysical law workable.

The first and basic set of springs is, as I have seen, an arrangement of discontinuous atomic orders fusing eventually into the field of the terrestrial hydrogen atom. The second set of springs is a system of layers of hydro-

gen atom fields constituting the field, more particularly the outer field, of a given complex atom. In this dual arrangement of greatly extensible, greatly compressible springs, an arrangement of which the variations as to delicacy, resiliency, strength and what not are numbered only by the possible syntheses, combinations, mixtures and agglomerations in which the ninety-two elements may unite, I find the touchstone of terrestrial mechanics.

It is in the field I believe that science will score its first major success in the game of tapping the atom for "energy." It will not be real energy but only the pseudo-energy of a coiled spring, but what does the name matter? Here in the springy layers of the atomic field is more "energy" than the world can ever use. Even the simple hydrogen atom field with its single undifferentiated layer will yield something. At the other extreme lies the enormously more dynamic "energy" lying latent in the compulsory rigidity but potentially explosive field substance of the nucleus, especially of the nuclei of the more complex atoms; and this may be reached in time. But the more amenable layers of the outer field seem to me to hold the most immediate promise. Meanwhile it is perhaps reasonable to assume that some portion of the field of any given atom is continually leaking into interatomic space. These emanations of coiled springs of the terrestrial field substance should be most apparent in the vicinity of the most complex of radioactive atoms and much might be learned and put to practical use in train of their observed behavior.

The question naturally arises, What is the relation between the field and chemical bond? I think the relation is a very close one verging on actual identity. What happens when two atoms of hydrogen enter the presence of an atom of oxygen under conditions favorable to a combination of the three? Is the electron of each hydrogen atom impelled toward the 16-proton nucleus of the oxygen atom by gravity? Does the electron draw into its new environment strands of its old field which serve to moor the atoms together during the life of the new combination? Or is there some more complete merger of the outer edges of the hydrogen field and the oxygen field? Does the visiting electron draw its old field substance into a bight to form an orbit in which to revolve about its adopted nucleus? Or does the entire field and proton-nucleus of the hydrogen atom join the truant electron in the revolution?

And what about the severance of the bond? Does some exterior cause, heat or what not, produce a distension of the oxygen atom's field, allowing the borrowed electron to withdraw to a distance from the oxygen atom nucleus where the hydrogen proton-nucleus can again assume control by the combined attraction of gravity and magnetism? Does the truant electron retire to its old orbit, pulling along with it the borrowed portion of the field which served as chemical bond? And thus do the atoms part and go their own separate ways as before?

Or does it happen in some more complicated combinations that the foreign influence causing the dispersal of

constituent atoms of a given molecule is such as to reduce the visiting electron to the field, leaving no material concentration by which gravity can function to maintain the status quo? And is the disestablished negative charge drawn back into its own field where it produces a new material electron from the field substance and resumes its old orbit and way of life? Quantum mechanics again?

I simply ask myself these questions and whether the chemical bond is not primarily perhaps a new aspect of the field. And whether all or most of the familiar chemical reactions are not in the first instance field reactions, manifestations of particular fields peculiar to the individual atom types alone and in given combinations with other types of field, the field of any given atom being qualitatively different, in effect, from the field of any other atom and no two combinations of fields being alike. It is a good deal to ask but there can be no harm in asking.

The Solar Light And Power Plant

Every star is either a hydrogen atom-as-star or a synthesis of four or more hydrogen atoms-as-stars, the complex evolving from the simple as in biological evolution. Let me refresh my imagination as to the genesis of the simplest atom-as-star.

A proton of the order of the nucleus of the hydrogen atom-as-star disperses its superfluous rind of matrix in which are incorporated protons of an inferior (terrestrial) order of magnitude which are themselves covered with unprocessed matrix in which still lesser orders of protons

await process of crystallization. This procedure continues to the bottom of matter where, as I have seen, the atomic process is organized and transmitted back to the higher orders of magnitude. The terrestrial protons become atoms and these terrestrial atoms (primary offspring of the astral proton) organize themselves as a field for the hydrogen atom-as-star-to-be. The astral proton, like all protons a crystal (perhaps bipyramidal with hexagonal halves), is polarized, having a positive charge of magnetic energy at its north pole, a negative charge at its south pole. With the completion of the field, by virtue of which the emergent atom-as-star becomes one body, there is a shift of polarity. The negative charge leaves the proton-nucleus and passes through the field to its outer part where it gathers up a portion of field substance to make for itself a host, a material electron of the order of a solar planet, which now becomes the atom's new south pole. Thus the atom completes itself, the north pole being permanently established at the positively charged proton-nucleus and the south pole at the negatively charged electron-as-planet, the magnetogravitational field comprising a substantial part of the whole atom-as-star by mass and all but a negligible fraction by volume.

The solar system is a synthesis of hydrogen atoms-as-stars of which nineteen unite to form one fluorin atom-as-star. The nucleus of this complex atom is my familiar sun. Within the sun, that is to say within less than one-tenth the space normally occupied by a free hydrogen atom-as-star, are somehow packed ten complete hydrogen

atoms-as-stars (presumably with all their ten fields intact though in an extremely highly condensed state) and, besides, nine unattached protons of the astral order. Each of these protons is a crystallized multiple of terrestrial hydrogen nuclei, and the charge of each sun proton, its quantum of positive magnetic energy, is the same multiple of the positive charge carried by a terrestrial hydrogen nucleus, being equal though opposite to the negative charge of each primary solar electron, whether nuclear or planetary, which again is the same multiple of the negative charge of a terrestrial electron. This multiple, as I have seen, is expressed by the constant of ordinal discontinuity according to volume/mass (v/moC) and of the order of 34×10^{66} .

The abnormal constriction of ten hydrogen atoms-as-stars within a small fraction of the space normally occupied by one has at least two important results. One, it draws the two poles of each hydrogen atom-as-star much closer together and proportionally intensifies the lines of magnetic "force" traversing the space between poles, in accordance with Coulomb's Law. Two, it condenses the nuclear field in a manner and to an extent favorable to the production of "electricity" by induction in the inter-polar space which must now be regarded literally as the field of a dynamo. Ten atoms, ten magnets, ten dynamos. This is the only reasonable explanation of solar radiation. It is the same kind of radiation, only quantitatively different, as science must one day detect in the terrestrial fluorin atom and all other complex terrestrial atoms.

I shall not try to trace to its localized source in the sun each special type of radiation, not because there is any intrinsic mystery in it (any qualified physicist should make short work of the problem) but simply because I am not qualified. Even I, though, can see two or three fundamental factors which must inevitably affect the radiation at its source and consequently determine the wave length of a given ray. First I would consider the locale in which the ray is generated, the locus, that is, with respect to maximal lines of dynamic force. Rays induced at a spot on a straight line between the centers of the two opposed poles of a hydrogen atom-as-star functioning as a true dynamo will naturally be dispatched with great intensity and short wave length. Rays generated at the intersection of lines of force projected from two or more such dynamos functioning as a battery might be expected to show still greater energy and shorter wave length. Is it possible that I have here, however crudely stated, inklings of variations at the source which determine that a given sample of radiation as received on earth shall be of a wave length earmarking it as visible light not ultraviolet rays? And may it not be possible one day to say that a given ray owes its longer wave length to the fact that it was generated at a spot in the sun somewhat removed from the maximal lines of dynamic force?

I must consider also the possibility of a secondary form of radiation, not true radiation which is of electrical origin as shown above, but beams composed of particles torn from the field by true radiation in passage and

carried into space by the impulse which dislodged it. Might not sunheat be of this nature? Whether or not, of one thing I am sure. The heat I receive from the sun is not the heat of combustion, not furnace heat, but a form of radiation, primary or secondary, of electrical origin or else projected from the sun by an electrical impulse in the shape of true primary radiation of one type or another.

Yet another factor suggests itself in connection with solar radiation and its variety of wave lengths. I am thinking now of the Compton Effect as a possible modifying influence.

Assuming ten protons to be paired in some atomic arrangement with the ten nuclear electrons, I have left nine protons roving at large in the sun-nucleus. I have already seen what a primary sun proton is like. It is a perfectly dense crystal some eleven miles in mean diameter, its mass the equivalent of some seventeen thousand earth masses. Being literally impervious, it is a perfect reflector. If it is, as I think I have shown it may be, a bipyramid with hexagonal halves, it has twelve triangular facets, each of several square miles' area, and these facets throw back with a longer wave length the rays which strike them on their way from their source to outer space. Whatever variety of effects are produced by these reflections, I cannot doubt they are such as cannot be matched by any terrestrial phenomena. The possible diversity of effects, moreover, is enhanced by the certainty that some at least of these reflected rays strike a second

roving proton, and maybe a third and others, before finally escaping into the outer field, for I must remember that there are nine of these unattached protons wandering through the sun, to say nothing of the ten presumably engaged in the atomic process. Considering all these possibilities and all the conceivable angles of incidence and the numerous other factors that would be apparent at once to a student of optics, it is plain that the marvel lies not in the great diversity of wave lengths noted in solar radiation, but in the fact that earth receives a dependable supply of specific types needed to carry on the business of living.

