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THE ANNUAL GENERAL MEETING OF THE INSTITUTE

WAS HELD IN THE ROOMS OF THE GEOLOGICAL SOCIETY ON WEDNESDAY, JULY 15TH, 1908.

THE RIGHT HON. THE EARL OF HALSBURY, D.C.L., F.R.S., PRESIDENT, IN THE CHAIR,

When the following Address was delivered by MR. E. WALTER MAUNDER, F.R.A.S., of Greenwich Observatory.

THE BIBLE AND ASTRONOMY.

I MAKE no apology for the subject which I have chosen for this afternoon's Address. It comes directly under the first of the three primary objects for which your Society was founded —"to investigate fully and impartially the most important questions of philosophy and science, but more especially those which bear upon the great truths revealed in Holy Scripture." My effort this afternoon, therefore, is to ascertain whether Holy Scripture can throw any light upon that particular science in which it has been my good fortune to be a labourer, and whether, in its turn, that science can throw any light upon Holy Scripture. In brief, What has the Bible to say respecting astronomy, and what has astronomy to say respecting the Bible?

A few centuries ago no one would have hesitated as to the answer which should be given to the first of these two questions. It was then thought that the Bible had everything to tell us, not only about astronomy, but about all the other sciences. It was the universal textbook. More important still, it was the infallible textbook. Every statement made in it was not only correct colloquially, but was scientifically accurate. The true way of attaining further light upon some question of physical research was, not to make experiments and observations on the object itself, but to enquire more searchingly into the rigorous meaning of the original words used in Scripture.

This idea of the function of Holy Scripture was, it seems to me, an unreasonable one. God has endowed us with our intellectual faculties, and we know of but one way in which they can be developed and improved, namely, by their exercise. If it had been His purpose to give us in Holy Scripture direct instruction on astronomy, geology and the like, what effect could this have had but the retardation of man's intellectual growth? We know that the schoolmaster who can train his pupil to find something out for himself has done far better for him, has *educated* him better than if he had merely *told* him

twenty times as much. We need not think then, as our forefathers did, that the references in the Bible to the sun's rising and setting and to his course across the sky, ever, at any time, justified men thinking that they had in them divine authority for asserting that the sun went round the earth. Nor need we suppose that the first chapter of Genesis was meant to give us a compact little bird's eye view of the geological and biological history of our globe. It is surely more reasonable to conclude that there was in that chapter no purpose whatever of teaching us anything about the physical relationships of land and sea, of tree and plant, of bird and fish; it seems, indeed, scarcely conceivable that it should have been the divine intention so to supply the ages with a condensed manual of the physical sciences. What useful purpose could it have served; what man would have been the wiser or better for it; who could have understood it until the time when men, by their own intellectual strivings had attained sufficient knowledge of their physical surroundings to do without such a revelation at all.

What answer then have we to give to our first question, "What has the Bible to say respecting astronomy?" In a real sense it has nothing to say whatsoever. The contrary idea that it had something to say was responsible for one of the great defeats of the Church, a defeat which has left its mark to the present day, the evil influence of which is incalculable, and is present with us continually.

One of the greatest men of science that the United States of America has yet produced, Dr. J. W. Draper, brought out a book entitled the *Conflict between Religion and Science*, and the chief incident that figures in that book is the well-known case of the condemnation of Galileo. It is an old story, one that has been told many a time, but it is worth while to tell it briefly yet once again, since the true lesson of the story is very generally missed

In February, 1616, the Qualifiers or official experts of the Holy Office, reported upon two propositions extracted from Galileo's work on sunspots. The propositions were:—

1. The sun is the centre of the world, and, therefore, immovable from its place.
2. The earth is not the centre of the world, and is not immovable, but moves, and also with a diurnal motion.

The report of the Qualifiers ran as follows:—

1. The first proposition is unanimously declared to be false and absurd philosophically, and formerly heretical, inasmuch as it expressly contradicts the

doctrines of Holy Scripture in many passages, both if taken in their literal meaning, and according to the interpretation of the Holy Fathers and learned theologians.

2. The second proposition is declared unanimously to deserve the like censure (as the first) in philosophy, and, as regards its theological aspect, to be at least erroneous in faith.

