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*PHYSICS*

BOOKS III AND IV

*Translated with Introduction and Notes*

*by*

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productive of motion, in respect of this opposition, and in respect of the hard and soft they are productive of being acted upon and not being acted upon, and so not of motion but rather of qualitative change. Let this then be our determination about void and of the ways in which it does and does not exist. 25

## CHAPTER 10

217<sup>b</sup>29. After what has been said, the next thing is to inquire into time. First, it is well to go through the problems about it, using the untechnical arguments as well [as technical ones]: whether it is among things that are or things that are not, and then what its nature is. 30

217<sup>b</sup>32. That it either is not at all or [only] scarcely and dimly is, might be suspected from the following considerations. (1) Some of it has been and is not, some of it is to be and is not yet. From these both infinite time and any arbitrary time are composed. But it would seem to be impossible that what is composed of things that are not should participate in being. (2) Further, it is necessary that, of everything that is resolvable into parts, if it is, either all the parts or some of them should be when it is. But of time, while it is resolvable into parts, some [parts] have been, some are to be, and none is. The now is not a part, for a part measures [the whole], and the whole must be composed of the parts, but time is not thought to be composed of nows. (3) Again, it is not easy to see whether the now, which appears to be the boundary between past and future, remains always one and the same or is different from time to time. 10  
(a) If it is always different, and if no two distinct parts of things that are in time are simultaneous—except those of which one includes the other, as the greater time includes the smaller—and if the now which is not but which previously was must have ceased to be at some time, then the nows too will not be simultaneous, and it must always be the case that the previous now has ceased-to-be. Now, that it has ceased-to-be in itself is not possible, because then it is; but it cannot be that the former now has ceased to be in another now, either. For we take it that it is impossible for the nows to be adjoining one 15

another, as it is for a point to be adjoining a point; so, since the now has not ceased to be in the next now but in some other one, it will  
 20 be simultaneously in the nows in between, which are infinitely many; but this is impossible. (*b*) Yet it is not possible either that the same now should always persist. For (*i*) nothing that is divisible and finite has [only] one limit, whether it is continuous in one direction or in more than one. But the now is a limit, and it is possible to take  
 25 a finite time. Again (*ii*) if to be together in time and neither before or after, is to be in the one and the same now, and if both previous and subsequent [nows] are in this present now, then events of a thousand years ago will be simultaneous with those of today and none will be either previous or subsequent to any other.

30 **218<sup>a</sup>30.** Let this much, then, be our examination of difficulties about the properties of time. As to what time is and what its nature is, this is left equally unclear by the recorded opinions [of earlier thinkers] and by our own previous discussions. Some say it is the  
 218<sup>b</sup> change of the universe, some the [celestial] sphere itself. Yet of the [celestial] revolution even a part is a time, though it is not a revolution. (The part considered is a part of a revolution, but not a revolution.) Again, if there were more than one world, time would equally be the change of any one whatever of them, so that there  
 5 would be many times simultaneously. The sphere of the universe was thought to be time, by those who said it was, because everything is both in time and in the sphere of the universe; but this assertion is too simple-minded for us to consider the impossibilities it contains. **218<sup>b</sup>9.** Since time is above all thought to be change, and a kind of  
 10 alteration, this is what must be examined. Now the alteration and change of anything is only in the thing that is altering, or wherever the thing that is being changed and altering may chance to be; but time is equally everywhere and with everything. Again, alteration may be faster or slower, but not time; what is slow and what is fast  
 15 is defined by time, fast being that which changes much in a short [time], slow that which changes little in a long [time]. But time is not defined by time, whether by its being so much or by its being of such a kind. It is manifest, then, that time is not change (let it make  
 20 no difference to us, at present, whether we say 'change' or 'alteration').

