SPACE AND THE WORLD IN SPACE.

THE postulate of the unknowable essence of things, the *Ding-an-sich,* and the unsolvability of certain cosmic riddles, the so-called antinomies, are older than Kant, and have since his day in certain quarters almost reached the value of a rock-ribbed dogma. In the words of a late exponent, Prof. Paul Natorp, the thing-in-itself is the x of an equation, the solution of which may again and again be attempted but never, fortunately, with any chance of complete success. That would be making an end of the eternal search for truth, which is one of the main blessings of humanity. *Being* is never given in its essence; it is continually being created by thought, as scientific research founded on experience advances from standpoint to standpoint. The road, the method of research, is consequently everything, the goal nothing.

While this position, possibly, on the whole is unassailable, there are generally included among the number of those riddles certain problems that to my mind really offer no great difficulty to human thought, and consequently should not henceforth be permitted to assist in discrediting our reasoning faculty, thereby furnishing consolation to the intuitionist, the mystic, and the advocate of religious superstition.

Among these I am inclined to include the problem of free will and determinism, that of time, and in part that of space.

The time has passed when theological attempts to defend the scientific accuracy of certain poetic creation myths is treated by the well-informed with anything but an impatient shrugging of the shoulders. So-called higher criticism and the comparative study of religions have attained that much. But there is really no more reason why otherwise brainy and fearless men should in our day defend the theological dogma of free will or the so-called idealistic or subjective conception of space. And yet this is, if I am not mistaken, continually being done at the great majority of universities and colleges which include philosophy among their studies.

The problem of free will has, I think, now been solved in a fairly satisfactory way by unbiased thinkers. I need only mention the excellent treatise of Prof. A. Riehl in his *Principles of Critical Philosophy.* We may say that man is free to the extent that he is able to accept distant motives for his actions instead of the immediate ones which generally determine the behavior of the brutes. And the aim of education is to furnish or elucidate those motives on the background of the highest good for the single individual, for the race, and for all humanity.

But this does not prevent every action of any importance from being rigorously determined by the external motives and by the character of the individual as formed and developed by his ancestry, his surroundings, and his own efforts. The quite unmotivated action is, according to Riehl, only found in insane asylums. Yet even the thoughts and talk of the insane are not any longer regarded as produced by evil spirits, but as the logical consequences of defects and disturbances in their own system.

One of the latest attempts to save the venerable specter of indeterminism is that of Henri Bergson, who has taken the trouble to invent a new theory of time for that purpose. He speaks of "concrete time, the time which we feel to be

the very stuff of our life," and in another place: "As regards the psychical life unfolding beneath the symbols which conceal it, we readily perceive that time is just the stuff it is made of....There is moreover no stuff more resistant nor more substantial." But even he admits that "any positive definition of freedom will insure the victory of determinism."

But the attempt to make time a substantial stuff that can act and influence physical or psychical processes, is of course utterly futile and hardly worthy of serious consideration. It is almost incredible that the personification of time in every-day speech, and by the Greeks as Kronos devouring his own children, should deceive anybody in a critical age like ours. Time is, to speak with the late Dr. Paul Carus (*Fundamental Problems*, 3d edition, Chicago, 1903, p. 287), "not a thing....it is nothing but a measure of the changes taking place around us. We employ as measures such changes as appear most regular, such as days and years. But there is no time apart from changes. Since we can imagine that some changes will always take place, and, even if they did not take place, since we could measure the time of a supposed rest by some certain measure (days, years, millenniums, billenniums), we say that time is infinite."

Things endure and change and move; but the change and the movement is, it is safe to say, not caused by a mystical entity time, but by the inherent forces of things, or if one so prefers by a Divinity. To quote Professor Riehl: "The idea of time is a concept; it does not belong to the phenomenal appearance of things....it is no intuition."

Our last problem, space, almost constantly treated on a par with time, to the great confusion of thought, is, however, not so easily disposed of. Otherwise there would

be no justification whatever for the subjective conception, which still crops up in the most unexpected places.