Sixteen years later, Galileo brought out his most popular work, *Dialogues on the Ptolemaic and Copernican Systems*, and the appearance of this book caused him to be summoned to Rome to answer a charge of heresy. The points upon which his teachings had been formerly condemned were brought up again, and he was compelled to abjure them explicitly. It is not necessary for me to go into the melancholy history in detail; to paint again for you the sorrows and sufferings of the old philosopher, to enlarge upon the inveterateness of his enemies, or the bitterness of his humiliation. We are all at one in condemning the treatment bestowed upon him; we are all at one in declaring the verdict upon him to have been wrong.

But why was it wrong? Wherein was it wrong? It is necessary for us to look very carefully at that, as there is much misapprehension as to wherein the error lay.

It is clear to all of us that the Qualifiers were utterly wrong in seeking to uphold the doctrine of Ptolemy that the earth is the centre of the universe and is immovable. But their critics overlook that they would have been equally wrong if they had substituted for the Ptolemaic theory the theory which Galileo was promulgating. These were the only two theories then before the world, and we know to-day that both were wrong. Two propositions were under consideration—the motion of the sun and the motion of the earth.

With regard to the first, the Ptolemaic theory declared that the sun moved. And the sun does move, but not at all in the sense in which the Ptolemaist used the words. Galileo held that the sun was immovable and in the centre of the universe. This we know to be untrue, though the statement was partly justifiable in the limited knowledge that Galileo possessed.

With regard to the second proposition, namely, that the earth was immovable we know that Ptolemy was wrong and Galileo right. But here again Galileo was at fault in the demonstration which he offered, as he gave the tides as the chief proof of the diurnal rotation of the earth, and refused to admit that they were due to the action of the moon.

We see then that if the Holy Office had done as Galileo would have had them do, as the apologists of to-day for Galileo would have had them do, if they had given approval to his views and had sent them forth with the seal and approbation of the Church, it would have inevitably followed that a century later she would have been compelled to launch her thunders against Sir Isaac Newton when he showed that the tides were due to the moon, and two centuries later against Sir William Herschel when he showed that not only the earth but also the sun was in motion. The error of the Holy Office in 1616 and 1633 lay not that they had put the seal of the Church on the wrong scientific doctrine, but that they had put it on a scientific doctrine *at all.* In a word they had confused the provinces of religion and of science. They used the Holy Scriptures in order to prove the relation of one astronomical body to another. It happened by a curious coincidence that, through a twofold ignorance, one of their decisions was verbally and superficially correct. Galileo's proposition "that the sun is the centre of the world" (*i.e.*, of the universe), "and therefore immovable from its place," has been condemned not only by the Holy Office but by the progress of science since his day. That coincidence in no way palliates their fault, which lay in the fact that they were applying Holy Scripture to a purpose for which it was never intended.

Some three years ago, when Professor Silvanus Thompson was giving a corresponding address to that which I am privileged to give to-day, he gave you a brief but eloquent summary of the marvellous development which physical science has made during the last few years. A man must indeed be blind and deaf to all that is going on around him if he does not recognise how faithful that picture was. The progress that has been seen in every field of science within the last half century is amazing, and the rate of that progress seems to be accelerated every year. The twentieth century has not yet seen its eighth birthday, yet, scientifically speaking, the nineteenth century has already become antiquated. If we could conceive that in the year 1900 the Church had been prevailed upon to adopt the science of that year as its own and to put its seal upon it, as final truth, now, in the year 1908, we should have already had more than one Galilean persecution; so far as that verdict of finality had been imposed, science would have been hindered, thwarted, sterilized, and the Church herself would again have been brought into dishonour as the enemy of progress and thought.

Yet at all times, eight years ago, as to-day, there have been those, some of them leaders in science, some leaders in theology, who would have had the seal of final authority set upon the science of the day, in astronomy, geology, biology, Biblical criticism, archæology, and each and all of the other sciences, and would have had the Church make it her own as the Church in Galileo's day, had made her own the science of Ptolemy and Aristotle. There was some excuse for the Qualifiers of the Holy Office in 1616, in thinking that the Ptolemaic idea of the solar system was eternal truth. The evidence of men's senses seemed to show them that the earth is solid and immovable; the evidence of men's senses seemed to show them that the sun and stars move round the earth every twenty-four hours, and that the sun has a further motion round the earth once every year. A great and elaborate science had been built upon this basis, which enabled the movements of the planets to be correctly foretold, and this theory had lasted without challenge for thousands of years. There is no excuse for any man repeating their mistake to-day, when science is progressing, that is to say, is changing, with a rapidity that has never been witnessed in the history of the world before. It is the glory of science that it does progress; that is to say, it is the glory of science that it changes, that it is continually undergoing reconstruction, that it continually requires restatement.