## CHAPTER 11

218<sup>b</sup>21. And yet [time is] not apart from alteration, either. When we ourselves do not alter in our mind or do not notice that we alter, then it does not seem to us that any time has passed, just as it does not seem so to the fabled sleepers in [the sanctuary of] the heroes in Sardinia, when they wake up; they join up the latter now to the former, and make it one, omitting what is in between because of failure to perceive it. So, just as, if the now were not different but one and the same, there would be no time, in the same way, even when the now *is* different but is not noticed to be different, what is in between does not seem to be any time. If, then, when we do not mark off any alteration, but the soul seems to remain in one indivisible, it happens as a consequence that we do not think there was any time, and if when we do perceive and mark off [an alteration], then we do say that some time has passed, then it is manifest that there is no time apart from change and alteration. It is manifest, then, that time neither is change nor is apart from change, and since we are looking for what time is we must start from this fact, and find what aspect of change it is. We perceive change and time together: even if it is dark and we are not acted upon through the body, but there is some change in the soul, it immediately seems to us that some time has passed together with the change. Moreover, whenever some time seems to have passed, some change seems to have occurred together with it. So that time is either change or some aspect of change; and since it is not change, it must be some aspect of change.

219<sup>a</sup>10. Now since what changes changes from something to something, and every magnitude is continuous, the change follows the magnitude: it is because the magnitude is continuous that the change is too. And it is because the change is that the time is. (For the time always seems to have been of the same amount as the change.)

219<sup>a</sup>14. Now the before and after is in place primarily; there, it is by convention. But since the before and after is in magnitude, it must also be in change, by analogy with what there is there. But in time, too, the before and after is present, because the one always follows the other of them. The before and after in change is, in

respect of what makes it what it is, change; but its being is different and is not change.

219<sup>a</sup>22. But time, too, we become acquainted with when we mark off change, marking it off by the before and after, and we say that  
 25 time has passed when we get a perception of the before and after in change. We mark off change by taking them to be different things, and some other thing between them; for whenever we conceive of the limits as other than the middle, and the soul says that the nows are two, one before and one after, then it is and this it is that we say time is. (What is marked off by the now is thought to be time: let  
 30 this be taken as true.) So whenever we perceive the now as one, and not either as before and after in the change, or as the same but pertaining to something which is before and after, no time seems to have passed, because no change [seems to have occurred] either. But whenever [we do perceive] the before and after, then we speak of time.

219<sup>b</sup> 219<sup>b</sup>1. For that is what time is: a number of change in respect of the before and after. So time is not change but in the way in which change has a number. An indication: we discern the greater and  
 5 the less by number, and greater and less change by time; hence time is a kind of number. But number is [so called] in two ways: we call number both (*a*) that which is counted and countable, and (*b*) that by which we count. Time is that which is counted and not that by which we count. (That by which we count is different from that which is counted.)

219<sup>b</sup>9. Just as the change is always other and other, so the time is  
 10 too, though the whole time in sum is the same. For the now is the same X, whatever X it may be which makes it what it is; but its being is not the same. It is the now that measures time, considered as before and after. The now is in a way the same, and in a way not the same: considered as being at different stages, it is different—that is what it is for it to be a now—but whatever it is that makes it a now  
 15 is the same. For change follows magnitude, as was said, and time, we assert, follows change. As it is with the point, then, so it is with the moving thing, by which we become acquainted with change and the before and after in it. The moving thing is, in respect of what makes it what it is, the same (as the point is, so is a stone or something else

of that sort); but in definition it is different, in the way in which the sophists assume that being Coriscus-in-the-Lyceum is different from being Coriscus-in-the-marketplace. That, then, is different by being in different places, and the now follows the moving thing as time does change. For it is by the moving thing that we become acquainted with the before and after in change, and the before and after, considered as countable, is the now. Here too, then, whatever it is that makes it the now is the same—it is the before and after in change. But its being is different: the now is the before and after, considered as countable. Moreover, it is this that is most familiar; for the change too is known by that which changes, and the motion by the moving thing, because the moving thing is a ‘this’, but the change is not. So the now is in a way the same always, and in a way not the same, since the moving thing too [is so].

**219<sup>b</sup>33.** It is manifest too that, if time were not, the now would not be either, and if the now were not, time would not be. For just as the moving thing and the motion go together, so too do the number of the moving thing and the number of the motion. Time is the number of the motion, and the now is, as the moving thing is, like a unit of number.