I believe it is the sun which will eventually throw light on the question of how protons and electrons are arranged in the nucleus of a complex atom. Are ten protons paired permanently with ten electrons to form ten hydrogen atoms in the nucleus of the fluorine atom? Or do they form, say, two helium atoms and two hydrogen atoms? And in the more complex atoms are there still more complex atom forms in the nucleus? From the evidence of alpha radiation in radioactivity it is apparent that at least helium atoms exist in the nuclei of radioactive atoms, but how much further is the process carried? Complex atoms within nuclei imply complex fields within complex fields and the possibilities on that line of thought are endless.

What about the protons? Do the nine rovers exchange places, at certain time intervals or at random, with the ten mated protons, assuming the ten to be mated as discussed above? And is each of the temporary or perma-

ment wanderers paired with some special planet-as-electron, or is it enough for the whole nine to maintain a wholesale magnetogravitational equilibrium with the planets? What is the behavior of the nine rovers with respect to one another?

The sun's center of gravity is probably in the vicinity of its geometric center where the ten, or less, atomic processes are assumed to be located. These posited atoms are magnetically neutral, offering no impediment to the free play of gravity between themselves and the positively charged roving protons. But as all nine of these would draw near the center their uniformly positive charges would set up a mutual repulsion in consequence of which all nine would be put to flight from the center and to some extent from one another. But here enters an ambivalence of impulse. At the same time that the positive charge of one proton repels the positive charge of a second proton their masses are mutually attracted by gravity. I think there is some reason to believe, from some of the quantitative observations I have made in various places above, that this magnetic repulsion and this gravitational attraction are of equal though opposite effect. If this be true I can imagine two protons circling each other at a fixed distance and describing a common circle around the center of gravity of the sun. And that something very like this happens seems to be attested by the phenomenon of sun spots.

The apparent similarity between a terrestrial volcano and a sunspot is marked. Both are attended by a violent

eruption of internal matter, field substance in the case of the sunspot, magma (a subcrustal viscous substance) in the case of the terrestrial volcano. Both, from all the evidence, are of cyclonic aspect, reminding me forcibly of the pattern in which I have before this imagined primeval energy of the two opposed signs as entering into a state of mutual fusion. Now, I know that earth, like any other planet, carries a negative magnetic charge equal to the positive charge of a sun proton. The proton's charge is lodged, as I have seen, on its surface subprotons with a tenacity prohibiting dislodgment except only with the simultaneous discharge of a proportional proton mass. I must assume that the planetary negative charge is established with some similar fixity at the surface of earth, being distributed on masses, molecules, atoms and other magnetically neutral bodies in the stratosphere, lower atmosphere, hard crust and viscous subcrustal magma. When a roving sun proton arrives in the course of its revolution at the earth side of the sun, is it not natural to suppose that its closer approach to my planet will stimulate the Coulomb forces to a degree directly proportional to the nearer drawing of the two opposite and mutually attractive charges? Except to remark the report that sunspots are observed to appear in pairs and that these pairs reverse their fields in a manner consonant with the mutual circling I have posited above, I say no more about sunspots, nor about the terrestrial magnetic storms that rise almost like a shout to greet them, signaling as I believe the straining of magnetic energy at its

tethers, the primeval impulse of the opposite signs towards a fusion at "the center", across an intervening ninety-three million miles of field.

Pageant Of The Planets

In the inequality of the planets with respect to mass, volume, and especially density, there is no intrinsic mystery. It is a relatively simple problem for the atomic physicist to work out in detail at his leisure. I need only indicate the salient factors as implied in foregoing sections.

I have seen how the fluorin atom-as-solar-system is composed of nineteen hydrogen atoms-as-stars in consequence of a synthesizing operation or, what is far more likely, of a series of syntheses. Thus, four hydrogen atoms-as-stars unite to form one helium atom-as-star, atomic number 2. Four helium atoms-as-stars become one oxygen atom-as-star, atomic number 8. Three additional hydrogen atoms-as-stars combine with one oxygen atom-as-star to form one fluorin atom-as-star, atomic number 9. If it happened somewhat otherwise, no matter, the outcome is the same.

The oxygen atom-as-solar-system had eight planets (ring electrons) not nine. Of the eight I can assume that the outer six were the now familiar planets Saturn, Jupiter, Mars, earth, Venus, and Mercury; and that the innermost two are now lost within the sun in consequence of the final synthesis by which Uranus, Neptune, and Pluto were added to the system, consummating its present

form. But when I say the planets named bear the same identity in this as in earlier syntheses I do not mean to imply that they are necessarily the same material spheres, but only that their negative magnetic charges are respectively the same charges now as then. The distinction is important.

The single planetary electron of a hydrogen atom is, as I have seen, a concentration of the atom's field produced by the action of the primitive proton's minus charge when it abandons the proton's south pole, passes through the field, and scoops up a portion of the field substance from which to fashion for itself a host (electron) to serve as the new south pole of the atom. Now does it not stand to reason that the density of the electron thus formed, and perhaps to a lesser extent its mass and volume, will be determined in part at least by certain physical properties (density, pressure, etc.) of the field in which this operation takes place? This field of an original hydrogen atom is uniformly rarefied and correspondingly responsive to manipulative action. In such a field the magnetic scoop would function on the grand scale, capturing a relatively large volume of stuff and molding it with an appropriately light pressure. But I know that an electron is sometimes, as in the violence of the synthesizing process, reduced to the field and subsequently reconstructed. When this happens in the comparatively dense inner layers of a complex atom field is it not to be expected that the resultant material electron, in consequence of the resistance offered by the denser, more

energetic material, will be of less volume and mass than an original hydrogen atom electron while exceeding it in density?

The four inner (minor) solar planets are of the same order of density, while the five outer planets are of a uniformly lesser order of density, the second group being on the average less than one-third as dense as the first. This systematic cleavage, to my mind, can only mean one thing, namely, that the members of the inner group were all dematerialized and subsequently reconstructed within comparatively dense field layers, some of them perhaps more than once, in consequence of the synthethizing operation, and that the members of the outer group are all original hydrogen atom electrons, though not all necessarily of exactly the same mass and volume as they were in their original state.

I suspect that the excessive volume and mass of Saturn and Jupiter may date from the final synthesis by which Uranus, Neptune and Pluto were added to the solar planets while two of the senior planets were forced into the sun. This particular synthesis was no doubt a comparatively mild one, not reducing all, if any, of the planets to the field, though more than likely shaking them all up a bit. There was in all probability a general magnetic discharge throughout the extent of the new fluorin atom-as-star. The negative magnetic charges of Saturn and Jupiter respectively were disturbed to the extent of reaching out and laying hold of additional field substance to be added to the original masses of these planets. The

process involved quite a lot of splashing about in the field, the evidence of which splashes may be seen in the rings and satellites of Saturn and the multiple satellites of Jupiter. Undoubtedly all the satellites were produced by such magnetic splashes, including the moon, which is of the same order of density as earth, as might reasonably be expected in view of all the foregoing. The moon, by the way, is the perfect exemplar of gravity in full effect. It keeps the same face always turned to earth, rotating only once in each revolution, and this, I believe, is precisely how a planet would behave with respect to the sun were it not for magnetic impulses. Gravity acts between the centers of gravity of distant bodies. Magnetism acts between charges lodged on the surfaces of distant bodies in the manner of a moving belt, and it is this that causes a planet to rotate.

Uranus, Neptune and Pluto are perhaps original hydrogen atom-as-star planets somewhat changed from their first state with respect to density, mass and volume. In reconstructing an average hydrogen atom-as-star planet I might better have confined my calculations to these three. But my averaging is perhaps as accurate as that which developed the basic terrestrial atom data providing my necessary point of departure and anyhow I am only trying to work out a method, not a table of exact measures. So long as I think right it is of little consequence whether my reckoning comes out right or wrong by a decimal or two. So I will stick to my own sample planet and the constants postulated by it.

Mercury and to a lesser extent Venus are doubtless conditioned by the excessive amount of radiation of which they are targets and by the intensified action of magnetism resulting from their nearness to the sun protons, but I shall not dwell on this. I am more interested to inquire as to the probable fate of the ten electrons engulfed in the sun. Are they reduced to little more than immaterial negative magnetic charges by the sun's high temperature and pressure, or are they able more or less to retain their material planetary form?

