The greater part of the head gave a bright continuous spectrum, obliterating the usual cometary bands, but one portion showed three bands, in the green, blue, and violet respectively. Measures of the principal band in the green show that it coincides with the band in the first spectrum of carbon (blue base of flame) at 5165, and not with that of the second spectrum (vacuum-tube) at 5198. The bands in the blue and violet appear to correspond, as nearly as could be estimated, with bands in the first spectrum of carbon. These observations were made with the half-prism spectroscope mounted on the 12¾-inch equatorial, a dispersive power of about 18½° from A to H being used, with a magnifying power of 14 on the view-telescope, as in the measures of star-motions in the line of sight. No decided polarisation was detected either in the head or the tail. Cloudy weather has prevented any observation of the comet since June 25.

THE UNITY OF NATURE.

By the Duke of Argyll.

IX.

THE ORIGIN OF RELIGION CONSIDERED IN THE LIGHT OF THE UNITY OF NATURE.

(Continued.)

These conceptions seems to have taken their form from the very violence of the revulsion which they indicate and explain. The peculiar tenet of Buddhism, which is or has been interpreted to be a denial of any Divine Being or of personal or individual immortality, seems the strangest of all doctrines on which to recommend a life of virtue, of self-denial, and of religious contemplation. But the explanation is apparently to be found in the extreme and ridiculous developments which the doctrines of Divine Personality and of individual immortality had taken under the Brahminical system. These developments do indeed seem almost incredible, if we did not know from many other examples the incalculable wanderings of the human imagination in the domain of religious thought. The doctrine of the transmigration of souls at death into the bodies of beasts was a doctrine pushed to such extravagances of conception, and yet believed in with such intense conviction that pious Brahmins did not dare even to breathe the open air lest by accident they should destroy some invisible animalculæ in which was embodied the spirits of their ancestors. Such a notion of immortality might well oppress and afflict the spirit with a sense of intolerable fatigue. Nor is it difficult to understand how that desire of complete attainment, which is, after all, the real hope of immortality, should have been driven to look for it rather in reabsorption into some one universal Essence, and so to reach at last some final rest. Freedom from the burden of the flesh, rendered doubly burdensome by the repeated cycles of animal existence which lay before the Brahmin, was the end most naturally desired. For, indeed, complete annihilation might well be the highest aspiration of souls who had before them such conceptions of personal immortality and its gifts. A similar explanation is probably the true one of the denial of any God. A prejudice had arisen against the very idea of a Divine Being from the concomitant ideas which had become associated with personality. The original Buddhist denial of a God was probably in its heart of hearts merely a denial of the grotesque limitations which had been associated with the popular conceptions of Him. It was a devout and religious aspect of that most unphilosophical negation which in our own days had been called the "Unconditioned." In short, it was only a metaphysical, and not an irreligious, Atheism. But although this was probably the real meaning of the Buddhistic Atheism in the mind of its original teachers, and although this meaning has reappeared and has found intelligent expression among many of its subsequent expounders, it was in itself one of those fruitful germs of error which are fatal in any system of Religion. The negation of any Divine Being or Agency, at least under any aspect or condition conceivable by Man, makes a vacuum which nothing else can fill. Or rather, it may be said to make a vacuum which every conceivable imagination rushes in to occupy. Accordingly, Buddha himself seems to have taken the place of a Divine Being in the worship of his followers. His was a real personality—his was the ideal life. All history proves that no abstract system of doctrine, no mere rule of life, no dreamy aspiration however high, can serve as an object of worship for any length of time. But a great and a good man can always be deified. And so it has been with Buddha. Still, this deification was, as it were, an usurpation. The worship of himself was no part of the Religion he taught, and the vacuum which he had created in speculative belief was one which his own image, even with all the swellings of tradition, was inadequate to fill. And so Buddhism appears to have run its course through every stage of mystic madness, of gross idolatry, and of true fetish-worship, until, in India at least, it seems likely to be reabsorbed in the Brahminism from which it originally sprang.

And so we are carried back to the origin of that great Religion, Brahminism, which already in the sixth or seventh century before the Christian era had become so degraded as to give rise to the revolt of Buddha. The course of its development can be traced in an elaborate literature which may extend over a period of about 2000 years. That development is beyond all question one of the greatest interest in the history of Religion, because it concerns a region and a race which have high traditional claims to be identified with one of the most ancient homes, and one of the most ancient families of man. And surely it is a most striking result of modern inquiry that in this, one of the oldest literatures of the world, we find that the most ancient religious appellation is Heaven-Father, and that the words "Dyaus-pitar" in which this idea is expressed are the etymological origin of Jupiter Ζεύς πατήρ—the name for the supreme Deity in the mythology of the Greeks.

