

Plutarch
Concerning Nature

BOOK II.

Having finished my dissertation concerning principles and elements and those things which chiefly appertain to them, I will turn my pen to discourse of those things which are produced by them, and will take my beginning from the world, which contains and encompasseth all beings.

CHAPTER I.

OF THE WORLD.

Pythagoras was the first philosopher that called the world [Greek omitted], from the order and beauty of it; for so that word signifies. Thales and his followers say the world is one. Democritus, Epicurus, and their scholar Metrodorus affirm that there are infinite worlds in an infinite space, for that infinite vacuum in its whole extent contains them. Empedocles, that the circle which the sun makes in its motion circumscribes the world, and that circle is the utmost bound of the world. Seleucus, that the world knows no limits. Diogenes, that the universe is infinite, but this world is finite. The Stoics make a difference between that which is called the universe, and that which is called the whole world;—the universe is the infinite space considered with the vacuum, the vacuity being removed gives the right conception of the world; so that the universe and the world are not the same thing.

CHAPTER II.

OF THE FIGURE OF THE WORLD.

The Stoics say that the figure of the world is spherical, others that it is conical, others oval. Epicurus, that the figure of the world may be globular, or that it may admit of other shapes.

CHAPTER III.

WHETHER THE WORLD BE AN ANIMAL.

Democritus, Epicurus, and those philosophers who introduced atoms and a vacuum, affirm that the world is not an animal, nor governed by any wise Providence, but that it is managed by a nature which is void of reason. All the other philosophers affirm that the

world is informed with a soul, and governed by reason and Providence. Aristotle is excepted, who is somewhat different; he is of opinion, that the whole world is not acted by a soul in every part of it, nor hath it any sensitive, rational, or intellectual faculties, nor is it directed by reason and Providence in every part of it; of all which the heavenly bodies are made partakers, for the circumambient spheres are animated and are living beings; but those things which are about the earth are void of those endowments; and though those terrestrial bodies are of an orderly disposition, yet that is casual and not primogenial.

CHAPTER IV.

WHETHER THE WORLD IS ETERNAL AND INCORRUPTIBLE.

Pythagoras [and Plato], agreeing with the Stoics, affirm that the world was framed by God, and being corporeal is obvious to the senses, and in its own nature is obnoxious to destruction; but it shall never perish, it being preserved by the providence of God. Epicurus, that the world had a beginning, and so shall have an end, as plants and animals have. Xenophanes, that the world never had a beginning, is eternal and incorruptible. Aristotle, that the part of the world which is sublunary is subject to change, and there terrestrial beings find a decay.

CHAPTER V.

WHENCE DOES THE WORLD RECEIVE ITS NUTRIMENT?

Aristotle says that, if the world be nourished, it will likewise be dissolved; but it requires no aliment, and will therefore be eternal. Plato, that this very world prepares for itself a nutriment, by the alteration of those things which are corruptible in it. Philolaus affirms that a destruction happens to the world in two ways; either by fire falling from heaven, or by the sublunary water being poured down through the whirling of the air; and the exhalations proceeding from thence are aliment of the world.

CHAPTER VI.

FROM WHAT ELEMENT GOD DID BEGIN TO RAISE THE FABRIC OF THE WORLD.

The natural philosophers pronounce that the forming of this world took its original from the earth, it being its centre, for the centre is the principal part of the globe. Pythagoras, from the fire and the fifth element. Empedocles determines, that the first and principal element distinct from the rest was the aether, then fire, after that the earth, which earth being strongly compacted by the force of a potent revolution, water springs from it, the exhalations of which water produce the air; the heaven took its origin from the aether, and fire gave a being to the sun; those things nearest to the earth are condensed from the remainders. Plato, that the visible world was framed after the exemplar of the intellectual world; the soul of the visible world was first produced, then the corporeal figure, first that

which proceeded from fire and earth, then that which came from air and water. Pythagoras, that the world was formed of five solid figures which are called mathematical; the earth was produced by the cube, the fire by the pyramid, the air by the octahedron, the water by the icosahedron, and the globe of the universe by the dodecahedron. In all these Plato hath the same sentiments with Pythagoras.

CHAPTER VII.

IN WHAT FORM AND ORDER THE WORLD WAS COMPOSED.

Parmenides maintains that there are small coronets alternately twisted one within another, some made up of a thin, others of a condensed, matter; and there are others between mixed mutually together of light and of darkness, and around them all there is a solid substance, which like a firm wall surrounds these coronets. Leucippus and Democritus cover the world round about, as with a garment and membrane. Epicurus says that that which abounds some worlds is thin, and that which limits others is gross and condensed; and of these spheres some are in motion, others are fixed. Plato, that fire takes the first place in the world, the second the aether, after that the air, under that the water; the last place the earth possesseth: sometimes he puts the aether and the fire in the same place. Aristotle gives the first place to the aether, as that which is impassible, it being a kind of a fifth body after which he placeth those that are passible, fire, air, and water, and last of all the earth. To those bodies that are accounted celestial he assigns a motion that is circular, but to those that are seated under them, if they be light bodies, an ascending, if heavy, a descending motion. Empedocles, that the places of the elements are not always fixed and determined, but they all succeed one another in their respective stations.

