

# CHAPTER IX., LEUKIPPOS OF MILETOS

- 171. [Leucippus and Democritus](#)
- 172. [Theophrastus on the Atomic Theory](#)
- 173. [Leucippus and the Eleatics](#)
- 174. [Atoms](#)
- 175. [The Void](#)
- 176. [Cosmology](#)
- 177. [Relation to Ionic Cosmology](#)
- 178. [The Eternal Motion](#)
- 179. [The Weight of the Atoms](#)
- 180. [The Vortex](#)
- 181. [The Earth and the Heavenly Bodies](#)
- 182. [Perception](#)
- 183. [Importance of Leucippus](#)

## 171. Leucippus and Democritus

WE have seen (§§ 31, 122) that the school of Miletos did not come to an end with Anaximenes, and it is a striking fact that the man who gave the most complete answer to the question first asked by Thales was a Milesian.<sup>1</sup>

It is true that the very existence of Leucippus has been called in question. Epicurus is reported to have said there never was such a philosopher, and the same thing has been maintained in quite recent times.<sup>2</sup> On the other hand, Aristotle and Theophrastos certainly made him the originator of the atomic theory, and they can hardly have been mistaken on such a point. Aristotle was specially interested in Demokritos, and his native Stageiros is not very far from Abdera, the seat of the Atomist school.

The question is intimately bound up with that of the date of Demokritos, who said that he himself was a young man in the old age of Anaxagoras, a statement which makes it unlikely that he founded his school at Abdera much before 420 B.C., the date given by Apollodoros for his *floruit*.<sup>3</sup> Now Theophrastos stated that Diogenes of Apollonia borrowed some of his views from Anaxagoras and some from Leucippus,<sup>4</sup> which must mean that there were traces of the atomic theory in his work.

Further, Diogenes is parodied in the *Clouds* of Aristophanes, which was produced in 423 B.C., from which it follows that the work of Leukippos must have become known before that date. What that work was, Theophrastos also tells us. It was the *Great Diakosmos* usually attributed to Demokritos.<sup>5</sup> This means further that what were known later as the works of Demokritos were really the writings of the school of Abdera, and included, as was natural, the works of its founder. They formed, in fact, a corpus like that which has come down to us under the name of Hippokrates, and it was no more possible to distinguish the authors of the different treatises in the one case than it is in the other.

Theophrastos found Leukippos described as an Eleate in some authorities, and, if we may trust analogy, that means he had settled at Elea.<sup>6</sup> It is possible that his emigration was connected with the revolution at Miletos in 450-49 B.C.<sup>7</sup> In any case, Theophrastos says distinctly that he had been a member of the school of Parmenides, and his words suggest that the founder of that school was then still at its head.<sup>8</sup> He may quite well have been so, if we accept Plato's chronology.<sup>9</sup> Theophrastos also appears to have said that Leukippos "heard" Zeno, which is very credible. We shall see, at any rate, that the influence of Zeno on his thinking is unmistakable.<sup>10</sup>

The relations of Leukippos to Empedokles and Anaxagoras are more difficult to determine. It has become part of the case for the historical reality of Leukippos to say that there are traces of atomism in the systems of these men; but the case is strong enough without that assumption. The chief argument for the view that Leukippos influenced Empedokles is that drawn from the doctrine of "pores"; but we have seen that this originated with Alkmaion, and it is therefore more probable that Leukippos derived it from Empedokles.<sup>11</sup> Nor is it at all probable that Anaxagoras knew anything of the theory of Leukippos. It is true that he denied the existence of the void; but it does not follow that any one had already maintained that doctrine in the atomist sense. The early Pythagoreans had spoken of a void too, though they had confused it with atmospheric air; and the experiments of Anaxagoras with the *klepsidra* and the inflated skins would only have had any point if they were directed against the Pythagorean theory.<sup>12</sup> If he had really wished to refute Leukippos, he would have had to use arguments of a very different kind.

## 172. Theophrastus on the Atomic Theory

Theophrastos wrote of Leukippos as follows in the First Book of his *Opinions*:

Leukippos of Elea or Miletos (for both accounts are given of him) had associated with Parmenides in philosophy. He did not, however, follow the same path in his explanation of things as Parmenides and Xenophanes did, but, to all appearance, the very opposite (R. P. 185). They made the All one, immovable, uncreated, and finite, and did not even permit us to search for *what is not*; he

assumed innumerable and ever-moving elements, namely, the atoms. And he made their forms infinite in number, since there was no reason why they should be of one kind rather than another, and because he saw that there was unceasing becoming and change in things. He held, further, that *what is* is no more real than *what is not*, and that both are alike causes of the things that come into being; for he laid down that the substance of the atoms was compact and full, and he called them *what is*, while they moved in the void which he called *what is not*, but affirmed to be just as real as what is. R. P. 194.

### 173. Leucippus and the Eleatics

It will be observed that Theophrastos, while noting the affiliation of Leukippos to the Eleatic school, points out that his theory is, *prima facie*,<sup>13</sup> just the opposite of that maintained by Parmenides. Some have been led by this to deny the Eleaticism of Leukippos altogether; but this denial is really based on the view that the system of Parmenides was "metaphysical," coupled with a great reluctance to admit that so scientific a hypothesis as the atomic theory can have had a "metaphysical" origin. This is merely a prejudice, and we must not suppose Theophrastos himself believed the two theories to be so far apart as they seem.<sup>14</sup> As this is really the most important point in the history of early Greek philosophy, and as, rightly understood, it furnishes the key to the whole development, it is worth while to transcribe a passage of Aristotle<sup>15</sup> which explains the historical connexion in a way that leaves nothing to be desired.