We must not allow any preconceived ideas to obscure the plain evidence which arises out of this simple fact. We bow to the authority of Sanskrit scholars when they tell us of it. But we shall do well to watch the philosophical explanations with which they may accompany their intimations of its import. Those who approach the subject with the assumption that the idea of a Divine Being or a Superhuman Personality must be a derivative, and cannot be a primary conception, allow all their language to be colored by the theory that vague perceptions of "The Invisible" or of "The Infinite," in rivers, or in mountains, or in sun and moon and stars, were the earliest religious conceptions of the human mind. But this theory cannot be accepted by those who remember that there is nothing in Nature so near to us as our own nature,—nothing so mysterious and yet so intelligible,—nothing so invisible, yet so suggestive of energy and of power over things that can be seen. Nothing else in Nature speaks to us so constantly or so directly. Neither the Infinite nor the Invisible contains any religious element at all, unless as conditions of a Being of whom invisibility and infinitude are attributes. There is no probability that any abstract conceptions whatever about the nature or properties of material Force can have been among the earliest conceptions of the human mind. Still less is it reasonable to suppose that such conceptions were more natural and more easy conceptions than those founded on our own personality and the personality of parents. Yet it seems as if it were in deference to this theory that Professor

Max Müller is disposed to deprecate the supposition that the "Heaven-Father" of the earliest Vedic hymns is rightly to be understood as having meant what we mean by God. Very probably indeed it may have meant something much more simple. But not the less on that account it may have meant something quite as true. I do not know, indeed, why we should set any very high estimate on the success which has attended the most learned theologians in giving anything like form or substance to our conceptions of the Godhead. Christianity solves the difficulty by presenting, as the type of all true conceptions on the subject, the image of a Divine Humanity, and the history of a perfect Life. In like manner, those methods of representing the character and attributes of the Almighty, which were employed to teach the Jewish people, were methods all founded on the same principle of a sublime Anthropomorphism. But when we come to the abstract definitions of Theology they invariably end either in self contradictions, or in words in which beauty of rhythm takes the place of intelligible meaning. Probably no body of men ever came to draw up such definitions with greater advantages than the Reformers of the English Church. They had before them the sublime imagery of the Hebrew Prophets—all the traditions of the Christian world—all the language of philosophy—all the subtleties of the Schools. Yet of the Godhead, they can only say, as a negative definition, that God is "without body, parts, or passions." But, if by "passions" we are to understand all mental affections, this definition is not only in defiance of the whole language of the Jewish Scriptures, but in defiance also of all that is conceivable of the Being who is the author of all good, the fountain of all love, who hates evil, and is angry with the wicked every day. A great master of the English tongue has given another definition in which, among other things it is affirmed that the attributes of God are "incommunicable."[4] Yet, at least, all the good attributes of all creatures must be conceived as communicated to them by their Creator, in whom all fullness dwells. I do not know, therefore, by what title we are to assume that "what we mean by God" is certainly so much nearer the truth than the simplest conceptions of a primeval age. It is at least possible that in that age there may have been intimations of the Divine Personality, and of the Divine Presence which we have not now. Moreover, there may have been developments of error in this high matter, which may well shake our confidence in the unquestionable superiority of "what we mean by God" over what may have been meant and understood by our earliest fathers in respect to the Being whom they adored. Some conceptions of the Divine Being which have been prevalent in the Christian Church, have been formed upon theological traditions so questionable that the developments of them have been among the heaviest burdens of the Faith. It is not too much to say that some of the doctrines derived from scholastic theology, and once most widely accepted in the Christian Church—such, for example, as the fate of unbaptized infants—are doctrines which present the nature and character of the Godhead in aspects as irrational as they are repulsive. One of the most remarkable schools of Christian thought which has arisen in recent times is that which has made the idea of the "Fatherhood of God" the basis of its distinctive teaching. Yet it is nothing but a reversion to the simplest of all ideas, the most rudimentary of all experiences —that which takes the functions and the authority of a father as the most natural image of the Invisible and Infinite Being to whom we owe "life and breath and all things." In the facts of Vedic literature, when we carefully separate these facts from theories about them, there is really no symptom of any time when the idea of some Living Being in the nature of God had not yet been attained. On the contrary, the earliest indications of this conception are indications of the sublimest character, and the process of evolution seems distinctly to have been a process not of an ascending but of a descending order. Thus it appears that the great appellative "Dyaus," which in the earliest Vedic literature is masculine, and stood for "The Bright or Shining One," or the Living Being whose dwelling is the Light, and in later times become a feminine, and stood for nothing but the sky.[5] It is quite evident that in the oldest times of the Aryan race, in so far as those times have left us any record, not only had the idea of a Personal God been fully conceived, but such a Being had been described, and addressed in language and under symbols which are comparable with the sublimest imagery in the Visions of Patmos. How firmly, too, and how naturally these conceptions of a God were rooted in the analogies of our own human personality, is attested by the additional fact that Paternity was the earliest Vedic idea of Creation, and Dyaus was invoked not only as the Heaven-Father, but specially as the "Dyaush pitâ ganitâ," which is the Sanskrit equivalent of the Greek Ζεὺς πατὴρ γενετήρ.