The spectroscope reveals traces of complex atoms in the sun. Now I know that the complex atom is confined to that concentration of the field known as the electron and that the field proper is composed wholly, or excepting only some such possible slight departures from the norm as the creative agency seems to delight in, of hydrogen atoms. Such casual, and as it were accidental, traces as might possibly occur in the field layers within the sun apart from the normal planetary process would scarcely become a consistent and systematic factor in spectroscopic experience. So the empirical evidence, as far as it goes, seems to indicate the presence in the sun of material electrons of the order of the visible solar planets. But if the sun were in fact anywhere near as hot as orthodox science assumes it to be, a material planet would not last as long in it as the sacrificial snowball in the lockerroom conception of a very hot place. And in the attendant combustion ten planets with a total aggregate mass of one hundred earths would not go very far toward light-

ing and warming the earth ninety-three million miles away over a period of time running into the billions of years. High temperature, high pressure, combustion, and all that as the effective cause of solar radiation is, as I have seen, no more than a curiously surviving atavistic notion at best, but the word combustion raises a point which I may as well dispose of now as later.

Granting the essential soundness of my concept of the atom-as-sun-as-dynamo producing solar radiation truly electrical in character, how am I to explain heat and light of terrestrial origin? To say combustion, to say oxidation is merely to translate the question into the argot of chemistry without answering any part of it, and certainly without throwing any light on the difference between solar and terrestrial radiation. And yet the solution should be simple if only I simplify the premise and assure myself that in a unified creation light must always be light, heat always heat, and no superficial manifestation of either should ever lead me into the error of conceding that a thing can be other than itself.

When an outer ring electron of a complex terrestrial atom is forced out of its normal orbit (either by chemical reaction or by friction, heat or electrical impulse from without) the magnetic equilibrium of the deformed atom is disturbed. The consequence is a vibration of the opposed poles of the several nuclear atoms functioning as magnets, or dynamos. The net result is a stimulation of the process of induction by which electricity is produced in the magnets' fields, which is the same as saying

that the atom's output of radiation of all types is increased. Meanwhile the deformed atom, now an effective ion, sets up an attractive impulse toward the outer ring electrons of neighboring atoms, inciting their nuclei in turn, and this behavior spreads from atom to atom, increasing the individual output of radiation of every atom within the phenomenal sphere of influence. This general increase of radiation of individual atoms throughout a perceptible area is defined, though not heretofore explained, as combustion, a form of oxidation, when, owing to the presence of carbon along with oxygen, the phenomenon is accompanied by a display of light and heat.

All perceptible heat and visible light of terrestrial origin is radiation emanating in abnormally large quantities from the magnetically disturbed nuclei of terrestrial complex atoms. This is the same radiation that I have seen somewhere above as continually emanating in normal quantities from all terrestrial complex atoms. Not only light and heat but other types of radiation are present, all the types, in fact, that are present in solar radiation. All these types of radiation, with the possible exception of heat and of course excepting the nonphotons of radioactivity, are true electricity. It is corpuscular in content, or more specifically, it is composed not of terrestrial electrons, as is solar radiation, but of electrons of the order of the terrestrial field atom, the mass and size of which are calculable by means of the constants of ordinal discontinuity according to mass and dimension respectively,

both of which I have adduced above. Its several wave lengths may be assumed to bear the same mutual relations as the various wave lengths of solar radiation bear to one another. As to how these subtiny wave lengths of terrestrial radiation can be apprehended by the human sensory apparatus I must choose between two possible answers. Either the sensory apparatus is responsive to cycles of magnitude of radiation, or secondary wave lengths of the order of the solar radiation wave lengths are superimposed on these lesser wave lengths of terrestrial origin, thus adapting them to the requirements of sensory apprehension.

There are, in short, at least two orders of radiation capable of conscious reception by the human sensory apparatus, solar radiation and terrestrial radiation. They are alike in kind and behavior and the difference between them is solely ordinal. But to mention these two orders of radiation is not to say there are no other orders of radiation, but simply that these are the two of which human senses have familiar conscious acquaintance.

The essential identity in kind of solar and terrestrial radiation seems to provide a conclusive answer to my earlier question as to the true nature of heat. The obviously different behaviors of heat and light of terrestrial origin, as in combustion, establish the fact that on earth at least heat is not electrical, while light manifestly is electrical. So I must decide that heat received from the sun is not primary radiation, electricity pro-

duced by induction, but inertial mass carried on the impulse of true radiation.

I need no longer consider, even as a remote possibility, the notion of the sun as a roaring furnace in the basement of the solar system. The heat of the sun is not a primary condition but a byproduct of the radiation produced in the sun and traversing its extent in all directions. It is the unavoidable and limited heat of a power house. In postulating fabulously high temperatures in the inner regions of the sun, science, I am satisfied, is engaged in a wild goose chase. And those solemn men who try to tell me just how long it will be before the sun will have "burnt itself out" are in no better case.

The essential parts of the sun, of any star, are everlasting within human power of counting time. The protons are virtually indestructible though capable of very gradual reduction of mass in consequence of atomic syntheses, as when an atom-as-star of simple type unites with other simple atoms-as-stars to form a more complex atom-as-star, and the time interval between two successive syntheses involving a given star must on the average be great even in terms of astronomical ciphers. The primary magnetic charges, both plus and minus are of a similar order of everlastingness and a negative charge can, as I have seen, form a new electron out of the field at will. The field itself, providing the raw material of radiation, is always renewable from the surrounding extranuclear field layers and from the universal field continuously at hand to rush in and fill a vacant place. These are my

atom-as-star ingredients and I should not like the job of trying to set a temporal limit on the life of any one ingredient. So long as the star is not disturbed from without it should be capable of outlasting several theological eternities added to any given number of philosophical infinities. Within its private precincts the sun is a power house provided with practically indestructible dynamos operating without fuel and producing electricity by induction from an inexhaustible field. And that reminds me that in my theoretical reconstruction of the sun I did not allow for the mass of the field, but I will let it go. The correction would apply to all the stars and so will not greatly affect the calculations with respect to star masses which I am going to try to make below, rough calculations at best.

What happens to the terrestrial protons of the sun's field bereft of their electrons in the dynamic process of radiation? I do not know. My best guess is that they are dispersed by the impulse of radiation into the outer field and the universe at large where they wander about as ions seeking lost electrons with which to mate in the formation of new atoms.

The field, both inside and outside the sun, is composed as I have seen above of primitive terrestrial hydrogen atoms. These atoms should in a virgin field be of greater individual mass than the common terrestrial hydrogen atom of earth, the greater number of which must have engaged in numerous syntheses since the formation of the planet, with consequent repeated losses of mass. The

field atoms, on the other hand, have not experienced this reducing process and should for the most part have retained their original mass intact. Possibly these virgin field atoms are of the order of the "heavy" hydrogen which is said to occur in minute traces in any given quantity of water. Is it possible that this heavy hydrogen represents a leakage from the field?

The field might also contain traces of primeval protons. I have seen above how all protons were at first bipolar, with a plus and minus charge at the north and the south pole respectively, and how the minus charge crossed the field in the formative state of the atom and fashioned an electron from the field substance to serve as the south pole of the atom. It is almost certain that many protons, perhaps through some fault of the field, failing to consummate the atomic process have persisted as isolated bipolarized protons. It would not be strange if some of these primeval abortive protons were to find their way into earth's stratosphere and lower atmosphere or even to solid earth itself. I wonder if these could be the "neutrons" (more properly, perhaps, "polarons") of the new science which are said to be "electrically neutral" and of greater mass than the common terrestrial proton and also to be found most frequently in company with the "deutons" of heavy hydrogen. And, finally, one may speculate on the possibility that some small fraction of these primeval protons would in the atom forming process have discharged not their minus but their plus magnetic charges, resulting in positively charged electrons and

negatively charged protons, inverted atoms, in short. Stranger things than that may have happened to proton in its flight.

So I leave the solar system of which the field comprises all but a tiny fraction by volume and some substantial part by mass. This field, a tissue of lesser fields swarming in and around the primary terrestrial hydrogen atoms, with its ultimate web of matrix filling the minute interstices of the atomic process of the final order, will long continue to hold depths beneath depths of the unknown. It will be useless to attempt any reconstruction of its composite vibrancy, its interordinal accommodations, with no more than the carpenter's three dimensions, even with relativity's time dimension thrown in. At least one new dimension must be added by which to recognize the profound truth that creation is more than the sum of its parts. I will say more of this somewhere below.

Other Stars-As-Atoms

The universal field is formed of extensions of individual star-as-atom fields meeting and fusing in interstellar space. It is of the same composition as the solar system field (terrestrial hydrogen) but probably less dense. Since the universe is of more recent construction than the individual hydrogen atoms-as-stars of which it is primarily composed, and possibly yet incomplete, it would be too much to assert categorically that the universal field is entire and uniform and consequently perfect in all its parts as a magnetogravitational medium.

All normal stars, as I have seen, have planets the count of which, if they were visible from earth, would reveal the elemental identity of any given star by the law of atomic number. Failing this clue no test is left me but that of atomic weight. If I know the mass of any given star in terms of the sun's mass I can work out its atomic weight and name the element of which it is a primary unit.

Of stars it is as true as it is of their terrestrial counterparts that the only real atom is hydrogen and that all complex so-called atoms are syntheses of it. But it is convenient to refer to the heavier-than-hydrogen stars as complex atoms-as-stars and I shall so refer to them.