Leukippos and Demokritos have decided about all things practically by the same method and on the same theory, taking as their starting-point what naturally comes first. Some of the ancients had held that the real must necessarily be one and immovable; for, said they, empty space is not real, and motion would be impossible without empty space separated from matter; nor, further, could reality be a many, if there were nothing to separate things. And it makes no difference if any one holds that the All is not continuous, but discrete, with its part in contact (*the Pythagorean view*), instead of holding that reality is many, not one, and that there is empty space. For, if it is divisible at every point there is no one, and therefore no many, and the Whole is empty (*Zeno*); while, if we say it is divisible in one place and not in another, this looks like an arbitrary fiction; for up to what point and for what reason will part of the Whole be in this state and be full, while the rest is discrete? And, on the same grounds, they further say that there can be no motion. In consequence of these reasonings, then, going beyond perception and overlooking it in the belief that we ought to follow the argument, they say that the All is one and immovable (*Parmenides*), and some of them that it is infinite (*Melissos*), for any limit would be bounded by empty space. This, then, is the opinion they expressed about the truth, and these are the reasons which led them to do so. Now, so far as arguments go, this conclusion does seem to follow; but, if we appeal to facts, to hold such a view looks like madness. No one who is mad is so far out of

his senses that fire and ice appear to him to be one; it is only things that are right, and things that appear right from habit, in which madness makes some people see no difference.

Leukippos, however, thought he had a theory which was in harmony with sense, and did not do away with coming into being and passing away, nor motion, nor the multiplicity of things. He conceded this to experience, while he conceded, on the other hand, to those who invented the One that motion was impossible without the void, that the void was not real, and that nothing of what was real was not real. "For," said he, "that which is strictly speaking real is an absolute *plenum*; but the *plenum* is not one. On the contrary, there are an infinite number of them, and they are invisible owing to the smallness of their bulk. They move in the void (for there is a void); and by their coming together they effect coming into being; by their separation, passing away."

In this passage Zeno and Melissos are not named, but the reference to them is unmistakable. The argument of Zeno against the Pythagoreans is clearly given; and Melissos was the only Eleatic who made reality infinite, a point which is distinctly mentioned. We are therefore justified by Aristotle's words in explaining the genesis of Atomism and its relation to Eleaticism as follows. Zeno had shown that all pluralist systems yet known, and especially Pythagoreanism, were unable to stand before the arguments from infinite divisibility which he adduced. Melissos had used the same argument against Anaxagoras, and had added, as a *reductio ad absurdum*, that, if there were many things, each one of them must be such as the Eleatics held the One to be. To this Leukippos answers, "Why not?" He admitted the force of Zeno's arguments by setting a limit to divisibility, and to each of the "atoms" which he thus arrived at he ascribed all the predicates of the Eleatic One; for Parmenides had shown that if *it is*, it must have these predicates somehow. The same view is implied in a passage of Aristotle's *Physics*.<sup>16</sup> "Some," we are there told, "surrendered to both arguments, to the first, the argument that all things are one, if the word *is* is used in one sense only (Parmenides), by affirming the reality of what is not; to the second, that based on dichotomy (Zeno), by introducing indivisible magnitudes." Finally, it is only by regarding the matter in this way that we can attach any meaning to another statement of Aristotle's that Leukippos and Demokritos, as well as the Pythagoreans, virtually make all things out of numbers.<sup>17</sup> Leukippos, in fact, gave the Pythagorean monads the character of the Parmenidean One.

#### 174. Atoms

We must observe that the atom is not mathematically indivisible, for it has magnitude; it is, however, physically indivisible, because, like the One of Parmenides, it contains no empty space.<sup>18</sup> Each atom has extension, and all atoms are exactly alike in substance.<sup>19</sup> Therefore all differences in things must be accounted for either by the shape of the atoms or by their arrangement. It seems probable that the three ways in which differences arise, namely, shape, position, and arrangement, were already distinguished by Leukippos; for Aristotle mentions his name in connexion with them.<sup>20</sup> This explains,

too, why the atoms are called "forms" or "figures," a way of speaking which is clearly of Pythagorean origin.<sup>21</sup> That they are also called φύσις<sup>22</sup> is quite intelligible if we remember what was said of that word in the Introduction (§ VII.). The differences in shape, order, and position just referred to account for the "opposites," the "elements" being regarded rather as aggregates of these (πανσπερμῖαι), as by Anaxagoras.<sup>23</sup>

#### 175. The Void

Leukippos affirmed the existence both of the Full and the Empty, terms which he may have borrowed from Melissos.<sup>24</sup> He had to assume empty space, which the Eleatics had denied, in order to make his explanation of the nature of body possible. Here again he is developing a Pythagorean view. The Pythagoreans had spoken of the void, which kept the units apart; but they had not distinguished it from atmospheric air (§ 53), which Empedokles had shown to be a corporeal substance (§ 107). Parmenides, indeed, had formed a clearer conception of space, but only to deny its reality. Leukippos started from this. He admitted, indeed, that space was not real, that is to say, corporeal; but he maintained that it existed all the same. He hardly, it is true, had words to express his discovery in; for the verb "to be" had hitherto been used by philosophers only of body. But he did his best to make his meaning clear by saying that "what is not" (in the old corporealist sense) "is" (in another sense) just as much as "what is." The void is as real as body.