The idea of space is due to, and dependent on, touch and vision, and *extension* is at least a phenomenon, an intuition. That much is, I take it, generally conceded even by philosophers of the subjective schools. But their contention is that occupancy of space or the quality of extension is not a characteristic of the *Ding-an-sich,* of the reality underlying the phenomena. I suppose the standpoint is well expressed by Lotze in his *Metaphysics* (Oxford, 1884, p. 259): "There is no such thing as space in which things are supposed to take their places. The case is rather that in spiritual beings there is formed the idea of an extension in which they themselves seem to have their lot and in which they spatially present to themselves their non-spatial relations to each other." And more recently (*The Monist*, July, 1918) Prof. W. B. Smith hazards the statement that "all forms of seeing, hearing, touching, etc..... are modes of constructing or forming space-and-time symbols that are not in space and time....the real is what we all construct alike." And, consequently, he easily gains his point, that a soul is not in a body, since the body is merely a construct of that very soul.

For people endowed with a moderately vivid sense of the reality with which alone we get acquainted on this little globe; for the weary traveler who carefully keeps tab of the miles he covers, be it by rail, by auto, or on foot; for the builder who cautiously calculates his strains and stresses; and for the astronomer who measures the distances of stars in light-years, such talk can certainly not sound very convincing. They may be ready to admit the relativeness of extension and distance, as estimated by various living beings, they may take more or less stock in the modern theories of physics, which are trying to reduce the atoms to electrical energy, but they are likely to treat with

scorn the notion that the smallest units of the sense-world in their interplay should lack some kind of extension, or that the very movement itself should be a pure fiction of our imagination.

It is safe to say that the idealistic denial of the reality of extension has its main foundation in a false psychology, or in false conclusions drawn from certain psychological theories, in addition to certain unwarranted conceptions of a Divinity. To the many strange qualities of the Supreme Being, infinity was curiously enough added at an early date, in spite of the fact that it was at the same time conceived as unextended invisible spirit and even as a distinct personality. For scholastic philosophy, only God is actually infinite. Space is divided into *actual* and *possible* space, the former corresponding to the entire created material world, including the hypothetical ether. Before creation there was nothing there and no "there," for God, being a spirit, does not himself exist in space or constitute space by his being. There was merely the *possibility* that God might create extended material body and thereby so much actual space—a mental conception, an *ens ideale*. Real space is then finite, but we may say that possibilities are infinite, and so also potential space. Space is, in other words, on a par with the numerical series. (Cf. B. C. A. Windle's *The Church and Science*, p. 65.)

Scholastic philosophy is, then, dualistic and does not rob creation of a certain reality or of actual extension. But it was reserved for another theologian, under the pressure of aggressive materialistic thinking, to deny this reality and the distinction so lucidly and convincingly established by Locke, between primary and secondary qualities of so-called matter. "For my part," says Berkeley, "I see evidently that it is not in my power to frame an idea of a body extended and moved, but I must withal give it some color or other sensible quality which is acknowledged to

exist only in the mind. In short, extension, figure and motion abstracted from all other qualities, are inconceivable. Where, therefore, other sensible qualities are, there must these be also, to wit, in the mind and nowhere else."

It looks at the first glance as if the venerable bishop had truly destroyed the entire external world at one fell swoop; but on a closer inspection this is not exactly the case. Pressed on this point, he soon distinguished between our fleeting ideas and dreams and the more permanent ideas of a Divinity, the latter alone representing the visible world, so that the new theory really amounted to a denial of the then scientific conception of a material, extended, moving entity which appears to human beings in the garb of sounds and colors. In other words, as recently pointed out by Prof. Fr. Woodbridge, his starting-point was that of naive realism. The world as we observe it is all there is to it. But it is merely God's idea, it has no independent validity. There is no permanent or even transient stuff or energy constituting it, but it is continually being created by being the perception of Divinity. Its *esse* is its *percipi* and nothing else.

And this strange theory, which at bottom amounts to a terrible arraignment of the wisdom, goodness, and power of Divinity, was offered without a shadow of proof. The good bishop could not clearly imagine the state of affairs described by science, and it seemed to lead to some rather dangerous free thinking. Therefore a peremptory denial was called for and might succeed in stemming the tide. And it stemmed the tide so well among theologizing philosophers, that even to-day one time and again will meet with the statement that Berkeley once and for all proved the subjective quality of the primary characters of matter. Seeing what he really did and noticing how well he succeeded in making a bold assertion look like philosophic proof, one cannot much blame Herbert Spencer for losing

his usually polite manners, speaking of the insanities of idealism.