I have a table giving a number of stars in terms of the sun's mass. Now, a hydrogen star would weigh approximately $1/19$ th of the sun's mass and should be credited in the table with a mass of 0.053. No star appears with a mass so small and this was to be expected, for the sun of a hydrogen atom-as-star is only some eleven miles in mean diameter and gives no light or heat other than reflected radiation from other stars. When I consider that our own sun is scarcely visible from the outer planets I recognize how impossible it will always be for a human eye to see a hydrogen atom-as-star, even though space swarm with them in the immediate vicinity of the solar system. So I try again.

A helium atom-as-star would have a mass $4/19$ ths of the sun's mass and should be credited in the table with 0.211. Well, here is Barnard's Star with a mass of 0.2

and I put it down as undoubtedly a helium atom-as-star, noting that it is a very close neighbor of our fluorin atom-as-solar-system, and give it two planets.

Here in the table are two separate stars, Alpha Centauri and Procyon, credited alike with 1.1 of the sun's mass, which multiplied by 19 gives the atomic weight 20.9, which is close enough to qualify as neon, atomic weight 20.2, atomic number 10. So I credit these two stars with ten planets each. And Capella, 4.2 heavier than the sun, must have an atomic weight of 79.8, which is almost the same as my given atomic weight for bromin, 79.9, atomic number 35, which is therefore the number of Capella's planets. And Arcturus, eight times heavier than the sun, must have an atomic weight of 152, which is exactly the atomic weight of europeum, atomic number 63, the number of Arcturus' planets. And Alpha Crucis, ten times heavier than the sun, must have an atomic weight of 190, which is close enough to osmium, atomic weight 190.8, atomic number 76, the number of planets I must give Alpha Crucis. And now I come to an impasse.

I find in the table Canopus with a given mass twenty times the sun's. That would mean an atomic weight of 380 as against the atomic weight, 238.17, of uranium, heaviest of known terrestrial atoms. If the things above are indeed as the things below no visible atom-as-star can have a mass less than 0.2 of the sun's mass and no true atom-as-star can be more than 12.6 times heavier than the sunstar. So I must choose

between two alternative assumptions, one, that the atom form is capable of synthesizing into atom types twice or several times more complex than uranium, or, two, that any star of a known mass greater than 12.6 sun masses is not in fact a single star but a binary or other multiple star, which is the same as saying a molecule composed of true atoms-as-stars in "chemical" combination. It must be one or the other, no compromise is possible. Of course I choose the second alternative and will wait patiently for evidence showing that all these over-size so-called stars are not true single stars but clusters, not only Canopus, but Betelgeuse, Beta Centauri, Antares, Rigel and Deneb and all the other alleged giants, not many of them in all, but all impossible by the present accepted table of the elements.

Having gone so far I may as well go the limit. The bismuth atom, atomic weight 209, exactly eleven times the atomic weight of fluorin, is the heaviest of nonradioactive atoms. I am satisfied that any single star of more than eleven times the sun's mass will show visible evidence of radioactivity. I examine the heavens for that evidence. And at length I find what to me seems a striking likeness in large of a terrestrial radioactive atom as it might appear to a hypothetical homunculus dwelling on the surface of the third ring electron from the nucleus of a discreetly distant terrestrial fluorin atom. I discover, in short, a planetary nebula. I see it, of course, not through my own undisciplined eyes, but through the eyes

of acknowledged specialists who have recorded their observations in detail.

The planetary nebulae are so called in token of their sharp outline, suggestive of a planet, and their great apparent size which seems to preclude the theory of a single star formation. And yet a single "faint but very hot" star can be seen at the center surrounding which are shells, or rings, of light of varying intensity. Spectroscopic analysis of this light shows, besides certain lines which have not yet been identified with any known terrestrial elements, two strong and typical lines in the green. This peculiar green light is of the order produced by bombardment of highly rarefied gas with highspeed electrical particles or ultraviolet rays. Thus my planetary nebula, some ten thousand times the earth's orbit in diameter, on the average, and with a mass of the order of the heaviest star masses, strips down to a nucleus that gives more heat than light, surrounded by distinguishable layers of a peculiar highly rarefied gasiform substance under bombardment of some extraordinary and intense type of radiation emanating from the glowing nucleus.

Out of my imagination I complete the picture of the planetary nebula as a radioactive atom-as-star, with its eighty-four to ninety-two planets (ring electrons) and the same number of field layers exterior to the sun-nucleus, with its sun containing scores of electrons of the order of the solar planets and some two hundred odd protons of the star order. Superimposed upon its normal

radiation of terrestrial electrons is its radioactive output, electrons (gamma rays) issuing as photons of the order of solar planets and traveling at the speed of light, the various other terrestrially familiar types of radioactive emanations, all raised to the star order of magnitude but otherwise identical with the corresponding earthly forms, including helium atom-as-star nuclei (alpha rays) moving away with a velocity of some twelve thousand to fifteen thousand miles a second and providing nimble minds with "evidence" of an expanding universe. It would be far less surprising to ascertain definitely that the planetary nebulæ are in fact radioactive atoms-as-stars (polonium, radium, uranium atoms of the order of magnitude of the star) than to discover at length that a given macrocosm can be so like a given microcosm in any number of particulars and yet be a wholly different kind of thing in a creation which, if it contain many more such identico-irreconcilables in its scheme, can scarcely be worth the serious consideration of an orderly minded observer. I choose to continue believing, however naïvely, in the reasonableness of creation. This faith emboldens me to examine certain other exceptional star forms to see if they can perhaps be explained as familiar terrestrial forms raised to a higher power. Novæ, for example.

Once a year or so some insignificant star, perhaps previously invisible or nearly so, flames up in a blaze of glory and for a while outshines neighboring stars of many times the "new" star's rightful brilliance. The phenomenon occurs most commonly in the densely pop-

ulated globular clusters in the region of Sagittarius, which happens to be rich in planetary nebulæ. Now I ask myself what would happen to an ordinary star hit by one of the planets or displaneted suns which are the corpuscles of radioactivity on the star plane of creation. Would not the victim blaze up in a kind of panic, owing to the displacement of its nuclear magnetic equilibrium, and then subside into its former state, or worse, having more than likely lost one or more of its component nuclear planets or suns? Would it not, in fact, behave as the novæ are observed to behave?

Or let me consider another case. Four invisible hydrogen atoms-as-stars come together under conditions favorable to synthesis. They unite with a display of light and heat and a simultaneous loss of mass, as happens in similar syntheses on the terrestrial plane. Then the whole show degenerates into just one more little helium atom-as-star.

Both of the above explanations seem to me to fit the nova. Where there is radioactivity there are sure to be hits and where there are simple atoms there is always the possibility of syntheses resulting in more complex atoms. In either case there would be an exceptional output of light and heat, but in the second case, that of the atomic synthesis, there would be other manifestations, and among them a production of cosmic rays.

When a terrestrial atomic synthesis occurs the lost mass expended in the attendant discharge of magnetic energy (pursuant to an insupportable increase either of attraction

between oppositely charged particles or repulsion between similarly charged particles) of the atoms involved in the synthesis) includes, possibly, negatively charged electrons of the order of the terrestrial field atom and, certainly, positively charged protons of the same order. When a similar synthesis occurs between atoms-as-stars the discharged particles must be of the order of the terrestrial atom, perhaps including negatively charged terrestrial electrons and most certainly including positively charged terrestrial protons. Here, then, is promising material for so-called cosmic radiation.

If novæ are in fact the source, or even one source, of cosmic radiation it is futile to look in any one direction for the place of origin. All light-giving stars have resulted from syntheses, at one time or another, of original hydrogen atoms-as-stars. So to the extent that these syntheses are indeed the source of cosmic radiation the source is universal. I may this moment be receiving cosmic radiation from star syntheses which had their consummation in some remote part of the universe at a point in past time long before the nineteen hydrogen atoms-as-stars of the solar system lost their virgin estate. But let me note here the certainty that stellar evolution is not a one-way street. Many stars are smaller now than they once were, having split into less complex atoms-as-stars. The history of a star is individual and there is no saying whether it was larger yesterday or will be smaller tomorrow. All I can say with certainty is this, that any star is a synthesis of some ascertainable number of hydrogen

atoms-as-stars and that it can grow heavier or less heavy only by the fixed measures of discontinuity indicated in the table of atomic weights that govern the terrestrial atom.

In any event, the abundance of cosmic rays is not surprising in view of the universality of the synthesizing process and the vast number of syntheses in process at any given point in time, to judge from the comparative frequency of the phenomenon in my tiny portion of visible space. But I must take care not to confuse these syntheses with the far more common phenomena of "chemical reactions" visibly in progress on the star plane of the atomic process, the plainest evidence of which I think I see in the variable stars.