Can the Holy Scriptures ever have been intended to teach us that which must always from its very nature be undergoing change? Is it not manifest that they deal with something very different; that is to say, not with science, the relation of thing to thing, but with religion, the relation of man to God. And in religion we find that which is essential and eternal. The creed, given to Israel of old, still remains true: "Hear, O Israel, the Lord our God is one Lord"; and the practical application of that creed to conduct, requires neither reconstruction nor restatement: "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind, and with all thy strength": And "Thou shalt love thy neighbour as thyself." Science deals with fact, which is temporal; religion deals with truth, which is eternal.

In a very real sense, therefore, the Bible has nothing to tell us of science, and therefore, nothing to tell us of the science of astronomy. Let us reverse the question, and ask, "What light has astronomy to throw upon the Bible?" This question we can treat from two points of view; from the point of view of the astronomy of the times when the books of Holy Scripture

were severally composed, and from that of the astronomy of the present day.

The former enquiry need not involve us in any question of the higher criticism, for though the dating of the books of the Bible, once almost universally accepted, has been so greatly disturbed within the last sixty years or so, we find in dealing with astronomy that we are relieved from the necessity of fixing the true dates of the various sacred books since we know that the science underwent very little change between the earliest and latest dates that can, upon any hypothesis, be assigned to any of them. For, on the one hand, the constellations, substantially as they are preserved to us in the poem of Aratus, were certainly designed before the time of Abraham. On the other hand the Old Testament Scriptures had been completed before the great astronomical revolution was affected which we associate with the name of Hipparchus of Bithynia. In the period of more than 2,000 years which separated the two, there was, beyond doubt, some advance: the five planets were discovered, and their movements watched with some degree of particularity; the calendar was set in order, different devices for this purpose being adopted in different countries; but broadly speaking, we may say that astronomy underwent no revolutionary development during the whole of this period, just as later there was no important change between the days of Hipparchus and those of Copernicus and Galileo. Broadly speaking we may say that the astronomy of the ages during which the Old Testament Scriptures were being written, was the astronomy of the constellations.

The constellations of Aratus and of Ptolemy themselves reveal to us their date by a simple fact. They do not cover the whole sky, but leave untouched a large space in the south, which evidently represents the invisible part of the heavens at the time and place of the origin of the constellation figures. Somewhere between N. Lat. 40° and 35°, sometime in the third millennium before our era, the astronomers of the ancient world set their hands to this great task, the task of making a primitive catalogue of the stars.

It is not only that the constellations were the chief asset of astronomy in general during the two thousand years between Abraham and the translation of the Hebrew Scriptures into Greek; they formed in all probability a principal part of the Hebrew astronomy. For we know from the constellations themselves, that they were designed before the time of Abraham. And we also know from Babylonian "boundary stones" and

inscriptions, that they were familiar at an early period in the very country from whence Abraham came out.

This inference gives, to an astronomer, a special interest to not a few Scripture passages. We know that Abraham and Moses, David and Amos, must have looked upwards to the same shining eyes as those that look down upon us, and it seems to bring those ancient worthies nearer to us, if we realise that those stars were associated to them with the same imagined frescoes as they are to us. To them, as to us, Ophiuchus strangled the Snake and trampled on the Scorpion; the Kneeler crushed the Dragon's head; the Virgin held the Ear of Corn; and the giant Orion attacked the Bull.

We find evidence of the acquaintance of the Hebrews with the ancient constellations in Joseph's dream, wherein the "eleven stars" evidently signify eleven out of the zodiacal twelve; the twelfth, traditionally Taurus the leader, representing Joseph himself. We learn from St. Stephen that the worship of the golden calf in the wilderness, was "star-worship"; the Israelites choosing the form of a calf, presumably because it was the form of Taurus:—

"The white bull with golden horns that opens the year,"

to quote Virgil. It was the stellar bull, the leader of the host of heaven, that they were worshipping as Him Who had led them out of the land of Egypt.

There is a definite and direct reference to one of the constellation forms in the twenty-sixth chapter of the book of Job. There Job says of God that:—

"By His spirit He hath garnished the heavens.
His hand has formed the crooked serpent."

Here the parallelism of Hebrew poetry obliges us to take "hath formed the crooked serpent" as a restatement of "hath garnished" (that is adorned) "the heavens"; the great constellation of the writhing Dragon, emphatically a "crooked serpent," placed at the very crown of the heavens, and encircling its two northern poles, being poetically put for all the constellations of the sky.