CHAPTER VIII.

WHAT IS THE CAUSE OF THE WORLD'S INCLINATION.

Diogenes and Anaxagoras state that, after the world was composed and had produced living creatures, the world out of its own propensity made an inclination toward the south. Perhaps this may be attributed to a wise Providence (they affirm), that thereby some parts of the world may be habitable, others uninhabitable, according as the various climates are affected with a rigorous cold, or a scorching heat, or a just temperament of cold and heat. Empedocles, that the air yielding to the impetuous force of the solar rays, the poles received an inclination; whereby the northern parts were exalted and the southern depressed, by which means the whole world received its inclination.

CHAPTER IX.

OF THAT THING WHICH IS BEYOND THE WORLD, AND WHETHER IT BE A VACUUM OR NOT.

Pythagoras and his followers say that beyond the world there is a vacuum, into which and out of which the world hath its respiration. The Stoics, that there is a vacuum into which

infinite space by a conflagration shall be dissolved. Posidonius, not an infinite vacuum, but as much as suffices for the dissolution of the world; and this he asserts in his first book concerning the Vacuum. Aristotle affirms, that a vacuum does not exist. Plato concludes that neither within nor without the world there is any vacuum.

CHAPTER X.

WHAT PARTS OF THE WORLD ARE ON THE RIGHT HAND, AND WHAT ON THE LEFT.

Pythagoras, Plato, and Aristotle declare that the eastern parts of the world, from whence motion commences, are of the right, those of the western are of the left hand of the world. Empedocles, that those that are of the right hand face the summer solstice, those of the left the winter solstice.

CHAPTER XI.

OF HEAVEN, WHAT IS ITS NATURE AND ESSENCE.

Anaximenes affirms that the circumference of heaven makes the limit of the earth's revolution. Empedocles, that the heaven is a solid substance, and hath the form and hardness of crystal, it being composed of the air compacted by fire, and that in both hemispheres it invests the elements of air and fire. Aristotle, that it is formed by the fifth body, and by the mixture of extreme heat and cold.

CHAPTER XII

INTO HOW MANY CIRCLES IS THE HEAVEN DISTINGUISHED; OR, OF THE DIVISION OF HEAVEN.

Thales, Pythagoras, and the followers of Pythagoras do distribute the universal globe of heaven into five circles, which they denominate zones; one of which is called the arctic circle, which is always conspicuous to us, another is the summer tropic, another is the solstice, another is the winter tropic, another is the antarctic circle, which is always out of sight. The circle called the zodiac is placed under the three that are in the midst, and is oblique, gently touching them all. Likewise, they are all divided in right angles by the meridian, which goes from pole to pole. It is supposed that Pythagoras made the first discovery of the obliquity of the zodiac, but one Oenopides of Chios challenges to himself the invention of it.

CHAPTER XIII.

WHAT IS THE ESSENCE OF THE STARS, AND HOW THEY ARE COMPOSED.

Thales affirms that they are globes of earth set on fire. Empedocles, that they are fiery bodies arising from that fire which the aether embraced within itself, and did shatter in pieces when the elements were first separated one from another. Anaxagoras, that the circumambient aether is of a fiery substance, which, by a vehement force in its whirling about, did tear stones from the earth, and by its own power set them on fire, and establish them as stars in the heavens. Diogenes thinks they resemble pumice stones, and that they are the breathings of the world; again he supposeth that there are some invisible stones, which fall sometimes from heaven upon the earth, and are there quenched; as it happened at Aegospotami, where a stony star resembling fire did fall. Empedocles, that the fixed stars fastened to the crystal, but the planets are loosened. Plato, that the stars for the most part are of a fiery nature, but they are made partakers of another element, with they are mixed after the resemblance of glue. Zenophanes, that they are composed of inflamed clouds, which in the daytime are quenched, and in the night are kindled again. The like we see in coals; for the rising and setting of the stars is nothing else but the quenching and kindling of them. Heraclitus and the Pythagoreans, that every star is a world in an infinite aether, and encompasseth air, earth, and aether; this opinion is current among the disciples of Orpheus, for they suppose that each of the stars does make a world. Epicurus condemns none of these opinions, for he embraces anything that is possible.

CHAPTER XIV.

OF WHAT FIGURE THE STARS ARE.

The Stoics say that the stars are of a circular form, like as the sun, the moon, and the world. Cleanthes, that they are of a conical figure. Anaximenes, that they are fastened as nails in the crystalline firmament; some others, that they are fiery plates of gold, resembling pictures.