When terrestrial atoms unite as molecules the result, as I have seen, is an excitation of the poles of the dynamic atoms (magnets) in the nuclei of the atoms involved in the chemical combination, and a consequent increase of radiation composed of electrons of the order of the terrestrial field atom. In the chemical combination on a large scale of certain particularly responsive atoms, such as oxygen with carbon, combustion is produced with attendant visible light and heat. Precisely the same effect is produced when atoms-as-stars combine to form molecules-as-star-clusters. The dynamos in the various suns set up a rhythmic vibration as their poles oscillate toward and away from each other with a corresponding periodicity of radiant activity as evidenced by the increase and fall in brilliance of the variable stars. Given a densely packed mass of oxygen and carbon atoms-as-stars I may

expect to see a spectacle in the heavens exactly identical with the phenomenon of terrestrial combustion, the only difference being that the heavenly combustion is produced by radiation composed of terrestrial electrons while the terrestrial combustion is produced by radiation composed of electrons of the order of the terrestrial field atom. Here I look for the plainest evidence of the essential qualitative identity between terrestrial and heavenly masses, an identity which is obscured ordinarily by my inability to see in proper perspective both mass and particles as one. It is the fate of man to be placed between two consecutive discontinuous orders of the atom so that he cannot see the particles of which he is an organized mass nor the mass one particle of which he lives upon and calls the world.

In the variable stars the chemist, the atomic physicist, the geologist should find rich ore of knowledge. The frequency and intensity of vibration of a given variable star can doubtless find a parallel in the corresponding manifestations of a similar terrestrial atom. If the astronomer will only weigh the stars and tell the laboratory man that this star is carbon, that star oxygen, that here nearby is a phosphorus atom-as-star, what is to prevent the chemist or physicist from reconstructing whole masses of the heavens and saying which is liquid, solid or gas and where the richest lodes of celestial minerals lie? But if I start off on that line I shall never reach the end. Anyhow, the implications are too obvious, they simply shout for expert notice. No Edison or Faraday of to-morrow

will work without a telescope in one hand and no conscientious Galileo will stray far from his microscope.

Now for a look at the universe from above.

Universe And Cosmos

A universe is a closed finite system including and bounding the whole field of possible experience and empirical knowledge of all its habitants. It is a sphere, an electron in form and fact. The test of universality is electronicity. Thus any completely organized electron is the conceptual universe of all real or hypothetical creatures inhabiting its primary component atoms and composed of its secondary component atoms. Any given solar planet, by virtue of its electronicity, is a universe in fact and the theoretical universe of a conceptual homunculus composed of terrestrial field atoms and dwelling on the surface of an electron of any of its component terrestrial atoms. Man's Universe is the electron upon one of the primary component atoms-as-stars of which man, made of terrestrial atoms, dwells.

A cosmos is the hydrogen atom which must be postulated along with any given electron-as-universe. Hence any completely organized hydrogen atom is a cosmos. To man The Cosmos is the hydrogen atom of which The Universe is the electron and without which the conception of the Universe-as-electron cannot stand.

Creation is a hydrogen atom and therefore of the form of a cosmos. Man's Cosmos is either identical with Creation or an exactly similar component part of it. If Crea-

tion contains more than one cosmos of the order of magnitude of The Cosmos the least number of these cosmoses in Creation must be of the order of the number of terrestrial hydrogen atoms in a hydrogen atom-as-star. But within the bounds of present knowledge The Cosmos satisfies every requirement of a complete creation of at least these six discontinuous orders of the dynastic atom:

1. CA, the atom-as-cosmos-as-creation.
2. SA, the atom-as-star.
3. TA, the terrestrial atom.
4. TFA, the terrestrial field atom.
5. DA, the demiatom.
6. IA, the interrupted atom.

Whether or not creation be in fact limited to these six orders, the comparative values shown in the following table retain their validity as affecting the mutual relations of the six. These relations are based upon the two constants of ordinal discontinuity which I have shown to possess the following respective values:

doC (constant of ordinal discontinuity according to dimension) equals:

$$33 \times 10^{21}$$

moC (constant of ordinal discontinuity according to mass) equals:

$$34 \times 10^{66}$$

The symbol f represents the unknown and perhaps indeterminate number of secondary protons which I saw in flight from the primary proton of creation as an incident to the crystallization of proton from matrix. By my premise this same f must also represent the number of tertiary protons evacuated from each secondary proton, the number of quaternary protons evacuated from each tertiary proton, and so on to the bottom of matter. It follows (with qualifications which will appear below) that the total number of protons (and therefore of hydrogen atoms) of any given order in all creation is expressible in terms of f , as in the following

TABLE OF COMPARATIVE DIMENSIONS, MASSES AND NUMBER OF MEMBERS OF EACH ORDER IN A SEXORDINAL CREATION

| | CA | SA | TA | TFA | DA | IA |
|---------------------|------------------|------------------|------------------|------------------|-------|-------|
| <i>Order</i> | 1 | 2 | 3 | 4 | 5 | 6 |
| <i>Dimensions</i> | doC ⁵ | doC ⁴ | doC ³ | doC ² | doC | 1 |
| <i>Mass</i> | moC ⁵ | moC ⁴ | moC ³ | moC ² | moC | 1 |
| <i>Total Number</i> | 1 | f | f^2 | f^3 | f^4 | f^5 |

And I know that the number of quanta of positive magnetic energy of the order IA carried by an individual proton of any given order (and also the number of quanta of negative magnetic energy of the order IA carried by an individual electron of any given order) is implicit in the line opposite "Mass" in the table.

So, to the extent that my assumption of a sexordinal creation be sound, I find myself back at the proton of creation, now resolved into the nucleus of the unique

hydrogen atom of creation with a magnetogravitational field composed of hydrogen atoms-as-stars of which the rotating and revolving electron-as-Universe is a concentration. This solitary atom of the first order is absolute in the restricted sense of having no neighbor atoms to condition its conformation and behavior. Instead of seeing it as an ordinary eggshaped hydrogen atom I must postulate for it the natural watch, or lense, shape which, owing to the evacuation of subprotons in approximately parallel planes from a parent proton revolving on a fixed axis, was the shape of all hydrogen atoms before distortion set in as a result of interatomic gravitational action. That the atomic process has been completed at the top I know from the internal evidence of the integrated electron-as-Universe, which marks the final stage of evolution of an individual hydrogen atom of whatever order.

The proton of creation, then, is a rotating crystal of calculable mass and mean diameter at the geometric center of the orbit of the rotating and revolving Universe, and all the space between is filled with hydrogen atoms-as-stars constituting the primary field of creation. Viewed from the surface of the Universe, all is darkness, for the nucleus of this cosmic atom is a dark, cold sun lacking the mechanism by which alone radiation can be produced, and the primary field atoms, all hydrogen atoms-as-stars (with the possible exception of sports of which I know nothing), are likewise cold, dark suns; all light, all heat is confined to the sphere of the Universe, though with this

qualification, that light and heat and all forms of radiation, though of lower orders than the solar order, may and indeed must exist in the depths of the individual atoms-as-stars of the cosmic field.

From my table of comparative dimensions and masses I know that the proton of creation carries a positive charge of magnetic energy equal to the negative charge carried by the electron-as-Universe and that in each case this cosmic quantum is equal to moC raised to the 5th power *times* the minimum quantum of corresponding sign carried by the polarized proton of the interrupted atom, represented by 1 in the table. This same figure gives the mass of the proton of creation in terms of the mass of the proton IA. Without pausing to reckon the mass of the Universe I will set down the significant dimensions of the atom of creation. I believe these dimensions are of the order of correctness, subject of course to the aberrations of my unlogarithmic reckoning and also to errata in the basic measurements of the terrestrial atom, which I have had to take on faith, and in my necessarily rough and ready averaging of solar planetary dimensions and masses.

TABLE OF SIGNIFICANT DIMENSIONS OF PRIMARY UNITS OF THE COSMIC ATOM

| <i>Dimension</i> | <i>Of the Order of</i> |
|-----------------------------------|--------------------------------|
| Atom CA, diameter..... | 10^{19} Light Years |
| Astronomical Unit..... | 5×10^{18} Light Years |
| Universal Electron, diameter..... | 10^{14} Light Years |
| Cosmic Proton, mean diameter..... | 5×10^{10} Light Years |

How many stars are there in the Universe? As many as there are terrestrial atoms in the planet of a hydrogen atom-as-star. As many as there are terrestrial field atoms in a terrestrial electron. Now, I know the terrestrial electron is by mass about one two-thousandth of the terrestrial proton and that the mass of the latter is lodged in a known number (the quantity m_0C) of terrestrial field protons. Consequently the number of terrestrial field protons (and thus the number of terrestrial field atoms) should be $1/2000$ th of the value m_0C if (and it is a considerable if) the mass of the terrestrial electron were lodged entirely in terrestrial field protons and not to some unknown extent in lower proton orders.