When, again, we are told by Sanskrit scholars that the earliest religious conceptions of the Aryan race, as exhibited in the Veda, were Pantheistic, and that the Gods they worshiped were "Deifications" of the Forces or Powers of Nature, we are to remember that this is an interpretation and not a fact. It is an interpretation, too, which assumes the familiarity of the human mind in the ages of its infancy with one of the most doubtful and difficult conceptions of modern science—namely, the abstract conception of Energy or Force as an inseparable attribute of Matter. The only fact, divested of all preconceptions, which these scholars have really ascertained is, that in compositions which are confessedly poetical the energies of Nature were habitually addressed as the energies of Personal or Living Beings. But this fact does not in the least involve the supposition that the energies of Nature which are thus addressed had, at some still earlier epoch, been regarded under the aspect of Material Forces, and had afterwards come to be personified, nor does it in the least involve the other supposition that, when so personified, they were really regarded as so many different beings absolutely separate and distinct from each other. Both of these suppositions may indeed be matter of argument; but neither of them can be legitimately assumed. They are, on the contrary, both of them open to the most serious, if not to insuperable objections. As regards the first of them—that the earliest human conceptions of Nature were of that most abstruse and difficult kind which consists in the idea of Material Force without any living embodiment or abode, I have already indicated the grounds on which it seems in the highest degree improbable. As regards the second supposition —viz,, that when Natural Forces came to be personified each one of them was regarded as the embodiment of a separate and distinct Divinity—this is a most unsafe interpretation of the language of poetry. The purest Monotheism has a Pantheistic side. To see all things in God is very closely related to seeing God in all things. The giving of separate names to divers manifestations of one Divine Power may pass into Polytheism by insensible degrees. But it would be a most erroneous conclusion from the use of such names at a very early stage in the history of religious development, that those who so employed them had no conception of One Supreme Being. In the Philosophy of Brahminism even, in the midst of its most extravagant Polytheistic developments, not only has this idea been preserved, but it has been taught and held as the central idea of the whole system. "There is but one Being—no second." Nothing really exists but the one Universal Spirit, called Brahmin; and whatever appears to exists independently is identical with that

[4] J. H. Newman, "Idea of a University," p. 60.

[5] Hibbert Lectures, pp. 276, 277.

Spirit.[6] This is the uncompromising creed of true Brahminism. If, then, this creed can be retained amidst the extravagant Polytheism of later Hindu corruptions, much more easily could it be retained in the early Pantheism of the Vedic hymns.

There is, however, one kind of evidence remaining, which may be said to be still within the domain of history, and that is the evidence derived from language, from the structure and etymology of words. This evidence carries us a long way further back, even to the time when language was in the course of its formation, and long before it had been reduced to writing. From this evidence as we find it in the facts reported respecting the earliest forms of Aryan speech, it seems certain that the most ancient conceptions of the energies of Nature were conceptions of personality. In that dim and far-off time, when our prehistoric ancestors were speaking in a language long anterior to the formation of the oldest Sanskrit, we are told that they called the sun the Illuminator, or the Warmer, or the Nourisher; the moon, the Measurer; the dawn, the Awakener; the thunder, the Roarer; the rain, the Rainer; the fire, the Quick-Runner.[7] We are told further that in these personifications the earliest Aryans did not imagine them as possessing the material or corporeal forms of Humanity, but only that the activities they exhibited were most easily conceived as comparable with our own. Surely this is a fact which is worth volumes of speculation. What was most easy and most natural then must have been most easy and most natural from the beginning. With such a propensity in the earliest men of whom we have any authentic record to see personal agency in everything, and with the general impression of unity and subordination under one system which is suggested by all the phenomena of Nature, it does not seem very difficult to suppose that the fundamental conception of all Religion may have been in the strictest sense primeval.

