

# *Physis* in the Pythagorean Tradition\*

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This paper discusses the notion of *physis* in the fragments of the Pythagoreans Philolaus of Croton and Archytas of Tarentum. Building on the twentieth-century discussion of the two basic meanings of *physis*, ‘growth’ and ‘being’ (section 2), it argues that Philolaus was most probably the author of the first treatise entitled Περὶ φύσεως, as the first-century BC writer Diogenes of Magnesia testifies. The remaining evidence on Presocratic books entitled Περὶ φύσεως is late and unreliable (section 3). ἅ φύσις in Philolaus B 1 and 6 denotes ‘all that exists’; the Pythagorean speaks of *physis* in a generalized collective sense as of everything that came into being and exists in the world-order (section 4). As distinct from Philolaus, Archytas did not develop a doctrine of principles, and his epistemology was not constrained by metaphysical presuppositions. Archytas B 1 considers *physis* from both cosmological and epistemological points of views, as ‘the nature of the whole’ that is available to human cognition. Without setting any conditions or limitations to this process, as Philolaus did, he reinforces the latter’s declaration that “all the things that are known have number” (B 4) by making four Pythagorean *mathēmata* the principal cognitive tools for scientific enquiry into nature (section 5).

**Keywords:** Philolaus of Croton, Archytas of Tarent, Pythagoreans tradition, *physis*.

## 1. The Ionians and the Pythagoreans

The Pythagorean *arithmos* has been frequently commented upon from the time of Aristotle (*Metaphysics* A), whereas the notion of *physis* in Pythagorean philosophies received much less attention. This is unfair, if only because in the preserved fragments of Philolaus and Archytas *physis* occurs no less often than *arithmos* and is no less significant: in both cases we can safely infer a new, comprehensive meaning of *physis*. Yet Philolaus’ fragments have been long regarded as spurious,<sup>1</sup> and Archytas until recently has not been considered a philosopher worthy of attention,<sup>2</sup> so scholars writing on the notion of *physis* in the Presocratics as a rule associated it primarily with the Ionians and their περὶ φύσεως ἰστορία.<sup>3</sup>

The fact, however, is that the sixth-century Milesians were engaged in the inquiry into nature without knowing the formula περὶ φύσεως ἰστορία that is first attested in Plato

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<sup>1</sup> Until Burkert 1972 (German original 1962) proved the authenticity of a part of them, B 1–7, 13.

<sup>2</sup> Even after Huffman 2005, a major work on Archytas, he is still missing in Graham 2010.

<sup>3</sup> Those who regarded Philolaus as spurious include e.g. Hardy 1884, 29–30; Heidel 1910, 97 n. 4, 111; Beardslee 1918, 14; Schmalzriedt 1970, 85 n. 7, but cf. 126 and n. 21; Kirk 1954, 230 n. 1.

(*Phd.* 96a). Though our evidence on the Milesians is very meagre, the phrase *περὶ φύσεως* never occurs in the fragments of the fifth-century Ionians Heraclitus, Anaxagoras, and Diogenes of Apollonia. Anaxagoras does not mention *φύσις* at all, while in Heraclitus and Diogenes it reveals a familiar notion of the particular ‘nature’ of an individual thing, not of ‘nature’ in general.<sup>4</sup> This is also true for Parmenides and Empedocles, though in some cases they employed *φύσις* in the sense of “birth”, “origin”.<sup>5</sup> As for the Pythagoreans, it can hardly be a coincidence that Philolaus was the first Presocratic philosopher to use the formula *περὶ φύσεως* and that it occurs in Archytas as well; both of them discussed *physis* in a wide cosmological context. Besides, there is a good chance that Philolaus wrote the very first treatise entitled *Περὶ φύσεως*. The fragments of both Pythagoreans bear important witness to how the concept of *physis* has evolved in the Presocratic period and can shed light on the problem of when *Περὶ φύσεως* became a generic title for the writings of the Presocratics. This also encourages us to take a fresh look at this topic.