CHAPTER XV.

OF THE ORDER AND PLACE OF THE STARS.

Xenocrates says that the stars are moved in one and the same superficies. The other Stoics say that they are moved in various superficies, some being superior, others inferior. Democritus, that the fixed stars are in the highest place; after those the planets; after these the sun, Venus, and the moon, in order. Plato, that the first after the fixed stars that makes its appearance is Phaenon, the star of Saturn; the second Phaeton, the star of Jupiter; the third the fiery, which is the star of Mars; the fourth the morning star, which is the star of Venus; the fifth the shining star, and that is the star of Mercury; in the sixth place is the sun, in the seventh the moon. Plato and some of the mathematicians conspire in the same opinion; others place the sun as the centre of the planets. Anaximander, Metrodorus of Chios, and Crates assign to the sun the superior place, after him the moon, after them the fixed stars and planets.

CHAPTER XVI.

OF THE MOTION AND CIRCULATION OF THE STARS.

Anaxagoras, Democritus, and Cleanthes say that all the stars have their motion from east to west. Alcmaeon and the mathematicians, that the planets have a contrary motion to the fixed stars, and in opposition to them are carried from the west to the east. Anaximander, that they are carried by those circles and spheres on which they are placed. Anaximenes, that they are turned under and about the earth. Plato and the mathematicians, that the sun, Venus, and Mercury hold equal measures in their motions.

CHAPTER XVII.

WHENCE DO THE STARS RECEIVE THEIR LIGHT?

Metrodorus says that all the fixed stars derive their light from the sun. Heraclitus and the Stoics, that earthly exhalations are those by which the stars are nourished. Aristotle, that the heavenly bodies require no nutriment, for they being eternal cannot be obnoxious to corruption. Plato and the Stoics, that the whole world and the stars are fed by the same things.

CHAPTER XVIII.

WHAT ARE THOSE STARS WHICH ARE CALLED THE DIOSCURI, THE TWINS, OR CASTOR AND POLLUX?

Xenophanes says that those which appear as stars in the tops of ships are little clouds brilliant by their peculiar motion. Metrodorus, that the eyes of frightened and astonished people emit those lights which are called the Twins.

CHAPTER XIX.

HOW STARS PROGNOSTICATE, AND WHAT IS THE CAUSE OF WINTER AND SUMMER.

Plato says that the summer and winter indications proceed from the rising and setting of the stars, that is, from the rising and setting of the sun, the moon, and the fixed stars. Anaximenes, that the rest in this are not at all concerned, but that it is wholly performed by the sun. Eudoxus and Aratus assign it in common to all the stars, for thus Aratus says:—

Thund'ring Jove stars in heaven hath fixed,
And them in such beauteous order mixed,
Which yearly future things predict.

CHAPTER XX.

OF THE ESSENCE OF THE SUN.

Anaximander says, that the sun is a circle eight and twenty times bigger than the earth, and has a circumference very much like that of a chariot-wheel, which is hollow and full of fire; the fire of which appears to us through its mouth, as by an aperture in a pipe; and this is the sun. Xenophanes, that the sun is constituted of small bodies of fire compacted together and raised from a moist exhalation, which condensed make the body of the sun; or that it is a cloud enfi red. The Stoics, that it is an intelligent flame proceeding from the sea. Plato, that it is composed of abundance of fire. Anaxagoras, Democritus, and Metrodorus, that it is an enfi red stone, or a burning body. Aristotle, that it is a sphere formed out of the fifth body. Philolaus the Pythagorean, that the sun shines as crystal, which receives its splendor from the fire of the world and so reflecteth its light upon us; so that first, the body of fire which is celestial is in the sun; and secondly, the fiery reflection that comes from it, in the form of a mirror; and lastly, the rays spread upon us by way of reflection from that mirror; and this last we call the sun, which is (as it were) an image of an image. Empedocles, that there are two suns; the one the prototype, which is a fire placed in the other hemisphere, which it totally fills, and is always ordered in a direct opposition to the reflection of its own light; and the sun which is visible to us, formed by the reflection of that splendor in the other hemisphere (which is filled with air mixed with heat), the light reflected from the circular sun in the opposite hemisphere falling upon the crystalline sun; and this reflection is borne round with the motion of the fiery sun. To give briefly the full sense, the sun is nothing else but the light and brightness of that fire which encompasseth the earth. Epicurus, that it is an earthy bulk well compacted, with ores like a pumice-stone or a sponge, kindled by fire.

CHAPTER XXI.

OF THE MAGNITUDE OF THE SUN.