#### 176. Cosmology

It might seem a hopeless task to disentangle the cosmology of Leukippos from that of Demokritos, with which it is generally identified; but that very fact affords a valuable clue. No one later than Theophrastos was able to distinguish their doctrines, and it follows that all definite statements about Leukippos in later writers must, in the long run, go back to him. If we follow this up, we shall be able to give a fairly clear account of the system, and we shall even come across some views which are peculiar to Leukippos and were not adopted by Demokritos.<sup>25</sup>

The fuller of the doxographies in Diogenes, which comes from an epitome of Theophrastos,<sup>26</sup> is as follows:

He says that the All is infinite, and that it is part full, and part empty. These (the full and the empty), he says, are the elements. From them arise innumerable worlds and are resolved into them. The worlds come into being thus. There were borne along by "abscission from the infinite" many bodies of all sorts of figures "into a mighty void," and they being gathered together produce a single vortex. In it, as they came into collision with one another and were whirled round in all manner of ways, those

which were alike were separated apart and came to their likes. But, as they were no longer able to revolve in equilibrium owing to their multitude, those of them that were fine went out to the external void, as if passed through a sieve; the rest stayed together, and becoming entangled with one another, ran down together, and made a first spherical structure. This was in substance like a membrane or skin containing in itself all kinds of bodies. And, as these bodies were borne round in a vortex, in virtue of the resistance of the middle, the surrounding membrane became thin, as the contiguous bodies kept flowing together from contact with the vortex. And in this way the earth came into being, those things which had been borne towards the middle abiding there. Moreover, the containing membrane was increased by the further separating out of bodies from outside; and, being itself carried round in a vortex, it further got possession of all with which it had come in contact. Some of these becoming entangled, produce a structure, which was at first moist and muddy; but, when they had been dried and were revolving along with the vortex of the whole, they were then ignited and produced the substance of the heavenly bodies. The circle of the sun is the outermost, that of the moon is nearest to the earth, and those of the others are between these. And all the heavenly bodies are ignited because of the swiftness of their motion; while the sun is also ignited by the stars. But the moon only receives a small portion of fire. The sun and the moon are eclipsed . . . (And the obliquity of the zodiac is produced) by the earth being inclined towards the south; and the northern parts of it have constant snow and are cold and frozen. And the sun is eclipsed rarely, and the moon continually, because their circles are unequal. And just as there are comings into being of the world, so there are growths and decays and passings away in virtue of a certain necessity, of the nature of which he gives no clear account.

As it comes substantially from Theophrastos, this passage is good evidence for the cosmology of Leukippos, and it is confirmed by certain Epicurean extracts from the *Great Diakosmos*.<sup>27</sup> These, however, give a specially Epicurean turn to some of the doctrines, and must therefore be used with caution.

#### 177. Relation to Ionic Cosmology

The general impression we get from the cosmology of Leukippos is that he either ignored or had never heard of the great advance in the general view of the world which was due to the later Pythagoreans. He is as reactionary in his detailed cosmology as he was daring in his general physical theory. We seem to be reading once more of the speculations of Anaximenes or Anaximander, though there are traces of Empedokles and Anaxagoras too. The explanation is not hard to see. Leukippos would not learn a cosmology from his Eleatic teachers; and, even when he found it possible to construct one without giving up the Parmenidean view of reality, he was thrown back upon the older systems of Ionia. The result was unfortunate. The astronomy of Demokritos was still of this childish character. He believed the earth was flat and rested on the air.

This is what gives plausibility to Gomperz's statement that Atomism was "the ripe fruit on the tree of the old Ionic doctrine of matter which had been tended by the Ionian physiologists."<sup>28</sup> The detailed cosmology was certainly such a fruit, and it was possibly over-ripe; but the atomic theory proper, in which the real greatness of Leukippos comes out, was wholly Eleatic in its origin. Nevertheless, it will repay us to examine the cosmology too; for such an examination will serve to bring out the true nature of the historical development of which it was the outcome.

#### 178. The Eternal Motion

Leukippos represented the atoms as having been always in motion. Aristotle puts this in his own way. The atomists, he says, "indolently" left it unexplained what was the source of motion, and did not say what sort of motion it was. In other words, they did not decide whether it was a "natural motion" or impressed on them "contrary to their nature."<sup>29</sup> He even said that they made it "spontaneous," a remark which has given rise to the erroneous view that they held it was due to chance.<sup>30</sup> Aristotle does not say that, however; but only that the atomists did not explain the motion of the atoms in any of the ways in which he himself explained the motion of the elements. They neither ascribed to them a natural motion like the circular motion of the heavens and the rectilinear motion of the four elements in the sublunary region, nor did they give them a forced motion contrary to their own nature, like the upward motion that may be given to the heavy elements and the downward that may be given to the light. The only fragment of Leukippos which has survived is an express denial of chance. "Naught happens for nothing," he said, "but everything from a ground and of necessity."<sup>31</sup>

Speaking historically, all this means that Leukippos did not, like Empedokles and Anaxagoras, find it necessary to assume a force to originate motion. He had no need of Love and Strife or Mind, and the reason is clear. Though Empedokles and Anaxagoras had tried to explain multiplicity and motion, they had not broken so radically as Leukippos with the Parmenidean One. Both started with a condition of matter in which the "roots" or "seeds" were mixed so as to be "all together," and they therefore required something to break up this unity. Leukippos, who started with an infinite number of Parmenidean "Ones," so to speak, required no external agency to separate them. What he had to do was just the opposite. He had to account for their coming together, and there was nothing so far to prevent his return to the old idea that motion does not require any explanation at all.<sup>32</sup>

This, then, is what seems to follow from the criticisms of Aristotle and from the nature of the case; but it is not consistent with Zeller's opinion that the original motion of the atoms is a fall through infinite space, as in the system of Epicurus. This view depends, of course, on the further belief that the atoms have weight, and that weight is the tendency of bodies to fall, so we must now consider whether and in what sense weight is a property of the atoms.

## 179. The Weight of the Atoms

As is well known, Epicurus held that the atoms were naturally heavy, and therefore fell continually in the infinite void. The school tradition is, however, that the "natural weight" of the atoms was an addition made by Epicurus himself to the original atomic system. Demokritos, we are told, assigned two properties to atoms, magnitude and form, to which Epicurus added a third, weight.<sup>33</sup> On the other hand, Aristotle distinctly says that Demokritos held the atoms were heavier "in proportion to their excess," and this seems to be explained by the statement of Theophrastos that, according to him, weight depended on magnitude.<sup>34</sup> Even so, however, it is not represented as a primary property of the atoms in the same sense as magnitude.