## 2. Discussion of the meaning of φύσις

By way of introduction, it is worth reminding ourselves of a discussion on the meaning of *physis* held in the previous century.<sup>6</sup> Some scholars believed that the basic etymological meanings of *φύσις*, “growth, origin, generation”, derived from *φύω/φύομαι*, is retained in the philosophical usage of the fifth century, whereas others denied or questioned this, insisting that “being, essence, nature” is the most usual meaning of the word. Thus, according to Frederick Woodbridge, the Presocratics meant under *physis* “birth”, “origin,” or “coming into being”, so that the title *Περὶ φύσεως* has to be understood as *On Origin, On Birth, On Coming into Being, On Growth*. For the definition of *περὶ φύσεως* ιστορία he referred to Plato’s middle dialogue *Phaedo*.<sup>7</sup> The opposite opinion has been formulated by John Burnet in his influential *Early Greek Philosophy*: the original meaning of *physis* in the early Presocratics was ‘primary substance’, as in the passage in Plato’s late dialogue *Laws* (891c). Accordingly, “the title *Περὶ φύσεως*, so commonly given to philosophical works of the sixth and fifth centuries BC, means simply *Concerning the Primary Substance*”.<sup>8</sup> It turned out, then, that Plato would suit both interpretations.<sup>9</sup>

Burnet’s view was energetically supported by Arthur Lovejoy: “...especially in the treatises of the cosmologists, *φύσις* meant ‘the intrinsic and permanent qualitative constitution of things’ or, more colloquially, ‘what things really are,’ or, — with a slight modification of Burnet’s translation, — ‘the essential character of the primary substance’”.<sup>10</sup> On the contrary, William Heidel considered Burnet’s interpretation too narrow; in a long and

<sup>4</sup> Heraclitus B 1: ... ὁκοίων ἐγὼ διηγέσθαι κατὰ φύσιν διαιρέων ἕκαστον καὶ φράζων ὅπως ἔχει; B 112: σωφρονεῖν ἀρετὴ μεγίστη, καὶ σοφίη ἀληθὲς λέγειν καὶ ποιεῖν κατὰ φύσιν ἐπαίοντας; B 123: φύσις δὲ καθ’ Ἡράκλειτον κρύπτεσθαι φιλεῖ. Diogenes B 2: ... εἰ τούτων τι ἦν ἕτερον τοῦ ἑτέρου, ἕτερον ὄν τῇ ἰδίᾳ φύσει, καὶ μὴ τὸ αὐτὸ ἔδν μετέπιπτε πολλαχῶς καὶ ἑτεροιοῦτο...

<sup>5</sup> 28 B 10, 16; 31 B 8, 63, 110. See Heinimann 1945, 89–92; Pohlenz 1953, 422 n. 1; Kahn 1960, 200–201; Schmalzriedt 1970, 114–116; Bremer 1989, 245, in detail Heinemann 2012, 107–109; 113–119.

<sup>6</sup> See useful overviews in Mannsperger 1969, 5–23 and Buchheim 1999, 7 n. 1.

<sup>7</sup> Woodbridge 1901, 367. ἐγὼ γάρ, ἔφη, ὦ Κέβης, νέος ὢν θαυμαστῶς ὥς ἐπεθύμησα ταύτης τῆς σοφίας ἦν δὴ καλοῦσι περὶ φύσεως ιστορίαν. ὑπερήφανος γάρ μοι ἐδόκει εἶναι, εἰδέναι τὰς αἰτίας ἕκαστου, διὰ τί γίγνεται ἕκαστον καὶ διὰ τί ἀπόλλυται καὶ διὰ τί ἔστι (96a6–10).

<sup>8</sup> Burnet 1908, 12–13.

<sup>9</sup> For the diversity of meanings of *physis* in Plato’s dialogues, see Mannsperger 1969.

<sup>10</sup> Lovejoy 1908, 376, cf. 383. See also Lovejoy 1910, 666.

learned article he decided to demonstrate that the primary meaning of φύσις, “growth”, is reflected in its philosophical usage as a “process”, “the beginning or end of the process”: “... as we have seen, while the inquiry or ἱστορία περὶ φύσεως concerned the question ‘what is it’ (ὅ τι ἐστὶ), the answer at once carried the inquirer to the further questions ‘of what is it constituted’ and ‘how did it come about’”.<sup>11</sup> In his dissertation on the use of φύσις in the fifth century John Beardslee did not find any instance when φύσις can be translated as “element”, noticing at the same time that the word had already lost its associations with φύω and had come to mean ‘nature’: “When the φύσις of an object is so spoken of, the whole nature of that object seems to be meant, its origin, its description, its manner of working, its effects. It is wrong to single out any one of these”.<sup>12</sup> Yet Burnet remained unimpressed by criticism; in an appendix to the third edition of his book he strongly questioned both that the original meaning of φύσις is “growth” and, on a related point, that its semantic connection with φύομαι was still palpable.<sup>13</sup>