Anaximander says, that the sun itself in greatness is equal to the earth, but that the circle from whence it receives its respiration and in which it is moved is seven and twenty times larger than the earth. Anaxagoras, that it is far greater than Peloponnesus. Heraclitus, that it is no broader than a man's foot. Epicurus, that he equally embraceth all the foresaid opinions,— that the sun may be of magnitude as it appears, or it may be somewhat greater or somewhat less.

CHAPTER XXII.

WHAT IS THE FIGURE OR SHAPE OF THE SUN.

Anaximenes affirms that in its dilatation it resembles a leaf. Heraclitus, that it hath the shape of a boat, and is somewhat crooked. The Stoics, that it is spherical, and it is of the same figure with the world and the stars. Epicurus, that the recited dogmas may be defended.

CHAPTER XXIII.

OF THE TURNING AND RETURNING OF THE STARS, OR THE SUMMER AND WINTER SOLSTICE.

Anaximenes believes that the stars are forced by a condensed and resisting air. Anaxagoras, by the repelling force of the northern air, which is violently pushed on by the sun, and thus rendered more condensed and powerful. Empedocles, that the sun is hindered from a continual direct course by its spherical vehicle and by the two circular tropics. Diogenes, that the sun, when it comes to its utmost declination, is extinguished, a rigorous cold damping the heat. The Stoics, that the sun maintains its course only through that space in which its sustenance is seated, let it be the ocean or the earth; by the exhalations proceeding from these it is nourished. Plato, Pythagoras, and Aristotle, that the sun receives a transverse motion from the obliquity of the zodiac, which is guarded by the tropics; all these the globe clearly manifests.

CHAPTER XXIV.

OF THE ECLIPSE OF THE SUN.

Thales was the first who affirmed that the eclipse of the sun was caused by the moon's running in a perpendicular line between it and the world; for the moon in its own nature is terrestrial. And by mirrors it is made perspicuous that, when the sun is eclipsed, the moon is in a direct line below it. Anaximander, that the sun is eclipsed when the fiery mouth of it is stopped and hindered from respiration. Heraclitus, that it is after the manner of the turning of a boat, when the concave seems uppermost to our sight, and the convex nethermost. Xenophanes, that the sun is eclipsed when it is extinguished; and that a new sun is created and rises in the east. He gives a farther account of an eclipse of the sun which remained for a whole month, and again of an eclipse which changed the day into night. Some declare that the cause of an eclipse is the invisible concourse of condensed clouds which cover the orb of the sun. Aristarchus placeth the sun amongst the fixed stars, and believeth that the earth [the moon?] is moved about the sun, and that by its inclination and vergency it intercepts its light and shadows its orb. Xenophanes, that there are many suns and many moons, according as the earth is distinguished by climates, circles, and zones. At some certain times the orb of the sun, falling upon some part of the world which is untenanted, wanders in a vacuum and becomes eclipsed. The same person affirms that the sun proceeding in its motion in the infinite space, appears to us to move orbicularly, taking that representation from its infinite distance from us.

CHAPTER XXV.

OF THE ESSENCE OF THE MOON.

Anaximander affirms that the circle of the moon is nineteen times bigger than the earth, and resembles the sun, its orb being full of fire; and it suffers an eclipse when the wheel makes a revolution, —which he describes by the divers turnings of a chariot-wheel, in the midst of it there being a hollow nave replenished with fire, which hath but one way of expiration. Xenophanes, that it is a condensed cloud. The Stoics, that it is mixed of fire

and air. Plato, that it is a body of the greatest part fiery. Anaxagoras and Democritus, that it is a solid, condensed, and fiery body, in which there are flat countries, mountains, and valleys. Heraclitus, that it is an earth covered with a bright cloud. Pythagoras, that the body of the moon was of a nature resembling a mirror.

CHAPTER XXVI.

OF THE SIZE OF THE MOON.

The Stoics declare, that in magnitude it exceeds the earth, just as the sun itself doth. Parmenides, that it is equal to the sun, from whom it receives its light.

CHAPTER XXVII.

OF THE FIGURE OF THE MOON.

The Stoics believe that it is of the same figure with the sun, spherical. Empedocles, that the figure of it resembles a quoit. Heraclitus, a boat. Others, a cylinder.

CHAPTER XXVIII.

FROM WHENCE IS IT THAT THE MOON RECEIVES HER LIGHT?

Anaximander thinks that she gives light to herself, but it is very slender and faint. Antiphon, that the moon shines by its own proper light; but when it absconds itself, the solar beams darting on it obscure it. Thus it naturally happens, that a more vehement light puts out a weaker; the same is seen in other stars. Thales and his followers, that the moon borrows all her light of the sun. Heraclitus, that the sun and moon are after the same manner affected; in their configurations both are shaped like boats, and are made conspicuous to us by receiving their light from moist exhalations. The sun appears to us more refulgent, by reason it is moved in a clearer and purer air; the moon appears more duskish, it being carried in an air more troubled and gross.

CHAPTER XXIX.