The ancient constellations have a very high archæological value, and this in two directions. First, they preserve to us a record of the earliest scientific work of man. Next, they throw an important light on the origin of myth.

For it is clear that the constellation figures were associated with the stars upon a deliberate, and, in the strictest sense, a scientific plan. The science was real if primitive. The

twelve constellations of the zodiac were clearly meant to mark out the apparent path of the sun, a fact that shows that the length of the year had been at least roughly determined, and that means had been found for identifying the sun's place amongst the stars, with whom he is never seen. The equator was marked as well as the ecliptic, the long constellation of Hydra being formed for this purpose. These two great circles being so clearly indicated, the significance of the position of the northern dragon, coiled symmetrically round their two poles, becomes apparent, as well as the attitude of a third serpentine figure, the snake carried by Ophiuchus, which is bent into a right angle at the intersection of the equator with the equinoctial colure. These positions of astronomical importance were no doubt marked by serpentine forms, because such could be bent or stretched out to take any desired shape. Further evidence of astronomical knowledge and of deliberate purpose is seen in the zodiacal figures; the ascending signs, facing the east, the sunrise; the descending, facing the west, the sunset. Thus the solstices were recognised and marked out as well as the equinoxes.

Such knowledge, such designs, were not within the reach of savages; they could only have resulted from steady and definite observation carried on for the purpose. But we are familiar with an immense number of myths, devised to explain how the constellations came into being, or else representing the sun as the hero of some exploit, suggested by one of the zodiacal figures. None of these myths could have preceded the formation of the constellations, none of these myths could have given rise to the constellations. The types of mind and states of civilization required for such a work as the construction of the constellations and for the inception of myths are wholly diverse; more than diverse, opposed and incompatible. All such myths, therefore, are not only later than the constellations but they imply that the constellations had been known, and their meaning forgotten or misunderstood. Such myths therefore are the evidence of knowledge on the downgrade; of astronomical knowledge lost; not of astronomical knowledge incipient.

The myths did not give rise to the constellations, but when the true origin of the constellations was forgotten, and the astronomical facts that they expressed were lost or misunderstood, then myths were invented to explain them; they were the ditch into which the blind led the blind. And as with astronomical myths, so no doubt with other nature myths; for myth is essentially the outcome of ignorance, the confusion of

things that differ, the artificial attempt to explain that which is unintelligible to the narrator.

Let me take one example. My friend, Dr. Hind, the explorer of Assiniboia and of the Labrador river Moisie, told me that his Indians were accustomed "to fix the sun" by setting two stakes, one upright, and the other to fit its shadow. In this way the members of the party following after could judge of the height and direction of the sun when the leaders passed, and so learn how many hours' journey they were ahead. If we turn now to Dr. J. G. Frazer's *Golden Bough*, vol. i, pages 117–119, under the title "Staying the Sun," we find a number of anecdotes. Dr. Frazer writes:—

"In their journeys the" (Australian) "natives are accustomed to place stones in trees at different heights from the ground, in order to indicate the height of the sun in the sky at the moment that they passed the particular tree. Those who follow are thus made aware of the time of day when their friends in the advance passed the spot."

The Indian custom mentioned by Dr. Hind, is an exceedingly simple, but pretty and effective, way of marking the time. The Australian custom, *as reported*, is perfectly useless, being incomplete. The question arises, is the incompleteness due to the stupidity of the explorer who did not understand what the natives told him, and left out the essential feature? Or did the Australians retain a vestige of a useful custom after they had ceased to understand its purpose and meaning? An allied Australian custom is reported thus:—

"When an Australian blackfellow wishes to stay the sun from going down till he gets home, he puts a sod in the fork of a tree, exactly facing the setting sun."

Did this mythical idea of "stopping the sun" arise from the stupidity of the Australian savage, who had retained and misunderstood a vestige of a once useful custom, or from the stupidity of the European, ignorant of the contrivances and necessities of primitive life? In either case the myth arises from knowledge lost. It is evidence of ignorance.

In astronomy then, we find that the sequence—whether now or in primitive ages—is observation, knowledge, then knowledge lost or misapprehended, then myth; and not the converse (as it is usually contended) of myth, out of which observation grows, and thence knowledge is gained.