It is impossible to solve this apparent contradiction without referring briefly to the history of Greek ideas about weight. It is clear that lightness and weight would be among the very first properties of body to be distinctly recognised as such. The necessity of lifting burdens must very soon have led men to distinguish them, though no doubt in a crude form. Both weight and lightness would be thought of as things that were in bodies. Now it is a remarkable feature of early Greek philosophy that from the first it was able to shake itself free from this idea. Weight is never called a "thing" as, for instance, warmth and cold are; and, so far as we can see, not one of the thinkers we have studied hitherto thought it necessary to give any explanation of it at all, or even to say anything about it.<sup>35</sup> The motions and resistances which popular theory ascribes to weight are all explained in some other way. Aristotle distinctly declares that none of his predecessors had said anything of absolute weight and lightness. They had only treated of the relatively light and heavy.<sup>36</sup>

This way of regarding the notions of weight and lightness is clearly formulated for the first time in Plato's *Timaeus*.<sup>37</sup> There is no such thing in the world, we are told there, as "up" or "down." The middle of the world is not "down" but "just in the middle," and there is no reason why any point in the circumference should be said to be "above" or "below" another. It is really the tendency of bodies towards their kin that makes us call a falling body heavy and the place to which it falls "below." Here Plato is really giving the view taken more or less consciously by his predecessors, and it is not till the time of Aristotle that it is questioned.<sup>38</sup> For reasons which do not concern us here, Aristotle identified the circumference of the heavens with "up" and the middle of the world with "down," and equipped the elements with natural weight and lightness that they might perform their rectilinear motions between them. As, however, Aristotle believed there was only one world, and did not ascribe weight to the heavens proper, the effect of this reactionary theory on his cosmical system was not great; it was only when Epicurus tried to combine it with the infinite void that its true character emerged. It seems to me that the nightmare of Epicurean atomism can only be explained on the assumption that an



Aristotelian doctrine was violently adapted to a theory which really excluded it.<sup>39</sup> It is totally unlike anything we meet with in earlier days.

This suggests at once that it is only in the vortex that the atoms acquire weight and lightness,<sup>40</sup> which are, after all, only popular names for facts which can be further analysed. We are told that Leukippos held one effect of the vortex to be that like atoms were brought together with their likes.<sup>41</sup> Here we seem to see the influence of Empedokles, though the "likeness" is of another kind. It is the finer atoms that are forced to the circumference, while the larger tend to the centre. We may express that by saying that the larger are heavy and the smaller light, and this will amply account for everything Aristotle and Theophrastos say; for there is no passage where the atoms outside the vortex are distinctly said to be heavy or light.<sup>42</sup>

There is a striking confirmation of this view in the atomist cosmology quoted above.<sup>43</sup> We are told there that the separation of the larger and smaller atoms was due to the fact that they were "no longer able to revolve in equilibrium owing to their number," which implies that they had previously been in a state of "equilibrium" or "equipoise." Now the word ἰσορροπία has no necessary implication of weight in Greek. A ῥοπή is a mere leaning or inclination in a certain direction, which is the cause rather than the effect of weight. The state of ἰσορροπία is therefore that in which the tendency in one direction is exactly equal to the tendency in any other, and such a state is more naturally described as the absence of weight than as the presence of opposite weights neutralising one another.

Now, if we no longer regard the "eternal motion" of the premundane and extramundane atoms as due to their weight, there is no reason for describing it as a fall. None of our authorities do as a matter of fact so describe it, nor do they tell us in any way what it was. It is safest to say that it is simply a confused motion this way and that.<sup>44</sup> It is possible that the comparison of the motion of the atoms of the soul to that of the motes in a sunbeam coming through a window, which Aristotle attributes to Demokritos,<sup>45</sup> is really intended as an illustration of the original motion of the atoms still surviving in the soul. The fact that it is also a Pythagorean comparison<sup>46</sup> so far confirms this; for we have seen that there is a real connexion between the Pythagorean monads and the atoms. It is also significant that the point of the comparison appears to have been the fact that the motes in the sunbeam move even when there is no wind, so that it would be a very apt illustration indeed of the motion inherent in the atoms apart from the secondary motions produced by impact and collision.

## 180. The Vortex

But what are we to say of the vortex itself which produces these effects? Gomperz observes that they seem to be "the precise contrary of what they should have been by the laws of physics"; for,

"as every centrifugal machine would show, it is the heaviest substances which are hurled to the greatest distance."<sup>47</sup> Are we to suppose that Leukippos was ignorant of this fact, which was known to Empedokles and Anaxagoras?<sup>48</sup> We know from Aristotle that all those who accounted for the earth being in the centre of the world by means of a vortex appealed to the analogy of eddies in wind or water,<sup>49</sup> and Gomperz supposes that the whole theory was an erroneous generalisation of this observation. If we look at the matter more closely, we can see, I think, that there is no error at all.

We must remember that all the parts of the vortex are in contact, and that it is just this contact (*ἐπίψαυσις*) by which the motion of the outermost parts is communicated to those within them. The larger bodies are more able to resist this communicated motion than the smaller, and in this way they make their way to the centre where the motion is least, and force the smaller bodies out. This resistance is surely just the *ἀντέρρσεις τοῦ μέσου* which is mentioned in the doxography of Leukippos,<sup>50</sup> and it is quite in accordance with this that, on the atomist theory, the nearer a heavenly body is to the centre, the slower is its revolution.<sup>51</sup> That is just the point which, as we have seen,<sup>52</sup> Anaximander would seem not to have observed. There is no question of "centrifugal force" at all, and the analogy of eddies in air and water is in reality quite satisfactory.