OF THE ECLIPSE OF THE MOON.

Anaximenes believes that the mouth of the wheel, about which the moon is turned, being stopped is the cause of an eclipse. Berasus, that it proceeds from the turning of the dark side of the lunar orb towards us. Heraclitus, that it is performed just after the manner of a boat turned upside downwards. Some of the Pythagoreans say, that the splendor arises from the earth, its obstruction from the Antichthon (or counter-earth). Some of the later philosophers, that there is such a distribution of the lunar flame, that it gradually and in a just order burns until it be full moon; in like manner, that this fire decays by degrees, until its conjunction with the sun totally extinguisheth it. Plato, Aristotle, the Stoics, and all the mathematicians agree, that the obscurity with which the moon is every month

affected ariseth from a conjunction with the sun, by whose more resplendent beams she is darkened; and the moon is then eclipsed when she falls upon the shadow of the earth, the earth interposing between the sun and moon, or (to speak more properly) the earth intercepting the light of the moon.

CHAPTER XXX.

OF THE PHASES OF THE MOON, OR THE LUNAR ASPECTS; OR HOW IT COMES TO PASS THAT THE MOON APPEARS TO US TERRESTRIAL.

The Pythagoreans say, that the moon appears to us terraneous, by reason it is inhabited as our earth is, and in it there are animals of a larger size and plants of a rarer beauty than our globe affords; that the animals in their virtue and energy are fifteen degrees superior to ours; that they emit nothing excrementitious; and that the days are fifteen times longer. Anaxagoras, that the reason of the inequality ariseth from the commixture of things earthy and cold; and that fiery and caliginous matter is jumbled together, whereby the moon is said to be a star of a counterfeit aspect. The Stoics, that on account of the diversity of her substance the composition of her body is subject to corruption.

CHAPTER XXXI.

HOW FAR THE MOON IS REMOVED FROM THE SUN.

Empedocles declares, that the distance of the moon from the sun is double her remoteness from the earth. The mathematicians, that her distance from the sun is eighteen times her distance from the earth. Eratosthenes, that the sun is remote from the earth seven hundred and eighteen thousand furlongs.

CHAPTER XXXII.

OF THE YEAR, AND HOW MANY CIRCULATIONS MAKE UP THE GREAT YEAR OF EVERY PLANET.

The year of Saturn is completed when he has had his circulation in the space of thirty solar years; of Jupiter in twelve; of Mars in two, of the sun in twelve months; in so many Mercury and Venus, the spaces of their circulation being equal; of the moon in thirty days, in which time her course from her prime to her conjunction is finished. As to the great year, some make it to consist of eight years solar, some of nineteen, others of fifty-nine. Heraclitus, of eighteen thousand. Diogenes, of three hundred and sixty-five such years as Heraclitus assigns. Others there are who lengthen it to seven thousand seven hundred and seventy-seven years.

BOOK III.

In my two precedent treatises having in due order taken a compendious view and given an account of the celestial bodies, and of the moon which stands between them and the terrestrial, I must now convert my pen to discourse in this third book of Meteors, which are beings above the earth and below the moon, and are extended to the site and situation of the earth, which is supposed to be the centre of the sphere of this world; and from thence will I take my beginning.

CHAPTER I.

OF THE GALAXY, OR THE MILKY WAY.

It is a cloudy circle, which continually appears in the air, and by reason of the whiteness of its colors is called the galaxy, or the milky way. Some of the Pythagoreans say that, when Phaeton set the world on fire, a star falling from its own place in its circular passage through the region caused an inflammation. Others say that originally it was the first course of the sun; others, that it is an image as in a looking-glass, occasioned by the sun's reflecting its beams towards the heavens, and this appears in the clouds and in the rainbow. Metrodorus, that it is merely the solar course, or the motion of the sun in its own circle. Parmenides, that the mixture of a thick and thin substance gives it a color which resembles milk. Anaxagoras, that the sun moving under the earth and not being able to enlighten every place, the shadow of the earth, being cast upon the part of the heavens, makes the galaxy. Democritus, that it is the splendor which ariseth from the coalition of many small bodies, which, being firmly united amongst themselves, do mutually enlighten one another. Aristotle, that it is the inflammation of dry, copious, and coherent vapor, by which the fiery mane, whose seat is beneath the aether and the planets, is produced. Posidonius, that it is a combination of fire, of finer substance than the stars, but denser than light.

CHAPTER II.

OF COMETS AND SHOOTING FIRES, AND THOSE WHICH RESEMBLE BEAMS.