The problem goes all the way back to the question of what proportion of original matrix went into the making of the proton of creation and what proportion remained to supply material for protons of inferior orders; for I have assumed that this same proportion of evacuated and unprocessed matrix holds good for each successively crystallized order of proton in flight. What this proportion is must remain, for me at least, an unanswered question. But I can at least make a guess based on the evident tendency of the creative agency to strike some sort of balance in all its processes that I have so far witnessed. My individual notion of a balance in this case would be a division which would place outside the proton of creation, and consequently outside every other proton in course of formation, the same mass as in it, thus attaining equilibrium by mass for creation as a whole and each of its component

atoms. This division would give me in the cosmic field one-half the number of secondary protons as in the proton of creation, the other half by mass going into protons of lesser orders. By this reckoning (based I know on an entirely unwarranted reading of teleological intent into the methodicity of the creative agency) I am enabled to formulate something like a calculation of the number of terrestrial field atoms in a terrestrial electron, that is by taking not 1/2000th but 1/4000th of 34×10 raised to the 66th power, which gives me, for the number of terrestrial field atoms in a terrestrial electron, and also for the number of stars in the universe

$$85 \times 10^{62}$$

This, however, is the number of original hydrogen atoms-as-stars, including both those which have remained single and invisible and those visible stars which are syntheses of from four to some two hundred-odd simple invisible hydrogen atoms-as-stars; and the total number of what are commonly called stars would be less in proportion to these synthetic multiplications.

Perhaps the least respectable of the quantities considered in my table of dimensions and masses is the one I have labeled *f*, and which purports to answer for the number of primitive protons of any given order that took flight from any single parent proton of the next higher order and the tabulated powers of which are presumed to give the total number "in creation" of protons of the six respective orders. There is good reason, I believe, to ac-

cept the validity of f as a constant measure of the number of protons projected uniformly from each parent proton crystal in the successive stages of the flight of proton. But all these protons in flight, hydrogen field atoms-to-be, did not stop within the ultimate boundaries, that is to say within the orbit of the electron revolving around the parent proton-as-nucleus, of the evolving upper atom. Some unknown fraction of them is known to have bled off in space to unite eventually with the bleeds of other incipient parent atoms to form a general (inter-atomic) field. It should not be a hopeless task for some more adult generation of science to estimate, as regards the individual atom, what fraction of original field atoms bled off as the individual atom's contribution to the general field and what fraction remained to serve as field for the individual atom proper. Then will be known what fraction of secondary protons remains within the cosmic atom as visible and invisible stars and what complementary part escaped outside the orbit of the universal electron, either to hang as a ragged fringe of cold, dark hydrogen atoms-as-stars to the cosmic atom or, in some part perhaps, to continue their flight into fieldless outer space, setting up free cosmoses on their own, independent creations of the second rank of the atomic dynasty; and the quantity f can then be corrected to fit. Meanwhile I wash my hands of it.

In fact, I attach no undue importance to the quantitative specifications of my cosmic structure. A man of my generation needs the comfort and reassurance of familiar

homely figures and is none the worse for them so long as he does not confound them with the reality that lies beyond and of which these meager computations are but fitful glimmers in the cosmic darkness. Even were it feasible to audit and perfect my simple calculations and at length pronounce them (by all the canons of mathematical authority) valid to the last cipher of a light year, I should still be no nearer the truth than on the night I first looked at the stars and saw for myself that the heavens are one; no nearer, that is to say, if I were content to have reduced the epic of creation to the blank verse of arabic numerals, or even to lyric lambdas. There is no academized highway to truth, the toll of which is understanding, and I must not seek it by the scientific method, which is only concerned with knowing and cannot always see the reality for the facts.

Truth. Reality. Big words, but let them stand.

Dimension In The Absolute

Beyond relativity is absolutivity.

I have identified the cosmic substance with one absolute essence with as it were two faces, one of which is energy, the other proton, with a median thickness of matrix constituting a zone of fusion between the two.

Magnetic and gravitational attraction have likewise fused for me into one absolute impulse of energy and matter respectively towards "the center."

It remains to frame these absolutes in some absolute and intelligible dimensional system and I know at once that I

cannot do it with the familiar terrestrial dimensions. A thing is said to be so long, so broad, so thick, but what does the saying mean? The units of "length", of "breadth", of "thickness", the very direction in which a given dimension shall apply with relation to the measured object, all is a conspiracy of expedience. These so-called dimensions have in fact no reality except only as mathematical cat-paws.

Of the four dimensions of relativity that of time comes closest to reality. Its direction and measuring rods are at least postulated on events and these events, to the extent of their actuality, give time a vicarious and qualified verity. Unquestionably a clock ticks so many times, an hourglass passes so many grains of sand, while earth turns once on its axis. And earth completes some given number of rotations while it revolves once around the sun. From numerical arrangements of lesser within greater approximately simultaneous events the calendar derives its days, months and years, and these time units are precisely as valid as the events they symbolize are real. But to the extent that these controlling events are only relative, apparent, and local, terrestrially reckoned time is a pragmatic fiction without cosmic significance.

In the depths of the absolutely eventless, inert, dense proton of creation, time cannot exist and the terrestrial concepts of length, breadth and thickness, with their necessarily subjective controls, are sterilized of absolute significance. Only an absolute metric can measure an abso-

lute and I find such an absolute metric in the proton substance itself.

I know the proton of the first order, what I call the proton of creation, is in form and fact an ideal crystal lattice, that is to say a geometrically uniform arrangement of secondary proton crystals, and that each of these secondary protons is similarly an ideal crystal lattice, as are the protons of the third, fourth and fifth orders. But the proton of the sixth order is the indivisible least particle of matter, a single crystal similar to protons of higher orders in form, equal to them in density and identical with them in every property except only its singleness and indivisibility. In this ultimately minute indivisible proton crystal of the sixth order I discover an absolute measuring rod with which to take the measure of any proton mass as regards what I can only define as the dimension of extension.

It is the simplest of measures. I take any proton mass and count its constituent 6th-order protons and so arrive at the extension. Thus I compute the total volume and mass, both of which are expressed by the same number as that which gives the tally of component indivisible proton particles, for I am working with a perfectly continuous, absolutely dense substance composed of similar particles of uniform mass and volume, so that no space remains unoccupied anywhere within the bounds of the measured homogeneous mass.

The absolute reality of the dimension of extension lies in this, that its measuring rod is a real thing incorporated

in and constituting the thing measured, the measure of the object being read in physical multiples of the measuring rod, a device than which nothing could be more objective. For convenience in reckoning I can use significant multiples of the basic unit of extension, such as the number expressing the content of a 5th-order proton in terms of 6th-order protons, but I must always bear in mind that it is only as multiples of 6th-order protons that these larger measuring rods are valid; the 6th-order proton alone is a direct crystallization of proton out of matrix out of energy and all other orders are but arrangements of 6th-order protons, arrangements subject to disturbance under certain extreme conditions which I have described somewhere above. Only the 6th-order proton is absolute and the absolute properties of higher proton orders are derived from and depend utterly upon this self-sufficient indivisible particle of which all matter is composed.

Extension, then, is an absolute dimension in which I can express the content of any given proton mass. By simply counting the 6th-order protons in a 4th-order proton I find it is the square of moC extensive. But let me try the other way around.

Given a proton mass within the proton of creation and having an extension of moC squared. Does this mass, on the strength of the data, resolve itself into a 4th-order proton? Not necessarily. It may be a nondescript thin scroll of proton meandering far and wide through the general mass of the primary proton, a thread too slight to contain so much as a single complete 5th-order proton, to

say nothing of a 4th-order proton, and yet satisfy my data.

Very well, let me enlarge my data. I know all protons of whatever order are of some unvarying crystal form and I have assumed a hexagonal structure, or specifically, a bipyramid hexagonal at both ends. Now let me break down my absolute dimension of extension into the conventional concepts of length, breadth and thickness and let me add them to my data in such fashion as to satisfy the dimensional requirements of a bipyramid with two hexagonal ends. Now I have the required volume and form of a 4th-order proton, but even this is not enough.

I have seen how the proton of creation and all its progressively lesser component protons are ideal crystal lattice structures which, though fused into an effective unity and a state of perfect continuity, nevertheless retain individually their original significant proton form and how in case of some conceivable violence causing the disruption of a superior proton, the component inferior proton crystals would emerge in their original form; how, in short, the lines of fracture would exactly define the natural proton continua. For all protons are realities behind the veil of fusion and not simply geometric structures of given mass, volume and "dimensions." It follows that a given section of any complex proton mass, though of the size, shape and mass of some order of proton, cannot nevertheless be a true proton without occupying exactly its proper place in the ideal crystal lattice of a superior proton of the order within which a

proton of the given extension would be a primary component unit.