"Matter being once expelled drags with it so many skeptical and impious notions," wrote Berkeley. "But really," says Prof. Riehl, "it drags with it so much else of which the pious philosopher cannot have taken earnest thought....Our knowledge is indeed relative, but only so far as concerns the character of its objects. It is not relative with reference to their existence."

But even this so-called Kantian standpoint is open to grave criticism. When Kant made space and time *a priori* or necessary forms of thought, he practically reduced even extension to a phenomenon, which in itself might be entirely different from what it appears to be. While energetically denying Berkeley's contention that there is no independent reality underlying the world of appearance, he uncritically accepted the theory of the subjectivity of the character of the extension of things. The new view was supposed to come to the aid of science as against the attacks of Hume and empirical skepticism, but its immediate effect was to furnish a loophole for the possibility that the underlying basis of the visible world may lack even extension, being entirely unknowable; and so the chief gainer was after all Berkeley's idealism.

But extended things and their motion, implying empty or comparatively empty space in which they move, with real distances that make a difference, are after all too persistent to be easily brushed aside by hairspun theories, and common sense seems for once to have hit the nail on the head. Extension as we perceive it is, to be sure, a very relative affair, but it is such a necessary form of thought just because it is derived from reality, from the extended things around us by a wonderful process of evolution in living beings. The burden of proof for its non-existence, for its pure subjectivity, must necessarily rest with the ideal-

istic philosophers, who undertake to deny a palpable fact of every-day observation. But their finespun, more or less ingenious phrases are given the lie at the first move they make at their own writing-table. And serious minds should be spared the necessity of committing the greatest folly next to denying an evident truth, which according to Hume is to take much trouble to defend it.

Yet space itself gives rise to real problems and the interminable discussions seem to center around the following four: (1) Is it a reality or merely an idea, or a necessary form of thought? (2) If a reality, is it finite or infinite? (3) Does it anywhere exist as a vacuum, or is it everywhere or in part filled with a semimaterial stuff called the ether, or again is it semimaterial in its own right and uniform throughout? (4) Is it relative or absolute?

As much of the haziness which generally pervades the treatment of our subject seems to be produced by a careless confusion of space and extension, a special attempt will be made to set these two concepts apart in the following definition: Extension is our name for an attribute or characteristic of existing things, for the fact that they appear to be, and no doubt are, spread out in three dimensions. It is in so far an abstraction like form, beauty, goodness, etc., and like these may be said to lack independent reality.

Things of the same kind have necessarily different locations. If they are not contiguous we say that there is distance between them, and by distance we mean the extension of real or imaginary lines stretched out between them. Distance is in so far a term used to designate a relation between material objects. Yet the expanse (empty or filled with an invisible stuff) which makes up a distance, does not disappear when the bodies move away, and in the absence of even the hypothetical ether, we may speak of pure extension or better, with Locke, pure expansion.

We say that objects occupy space or are in space. *Empty or pure space is then, if it exists anywhere, the vacuum, the sheer emptiness, the pure expansion, the non-being, the nothing (= no-thing) which is left when existing active things are withdrawn, and which offers no obstruction to new extended bodies, but stands everywhere ready to receive something.*

This emptiness, this vacuum, can strictly speaking not be said to *have* extension. Only real objects *have* extension. It *is* pure expansion or identical with expansion. We can in imagination think of empty space as made up of larger or smaller pure expansions, and a certain expansion will give room only to things that have a definite outspread of such and such cubic content. Otherwise the science of astronomy would be pure fiction.