Might I ask your serious consideration of the point which I have raised here, namely, that in the case of constellation

myths, we have direct evidence that they are knowledge lost. An immense amount has been written upon myths in recent years, and the assumption has almost always been that they are primitive, original, the first stage towards knowledge. That is an assumption, and,—in this case, where we can test it,—it is an untrue assumption.

If, in science, myth means the degradation of knowledge, does the very opposite of this hold good in religion? Have we the right to assume that in religion, myth is knowledge in the germ?

In the Address given you a year ago, Dr. Welldon affirmed that it is so. He said:—

"Primitive man then personifies Nature. He spiritualises Nature. He invests objects not with life only but with will; and his religion, as expressing the relation which he conceives to exist between his own spirit and the spiritual force outside himself, naturally takes the form of an attempt to influence the unseen powers in which he instinctively believes.

"This is the beginning of religion. It contains the germs of all the infinitely various creeds and cults which have elevated or desolated humanity.

"For as man's intellectual faculties were strengthened by observation and reflection, it was almost inevitable that he should effect the speculative transition from so-called idolatry to polytheism, from the worship of many gods to the worship of fewer gods, and in the end to monotheism. The spiritual powers resident in all natural objects converge into the one great spiritual power who is called God. And the gradual ennoblement of religion lies in the purging away of all the material imaginations which have gathered around the pure spirituality of God Himself. For when once the existence of spiritual beings, many or few, was apprehended, the belief in the supreme Being was a sure result of time and thought."

Is this so? Have we on record a single observed case in which a religion has evolved in this sequence of spiritism, polytheism, henotheism, and finally monotheism? Have we in all history an example of polytheism passing into monotheism except through the influence of monotheism from without? We have abundant illustration of a conflict between the two ideas—coming from different quarters—and of the victory of the purer faith. But where and when have we an instance of the direct evolution of polytheism into the worship of One and Only God?

On this point let us look at the evidence supplied by the first

chapter of Genesis, and read verses 14–19, especially verse 16 :—

"And God made two great lights, the greater light to rule the day and the lesser light to rule the night: He made the stars also."

I would ask you to weigh the extreme simplicity of these words, and to see what it signifies. Consider that the sun and moon have no distinctive names assigned to them. There is no recognition of any of the planets. There is no recognition even of the grouping of the stars into constellations. The celestial bodies could not be referred to in a more simple manner.

What does that mean? It means that we have before us the expression of man's earliest observation of the heavenly bodies. Whenever the book of Genesis as a whole was written, there was incorporated in it this primitive record whether preserved orally or in writing. But primitive it is beyond possibility of challenge. It is probably the earliest document existing. The astronomy is indeed primitive and simple in character, the very simplest possible, but it is astronomy of observation. It concerns the observed brightness of sun, moon and stars. But it is not myth; there is not the faintest trace of the deification of sun, moon or stars, or of spiritism. There is no confusion of ideas; no anthropomorphic treatment of sun or moon.

And as the astronomy of the chapter is simple and sane, and (we may truly say to the very small extent that it goes) scientific; so is the religion of the chapter. It is, as we have seen, a primitive document, but there is no personification of Nature, no spiritualisation of Nature, no endowing natural objects, not with life only, but with will. There are no myths of hideous demon monsters and of unnatural births. There is no confusion of ideas; no inability to discern between Creator and Creation. The religion of the chapter,—the religion of this earliest age,—is perfect in its sanity and truth.

But it has been urged that this first chapter of Genesis was borrowed by the Jews from a Babylonian Creation Epic, though we are obliged to suppose that, as Professor Fr. Delitzsch puts it, "the priestly scholar who composed Genesis, Chapter I, endeavoured of course to remove all possible mythological features of this creation story." It has escaped the notice of those who press this view that it ascribes a measureless superiority in intellectual and spiritual standing to the Jew over the Babylonian, seeing that the former could recognise and bring to light the truth hidden beneath the debased and irrational Babylonian myth. But there is no need to suppose this miracle. The evidence of any connection between the

account of creation given in the Babylonian poem and that given in Genesis, is of the slightest. Any account of creation, mythical or otherwise, must necessarily notice the chief classes of natural objects, and to that extent any one account must resemble any other. Beyond that the only point in common between the two narratives lies in the resemblance between the Hebrew word for "deep," (*tehom*), and the Babylonian name, (*Tiamat*), given to the she-dragon of Chaos. If this resemblance is sufficient to show a connection, then it is indisputable that the Babylonian myth must be a distortion of the narrative in Genesis, since the natural object itself, which gives us the Hebrew word, must necessarily have preceded the mythological personification of it, which gives us the Babylonian. Besides, as we have seen, the astronomy of the Genesis narrative is primitive, the earliest possible. The Babylonian epic, on the other hand refers to the equal division of the zodiac, and hence the epic must be of later date than 700 B.C., since that is the earliest date at which such division can have taken place.