Further research wavered back and forth, though on a more sophisticated and comprehensive level, between positions already taken on, i.e. between “growth” and “being”, two meanings already embedded in the Indo-European root *\*bheu-/ \*bhū-*.<sup>14</sup> Thus, Harald Patzer’s brilliant study, submitted as a 1939 *Habilitationschrift* to Marburg University but published only half a century later, convincingly presented the history of the word φύσις as an unfolding of the basic meaning of the verbal root φν-, “to grow”, related to the plant world:

„...wie die Wurzel γεν- ursprünglich auf das eigentümlich tierische Hervorbringen oder Hervorgehen („gebären“ oder „geboren werden“) geht, so die Wurzel φν- auf das pflanzliche Hervorbringen oder Hervorgehen. Die *Pflanze* ist dementsprechend der gesuchte Urbereich der Wurzel φν- und das Hervorbringen oder *Wachsen* die in dieser Wurzel angesprochene Urerscheinung.“<sup>15</sup>

On the contrary, the principal thesis of his learned opponent Douwe Holwerda was that the fundamental and etymological meaning of φύσις is τὸ εἶναι (copulative and existential); this word refers to “being” and “essence”, not to “growth”, so that very few examples of φύσις = φύειν, φύεσθαι were relegated to the very end of Holwerda’s dissertation.<sup>16</sup> At the same time, he agreed with many particular interpretations of Patzer because the latter maintained that φύσις means not the *process* of φύειν and φύεσθαι but its result: “φύσις und φνὴ bedeuten also ein Sein, und zwar das sich im φύειν und φύεσθαι zur Erscheinung bringt und dadurch den ablösbaren Inhalt der Verben ausmacht”.<sup>17</sup> By the mid-century the double aspect of the root *\*bheu-/ \*bhū-* has become generally accepted, and the discussion centred on which of them, dynamic or static, was decisive in the history of φύσις.

<sup>11</sup> Heidel 1910, 97; 129.

<sup>12</sup> Beardslee 1918, 11; 65; 93.

<sup>13</sup> Burnet 1920, 393–394.

<sup>14</sup> Frisk 1970, 1052; Chantraine 1974, 1235; Beekes 2010, 1597: IE *\*bheh2u-* ‘grow, arise, be’, φύομαι in-tr. med. ‘to grow, arise, spring up, become’, perf. (and aor.) ‘to exist or be endowed by nature, be there’, trans. act. (factitive) ‘to make grow, beget, bring forth’ (Il.). φύσις ‘growth, character, descent, nature, being, etc.’

<sup>15</sup> Patzer 1993, 12.

<sup>16</sup> Holwerda 1955, 12; 108–109; 110–116. He approvingly cites Geoffrey Kirk: “Rather the truth is that at the ‘primitive’ stage of language there is no firm distinction between ‘become’ and ‘be’. The root φν- simply implies existence, and the broad general sense of φύσις, from which all specialized senses are derived, is ‘essence’ or ‘nature’” (Kirk 1954, 228).

<sup>17</sup> Patzer 1993, 41.

Dietrich Mannsperger, for example, asserted that Patzer too closely related the noun φύσις to the verb φύεσθαι, thus giving it too dynamic a character. He admitted, however, that Patzer represented the opinion dominant in German scholarship,<sup>18</sup> whereas in English speaking countries Burnet's authority still stood in the background,<sup>19</sup> and, one should add, no noteworthy general studies on the meaning of φύσις appeared since Beardslee.<sup>20</sup>

More consensus has been reached on another aspect of the concept of *physis*, namely, that it acquires its comprehensive meaning and becomes *Allphysis*, universal 'nature' and not 'nature' of something particular, in the last third of the fifth century. Respectively, a title Περί φύσεως, where φύσις is used absolutely, without limiting genitive, becomes possible from this very period, when Philolaus' book was most probably published. Such a title is not safely attested earlier and if it were it would have meant something different. Already Heidel noted that early prose writings had no formal titles and that philosophical works bearing the title Περί φύσεως appeared in the late fifth century.<sup>21</sup> Although sporadic attempts to trace the history of this title up to Anaximander are still being made,<sup>22</sup> they are not convincing.