It is then probably futile to speak of pure space as really divisible, infinitely or otherwise. Sheer emptiness does not lend itself to real division. Only material, or possible semimaterial things like the ether, can properly speaking be divided, but not infinitely. There is the *minimum perceptibile* of common sense, and science stops at present at the electron, which one cannot help connecting with some extension, however infinitesimal. And when mathematicians speak of pure space as made up of extensionless points, they can only mean that it is a continuum and no compound (cf. Sellars, Riehl, Boodin, and others).[1]

Space is necessarily infinite and in this respect different from existing things and even from time and the numerical series which are only potentially infinite. This is a legitimate conclusion from the logical reasoning, that we cannot possibly imagine any bounds to it, which would not in their turn be either extended things filling space, or

[1] Professor Spaulding and other New Realists seem to make an entirely unwarranted use of the mathematical theory of space. It is probably safe to say that real expansion cannot be made up of quite unextended points. The analogies adduced, for instance, from single men and a crowd are clearly not to the point.

things with empty space beyond. We cannot help thinking a beyond to every supposed limit. *There cannot, in other words, anywhere be less than the nothingness which is empty space.*

The identification of space with nothing in the sense of "no existing thing," the non-being of old Democritos, calls for a few remarks. The idealist Professor Bowne (*Metaphysics,* 1st ed.) says: "It is held that space is not a nothing but a peculiar kind of existence, which can be described only in terms of itself....The common-sense view is that there is something and its opposite nothing, but, then, there is a third conception space, which cannot be defined in the terms of the other two....But the attempt to make space real and yet distinct both from things and from nothing is a failure. Either we must make it a pure nothing in reality, or we must make it a thing in interaction with itself and with other things. Both of these views are untenable, and the former is absurd." The trouble is, however, really religious, as we learn on p. 185: "The view that space is uncreated is contradicted by the necessary unity of the basal reality." But the dualist Prof. G. S. Fullerton, in his *System of Metaphysics,* arrives at a different conclusion: "Empty space," he says (p. 225), "is not synonymous with 'nothing at all,' it is empty space, and is quite distinguishable from empty time. The conception 'thing'....and the conception 'nothing at all' do not exhaust the possibilities between them....By distance between two things we do not mean a third thing, but neither do we mean nothing at all."

It can hardly be too strongly emphasized that space itself, although a reality, cannot be an active entity or thing. It is true that distance makes a difference to the active forces of the world, to human intercourse no less than to the gravitational pull of solar systems, but this difference cannot be caused by pure space itself as an

agent. The gravitational pull loses part of its force as it spreads out, and space is a condition of the spreading, but it is not its cause. If gravitation cannot be explained by the inherent qualities of material things, then we must take our resort to some kind of an invisible medium, which fills the intervening space. It seems nonsense to make empty space an agent.

Neither is it strictly speaking a form or plan, as held by Fullerton. Form or plan is a property of matter, it is not furnished to matter by space. It is furnished by a being who shapes that form or that plan (the moulder, architect, etc.) or, as in nature, by the particular character of matter itself. But if there is no possibility in the real universe for extension, for things to spread out and move, if all there is be unextended spirit, there can, of course, be no real plan drawn. In so far it must be permissible to say that space is a *condition* or *possibility* of the plan or form of things. When matter is withdrawn there is no form left, only pure expansion and emptiness, or else space filled with the formless and semimaterial ether.

If human reason counts for anything, pure space could not be annihilated except by making the world, the something, infinite and continuous, so that the vacuum and pure expansion became a mere idea. It is inconceivable that empty space would be destroyed by the annihilation of existing things, including the ether. We cannot hold on to the idea that it would collapse like an empty balloon or shrivel to a point, thus putting an insurmountable obstacle in the way of the creation of a new world. Pure emptiness or non-being would seem to be surely indestructible as well as uncreated.

It is claimed that non-Euclidean geometry may make it possible that space may be finite without having definite limits, in that it, in a mysterious way, so to speak, bites in its own tail, since straight lines may not belong to the

system of the universe. I confess inability to grasp this idea as applied to real space. It seems to be founded on the mathematical conception of space as built up of points and lines. Only the lines instead of being straight are supposed to be ultimately curved. This is a legitimate hypothesis for mathematical constructions, but when it is applied to three-dimensional space, our reasoning faculty balks. The trouble is that space, if treated as a slightly curved plane, would already in addition to unbounded length and width possess infinite thickness. It would, we feel constrained to believe, extend without any boundary to stop it in every direction outside of any curved plane of any but infinite thickness. You cannot make a finite globe of infinite space.