Throughout the Holy Scriptures there is but one astronomical reference that may be fairly termed mythical. When Job cursed the day on which he was born he said:—

> "Let them curse it who curse the day,
> Who are skilful to rouse up leviathan
> Let the stars of the twilight thereof be dark:
> Let it look for light, but have none;
> Neither let it behold the eyelids of the morning."

Here leviathan is the mythical dragon of eclipse derived from one of the stellar dragons; either *Draco* who curled in a figure of eight round the poles of the then equator and ecliptic, or *Hydra* who then stretched almost from one node to another along the equator. The symbol of a coiled snake is used in astronomy to this day as the ideogram of a "node," and since the moon must be at one of the nodes of her orbit for an eclipse to take place, with its consequent darkness, the myth early arose (again an instance of knowledge lost), that the eclipse was due to a dragon devouring the sun or the moon. But in referring to leviathan, this dragon of eclipse, Job was no more necessarily giving his assent to the myth than we are, when we speak of a "draconic month," meaning the period that the moon takes from one passage through her node until her next passage through the same node.

Poetry, allegory, fable, all presuppose purpose, knowledge, clearness of perception in the originator. Human words and

actions may be ascribed to animals or things, but neither speaker nor hearer really mistake their true relations. Of astronomical allusions of this poetical character, there are many in the Bible, but there is no confusion of identity. In Psalm xix, the writer likens the sun to a bridegroom, coming forth from his tent. But the likeness lies only in its splendour; the writer does not consider the sun to be actually a bridegroom, and endow him with a bride and children. In the myths of the nations surrounding the Israelites, of Baal, of Istar, of Merodach, the characteristics, human and animal, divine and astronomical, are mingled together in inextricable confusion, and it is impossible to say whether Istar is goddess or woman, or supernatural cow, or the moon or the planet Venus, or the Virgin of the zodiac, or the sun when in that sign, or the personification of passion, or of the powers of reproduction, or the confusion of any and all of these. This confusion is the essential quality of myth, and it leads up to no clearness of thought, to no knowledge, either in science or in religion.

I have already said that from the point of view of their astronomical bearing, it does not matter how we date the books of the Bible, since there was no great development of astronomy during the whole period covered by them. The constellations had already been designed before the earliest book was written. The great advances which took place under Hipparchus were not made till after the Old Testament Canon was complete.

But reversing the position we do find that some astronomical allusions of Scripture can throw a little light on the dating. Thus there are three constellation names in Scripture, *Ash*, *Kimah* and *Kesil*. All three terms occur in the book of Job, two of them occur in Amos, and one in Isaiah. What do they signify, and from what source do they come?

Here we are met with a difficulty. The meaning of these names was lost before the Seventy made their rendering of the Hebrew Scriptures into Greek; for in one passage they left *Kimah* and *Kesil* untranslated, and they translated *Ash* and *Kesil* differently in different passages. The names have not been found as yet as stellar names on any cuneiform inscription; indeed, had their significance been known in Babylon, it is most improbable that the Alexandrian translators would have failed to obtain the necessary information therefrom. But it is clear that the prophet Amos and the writers of the book of Job, and of the thirteenth chapter of Isaiah were quite familiar with them. The obvious and sufficient explanation of the later ignorance respecting them, lies in the terrible catastrophes which overtook

the sister kingdoms of Israel and Judah; their conquest and carrying away into captivity. Those critics are therefore right who assign Job and this portion of Isaiah to the period before the captivities, and the three names come to us as the indications, not of a Babylonian science of astronomy learned by the Jews during their exile, but of a Hebrew astronomy destroyed by the unspeakable disaster of the captivity. And when you come to think about it, the complete conquest of a country by a ruthless invader, wiping "Jerusalem as a man wipeth a dish, wiping it and turning it upside down," *is* more likely to destroy the science of a nation than to inaugurate it.