#### 181. The Earth and the Heavenly Bodies

When we come to details, the reactionary character of the atomist cosmology is very manifest. The earth was heavenly shaped like a tambourine, and floated on the air.<sup>53</sup> It was inclined towards the south because the heat of that region made the air thinner, while the ice and cold of the north made it denser and more able to support the earth.<sup>54</sup> This accounts for the obliquity of the zodiac. Like Anaximander (§ 19), Leukippos held that the sun was farther away than the stars, though he also held that these were farther away than the moon.<sup>55</sup> By this time the occultation of the planets by the moon must have been observed. There seems to be no very clear distinction between the planets and the fixed stars. Leukippos appears to have known the theory of eclipses as given by Anaxagoras.<sup>56</sup> Such other pieces of information as have come down to us are mainly of interest as showing that, in some important respects, the doctrine of Leukippos was not the same as that taught afterwards by Demokritos.<sup>57</sup>

#### 182. Perception

Aetios expressly attributes to Leukippos the doctrine that the objects of sense-perception exist "by law" and not by nature.<sup>58</sup> This must come from Theophrastos; for, as we have seen, all later writers quote Demokritos only. A further proof of the correctness of the statement is that we also find it attributed to Diogenes of Apollonia, who, as Theophrastos tells us, derived some of his views from

Leukippos. There is nothing surprising in this. Parmenides had already declared the senses to be deceitful, and said that colour and the like were only "names,"<sup>59</sup> and Empedokles had also spoken of coming into being and passing away as only a name.<sup>60</sup> It is not likely that Leukippos went much further than this. It would probably be wrong to credit him with Demokritos's clear distinction between "true-born" and "bastard" knowledge, or that between the primary and secondary qualities of matter.<sup>61</sup> These distinctions imply a definite theory of knowledge, and all we are entitled to say is that the germs of it were already to be found in the writings of Leukippos and his predecessors. Of course, these do not make Leukippos a sceptic any more than Empedokles or Anaxagoras, whose remark on this subject (fr. 21a) Demokritos is said to have quoted with approval.<sup>62</sup>

There appear to be sufficient grounds for ascribing the theory of perception by means of *simulacra* or εἶδωλα which played such a part in the systems of Demokritos and Epicurus, to Leukippos.<sup>63</sup> It is a natural development of the Empedoklean theory of "effluences" (§ 118). It hardly seems likely, however, that he went into detail on the subject, and it is safer to credit Demokritos with the elaboration of the theory.

### 183. Importance of Leucippus

We have seen incidentally that there is a wide divergence of opinion among recent writers as to the place of Atomism in Greek thought. The question at issue is really whether Leukippos reached his theory on what are called "metaphysical grounds," that is, from a consideration of the Eleatic theory of reality, or whether, on the contrary, it was a pure development of Ionian science. The foregoing exposition will suggest the true answer. So far as his general theory of the physical constitution of the world is concerned, it has been shown, I think, that it was derived entirely from Eleatic and Pythagorean sources, while the detailed cosmology was in the main a more or less successful attempt to make the older Ionian beliefs fit into this new physical theory. In any case, his greatness consisted in his having been the first to see how body must be regarded if we take it to be ultimate reality. The old Milesian theory had found its most adequate expression in the system of Anaximenes (§ 31), but of course rarefaction and condensation cannot be clearly represented except on the hypothesis of molecules or atoms coming closer together or going farther apart in space. Parmenides had seen that very clearly (fr. 2), and it was the Eleatic criticism which forced Leukippos to formulate his system as he did. Even Anaxagoras took account of Zeno's arguments about divisibility (§ 128), but his system of qualitatively different "seeds," though in some respects it goes deeper, lacks that simplicity which had always been the chief attraction of atomism.

1. Theophrastos said he was an Eleate or a Milesian (R. P. 185), while Diogenes (ix. 30) says he was an Eleate or, according to some, an Abderite. These statements are just like the discrepancies about the native cities of Pythagoreans already noted (Chap. VII. p. 283, n. 1). Diogenes adds that, according to others, Leukippos was a Melian, which is a common confusion. Aetios (i. 7. i) calls Diagoras

of Melos a Milesian (cf. *Dox.* p. 14). Demokritos was called by some a Milesian (Diog. ix. 34; R. P. 186) for the same reason that Leukippos is called an Eleate. We may also compare the doubt as to whether Herodotos called himself a Halikarnassian or a Thourian.

2. Diog. x. 13 (R. P. 185 b), ἀλλ' οὐδὲ Λεύκιππὸν τινα γεγενῆσθαί φησι φιλόσοφον οὔτε αὐτὸς (SC. Ἐπίκουρος) οὔτε Ἐμαρχος. This led E. Rohde to maintain that Leukippos never existed (*Kl. Schr.* i. 205), but this is to make too much of a characteristic Epicurean sally. I suggest that Epicurus said something like Λεύκιππον οὐδ' εἰ γέγονεν οἶδα, which would be idiomatic Greek for "I (purposely) ignore him," "I decline to discuss him." (Cf. e.g. *Dem. De cor.* § 70 Σέρριον δὲ καὶ Δορίσκον καὶ τὴν Πεπαρήθου πόρθησιν . . . οὐδ' εἰ γέγονεν οἶδα.) That would be just like Epicurus.

3. Diog. ix. 41 (R. P. 187). As Diels says, the statement suggests that Anaxagoras was dead when Demokritos wrote. It is probable, too, that this is what made Apollodoros fix his *floruit* just forty years after that of Anaxagoras (Jacoby, p. 290). We cannot make much of the statement of Demokritos that he wrote the *Μικρὸς διάκοσμος* 750 years after the fall of Troy; for we cannot tell what era he used (Jacoby, p. 292).