**220<sup>a</sup>4.** Moreover, time is both continuous, by virtue of the now, and divided at the now—this too follows the motion and the moving thing. For the change and the motion too are one by virtue of the moving thing, because that is one (not [one] X, whatever X it may be that makes it what it is—for then it might leave a gap—but [one] in definition). And this bounds the change before and after. This too in a sense follows the point: the point, too, both makes the length continuous and bounds it, being the beginning of one and the end of another. But when one takes it in this way, treating the one [point] as two, one must come to a halt, if the same point is to be both beginning and end. But the now is always different, because the moving thing changes. Hence time is a number, not as [a number] of the same point, in that it is beginning and end, but rather in the way in which the extremes [are the number] of the line—and not as the parts [of the line] are, both because of what has been said (one will treat the middle point as two, so that there will be rest as a result), and further [because] it is manifest that the now is no portion of

time, nor [is] the division [a portion] of the change, any more than  
 20 the point is of the line (it is the two lines that are portions of the  
 one). So, considered as a limit, the now is not time but is accidentally  
 so, while, considered as counting, it is a number. (For limits are of  
 that alone of which they are limits, but the number of these horses,  
 the ten, is elsewhere too.)

220<sup>a</sup>24. It is manifest then that time is a number of change in  
 25 respect of the before and after, and is continuous, for it is [a number]  
 of what is continuous.

## CHAPTER 12

220<sup>a</sup>27. The least number, without qualification, is the two; but  
 [a least] particular number there in a way is and in a way is not, e.g.  
 of a line, the number least in multiplicity is two lines or one line, but  
 30 in magnitude there is no least number, for every line always gets  
 divided. So it is, then, with time too: the least time in respect of  
 number is one time or two times, but in respect of magnitude there  
 is none.

220<sup>a</sup>32. It is manifest too that it is not said to be fast or slow, but  
 220<sup>b</sup> is said to be much and little, and long and short. It is as being con-  
 tinuous that it is long and short, and as a number that it is much and  
 little. But it is not fast or slow—nor indeed is any number by which  
 we count fast or slow.

5 220<sup>b</sup>5. It is the same time, too, everywhere together, but before  
 and after it is not the same [time], since the present alteration is one,  
 but the past alteration and the future one are different, and time is  
 not the number by which we count but the number which is  
 counted, and this number turns out to be always different before  
 10 and after, because the nows are different. (The number of a hundred  
 horses and that of a hundred men is one and the same, but the things  
 of which it is the number are different—the horses are different from  
 the men.) Again, in the sense in which it is possible for one and the  
 same change to occur again and again, so too with time: e.g. a year,  
 or spring or autumn.

15 220<sup>b</sup>14. Not only do we measure change by time, but time by



change also, because they are defined by one another. The time defines the change, being its number, and the change the time. We speak of 'much time' and 'little time', measuring it by change, just as we measure the number by what is countable: e.g. by the one horse we measure the number of the horses, for it is by number that we become acquainted with the multiplicity of the horses and, conversely, by the one horse that we become acquainted with the number of horses itself. Similarly, in the case of time and change, we measure the change by the time and the time by the change. It is reasonable that this should turn out so, because change follows magnitude, and time follows change, in being a quantity and continuous and divisible: for it is because the magnitude is of this kind that the change has these properties and because change is that time does. And we measure both magnitude by change and change by magnitude: we say the road is long, if the journey is long, and we say the journey is long, if the road is; and the time, if the change is, and the change, if the time is.

**220<sup>b</sup>32.** Since time is a measure of change and of being-in-change, and since it measures change by defining some change which will measure out the whole change (just as the cubit measures length by defining some magnitude which will measure off the whole magnitude), and since for a change the being in time is the being measured by time both of the change itself and of its being (time measures at once the change and the being of the change, and this is what it is, for the change, to be in time, viz. its being's being measured), it is clear, then, that for other things too this is what it is to be in time: their being's being measured by time. For to be in time is one or other of two things: *either*, to be when time is; *or*, [to be in it] in the way in which we say that some things are 'in number', which means that [something is in number] *either* as a part or property of number, and, in general, that it is some aspect of number, *or* that there is a number of it. And since time is a number, the now and the before and everything of that kind are in time in the way in which the limit and the odd and the even are in number (they are aspects of number as the others are of time). But objects are [in time] as they are in number. If so, they are surrounded by time just as the things in number are by number and the things in place by place.