### 3. Philolaus' title

Demetrius of Magnesia, a Hellenistic grammarian and librarian and acquaintance of Cicero, was first to mention the title of Philolaus' book in his bio-bibliographical work *On Poets and Writers of the Same Name*.<sup>23</sup> According to Diogenes Laertius (8, 85 = 44 A 1), τοῦτον (sc. Philolaus) φησι Δημήτριος ἐν Ὀμωνύμοις πρῶτον ἐκδοῦναι τῶν Πυθαγορικῶν Περί φύσεως, ὧν ἀρχὴ ἦδε· ἡ φύσις δ' ἐν τῷ κόσμῳ ...<sup>24</sup> — "Philolaus was the first among the Pythagoreans to publish *On Nature*, the beginning of which is 'The nature in the world-order...'"<sup>25</sup> Demetrius evidently had in his hands Philolaus' book, which he considered authentic (unlike Hippasus' spurious Μυστικὸς λόγος)<sup>26</sup> and from which he, following the Alexandrian bibliographical tradition established by Callimachus, cited the first line. Demetrius was unaffected by the story that emerged in the late third century that Plato bought from Philolaus 'three Pythagorean books' published by him, containing the previously unavailable teaching of Pythagoras — the famous *tripartitum*.<sup>27</sup> However, Hermann

<sup>18</sup> See e.g. Diller 1939/1971, 145–147; Leisegang 1941, 1138; Heinemann 1945, 89; Pohlenz 1953, 422 n. 1, 426; Schmalzriedt 1970, 113–119; Bremer 1989, 242–243; Rechenauer 1991, 116–125; Buchheim 1999; Heinemann 2005, 19–21.

<sup>19</sup> Mannsperger 1969, 19, cf. Buchheim 1999, 9–10. But see Kahn 1960, 201–202.

<sup>20</sup> Naddaf 2005, translated from French, is derivative even when it is correct. See critical reviews: Mansfeld 1997; Schofield 2006.

<sup>21</sup> Heidel 1910, 81 and n. 10. To this category he also related such Hippocratic writings as Περί φύσεως ἀνθρώπου, Περί φύσεως παιδίου, etc.

<sup>22</sup> See e.g. Rosetti 2006.

<sup>23</sup> Demetrius' fragments are collected in Mejer 1981.

<sup>24</sup> Reiske's conjecture <τὰ> Περί φύσεως accounts for the plural ὧν and is accepted i.a. by M. Marcovich and T. Dorandi in their editions of Diogenes Laertius, but ὧν, as Burkert 1972, 241 n. 10 noted, does not necessarily mean that more than one book is intended. See also Huffman 1993, 93–94.

<sup>25</sup> See also B 13 = *Theol. Arithm.* 25.18 de Falco, from Nicomachus: Φιλόλαος ἐν τῷ Περί φύσεως λέγει, and B 11 = Theon Smyrn. 106.10, from an unauthentic work: Φιλόλαος ἐν τῷ Περί φύσεως.

<sup>26</sup> According to Sotion (D. L. 8,7), this was Hippasus' work, but Demetrius says that he left no writings (D. L. 8, 84). See Mejer 1981, 467–468.

<sup>27</sup> D. L. 3, 9, cf. 8, 6. 9. 15: Μέχρι δὲ Φιλολάου οὐκ ἦν τι γινῶναι Πυθαγόρειον δόγμα· οὗτος δὲ μόνος ἐξήνεγκε τὰ διαβόητα τρία βιβλία, ἃ Πλάτων ἐπέστειλεν ἑκατὸν μνῶν ἀνηθῆναι; Aul. Gell. 3,17,1–5; Iamb.