Evidently the dimension of extension is not enough to give the whole reality of any proton below the proton of creation, which is unique, and above the indivisible 6th-order proton, which is the only particle in creation of the value 1 in extension. The difficulty lies in this, that the complex system of interpenetrating ideal crystal lattices constituting the proton process, though materially continuous is arrangementally discontinuous. Now, extension can only function in the continuous. Having once elected its unit of count it must stick to it until the tally is finished, as the count of individual cigars in a dealer's stock can only be made by reducing the concept of boxes of cigars to the reality of single cigars contained in the boxes. In the same manner, extension by breaking down a larger proton into smaller component protons destroys the significance of the ideal crystal lattice system and reduces the whole concept of the proton process to a question of corpuscular content.

Clearly, to supplement the dimension of extension, dealing wholly in continuous content, I require some dimensional device by which to express the arrangemental discontinuity of the ideal crystal lattice system constituting the proton process. I want a dimension in which I can count and compare superimpositions of one order upon another as easily as I can reckon the number of corpuscles of a given order juxtaposed to produce a calculable total content. By this very requirement I know

before satisfying it that the new dimension must be an ordinal dimension, expressible in rank, and not, like extension, a cardinal dimension expressible only in digits and ciphers.

Whatever this new dimension may be like, there can be but one name for it, a name that I have been using a long time now without recognizing its absolute significance. I can only call it the dimension of order. Let me see if I can make sense of it.

I think of a circle, any circle. I know that the length of the diameter multiplied by the constant pi will give me the measure of the circumference. But to take a given length of diameter and then to describe about a point a curved line of which the ends meet and of which the extent equals the given length of "diameter" multiplied by 3.14159+ does not necessarily give me a circle. It does not become a circle until the diameter, turning upon a point bisecting it, a center, always rests its extremities on the enclosing curve, the circumference.

Now I think I can see a certain conceptual likeness between the circle and the proton process. I conceive of the extension of a given proton as a "diameter." In place of the constant pi I have moC , the constant of ordinal discontinuity. The product of the two gives me the extension of the next higher order of proton. But, as with the circle, something more is required of a true proton than that it have a particular measure in extension. Before investigating this something more let me remind myself that in my assumed sexordinal creation the protons

of the 1st, 2nd, 3rd, 4th, 5th, and 6th orders have, respectively, in terms of the 6th-order proton, these extensions:

$$\text{moC},^5 \text{ moC},^4 \text{ moC},^3 \text{ moC},^2 \text{ moC}, \text{ 1}$$

I take a proton extension of the 3rd order, moC cubed, and conceive of it as a "diameter." Multiplying this extension-as-diameter by the constant moC, I get moC raised to the 4th power, which corresponds to the extension of a 2nd-order proton. But to realize the proton entire I must go further. I know the number of 3rd-order protons in a 2nd-order proton is moC, so I conceive of this number of extensions-as-diameters as constituting the body of a 2nd-order proton. Now I conceive of each diameter as having at one extremity a "plus" pole and at the other a "minus" pole. And here I depart from the geometrical figure of the circle. Instead of demanding, as in the circle, that each diameter be bisected by a common center, I require this: each extension-as-diameter must rest its two extremities, its plus and minus poles, at exactly "opposite" points in the proton process (ideal crystal lattice system). In other words, for each position occupied in a proton extension of the 2nd order by a proton extension of the 3rd order a proton extension of the 4th order must occupy a similar position in each proton extension of the 3rd order contained in the given proton extension of the 2nd order. Only so can the system of interpenetrating ideal crystal lattices constituting a 2nd-order proton be realized. And by projecting the ex-

tensions-as-diameters as may be necessary to answer the extensive requirements of the 1st-order proton (proton of creation) above and the 5th and 6th orders below, and by insisting upon the foregoing rule of "oppositeness" wherever I go in the proton process, I achieve a crude graphic representation of the dimension of order.

Thus the proton process becomes expressible in the two dimensions of order and extension. Extension is inexpressive of any but quantitative properties. Order has no quantitative significance. It is the dimension of arrangement, purely ordinal. But it fulfills the first requirement of a true dimension, which is a uniform unit of measure. Thus each step in the system of interpenetrating ideal crystal lattices is exactly equal to the preceding and the following step. But it is the equality characterizing not an arithmetical but a geometrical progression. So the steps are not quantitatively interchangeable, as the first and third feet of a yard are interchangeable, and herein lies the quality of discontinuity, a discontinuity which, being purely quantitative, is inexpressible in terms of the dimension creating it, the dimension, of course, of order. For order is not concerned with the quantitative results it produces but only with the arrangement, always the same, by which the proton process progresses from one ideal crystal lattice to the next.

The extension of any proton is given with its order, and from this it would be easy to argue that order and extension are, respectively, the ordinal and cardinal expressions of one and the same fundamental dimension;

but this would be tantamount to arguing that form and content are identical, which is manifestly absurd. By the dimension of extension I determine the quantity of proton matter contained in the mass measured. By the dimension of order I determine to which of several similar frames a given system of proton ideal crystal lattices must be assigned. But the dimension of order is none the less real for its immaterial association. Manifestly order is the formal arrangement in which I have seen energy dispose itself in consequence of the primeval meeting and movement of the two opposite signs, a movement which impressed itself arrangementally upon matrix and retained the arrangement in the crystallized state of proton. Thus order may be identified with number in the Pythagorean sense. It is the absolute metric of the cosmic rhythm.

To sum up my findings in the absolute, I have

One essence: energy/proton.

One impulse: magnetism/gravity.

Two dimensions: order and extension.

Order In The Universe

In the existing state of human knowledge there is no possibility of reducing universal truth to the exact cold dimensional verities of the preatomic proton. But it may be amusing to indicate a method and beginning. To appreciate the difficulty I need only consider a few of the more obvious complexities and delicacies out of which

my planetary universe is ultimately compounded. First I consider time.

Time, as I have seen, is a pragmatic assumption predicated on observation of certain movements of given heavenly bodies as seen from the planetary domicile of the observer. Each star, yes, each planet, has its private time system and temporal units; all this in the single order of the atom-as-star. Every atom, likewise, and each of its planetary electrons has a time system of its own, or at least could have at the will of a conceptual microman living on it and viewing subjectively the temporal relations apparently existing between his home atom and electron and their neighbors in interatomic space; and so too could have every atom and electron of the subterrestrial orders of the atom. Any easy assumption (purely gratuitous if not pompous) that conscious life exists on earth alone of all the planets and orders of planets does not affect the cosmic and objective validity of all these times within Time. And the same is true of light.

I have seen how light, all radiation, is of atomic origin and how each complex atom of whatever order emits radiation quantitatively determined by the atom's order but qualitatively identical with sunlight and the various other forms of solar radiation. (I have recognized the quantitative difference and the qualitative identity existing between sunlight and the light incidental to combustion of terrestrial origin.) Now, all these several distinct and discontinuous lights within Light, of times within Time, must find some reasonable and mutual accommodation in

any truly cosmic view of the universe I live in. This accommodation I do not find in my slim stock of classroom mathematics, nor do I discover it in all I hear and read of the carpenter's three dimensions or even in relativity's fourth dimension, "time."

The reason is plain. These dimensions are pragmatic and relative and the absolute truth is not in them. And yet I must use them for these are the frames removed from which all my empirical knowledge of creation becomes void of meaning. Let me try; and I will begin with a relatively simple problem in lineation and see if I can give my solution the shape and color at least of absolute reasonableness.

What I need first of all, of course, is a truly cosmic measuring rod with which to replace year, mile, light year, and suchlike pragmatic units.

In the proton of creation I found my absolute measuring rod in the indivisible least proton itself and reduced all problems of measurement (in the dimension of extension at least) to a process of laying end to end all the indivisible particles contained in the absolutely continuous proton mass to be measured and recording the total count. This is an absolutely just and objective mensuration, but when I remove myself from the state of absolutivity into a relativistic and discontinuous universe, the problem becomes more formidable, even such a relatively simple problem (say) as to find a just expression, in absolute terms, of the range of vision.

With my naked eye I can count (so I am told) on a

clear night some two to three thousand stars and can see heavenly bodies one thousand (more or less) light years away. Through a one-hundred-inch telescope I could see much farther, some 140 million light years. Now that is a clear statement and suffices for my terrestrial needs, but it fails to express a truth of cosmic application and for this reason: vision dV , as cosmic, or even universal, reality, must be definitive not only of visibility on a single plane of the atomic process, but equally and simultaneously of visibility on every plane, that is in every order of the atomic dynasty. Terrestrial miles and light years would mean nothing to a conceptual manikin on the third electron from the nucleus of a terrestrial fluorin atom. To convey a meaning to him I must translate light years into some absolute unit with which he can be as familiar as I. If he be only as intelligent as a tellurian he will recognize such a unit in the proton.

Now, I know about how many proton diameters there are to an inch and from this can calculate the number of proton diameters in 140 million light years. This is as far as I can go in the dimension of length (which along with breadth, thickness, and time is a relativistic sophistication of the absolute dimension of extension); but it is just far enough, for the reason that when I say proton I refer to the terrestrial proton and when my tiny electro-nian says proton he is thinking of the terrestrial field proton. To give the proton an absolute and cosmically recognizable value I need only resort to the absolute dimension of order. This I do by reducing the problem to a very

simple equation of cosmic effect; but I think I will use, in place of the absolute proton, the relativistic hydrogen atom; the process will be exactly the same and I can at the same time be illustrating the adaptability of the absolute dimension of order to my own relativistic environment.