It is manifest, too, that to be in time is not to be when time is, any  
 20 more than to be in change or in place is to be when change is or  
 place is. If this is what 'in something' is to mean, then all objects will  
 be in anything whatever, and the world will be in the grain of millet,  
 since when the grain is, the whole is too. This is accidentally so, but  
 the other is a necessary consequence: for what is in time there must  
 25 be some time when that too is, and for what is in change there must  
 then be change.

221<sup>a</sup>26. Since what is in time is so as in a number, there will be  
 found a time greater than anything that is in time, so that of  
 necessity all things that are in time are surrounded by time, just like  
 all other things that are in something: e.g. the things that are in place  
 30 [are surrounded] by place. Moreover, they are acted upon in some  
 respect by time, just as we are in the habit of saying 'time wears  
 things away' and 'everything grows old through time' and 'forgets  
 because of time'—but not 'learns because of time' or 'becomes  
 221<sup>b</sup> young' or 'becomes beautiful'. For time, in itself, is responsible for  
 ceasing-to-be rather [than for coming-to-be]; for it is the number of  
 change, and change removes what is present. So it is manifest that  
 the things that always are, considered as such, are not in time, for  
 5 they are not surrounded by time, nor is their being measured by  
 time, and an indication of this is that they are not acted on at all by  
 time either, which shows that they are not in time.

221<sup>b</sup>7. And since time is the measure of change, it will be the  
 measure of rest also. For all rest is in time; it is not the case that, as  
 10 what is in change must change, so what is in time must, since time is  
 not change but the number of change, and in the number of change  
 there can also be that which is at rest. For it is not everything that is  
 unchanging that is at rest, but that which, while deprived of change,  
 has it in its nature to change, as was said earlier. For a thing to be in  
 15 number is for there to be some number of the object, and for its  
 being to be measured by the number in which it is, and so, if it is in  
 time, by time. Time will measure what is changing and what is at  
 rest, the one *qua* changing and the other *qua* at rest; for it will  
 measure their change and their rest, [measuring] how great each is.  
 Hence, what is changing is not measurable by time simply inasmuch  
 20 as it is of some quantity, but inasmuch as its change is of some

quantity. And so all that neither changes nor is at rest is not in time; for to be in time is to be measured by time, and time is a measure of change and rest.

221<sup>b</sup>23. It is manifest, therefore, that not everything that is not will be in time either; for example, all the things that cannot be otherwise [than not being], like the diagonal's being commensurate with the side. For in general, if time is a measure in itself of change and of other things accidentally, it is clear that all things of which it measures the being must have their being in being at rest or changing. Now all things that admit of ceasing-to-be and coming-to-be and, generally, that at some time are and at some time are not, must be in time—there will be some greater time which will exceed both their being and that [time] which measures their being. But, of things that are not, all that time surrounds either were (e.g. Homer once was) or will be (e.g. something future), on whichever side [of the present] it may surround them; and if on both sides, both. But all the things that it nowhere surrounds neither were nor are nor will be; and, among things that are not, such are all those that are such that their contraries always are: e.g. the diagonal's being incommensurable always is, and this will not be in time. So its being commensurable will not be [in time] either; so *that* always is not being opposite to what always is. But everything of which the opposite not always is, is capable of being and of not being, and there is coming-to-be of it and ceasing-to-be. 5

### CHAPTER 13

222<sup>a</sup>10. The now is a link of time, as has been said, for it links together past and future time, and is a limit of time, since it is a beginning of one and an end of another. But this is not manifest, as it is in the case of the point at rest. It divides potentially, and *qua* such, the now is always different, but *qua* binding together it is always the same, just as in the case of mathematical lines: [a point is] not always the same point in thought, for if one divides the line it is different in different cases, but inasmuch as [the line] is one, [the point] is the same everywhere. So too the now is on the one hand a division of time, in potentiality, on the other hand the limit and 15