With realistic philosophers of every shade it is safe to deny that space is merely the form furnished by mind to the objective world. We regard objects as extended, because they really are extended. But I also deny that actual space is a mere abstract idea or that it is identical with the extension of things. This amounts to a denial of the possibility of empty space beyond the existing world of things, and few thinkers and scientists of note have taken this stand. The majority admits the possibility of motion infinitely in every direction, or they speak with Fullerton and the scholastics of theoretically possible space-relations of real things, or of "the possibility that quantities may be determined with reference to space" (Riehl).

But one cannot help feeling that this is a makeshift which evades the real issue, and such statements fail to illustrate the different character of space from time and from the numerical series. If space actually exists as emptiness outside of the world of things, including the ether, then it is not merely potentially infinite. It is actually infinite at any and all times, and in that respect quite distinct from duration and from the numerical series. The

distinction between reality and possibility in this connection clearly means swallowing the old scholastic subterfuge dictated by the theological necessity of denying the actual infinity of anything but Divinity.

Pure space is not properly speaking a phenomenon. It is the absence of sense-things, or phenomena. It is an inference drawn from our sight and touch experience, but it has never been seen by a human eye or touched by a human hand. There is no appearance whatever, only gaps between appearances; but our experience of the invisible air must make us cautious in denying that space may yet be filled with a semimaterial stuff. The fact that it seems empty does not warrant the conclusion that it is a pure vacuum or non-being. But if such a vacuum exists, its infinity offers no antinomy to reason, even if it cannot, of course, be clearly imagined.

The real problem connected with pure space arises from its unique quality of a nothingness that evidently has a constant and measurable expansion, as contended by astronomers and mathematicians. This problem is hardly solved by following in the wake of certain modern physicists, who, in desperation over the difficulties connected with the hypothetical ether, have proposed to make space itself semimaterial. I need only mention Aloys Müller in his *Das Problem des absoluten Raumes*.

If space itself is semimaterial, possessing qualities which account for gravitation and for the propagation of light, then this state of things would be equivalent to an infinite space, everywhere filled with on the whole immovable ether. The difference would be merely one of terminology. This semimaterial space would have to possess the faculty of partial movement or vibration. But our reason balks at the idea of such a space, which runs up against the definition given by an authority like New-

ton.[2] From the standpoint of logical thought it would seem much more reasonable to dispense entirely with a medium for gravitation and the propagation of light, making the former a force inherent in the material bodies, which can act through vacuum, and the light a corpuscular entity propagated through empty space. If I am not mistaken, both possibilities have really come to the front again recently among physicists. This is, however, a matter that must be decided by them, and the venerable ether hypothesis seems still able to line up such a formidable following that the philosophers seem justified in holding on to it for the time being.

But if this ether exists, must it therefore necessarily be infinite? Might it not share with material things the fate of being potentially measurable and finite?

Scientific men of high repute, like Büchner, Haeckel, and Arrhenius, have held the theory that the material universe, including the ether, must be infinite in extension and fill space everywhere, and some of them have given what they considered conclusive arguments for this belief. Thus Büchner contends that the material world, if it had limits. would rush together in one solid lump on account of the force of gravitation. Professor Arrhenius, on the other hand, in his *Worlds in the Making*, holds that the matter of an originally finite world in the course of infinite time would have been radiated and expelled into infinite space, leaving no stars and planets. These are the only important arguments that I have seen advanced by physicists. But since they are contradictory, might it not be that they both taken together explain the situation? What prevents the radiation into space is exactly this fact of gravitation, as suggested by Prof. R. W. Sellars and others, and gravitation is counterbalanced in its turn by the radiating and

[2] "Absolute space in its own nature, without relation to anything external remains always similar and immovable."

expansive forces in nature, even if that nature is limited. Any piece of matter is now generally supposed to have empty spaces inside of it, even at the core of a globe, and there is no more reason for doubting that there are forces active to keep the suns and planets apart, even if there is an end to their number and distribution in space.