The hydrogen atom, as must be clear to me by now, is a secondary structure superimposed on the primary ideal crystal lattice structure of the proton process. Unlike the proton, which is fixed and unvarying in its extension (according to its order), the hydrogen atom is variable according to temperature, pressure, and what not. So I must assume a given temperature and pressure for the hydrogen atom of which I am given the diameter and predicate all my calculations on these given conditions as applying to all hydrogen atoms of whatever order involved in the calculation.

Very well. I can see, say, 1000 light years and this gives me my basic equation:

$$dV = 1000 \text{ light years}$$

Now, a hydrogen atom-as-star diameter equals (about) 2,000,000,000 miles or 1/3000 of a light year. I convert my light years into hydrogen atom-as-star diameters and my equation appears thus:

$$dV = 3,000,000 \text{ hydrogen diameters}$$

This is a truly cosmic statement, qualified only by errata in the data. It is true of the concept dV in all orders

of the dynastic atom. Not only does dV equal three million hydrogen star-as-atom diameters from the tellurian viewpoint; it has precisely the same value for my conceptual electronian gazing out into interatomic space. To amuse myself I calculate how far he could see in terrestrial inches.

One terrestrial hydrogen diameter equals $1/250$ millionth of an inch. I multiply this dimension by 3 million and get 0.012 inches, or just less than $1/80$ th of an inch. And the relation of this to planetary dimensions is a just statement of the relation of naked-eye human vision to the extent of the universe, though thanks to the hundred-inch telescope I can see 140,000 times farther, as far, in effect, as 140 "feet" (*mutatis mutandis*) into the deep darkness of the universal planet.

That is the method and it can be applied with equally amusing results to cosmic "years" and "days" and "light years", and also to "astronomical units." (To the solitary planet of a hydrogen atom-as-star the astronomical unit is one billion miles; to the terrestrial hydrogen electron, $1/500$ millionth of an inch; to the universal planet, 5 times 10 raised to the 18th power light years.) Only by some such method can science speak in the *lingua franca* of creation.

It would be easy to make the mistake of proposing order as a fifth dimension added to relativity's familiar four. The truth is that order is not the fifth but the first dimension, not only in absolutivity but in relativity no less. In relativity as in absolutivity there are only two

real dimensions, order and extension. Length, breadth, thickness, and time are not real dimensions but rather tokens of the human failure to see things whole, pragmatic fragments of the real dimension of extension. It is not a shameful failure but inevitable, for man has had no direct experience of reality in his environment. The only absolute things in the universe (magnetic energy and the indivisible least proton) show to the mortal eye aspects wholly misleading, so it is no wonder that impatient professional seekers have from time to time found solace in the narcotic of absurdity; no absurdity they can think up can be more absurd than the universe seems to be. But it might do a man good once in a while to rest and contemplate not his umbilicus but the profound objective truth that of all known things in man's universe nothing is so far removed from reality as man.

This Thing Called Life

I have shown myself how the hydrogen atom is a secondary structure superimposed on the primary ideal crystal lattice structure of the proton process. I have noted how the hydrogen atom evolves on two wavering and occasionally intercrossing lines to fabricate out of itself, first, complex atoms and, secondly, molecules; and how these very various forms (as also the unnumbered intricate chemical combinations and physical agglomerations stemming from them) constitute the progressively involved superstructures rising higher upon lower to produce the life cell and at last the human gene and chromosome.

To the extent that the human organism is perhaps the most complicated adventure in the epic of the atom, or more precisely in the admirable achievement of proton operating through the atomic process to compose the supreme symphony of creation out of the absolutely dense, inflexible substance of itself, man, to this extent, is the farthest removed of all things from reality. So far distant now is the sophisticated human mind from the absolute simplicity of proton that he has but one chance of finding his way back, and that is the chance of going forward and completing the circle which begins and ends with preatomic energy-proton. This journey the imagination of mankind must make before it can find peace.

How much farther away from reality can man travel biologically? I have observed how the hydrogen atom went so far and could go no farther in the evolution of complex atoms, how the beginning of radioactivity in polonium gives fair warning of the end of that road in uranium. It is on the other, the molecular, road that man finds himself, and how near to the end of it, I cannot say. But that this road too has a predictable and approximately calculable terminus, I do believe.

What is so manifestly true of life on earth must be essentially true of life on all the planets producing it. The materials are ineluctably the same (always proton responding to the uncompromising law of magnetogravity in the formation of not unpredictable combinations of itself); only the environment can be different and there are finite limits to the possibilities of this differentness.

Thus the differences between terrestrial human life and intelligent life elsewhere are differences solely of degree. Within my own environment I possess all the necessary data (if not the power to use it fully) by which to ascertain the sum of life's possibilities in creation. It should be comforting to the welfare branch of science, and indeed to all soundly loyal tellurians, to reflect that nowhere can life forms exist of a kind so far removed from human life as to be unintelligible to the human mind. Planets cannot be so dissimilar as to produce so decisive a departure from the terrestrial norm. The atom can only behave as it predictably must within a given order.

The variations of planets in size, density, mass, astronomical units, atmospheric phenomena and all other factors contributing to the production and maintenance of life are deducible from a more exact study of the electrons of the various forms of the terrestrial atom. From these data the inevitable characteristics of planetarians everywhere must follow. Undoubtedly there are giants and pigmies in the universe, wiser souls, more capable hands, vastly inferior and greatly superior civilizations; environment and time instruct the ubiquitous atom in these matters and the atom has free will no more than I.

That all life is planetary goes without saying and for so many reasons apparent in the foregoing pages that I need not mention any. Some planets manifestly cannot support life, as for one example the solitary planet of a dark, cold hydrogen star, and for another the uneasy planets of any radioactive star (the planetary nebula, as I have surmised). I know that life can persist on the

third planet from the sun-nucleus of a fluorin atom-as-star, and this is all I know of my own knowledge; I do not know that all fluorin atoms-as-stars are similarly tolerant of the life process; much must depend upon the situation of the star in space, its neighbors and their habits and influence. And the individual planet itself must have a favorable inclination of its axis with respect to its sun, and a number of things like that. All this is known. But can life, intelligent life even, exist on the surface of the third electron from the nucleus of a terrestrial fluorin atom? Again, I do not know.

The probable duration of life on earth, of earth itself, is almost purely a physicochemical problem. Here is this fluorin atom-as-star floating in a fairly rarefied section of universal space (though not necessarily so rarefied as might appear, for I know the near heavens may be aswarm with cold, dark hydrogen atoms-as-stars and I have already noted how all interstellar space is filled by the field composed of terrestrial hydrogen atoms); and here nearby are at least two neon atoms-as-stars, and a europium one, and at least one of helium; and near enough to be amusing are all these radioactive atoms-as-stars (known to academic science as the planetary nebulæ) firing helium atom nuclei-as-suns and loose planets all over the place; and I see unmistakable evidences of celestial combustion here and there; and now and then I see a new star being born of several smaller ones.

All these things I see and wonder how long an atom of pale-greenish fluorin gas can live in a place like this, how long a "time" must pass before my astral fluorin atom

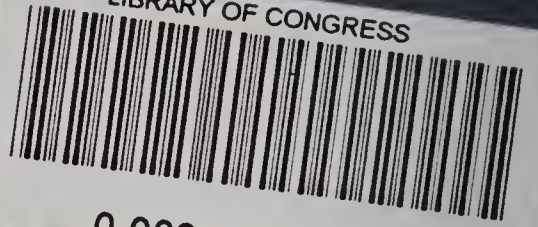
unites with the even now approaching stranger star to form some larger or smaller atom-as-star in which I can have no place, not I, nor my like, nor our common planet earth; for earth too must pass away into the indifferent solar field; though not before this present society of variegated minute atoms which now address me calling themselves *I* has dispersed its membership to travel many a far and separate individual road and to implicate their numbered selves in the beings, the joys and agonies, and the very diverse and numerous curious preoccupations of more *its* and *Is* than one creature can well imagine. But the planet, it at least will be reborn, in the decorous slow cosmic way.

Let me not measure this present earth's chances of survival by the sun's. The sun will carry on (as a smaller or larger sun) incalculable eons after earth has turned to field dust. Long before that turning, earth will feel the neardrawing of the stranger star. Earth's atmosphere, along with the rest of the solar field, will strain (gravity will see to this) toward the newcomer, will grow more rarefied; and the sun's rays will burn hotter through the thinning veil. Heart diseases will be endemic owing (thus the good doctors of that neomodern day) to the reckless fashion of weekendening in the stratosphere and the growing popularity of flights to Mars.

How long? And more precisely how? I must ask the journeyman chemist about that.

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