4. Theophr. *ap. Simpl. Phys.* p. 25, 1 (R. P. 206 a).

5. This was stated by Thrasylos in his list of the tetralogies in which he arranged the works of Demokritos, as he did those of Plato. He gives Tetr. iii. thus: (1) Μέγας διάκοσμος (ὃν οἱ περὶ Θεόφραστον Λεύκιππου φασὶν εἶναι); (2) Μικρὸς διάκοσμος; (3) Κοσμογραφίη; (4) Περί τῶν πλανήτων. The two διάκοσμοι would only be distinguished as μέγας and μικρός when they came to be included in the same *corpus*. A quotation from the *περὶ νοῦ* of Leukippos is preserved in Stob. 1. 160. The phrase ἐν τοῖς Λεύκιππου καλουμένοις λόγοις in *M.X.G.* 980 a 8 seems to refer to Arist. *De gen. corr.* A, 8. 325 a 24, Λεύκιππος δ' ἔχειν ῥήθη λόγους κτλ.. Cf. Chap. II. p. 126, n. 1.

6. See above, p. 330, n. 1.

7. Cf. [Xen.] *Aθ. πολ.* 3, 11. The date is fixed by *C.I.A.* i. 22 a.

8. Theophr. *ap. Simpl. Phys.* p. 28, 4 (R. P. 185). Note the difference of case in *κοινωνήσας Παρμενίδη τῆς φιλοσοφίας* and *κοινωνήσας τῆς Αναξιμένους φιλοσοφίας*, which is the phrase used by Theophrastos of Anaxagoras (p. 253, n. 2). The dative seems to imply a personal relationship. It is quite inadmissible to render "was familiar with the doctrine of Parmenides," as is done in Gomperz, *Greek Thinkers*, vol. i. p. 345.

9. See § 84.

10. Cf. Diog. ix. 30, οὗτος ἤκουσε Ζήνωνος (R. P. 185 b); and *Hipp. Ref.* i. 12, 1, Λεύκιππος . . . Ζήνωνος ἐταῖρος.

11. See above, Chap. V. p. 194, n. 3.

12. See above, Chap. VI. § 131; and Chap. VII. § 145.

13. The words ὡς δοκεῖ do not imply assent to the view introduced by them; indeed they are constantly used in reference to beliefs which the writer does not accept. The translation "methinks" in Gomperz, *Greek Thinkers*, vol. i. p. 345, is therefore most misleading, and there is no justification for Brieger's statement (*Hermes*, xxxvi. p. 165) that Theophrastos dissents from Aristotle's view as given in the passage about to be quoted.

14. This prejudice is apparent all through Gomperz's *Greek Thinkers*, and seriously impairs the value of that fascinating, though somewhat imaginative work. It is amusing to notice that Brieger, from the same point of view, regards the custom of making Anaxagoras the last of the Presocratics as due to theological prepossessions (*Hermes*, xxxvi. p. 185).

15. Arist. *De gen. corr.* A, 8. 324 b 35 (R. P. 193).

16. Arist. *Phys.* A, 3. 187 a 1 (R. P. 134 b).

17. Arist. *De caelo*, Γ, 4. 303 a 8, τρόπον γάρ τινα καὶ οὗτοι (Λεύκιππος καὶ Δημόκριτος) πάντα τὰ ὄντα ποιοῦσιν ἀριθμούς καὶ ἐξ ἀριθμῶν. This also serves to explain the statement of Herakleides attributing the theory of corporeal ὄγκοι to the Pythagorean Ekphantos of Syracuse (above, p. 291, n. 3).

18. The Epicureans misunderstood this point, or misrepresented it in order to magnify their own originality (see Zeller, p. 857, n. 3).