- union of both [times]; the division and the unification are the same thing and in respect of the same thing, but their being is not the same. This then is one sense of 'now'; another is when the time of a thing is close at hand: 'he will come now' because he will come today, 'he has now come', because he came today. But it is not the case that the Trojan war has *now* occurred, or the deluge: the time is continuous [from now] to then, but they are not close at hand.
- 20 **222<sup>a</sup>24.** The 'at some time' is a time defined in relation to the now (in the former sense): e.g. 'Troy fell at some time', 'the deluge will occur at some time'—the time must be finite in relation to the now. Therefore there will be a certain quantity of time from this to that, and there was [from this] to the past one. If there is no time which is not 'at some time', every time will be finite. Will time then give
- 30 out? Or not, if there always is change? Will it then be different, or the same many times over? It is clear that, as change is, so will time too be; if one and the same change comes to be at some time, the time too will be one and the same, and if not, not. Since the now is
- 222<sup>b</sup>** an end and a beginning of time, but not of the same time, being the end of past time and the beginning of future time, time will be like the circle—the convex and the concave are in what is in a sense the same—so too time is always at a beginning and at an end. And for
- 5 this reason it is thought always different, for the now is not the beginning and the end of the same thing; otherwise opposites would hold simultaneously and in respect of the same thing. And so time will not give out, for it is always at a beginning.
- 222<sup>b</sup>7.** The *just* is that which is close to the present indivisible now, whether it is a part of future time ('when are you taking a walk?' 'I'm just taking it'—because the time in which he is going to
- 10 go is near) or of past time, when it is not far from the now ('when are you taking a walk?' 'I've just taken it'). But to say that Troy has just fallen—we do not say it, because that is too far from the now. The *recently* is the portion of the past which is close to the present now. ('When did you come?' 'Recently', if the time is close to the actual now.) What is far away [from the now] is *long ago*. The
- 15 *suddenly* is that which removes out of its previous state in a time which is so small as to be imperceptible.
- 222<sup>b</sup>16.** It is in time that everything comes to be and ceases to be.

For this reason some called it the wisest of things, but the Pythagorean Paron the most foolish, because people forget in time too; and he was more correct. It is clear, then, that it is, in itself, responsible for ceasing-to-be rather than for coming-to-be, as was stated earlier, because alteration, in itself, is productive of removal from a previous state—but it is, accidentally, responsible for coming-to-be and for being. A sufficient indication is that nothing comes to be without its being changed in some way and being acted upon, but a thing may cease to be even though it is not changed, and this is above all what we usually call ceasing-to-be by the agency of time. Yet even this is not produced by time, but it happens that this alteration too occurs in time. 20

222<sup>b</sup>27. It has now been stated that time is, and what it is, and in how many ways 'now' is said, and what 'at some time' and 'recently' and 'just' and 'long ago' and 'suddenly' are. 25

#### CHAPTER 14

222<sup>b</sup>30. Now that we have determined these matters in this way, it is manifest that every alteration and all that changes is in time. 'Faster' and 'slower' apply to every alteration, since in every case this is obviously true. (I say that changes faster which is earlier to alter into a given [state], changing over the same extension and with a uniform change (e.g., in the case of locomotion, if both things are changing along the curve or along the straight line, and in other cases similarly).) But the before is in time, for we use 'before' and 'after' according to the distance from the now, and the now is the boundary of the past and the future. So, since the nows are in time, the before and after will also be in time; for the distance from the now will be in that in which the now is. ('Before' is applied in opposite ways in relation to past time and to future time: in the past, we call 'before' what is further from the now, and 'after' what is nearer to it, but in the future we call 'before' what is nearer and 'after' what is further.) So, since the before is in time, and the before accompanies every change, it is manifest that every alteration and every change is in time. 223<sup>a</sup> 5 10 15