As regards the argument of Professor Arrhenius, it would clearly fall to the ground if we could make it plausible that even the ether is an existing quantity, i. e., not infinite. For in that case there could be no radiation beyond the ether ocean, on the present theory of light.

The difficulty connected with the idea of an infinite material world or even an endless ether ocean is, as held by some of the acutest philosophers, that existing things must necessarily be of a definite number or quantity. According to Dühring, "everything posited as actually given in terms of number can only exist in a definite quantity." According to Riehl, "the sense-world has spatial greatness (i. e., is finite as to mass) though perhaps no definite limits in space.... The world never had a beginning. It has no limits in time." Prof. J. S. Mackenzie (*Elements of Constructive Philosophy,* pp. 208, 412) says: "Apart from any metaphysical theories, there appear to be physical grounds for regarding the material universe as a limited system," while "intensity and extension are infinite orders," and "side-by-sideness regarded simply as an external order seems clearly to be infinite."

On the other hand, Kant, according to Fr. Paulsen, really seems to have believed that matter is the movable which fills all space, there being no such thing as empty space. This would agree with his well-known proof of the antithesis of the first antinomy: "The world has no beginning and no limits in space." Assuming the opposite: "In that case the world would exist in an empty space without limits. We should therefore have not only a rela-

tion of things *in space* but also of things to space. As, however, the world is an absolute whole outside of which no object of intuition and therefore no correlate of the world can be found, the relation of the world to empty space would be a relation of no object. Such a relation, and the limitation of the world by empty space is nothing, and therefore the world is not limited with regard to space, that is, it is infinite."

The only excuse for this shallow reasoning seems to be the old Aristotelian idea of space "as the immovable limit of whatever is moved," a remnant of the naive conception of space as a vessel that contains the world inside of a firmament. Kant realized the weakness of this theory and saw that empty space cannot set any limits. But his fallacy was the conclusion, that this implied a world of appearance as endless as space itself, and a relation of the world to nothing. For what prevents us from saying that the extended world sets its own limits? And the relation of matter to apparently empty space is one of the most familiar experiences of our daily life. A logical quibble can generally be overcome by a simple verbal substitution.

The question is still before us, whether the invisible ether may not fill all space. But as far as logic and conceptual thought is concerned, the idea of a world of planets and suns and stars and an ether ocean that are limited in number and quantity, would seem to be much better founded than the opposite assumption. I cannot, on the other hand, with Riehl speak thus lightly of Kant's proof for a limited world: "An infinite aggregate of real things cannot be regarded as a given whole, nor therefore as given at the same time." This reasoning follows the proper definition of a "whole," and it is in line with that of the above philosophers.

If we scrutinize this idea closely and succeed in keeping our mental poise in front of the mystic and mysterious in-

finite, it seems self-evident that what exists at a given instant as a material or semimaterial entity, cannot be infinite as to number and quantity, not to mention the contradiction of an infinite "whole." The changing number of planets and stars and nebula cannot exceed any figure that might be written down on paper, for it is the nature of figures to be potentially greater than anything which is, so to speak, lifted out of the ocean of non-being. The astronomers guess at from fifty to several hundred millions of stars and a universe so vast that it would take light, which speeds along at the rate of ca. 186,000 miles per second, all the way from 3000 to 30,000 years to traverse the expanse. But even if the number of dead stars and planets should, as some of them guess, exceed the above figure, this would not even be a fraction of infinity.

And when certain philosophers have tried to make an exception for the ether on the ground that it may not be a compound of single parts, I should think this assumption can be proved to be unwarranted.

The ether must, if it is of any use for science and the world, be a very real thing that can act and be acted upon. It must be an existing something, and it is unthinkable that it should not exist in a given quantity at any given time. But the same reasoning does not apply to the non-being, the vacuum which is pure space.