19. Arist. *De caelo*, A, 7. 275 b 32, τὴν δὲ φύσιν εἶναι φασιν αὐτῶν μίαν. Here φύσις can only have one meaning. Cf. *Phys.* Γ, 4. 203 a 34, αὐτῶ (Δημόκριτῳ) τὸ κοινὸν σῶμα πάντων ἐστὶν ἀρχή.
20. Arist. *Met.* A, 4. 985 b 13 (R. P. 192); cf. *De gen. corr.* A, 2. 315 b 6. As Diels suggests, the illustration from letters is probably due to Demokritos. It shows, in any case, how the word στοιχείον came to be used for "element." We must read, with Wilamowitz, τὸ δὲ Ζ τοῦ Η θέσει for τὸ δὲ Ζ τοῦ Ν θέσει, the older form of the letter Ζ being just an Η laid upon its side (Diels, *Elementum*, p. 13, n. 1).
21. Demokritos wrote a work, Περὶ ἰδεῶν (*Sext. Math.* vii. 137 ; R. P. 204), which Diels identifies with the Περὶ τῶν διαφερόντων ὄσμων of Thrasylos, *Tetr.* v. 3. Theophrastos refers to Demokritos, ἐν τοῖς περὶ τῶν εἰδῶν (*De sensibus*, § 51). *Plut. Adv. Col.* 1111 a, εἶναι δὲ πάντα τὰς ἀτόμους, ἰδέας ὑπ' αὐτοῦ καλουμένας (so the MSS.: ἰδίως, Wyttenbach; <ῆ> ἰδέας Diels). Herodian has ἰδέα . . . τὸ ἐλάχιστον σῶμα (Diels, *Vors.* 55 B 141). So Arist. *Phys.* Γ, 4. 203 a 21, (Δημόκριτος) ἐκ τῆς πανσπερμίας τῶν σχημάτων (ἄπειρα ποιεῖ τὰ στοιχεῖα). Cf. *De gen. corr.* A, 2. 315 b (R. P. 196).
22. Arist. *Phys.* Θ, 9. 265 b 25; *Simpl. Phys.* p. 1318, 33, ταῦτα γὰρ (τὰ ἄτομα σώματα) ἐκεῖνοι φύσιν ἐκάλουν.
23. *Simpl. Phys.* p. 36, 1 (Diels, *Vors.* 54 A 14), and R. P. 196 a.
24. Arist. *Met.* A, 4. 985 b 4 (R. P. 192). Cf. Melissos, fr. 7 *sub fin.*
25. Cf. Zeller, "Zu Leukippos" (*Arch.* xv. p. 138).
26. *Diog.* ix. 31 sqq. (R. P. 197, 197 c). This passage deals expressly with Leukippos, not with Demokritos or even "Leukippos and Demokritos." For the distinction between the "summary" and "detailed" doxographies in Diogenes, see Note on Sources, § 15.
27. See *Aet.* i. 4 (*Dox.* p. 289 ; *Vors.* 54 A 24 ; Usener, *Epicurea*, fr. 308). Epicurus himself in the second epistle (*Diog.* x. 88 : Usener, p. 37, 7) quotes the phrase ἀποτομὴν ἔχουσα ἀπὸ τοῦ ἀπείρου.
28. Gomperz, *Greek Thinkers*, Vol. i. p. 323.
29. Arist. *Phys.* Θ6, 1. 252 a 32 (R. P. 195 a); *De caelo*, Γ, 2. 300 b 8 (R. P. 195); *Met.* A, 4. 985 b19 (R. P. *ib.*).
30. Arist. *Phys.* B, 4. 196 a 24 (R. P. 195 d). Cicero, *De nat.* d. i. 66 (R. P. *ib.*). The latter passage is the source of the phrase "fortuitous concurrence" (*concurrere*=συντρέχειν).
31. *Aet.* i. 25, 4 (*Dox.* p. 321), Λεύκιππος πάντα κατ' ἀνάγκην, τὴν δ' αὐτὴν ὑπάρχειν εἰμαρμένην. λέγει γὰρ ἐν τῷ Περὶ νοῦ· Οὐδὲν χρῆμα μάλιστα γίνεταί, ἀλλὰ πάντα ἐκ λόγου τε καὶ ὑπ' ἀνάγκης.
32. *Introd.* § VIII.
33. *Aet.* i. 3, 18 (of Epicurus), συμβεβηκέναι δὲ τοῖς σώμασι τρία ταῦτα, σχῆμα, μέγεθος, βάρος. Δημόκριτος μὲν γὰρ ἔλεγε δύο, μέγεθος τε καὶ σχῆμα, ὃ δὲ Ἐπίκουρος τούτοις καὶ τρίτον βάρος προσέθηκεν· ἀνάγκη γὰρ, φησί, κινεῖσθαι, τὰ σώματα τῆ τοῦ βάρους πληγῆ· ἐπεὶ οὐ κινήθησεται; *ib.* 12, 6, Δημόκριτος τὰ πρῶτά φησι σώματα, ταῦτα δ' ἦν τὰ ναστά, βάρος μὲν οὐκ ἔχειν, κινεῖσθαι δὲ κατ' ἀλληλοτυπίαν ἐν τῷ ἀπείρῳ. Cic. *De fato*, 20, "vim motus habebant (atomi) a Democrito impulsione quam plagam ille appellat, a te, Epicure, gravitatis et ponderis." These passages represent the Epicurean school tradition, which would hardly misrepresent Demokritos on so important a point. His works were still accessible. It is confirmed by the Academic tradition in *De fin.* i. 17 that Demokritos taught the atoms moved "in infinito inani, in quo nihil nec summum nec infimum nec medium nec extremum sit." This doctrine, we are quite rightly told, was "depraved" by Epicurus.
34. Arist. *De gen. corr.* A, 8. 326 a 9, καίτοι βαρύτερόν γε κατὰ τὴν ὑπεροχὴν φησὶν εἶναι Δημόκριτος ἕκαστον τῶν ἀδιαίρετων. I cannot believe this means anything else than what Theophrastos says in his fragment on sensation, § 67 (R. P. 199), βαρὺ μὲν οὖν καὶ κοῦφον τῷ μεγέθει διαίρει Δημόκριτος.
35. In *Aet.* i. 12, where the *placita* regarding the heavy and light are given, no philosopher earlier than Plato is referred to. Parmenides (fr. 8, 59) speaks of the dark element as ἐμβριθέες. Empedokles (fr. 17) uses the word ἀτάλαντον. I do not think that there is any other place where weight is even mentioned in the fragments of the early philosophers.
36. Arist. *De caelo*, Δ, I. 308 a 9, περὶ μὲν οὖν τῶν ἀπλῶς λεγομένων (βαρέων καὶ κούφων) οὐδὲν εἴρηται παρὰ τῶν πρότερον.
37. Plato, *Tim.* 61 c 3 sqq.