- 223<sup>a</sup>16. It is also worth investigating how time is related to the soul, and for what reason it is that time is thought to be in everything—on earth and in the sea and in the heavens. Is it that it is a property or a state of change, being the number [of it], and all these
- 20 things are changeable, since they are all in place, and time and change are together both in potentiality and in actual operation? One might find it a difficult question, whether if there were no soul there would be time or not. For if it is impossible that there should be something to do the counting, it is also impossible that anything should be countable, so that it is clear that there would be no number either, for number is either that which has been counted or that
- 25 which can be. But if there is nothing that has it in its nature to count except soul, and of soul [the part which is] intellect, then it is impossible that there should be time if there is no soul, except that there could be that X which time is, whatever X makes it what it is; as for example if it is possible for there to be change without soul. The before and after are in change, and time is these *qua* countable.
- 223<sup>a</sup>29. One might also find it a difficult question: of what kind of
- 30 change is time a number? Perhaps of any kind whatever? After all, [things] come to be and cease to be and increase in size and change qualitatively and move in time. So it is a number of each change, in as much as there is change. Hence it is, without qualification, a number of continuous change, not of a particular [kind of] change. But
- 223<sup>b</sup> it is possible that now something else as well has been made to change: so it would be the number of either change. Is there then another time, and will there be two equal times together? Perhaps not, for the time which is equal and together is one and the same (and even those which are not together are the same in kind).
- 5 Suppose there are some dogs and some horses, seven of each; the number is the same. In the same way, the time is the same of changes that reach a limit together, though one perhaps is fast and one not, one is locomotion and one a qualitative change. Still, the time is the same, if it is equal and together, of both the qualitative
- 10 change and the locomotion. And this is why, while changes are various and in different places, time is everywhere the same, because the number, too, of things equal and together is one and the same everywhere.

223<sup>b</sup>12. Since there is locomotion, and, as a kind of locomotion, circular motion, and since each thing is counted by some one thing of the same kind (units by a unit, horses by a horse), and therefore time too by some definite time, and since, as we said, time is measured by change and change by time (that is, the quantity of the change and of the time is measured by the change defined by time)—if, then, that which is first is the measure of all things of the same sort, then uniform circular motion is most of all a measure, because the number of this is most easily known. (There is no uniform qualitative change or uniform increase in size or uniform coming-to-be, but there *is* uniform locomotion.) This is why time is thought to be the motion of the [celestial] sphere, because the other changes are measured by this one, and time by this change. And for this reason too, what is commonly said turns out true: people say that human affairs are a cycle, and so is what happens to the other things that have a natural motion and come to be and cease to be. This is so because all these things are discerned by means of time, and make an end and a beginning as if according to some circular course. Indeed, time itself is thought to be a kind of cycle, and this, in turn, is thought because it is the measure of that kind of motion and is itself measured by that kind. So that to say that those things that come to be are a cycle is to say that there is a kind of cycle of time; and this is so, because it is measured by circular motion. For, over and above the measure, nothing else is apparent which is obviously measured, but the whole is either one measure or more than one. 224<sup>a</sup>

224<sup>a</sup>2. It is correct, too, to say that the number of the sheep and of the dogs is the same, if each number is equal, but that the ten is not the same [ten] nor [are there] ten of the same; just as the equilateral and the scalene are not the same triangles, though they are the same figure, in that both are triangles. For a thing is said to be the same X if it does not differ by the difference of an X, but not [the same X] if it does: e.g. a triangle differs from a triangle by the difference of a triangle, and therefore they are different triangles; but it does not [differ by the difference] of a figure, but the two are in one and the same division. For one kind of figure is a circle, another a triangle, and one kind of triangle is equilateral, another is scalene. So they are the same figure, namely a triangle, but not the same triangle. And so

too it is the same number, since the number of them does not differ by the difference of a number, but not the same ten, since the things  
15 it is said of are different: dogs in one case, horses in another.

**224<sup>a</sup>15.** An account, then, has been given both of time itself and of the connected matters proper to our inquiry.