But the earliest records of Aryan worship and of Aryan speech are not the only evidences we have of the comparative sublimity of the earliest known conceptions of the Divine Nature. The Egyptian records are older still; and some of the oldest are also the most sublime. A hymn to the rising and setting sun, which is contained in the 125th chapter of the "Book of the Dead," is said by Egyptian scholars to be "the most ancient piece of poetry in the literature of the world."[8] In this Hymn the Divine Deity is described as the Maker of Heaven and of Earth, as the Self-existent One; and the elementary forces of Nature, under the curious and profound expression of the "Children of inertness," are described as His instruments in the rule and government of Nature.[9] Nor is it less remarkable that these old Egyptians seem to have grasped the idea of Law and Order as a characteristic method of the Divine Government. He who alone is truly the Living One is adored as living in the Truth, and in Justice considered as the unchanging and unchangeable Rule of Right, in the moral world, and of order in the physical causation.[10] The same grand conception has been traced in the Theology of the Vedas. The result of all this historical evidence may be given in the words M. Renouf: "It is incontestably true that the sublimer portions of the Egyptian Religion are not the comparatively late result of a process of development or elimination from the grosser. The sublimer portions are demonstrably ancient; and the last stage of the Egyptian Religion, that known to the Greek end Latin writers, was by far the grossest and most corrupt."

[6] Professor Monier Williams, "Hinduism," p. 11.

[7] Max Muller, Hibbert Lectures, 1878, p. 193.

[8] Renouf Hibbert, Lectures, 1879, p. 197.

[9] Hibbert Lectures. by Renouf, pp. 198, 199.

[10] *Idem*, 1879, pp, 119, 120.

ANCIENT PLANETARY RINGS, VOLUME, MASS AND DENSITY.

By Edgar L. Larkin.

IV.

In Astronomical literature there is engrafted a venerable doctrine giving details of the processes of evolution of the solar system, trom a mass of incandescent gas. The theory is a hundred years old. It says, all matter now in the sun and planets was once in a state of rare gas, extending beyond the orbit of Neptune. The gas was hot; it cooled, contracted, and rotated. When by condensation it had dwindled to the insignificant limits of the Neptunian orbit, its velocity of rotation was so great that a ring of gas was detached from the equator of the shrinking sphere. This ring in time formed Neptune. In like manner all the planets were formed, the residue of the primordial mass being the sun. This error has been taught to children, and so tenacious are the traditions of youth, that geometers have been known to cling to the illusion in mature years. It has but one rival—perpetual motion—and is known as the Nebular Hypothesis. If it is true it can be handled by arithmetic; if false, computation will detect the fallacy.

How shall it be attacked; and what can be learned of the primeval state of matter? Can we peer into the depths of primordial time when worlds were in development? The geologist penetrates strata, and writes the records of the earth. Can the history of Neptune be written? And can we trace the processes of its evolution? If so, the mass, volume and thence the density, of the ring whence it formed must be determined. We know its mass in terms of terrestrial matter, it was 102 sextillion tons, or 204 septillion pounds; because that is the amount of matter now in Neptune. By what possible means can its volume be learned? The problem seems incapable of solution, mathematics apparently being unable to furnish a method of grappling with the question. We have used diligence to find records showing that the volume and density of the ring have ever been calculated, and failed. But there is one way of learning the magnitude of the mass of gas whence Neptune condensed. It is based on the doctrine of the CENTRE OF GRAVITY, and it is a fact in nature which subverts the Nebular Hypothesis. We know that if the revolving sphere discarded equatorial matter to make Neptune, the planet formed in the line of its centre of gravity. There are formulæ for the determination of the distances of centres of gravity of segments from the centre of the circles whence they were cut. There are only three possible forms of rings that can be cut from the periphery of a sphere—segmental, cylindric and another, whose sections are in shape like sections cut by a perpendicular plane passing through a bi-convex lens. This geometrical figure is formed by the revolution of a segment of a circle about its chord held quiescent; and the solid generated is a circular spindle. This form we overlooked in the previous paper. The volumes of these rings are sought, the data being the distances of their centres of gravity from the centre of the sphere, which is the distance of Neptune from the sun—2,780,000,000 miles. It has been shown in these notes that the radius of the only sphere large enough to afford a segment of sufficient size to have its centre of gravity coincide with Neptune's orbit, was three (3) billion miles. The dimensions of this segmental ring cut off by passing the chord of the segment around the sphere, were: chord, 2,600,000,000; altitude, 300,000,000; and length, 17,500,000,000 miles, the length of the path of Neptune. Therefore its volume was nine (9) octillion cubic miles, and as this number of miles had to contain 204 septillion pounds, one cubic mile held .0224 pounds, or 157 grains, 45 cubic miles being required to contain one pound of gas.

"At 15.5° C, (60° F.), and 30 inches barometric pressure, 100 cubic inches of Hydrogen weigh 2.14 grains."