38. Zeller says (p. 876) that in antiquity no one ever understood by weight anything else than the property of bodies in virtue of which they move downwards; except that in such systems as represent all forms of matter as contained in a sphere, "above" is identified with the circumference and "below" with the centre. As to that, I can only say that no such theory of weight is to be found in the fragments of the early philosophers or is anywhere ascribed to them, while Plato expressly denies it.
39. The Aristotelian criticisms which may have affected Epicurus are such as we find in *De caelo*, A, 7. 275 b 29 *sqq.* Aristotle there argues that, as Leukippos and Demokritos made the φύσις of the atoms one, they were bound to give them a single motion. That is just what Epicurus did, but Aristotle's argument implies that Leukippos and Demokritos did not. Though he gave the atoms weight, even Epicurus could not accept Aristotle's view that some bodies are naturally light. The appearance of lightness is due to ἔκθλιψις the squeezing out of the smaller atoms by the larger.
40. In dealing with Empedokles, Aristotle expressly makes this distinction. Cf. *De caelo*, B, 13, especially 295 a 32 *sqq.*, where he points out that Empedokles does not account for the weight of bodies on the earth (οὐ γὰρ ἢ γε δίνη πλησιάζει πρὸς ἡμᾶς), nor for the weight of bodies before the vortex arose (πρὶν γενέσθαι τὴν δίνην).
41. Diog. *loc. cit.* (p. 338).
42. This seems to be in the main the view of Dyroff, *Demokritstudien* (1899), pp. 31 *sqq.*, though I should not say that lightness and weight only arose in connexion with the atoms of the earth (p. 35), If we substitute "world" for "earth," we shall be nearer the truth.
43. See above, p. 338.
44. This view was independently advocated by Brieger (*Die Urbewegung der Atome und die Weltentstehung bei Leucipp and Demokrit*, 1884) and Liepmann (*Die Mechanik der Leucipp-Demokritischen Atome*, 1885), both of whom unnecessarily weakened their position by admitting that weight is an original property of the atoms. On the other hand, Brieger denies that the weight of the atoms is the cause of their original motion, while Liepmann says that before and outside the vortex there is only a latent weight, a *Pseudoschwere*, which only comes into operation in the world. It is surely simpler to say that this weight, since it produces no effect, does not yet exist. Zeller rightly argues against Brieger and Liepmann that, if the atoms have weight, they must fall; but, so far as I can see, nothing he says tells against their theory as I have restated it. Gomperz adopts the Brieger-Liepmann explanation. See also Lortzing, *Bursians Jahresber.*, 1903, pp. 136 *sqq.*
45. Arist. *De an.* A, 2. 403 b 28 *sqq.* (R. P. 200).
46. Ibid. A, 2, 404 a 17 (R. P. 86 a).
47. Gomperz, *Greek Thinkers*, i. p. 339.
48. For Empedokles, see Chap. V. p. 237; Anaxagoras, see Chap. VI. p. 269.
49. Arist. *De caelo*, B, 13. 295 a 10 ταύτην γὰρ τὴν αἰτίαν (sc. τὴν δίνησιν) πάντες λέγουσιν ἐκ τῶν ἐν τοῖς ὑγροῖς καὶ περὶ τὸν ἀέρα συμβαινόντων· ἐν τούτοις γὰρ αἰεὶ φέρεται τὰ μείζω καὶ τὰ βαρύτερα πρὸς τὸ μέσον τῆς δίνης.
50. Diog. ix. 32. Cf. especially the phrases ὧν κατὰ τὴν τοῦ μέσου ἀντέρεισιν περιδινουμένων, συμμενόντων αἰεὶ τῶν συνεχῶν κατ' ἐπίμαυσιν τῆς δίνης, and συμμενόντων τῶν ἐνεχθέντων ἐπὶ τὸ μέσον.
51. Cf. Lucr. v. 621 *sqq.*
52. See p. 69.
53. Aet. iii. 3, 10, quoted above, p. 79, n. 1.
54. Aet. iii. 12, 1, Λεύκιππος παρεκπεσεῖν τὴν γῆν εἰς τὰ μεσημβρινὰ μέρη διὰ τὴν ἐν τοῖς μεσημβρινοῖς ἀραιότητα, ἅτε διὰ πεπηγότων τῶν βορείων διὰ τὸ κατενῦχθαι τοῖς κρυμοῖς, τῶν δὲ ἀντιθέτων πεπερωμένων..
55. Diog. ix. 33, εἶναι δὲ τὸν τοῦ ἡλίου κύκλον ἐξώτατον, τὸν δὲ τῆς σελήνης προσγειότατον, <τοὺς δὲ> τῶν ἄλλων μεταξύ τούτων.
56. From Diog. *loc. cit.* (supra, p. 339), it appears that he dealt with the question of the greater frequency of lunar as compared with solar eclipses.

57. Diels pointed out that Leukippos's explanation of thunder (πυρὸς ἐναποληφθέντος νέφεσι παχυτάτοις ἔκπτωσιν ἰσχυρὰν βροντὴν ἀποτελεῖν ἀποφαίνεται, Aet. iii. 3, 10) is quite different from that of Demokritos (βροντὴν . . . ἐκ συγκρίματος ἀνωμάλου τὸ περιελιφὸς αὐτὸ νέφος πρὸς τὴν κάτω φορὰν ἐκβιαζομένου, *ib.* 11). The explanation given by Leukippos is derived from that of Anaximander, while Demokritos is influenced by Anaxagoras. See Diels, 35 *Philol.-Vers.* 97, 7.

58. Aet. iv. 9, 8, οἱ μὲν ἄλλοι φύσει τὰ αἰσθητά, Λεύκιππος δὲ Δημόκριτος καὶ Διογένης νόμῳ. See Zeller, *Arch.* v. p. 444

59. Chap. IV. p. 176. The remarkable parallel quoted by Gomperz (p. 321) from Galileo, to the effect that tastes, smells, and colours *non sieno altro che puri nomi* should, therefore, have been cited to illustrate Parmenides rather than Demokritos.

60. See p. 206, fr. 9.

61. For these see Sext. *Math.* vii. 135 (R. P. 204).

62. Sext. vii. 140, "ὄψις γὰρ ἀδήλων τὰ φαινόμενα" ὡς φησιν Ἀναξαγόρας, ὃν ἐπὶ τούτῳ Δημόκριτος ἐπαινεῖ.

63. See Zeller, "Zu Leukippos" (*Arch.* xv. p. 138). The doctrine is attributed to him in Aet. iv. 13, 1 (*Dox.* p. 403); and Alexander, *De sensu*, pp. 24, 14 and 56, 10, also mentions his name in connexion with it. This must come from Theophrastos.