Some of the Pythagoreans say, that a comet is one of those stars which do not always appear, but after they have run through their determined course, they then rise and are visible to us. Others, that it is the reflection of our sight upon the sun, which gives the resemblance of comets much after the same manner as images are reflected in mirrors. Anaxagoras and Democritus, that two or more stars being in conjunction by their united light make a comet. Aristotle, that it is a fiery coalition of dry exhalations. Strato, that it is the light of the star darting through a thick cloud that hath invested it; this is seen in light shining through lanterns. Heraclides, native of Pontus, that it is a lofty cloud inflamed by a sublime fire. The like causes he assigns to the bearded comet, to those circles that are seen about the sun or stars, or those meteors which resemble pillars or

beams, and all others which are of this kind. This way unanimously go all the Peripatetics, holding that these meteors, being formed by the clouds, do differ according to their various configurations. Epigenes, that a comet arises from a rising of spirit or wind, mixed with an earthy substance and set on fire. Boethus, that it is a phantasy presented to us by fiery air. Diogenes, that comets are stars. Anaxagoras, that those styled shooting stars descend from the aether like sparks, and therefore are soon extinguished. Metrodorus, that it is a forcible illapse of the sun upon clouds which makes them to sparkle as fire. Xenophanes, that all such fiery meteors are nothing else but the conglomeration of the en-fired clouds, and the flashing motions of them.

CHAPTER III.

OF VIOLENT ERUPTION OF FIRE OUT OF THE CLOUDS. OF LIGHTNING. OF THUNDER. OF HURRICANES. OF WHIRLWINDS.

Anaximander affirms that all these are produced by the wind after this manner: the wind being enclosed by condensed clouds, on account of its minuteness and lightness violently endeavors to make a passage; and in breaking through the cloud gives noise; and the tearing the cloud, because of the blackness of it, gives a resplendent flame. Metrodorus, that when the wind falls upon a cloud whose densing firmly compacts it, by breaking the cloud it causeth a great noise, and by striking and rending the cloud it gives the flame; and in the swiftness of its motion, the sun imparting heat to it, it throws out the bolt. The weak declining of the thunderbolt ends in a violent tempest. Anaxagoras, that when heat and cold meet and are mixed together (that is, ethereal parts with airy), thereby a great noise of thunder is produced, and the color observed against the blackness of the cloud occasions the flashing of fire; the full and great splendor is lightning, the more enlarged and embodied fire becomes a whirlwind, the cloudiness of it gives the hurricane. The Stoics, that thunder is the clashing of clouds one upon another, the flash of lightning is their fiery inflammation; their more rapid splendor is the thunderbolt, the faint and weak the whirlwind. Aristotle, that all these proceed from dry exhalations, which, if they meet with moist vapors, forcing their passage, the breaking of them gives the noise of thunder; they, being very dry, take fire and make lightning; tempests and hurricanes arise from the plenitude of matter which each draw to themselves, the hotter parts attracted make the whirlwinds, the duller the tempests.

CHAPTER IV.

OF CLOUDS, RAIN, SNOW, AND HAIL.

Anaximenes thinks that the air by being very much condensed clouds are formed; this air being more compacted, rain is compressed through it; when water in its falling down freezeth, then snow is generated; when it is encompassed with a moist air, it is hail. Metrodorus, that a cloud is composed of a watery exhalation carried into a higher place. Epicurus, that they are made of vapors; and that hail and snow are formed in a round figure, being in their long descent pressed upon by the circumambient air.

CHAPTER V.
OF THE RAINBOW.

Those things which affect the air in the superior places of it are of two sorts. Some have a real subsistence, such are rain and hail; others not. Those which enjoy not a proper subsistence are only in appearance; of this sort is the rainbow. Thus the continent to us that sail seems to be in motion.

Plato says, that men admiring it feigned that it took origination from one Thaumias, which word signifies admiration. Homer sings:—

Jove paints the rainbow with a purple dye, Alluring man to
cast his wandering eye.
(Iliad, xvii. 547.)

Others therefore fabled that the bow hath a head like a bull, by which it swallows up rivers.

But what is the cause of the rainbow? It is evident that what apparent things we see come to our eyes in right or in crooked lines, or by refraction: these are incorporeal and to sense obscure, but to reason they are obvious. Those which are seen in right lines are those which we see through the air or horn or transparent stones, for all the parts of these things are very fine and tenuous; but those which appear in crooked lines are in water, the thickness of the water presenting them bended to our sight. This is the reason that oars in themselves straight, when put into the sea, appear to us crooked. The third manner of our seeing is by refraction, and this is perspicuous in mirrors. After this third sort the rainbow is affected. We conceive it is a moist exhalation converted into a cloud, and in a short space it is dissolved into small and moist drops. The sun declining towards the west, it will necessarily follow that the whole bow is seen opposite to the sun; for the eye being directed to those drops receives a refraction, and by this means the bow is formed. The eye doth not consider the figure and form, but the color of these drops; the first of which colors is a shining red, the second a purple, the third is blue and green. Let us consider whether the reason of this red shining color be the splendor of the sun falling upon these small drops, the whole body of light being refracted, by which this bright red color is produced; the second part being troubled and the light languishing in the drops, the color becomes purple (for the purple is the faint red); but the third part, being more and more troubled, is changed into the green color. And this is proved by other effects of Nature; if any one shall put water in his mouth and spit it out so opposite to the sun, that its rays may be refracted on the drops, he shall see the resemblance of a rainbow; the same appears to men that are blear-eyed, when they fix their watery eyes upon a candle. Anaximenes thinks the bow is thus formed; the sun casting its splendor upon a thick, black, and gross cloud, and the rays not being in a capacity to penetrate beyond the superficies. Anaxagoras, that, the solar rays being reflected from a condensed cloud, the sun being placed directly opposite to it forms the bow after the mode of the repercussion of a mirror; after the same manner he assigns the natural cause of the Parhelia or mock-