An infinite object can, of course, not be pictured by the inner eye, and our imagination persistently clings to the concave firmament above us as the prototype of a real space boundary somewhere. But if we succeed in holding on to the idea that there can absolutely nowhere be less than the vacuum which is empty space, and that the existing universe, or universes, including the ether, necessarily must be finite, the difficulty assumes a less formidable aspect.[8]

[8] Since this was first written, I was gratified to read in *Astronomy of*

We see the sidereal universe strung out in its immensity, not as lamps in a fixed, concave firmament, but as tremendous balloons moving along in and with the vast ether ocean, which may stretch out for billions of miles in every direction outside of the system of stars. This ocean is to the world of stars and planets what the atmosphere is to the earth, and we have no difficulty in imagining the entire system in a majestic procession from eternity to eternity, since there is absolutely nothing to retard its course.

To use a personification, the infinite vacuum which is empty space willingly opens its doors to welcome it, and patiently remains in its solitude, when the tremendous procession has finally passed with all its noise and bustle, its joys and its sorrows, its struggling heapful of truths and its mountains of misconceptions and ignorance, a wonderful world of mysteries, bravely accepting the fact of its own existence and ceaselessly striving to solve its own riddle.

The universe may not proceed in a straight course.[4] Considerations connected with non-Euclidean geometry make it conceivable that we have to do with an irregular eliptic orbit, partly caused by the internal arrangement of the "wheels," the rotating stars and planets. But the important fact is that it moves on in its entirety, for this general, absolute movement is bound to have some significance for the self-created movement of its greater and smaller parts, the march of the suns as well as the play of the electrons, the very condition of its existence as a visible, active world.

To-day, by Dr. C. G. Dolmage, that the idea of a finite ether ocean, enclosing a rounded finite universe like an atmosphere, was suggested by Mr. G. E. Gore already in 1888.

[4] I understand that certain astronomers speak of two star streams that seem to proceed in somewhat different directions. But this may only mean that a smaller universe has mingled with the main current so that the general direction of the whole will in the course of time again be one. Or might it not be that the entire universe is slowly revolving around an axis, as it moves forward?

The much-disputed question of the relativity or absoluteness of space would on this theory have found its solution. Absolute space is, according to Aloys Müller, a space which permits absolute movement, and our moving sidereal universe would be just such an absolutely moving body. This does, of course, not do away with all kinds of relative movements inside of the sidereal system, the only movements furthermore which can be measured by human beings.

It is frequently contended that only science can settle the question of the extent of the universe, and that it is not yet capable of venturing an answer. That may be so. Yet human reason counts for something, and it seems unhesitatingly to demand a finite world or worlds. The probability or non-probability of more than one sidereal universe can hardly be vouched for by either. Such worlds would have absolutely no means of communication if the propagation of light requires a medium and if this medium, as here contended, does not pervade space everywhere.

It can hardly be argued that through infinite time, whatever existing things there are, must have had a chance to collide or somehow get together into one system or cosmos. For the pure expansion, the non-being which is empty space, is also posited as infinite.

But those who are more apt to ponder the misery, the meanness, the ugliness, the disharmony and falsehood, than the happiness, the goodness, the beauty, the harmony and truth, which our one sidereal universe contains, and probably will go on containing during its eternal partial evolution and dissolution, from nebula to stars and planets and back again to nebula, may find some reason for pinning their faith in a new article of religious belief: that the universe is after all only a single limited cosmos, and that frail, disharmonious, suffering beings like ourselves may not be found on very many of its numerous planets.

The primitive conception of the world was naturally too narrow in every race and tribe. Our little earth was considered the center and fixed base of everything there is, and human beings counted for something in the make-up of the universe. Recent speculations have generally gone to the opposite extreme, making old Tellus only an insignificant speck in an infinite abyss of stars and habitable planets.

While the idea of an infinite creation ought to be foreign and even repugnant to a theistic mind, those of a pantheistic tendency have perhaps justly feared that the awe and mystery so necessary to religious feeling, would suffer a serious loss if one had to conceive the universe, the outward expression of Divinity, as a finite thing.

But for the fearless and sober investigators of the world riddle, for those who are continually striving to get ever nearer to the unknown x of the world equation, it is, I should think, of some importance to get rid of the hazy and mystic verbiage connected with the discussions of the infinite, in order to be able to concentrate attention on immediate and more fruitful problems. And our one sidereal universe is surely wonderful enough and big enough to keep poor groping humanity busy for ages and ages to come.

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