The science of a nation could hardly fail to go down in ruin under such a catastrophe. The life of its religion was more deep seated and survived. The Jews came back from exile devoted to two things—to monotheism, and to the observance of the Sabbath. The first they had possessed before the overthrow, but had held it lightly until they had learned devotion to it in the furnace of affliction. Had they possessed the Sabbath also before their captivity? Or had they learned it from their conquerors, as some now assert that they did?

Not from their conquerors. For whilst the Babylonian week and Sabbaths were dependent strictly upon the lunar month, and were therefore astronomical, the Jewish week was a "free" week, independent of month or year; that is, of any natural division of time. And history shows us that it has been the Jewish week that has had the power of asserting itself, not the Babylonian. No other race adopted from the Babylonians their week or Sabbaths; but the Jews, though conquered and enslaved, succeeded in imposing, to no small degree, the observance of their Sabbath, both upon the Greeks and the Romans. Indeed, the week, both of the Christians and of the Mahommedans, is derived directly from the Jews, though with a change of the day of observance.

Further, the Babylonian Sabbath differed from that of the Jews, not only by the manner in which its incidence was regulated, but also in the way in which it was observed. The Jewish Sabbath was a day of rejoicing and complete rest from work. The Babylonian was only marked in the ritual of court and temple; it was no day of general rest. This we know; for Professor Schiaparelli has examined the dating of nearly 3,000 Babylonian deeds and contracts, and has found that business was transacted as freely on the Sabbaths as on other days. The Babylonians could not possibly give to the Jews

that which they did not possess themselves, and they possessed neither the knowledge of One Only God, nor the observance of the seventh day of rest.

Turning now to the light which the astronomy of to-day can throw upon Scripture, we first note the significance it gives to many allusions. Thus St. John uses both the fall of a great aerolite or bolide, and a meteoric shower in his prophetic imagery. "There fell a great star from heaven, burning as it were a lamp," and "The stars of heaven fell unto the earth, even as a fig-tree casteth her untimely figs, when she is shaken of a mighty wind." The great Leonid meteoric swarm, which has afforded us the most striking displays in modern times, had probably not entered the solar system when St. John wrote, but some similar sight no doubt, suggested his simile. Joel and Amos refer to eclipses both of sun and moon, "The sun shall be turned into darkness and the moon into blood"; possibly having the tradition or recollection of the solar eclipse of B.C. 831, which occurred about midday in Judea. Modern meteorology illustrates quite a large number of passages, and these, taken together, show the Hebrews to have had a very clear and complete idea of the atmospheric circulation. Thus Elihu describes the process of evaporation :—

> "For God draweth up the drops of water,
> Which distil in rain from his vapour
> Which the skies pour down,
> And drop upon man abundantly."

Referring to the mystery of how it is that the clouds float, each in its own place, at its own level, each perfectly "balanced" in the thin air, he asks the significant question which we still have to leave without full answer :—

> "Dost thou know the balancings of the clouds, the wondrous works of Him which is perfect in knowledge?"

Astronomy comes into two or three of the Scripture narratives. In the case of the return of the shadow on the "dial of Ahaz," and in that of the Star of Bethlehem, we are obliged to conclude that the narratives are too incomplete—from the astronomical point of view—to justify any astronomical deductions. All that the science can do to help us—but this is not an insignificant matter—is to enable us to reject, as unsatisfactory, several explanations that have been suggested.

The case is different with the narrative of Joshua's "Long Day." Here I believe that I have myself been the first to analyse the narrative from an astronomical point of view, and the result is a striking one. Hitherto, the idea popular among critics has been that the chief incident was the result of a late and uncritical historian interpolating into an old chronicle a piece of poetic hyperbole from an old war ballad, and taking it literally. The astronomical analysis shows that this view is untenable. The chronicle and the ballad convey the same statement, but in such a different manner that it was impossible in those times to have inferred one from the other. Both the chronicle and the ballad, therefore, must have recorded an observed fact, and recorded it at the time. In no other way can their agreement be explained. That fact, if recorded in the language and from the knowledge of to-day would probably be expressed thus: "The Israelites marched between noon and sunset of that memorable day, a distance that it would have ordinarily taken them a full day to traverse." But recorded in the language and from the knowledge of the time it could only be given as we actually read it. "So the sun stood still in the midst of heaven and hasted not to to go down about a whole day."

It will be seen that in this case, and in two or three others, the astronomical point of view has not led me to the conclusions now most generally held by Biblical critics. I would not for one moment be understood as seeking to give this fact any disproportionate weight. I have no claim to any authority in Biblical criticism, except where my own science may incidentally touch upon it. But I would respectfully offer these few remarks as suggestive of a possible line of enquiry that has hitherto been neglected, but may be made fruitful in the future.