suns, which are often seen in Pontus. Metrodorus, that when the sun casts its splendor through a cloud, the cloud gives itself a blue, and the light a red color.

CHAPTER VI.

OF METEORS WHICH RESEMBLE RODS, OR OF RODS.

These rods and the mock-suns are constituted of a double nature, a real subsistence, and a mere appearance;—of a real subsistence, because the clouds are the object of our eyes; of a mere appearance, for their proper color is not seen, but that which is adventitious. The like affections, natural and adventitious, in all such things do happen.

CHAPTER VII.

OF WINDS.

Anaximander believes that wind is a fluid air, the sun putting into motion or melting the moist subtle parts of it. The Stoics, that all winds are a flowing air, and from the diversity of the regions whence they have their origin receive their denomination; as, from darkness and the west the western wind; from the sun and its rising the eastern; from the north the northern, and from the south the southern winds. Metrodorus, that moist vapors heated by the sun are the cause of the impetuosity of violent winds. The Etesian, or those winds which annually commence about the rising of the Little Dog, the air about the northern pole being more compacted, blow violently following the sun when it returns from the summer solstice.

CHAPTER VIII.

OF WINTER AND SUMMER.

Empedocles and the Stoics believe that winter is caused by the thickness of the air prevailing and mounting upwards; and summer by fire, it falling downwards.

This description being given by me of Meteors, or those things that are above us, I must pass to those things which are terrestrial.

CHAPTER IX.

OF THE EARTH, WHAT IS ITS NATURE AND MAGNITUDE.

Thales and his followers say that there is but one earth. Hicetes the Pythagorean, that there are two earths, this and the Antichthon, or the earth opposite to it. The Stoics, that this earth is one, and that finite and limited. Xenophanes, that the earth, being compacted of fire and air, in its lowest parts hath laid a foundation in an infinite depth. Metrodorus, that the earth is mere sediment and dregs of water, as the sun is of the air.

CHAPTER X.

OF THE FIGURE OF THE EARTH.

Thales, the Stoics, and their followers say that the earth is globular. Anaximander, that it resembles a smooth stony pillar. Anaximenes, that it hath the shape of a table. Leucippus, of a drum. Democritus, that it is like a quoit externally, and hollow in the middle.

CHAPTER XI.

OF THE SITE AND POSITION OF THE EARTH.

The disciples of Thales say that the earth is the centre of the universe. Xenophanes, that it is first, being rooted in the infinite space. Philolaus the Pythagorean gives to fire the middle place, and this is the source fire of the universe; the second place to the Antichthon; the third to that earth which we inhabit, which is placed in opposition unto and whirled about the opposite,—which is the reason that those which inhabit that earth cannot be seen by us. Parmenides was the first that confined the habitable world to the two solstitial (or temperate) zones.

CHAPTER XII.

OF THE INCLINATION OF THE EARTH.

Leucippus affirms that the earth vergeth towards the southern parts, by reason of the thinness and fineness that is in the south; the northern parts are more compacted, they being congealed by a rigorous cold, but those parts of the world that are opposite are enfired. Democritus, because, the southern parts of the air being the weaker, the earth as it enlarges bends towards the south; the northern parts are of an unequal, the southern of an equal temperament; and this is the reason that the earth bends towards those parts where the earth is laden with fruits and its own increase.

CHAPTER XIII.

OF THE MOTION OF THE EARTH.

Most of the philosophers say that the earth remains fixed in the same place. Philolaus the Pythagorean, that it is moved about the element of fire, in an oblique circle, after the same manner of motion that the sun and moon have. Heraclides of Pontus and Ecphantus the Pythagorean assign a motion to the earth, but not progressive, but after the manner of a wheel being carried on its own axis; thus the earth (they say) turns itself upon its own centre from west to east. Democritus, that when the earth was first formed it had a motion, the parts of it being small and light; but in process of time the parts of it were condensed, so that by its own weight it was poised and fixed.

CHAPTER XIV.

INTO HOW MANY ZONES IS THE EARTH DIVIDED?

Pythagoras says that, as the celestial sphere is distributed into five zones, into the same number is the terrestrial; which zones are the arctic and antarctic, the summer and winter tropics (or temperate zones), and the equinoctial; the middle of which zones equally divides the earth and constitutes the torrid zone; but that portion which is in between the summer and winter tropics is habitable, by reason the air is there temperate.

CHAPTER XV.

OF EARTHQUAKES.

Thales and Democritus assign the cause of earthquakes to water. The Stoics say that it is a moist vapor contained in the earth, making an irruption into the air, that causes the earthquake. Anaximenes, that the dryness and rarity of the earth are the cause of earthquakes, the one of which is produced by extreme drought, the other by immoderate showers. Anaxagoras, that the air endeavoring to make a passage out of the earth, meeting with a thick superficies, is not able to force its way, and so shakes the circumambient earth with a trembling. Aristotle, that a cold vapor encompassing every part of the earth prohibits the evacuation of vapors; for those which are hot, being in themselves light, endeavor to force a passage upwards, by which means the dry exhalations, being left in the earth, use their utmost endeavor to make a passage out, and being wedged in, they suffer various circumvolutions and shake the earth. Metrodorus, that whatsoever is in its own place is incapable of motion, except it be pressed upon or drawn by the operation of another body; the earth being so seated cannot naturally be moved, yet divers parts and places of the earth may move one upon another. Parmenides and Democritus, that the earth being so equally poised hath no sufficient ground why it should incline more to one side than to the other; so that it may be shaken, but cannot be removed. Anaximenes, that the earth by reason of its latitude is borne upon by the air which presseth upon it. Others opine that the earth swims upon the waters, as boards and broad planks, and by that reason is moved. Plato, that motion is by six manner of ways, upwards, downwards, on the right hand and on the left, behind and before; therefore it is not possible that the earth should be moved in any of these modes, for it is altogether seated in the lowest place; it therefore cannot receive a motion, since there is nothing about it so peculiar as to cause it to incline any way; but some parts of it are so rare and thin that they are capable of motion. Epicurus, that the possibility of the earth's motion ariseth from a thick and aqueous air under the earth, that may, by moving or pushing it, be capable of quaking; or that being so compassed, and having many passages, it is shaken by the wind which is dispersed through the hollow dens of it.

CHAPTER XVI.

OF THE SEA, AND HOW IT IS COMPOSED, AND HOW IT BECOMES TO THE TASTE BITTER.

Anaximander affirms that the sea is the remainder of the primogenial humidity, the greatest part of which being dried up by the fire, the influence of the great heat altered its quality. Anaxagoras that in the beginning water did not flow, but was as a standing pool; and that it was burnt by the movement of the sun about it, by which the oily part of the water being exhaled, the residue became salt. Empedocles, that the sea is the sweat of the earth heated by the sun. Antiphon, that the sweat of that which was hot was separated from the rest which were moist; these by seething and boiling became bitter, as happens in all sweats. Metrodorus, that the sea was strained through the earth, and retained some part of its density; the same is observed in all those things which are strained through ashes. The schools of Plato, that the element of water being compacted by the rigor of the air became sweet, but that part which was expired from the earth, being enfired, became of a brackish taste.

CHAPTER XVII.

OF TIDES, OR OF THE EBBING AND FLOWING OF THE SEA.

Aristotle and Heraclides say, they proceed from the sun, which moves and whirls about the winds; and these falling with a violence upon the Atlantic, it is pressed and swells by them, by which means the sea flows; and their impression ceasing, the sea retracts, hence they ebb. Pytheas the Massilian, that the fulness of the moon gives the flow, the wane the ebb. Plato attributes it all to a certain balance of the sea, which by means of a mouth or orifice causes the tide; and by this means the seas do rise and flow alternately. Timaeus believes that those rivers which fall from the mountains of the Celtic Gaul into the Atlantic produce a tide. For upon their entering upon that sea, they violently press upon it, and so cause the flow; but they disemboгуing themselves, there is a cessation of the impetuosity, by which means the ebb is produced. Seleucus the mathematician attributes a motion to the earth; and thus he pronounceth that the moon in its circulation meets and repels the earth in its motion; between these two, the earth and the moon, there is a vehement wind raised and intercepted, which rushes upon the Atlantic Ocean, and gives us a probable argument that it is the cause the sea is troubled and moved.

CHAPTER XVIII.

OF THE AUREA, OR A CIRCLE ABOUT A STAR.

The aurea or circle is thus formed. A thick and dark air intervening between the moon or any other star and our eye, by which means our sight is dilated and reflected, when now our sight falls upon the outward circumference of the orb of that star, there presently seems a circle to appear. This circle thus appearing is called the [Greek omitted] or halo; and there is constantly such a circle seen by us, when such a density of sight happens.