Of all the points in which modern astronomy has illustrated Scripture, none are so striking as the knowledge which it has brought to us of the numbers and the distances of the stars. Scripture uses the stars as the example of limitless number. "Look now toward heaven, and tell the stars, if thou be able to number them": "As the host of heaven cannot be numbered." Scripture uses the distance of the stars as the example of limitless space. "Is not God in the height of heaven? and behold the height of the stars, how high they are": "For as the heaven is high above the earth, so great is His mercy toward them that fear Him."

What a fulness of meaning these references to the number and

height of the stars, have in the light of the astronomy of to-day. The star catalogue of Hipparchus contained a little over 1,000 entries; the great International Photographic Chart will show the images of more than 50,000,000 stars. There are photographs in existence showing upwards of 100,000 stars on one single small plate; and no one believes that we have reached the limit in any direction.

So with their distances. By using the enormous base line of the diameter of the earth's orbit—186,000,000 of miles—we have been able to get a hint of the distances of some 40 or 50 stars; all the untold millions beside are, as yet, beyond our reach.

And the nearest of these stars, where is it placed? If we represent this vast globe on which we live by a single pin-point, a hundredth of an inch in diameter; if we place an inch marble, 9 feet away, to represent the sun, we then should have to travel to Liverpool before we should be able to indicate the place of our nearest neighbour amongst the stars. Nor have we come across any token of the end; we can put no limit to the extent of the universe of stars.

Has the progress of science rendered inappropriate or obsolete these two Scripture illustrations of limitless number and of limitless space? Has it not rather furnished them with superlative justification?

I said early in my Address that in one sense the Bible had nothing to say respecting astronomy. I want to reverse that now. It has everything to say that is of vital importance. I do not know how large Job, David and Isaiah conceived the sun to be; they may possibly have thought it no more than 80 feet across. Anaxagoras of Greece rose to a bolder conception, and suggested that it might be as big as the Peloponnesus—80 miles across. We now know that it is more than 800,000 miles, and that it is only one out of many million suns, nor is it the largest of these; it has been argued that Arcturus may be 80,000,000 of miles in diameter.

Well, if so, if instead of being a fiery ball 80 feet across, the sun is really 800,000 miles or for the matter of that if it were 80,000,000 of miles, what difference does it make to the fundamental relation of man to the Creator on the one hand, and to the Creation on the other? Now from one end of the Bible to the other, no matter when its different books were written, where, or by whom, there is no faltering nor uncertainty in the teaching which it gives on this absolutely fundamental point. God is the Maker and Creator of all things; and Creation consists

of things, not of gods; man is the one creature that is made in the image of God, that has communion with Him on the one hand, and can examine into and appreciate the glories of the visible creation on the other.

Here we are dealing with the basis of all religion, with truth which is eternal, with a relation which does not change, and the progress of science cannot modify in its essence.

If the progress of science could alter this relation, could alter the fundamental basis of religion, what would follow? Necessarily that religion must be closed to all but the few. The poor, the ignorant, would have no part in it. It would be the monopoly of the few giant intellects which were at the head of the science of the day.

Of the science of the day, which the science of the morrow would make obsolete. For science deals with things that change and of their changes, and is the changing thought of man concerning these. But religion deals with that which is eternal and reaches all, even the poor, the ignorant and the young. Nay it is especially for these, for it is eternally true that unless we be converted and become as little children, we cannot enter the kingdom of heaven. The little child can apprehend as well as the wisest sage, the first article of religion:—

"I believe in God the Father Who made me and all the world."

That truth, whether so expressed, or expressed as in the first words of Genesis:—

"In the beginning God created the heaven and the earth,"

is the foundation of all science as well as of all religion. It cuts at the root of all animism, nature worship, and polytheism and of all the endless and degrading myths which have sprung therefrom, and have debased the spirit of man, and enslaved his intellect. That truth has set man free, free to examine into the whole wide creation without restriction and without fear; free also to glorify God and to enjoy Him for ever.

The Address was listened to with great interest, and the thanks of the Meeting for it were moved by the Very Rev. Dr. Wace, Dean of Canterbury, seconded by Rev. Chancellor Lias, and being put from the Chair by the President, were carried unanimously.

At the conclusion of the proceedings a cordial vote of thanks to the President for his conduct in the Chair was carried unanimously.