Diels, who authored an excellent article on the pseudo-Pythagorean *tripartitum*,<sup>28</sup> decided in his *Vorsokratiker* to relate this story to Demetrius' report and printed the following text: Philolaus πρῶτον ἐκδοῦναι τῶν Πυθαγορικῶν <βιβλία καὶ ἐπιγράψαι Περί> φύσεως, ὧν ἀρχὴ ἦδε (44 A 1). Diels' unsuccessful supplement greatly contributed to the popularity of the idea that Philolaus' book was the first written record of the Pythagorean doctrines and that he was the first Pythagorean to write a book.<sup>29</sup> This obviously contradicts Demetrius' report stating that Philolaus was the first Pythagorean to publish a book entitled Περί φύσεως, not that there were no books by the Pythagoreans before him. Indeed, we know of the books by Alcmaeon (24 B 1), Menestor (32 A 1-7), two works by Hippon (38 A 11), all of whom lived before Philolaus (no title for these writings is safely attested in the tradition). Demetrius, being a polyhistor (Dion. Hal. *Din.* 1), must have heard of them too. And of course, Philolaus' book contained not a 'Pythagorean *dogma*' (no all-Pythagorean philosophical teaching ever existed),<sup>30</sup> but his own theories, which may or may not have coincided with the views of other Pythagoreans.

Demetrius is not an early author and yet his account on Philolaus' book is by far the first *secure* attestation of the title Περί φύσεως for a Presocratic philosopher.<sup>31</sup> The catalogue of Democritus' writings, compiled by Thrasyllus of Alexandria (died ca. 36 AD), contains about seventy titles one of which is Περί φύσεως πρῶτον (D. L. 9, 46), but it is hard to say how authentic they are.<sup>32</sup> All the other such titles appeared since the second century AD and/or do not look authentic: Rufus of Ephesus *ap.* Galen attests for Diogenes of Apollonia (64 B 9), Galen for Alcmaeon, Heraclitus, Parmenides, Empedocles, Melissus, Gorgias, Prodicus "and all the others" (24 A 2; 64 A 9; *In Hipp. de nat. hom.* XV, 5 Kühn), Sextus Empiricus again for Heraclitus (22 A 16), Parmenides (28 B 1), and Gorgias (82 B 3), Diogenes Laertius for Heraclitus (9, 5 = 22 B 1) and Empedocles (8, 77 = 31 B 1), Stobaeus for Xenophanes (21 A 36, B 30), Simplicius for Anaxagoras (59 B 4),<sup>33</sup> Parmenides (28 A 14), Melissus (28 A 14, cf. 30 A 4), and Diogenes of Apollonia (64 A 4), the *Suda* (Hesychius) for Zeno of Elea (29 A 2).<sup>34</sup> Something must have happened between ca. 50 BC, when Demetrius witnessed Philolaus' title, and ca. 170–190 AD, when Galen resolutely ascribed the title *On Nature* to writings of all the ancients.<sup>35</sup>

In the framework of this paper we leave open the question of what exactly has happened during this period. It should be stressed, however, that we cannot assume, as it is usually done, that the title Περί φύσεως generally applied to the Presocratics' works

VP 199. See Zhmud 2012, 161–162.

<sup>28</sup> Diels 1890/1969.

<sup>29</sup> See e.g. Burkert 1972, 225 n. 35; Huffman 1993, 15.

<sup>30</sup> Zhmud 2012, 109–111, 387–414.

<sup>31</sup> 'Liber de natura' in Cicero refers (*pace* Diels) to the subject of Metrodorus of Chios' book not to its title: is qui hunc [Democritus] maxime est admiratus, Chius Metrodorus, initio libri qui est de natura, 'nego' inquit, 'scire nos sciamusne aliquid an nihil sciamus...' (*Acad.* 11.23.73 = 70 B 1). For a useful overview of the evidence, see Heinemann 2011/2012, 205–212.

<sup>32</sup> "Auf die Titel, die zudem oft variieren, ist kein Verlass", DK II, 130.7, cf. 68 B 5c: Περί φύσεως α' <ἢ Περί κόσμου φύσεως>. Similarly Luria 1970, 410, 411 n. 13. The first list of Democritus' writings was compiled by Callimachus.

<sup>33</sup> But three other times Simplicius calls Anaxagoras' work Φυσικά (59 B 1, 16–17).

<sup>34</sup> Themistius (*Or.* 35, p. 17 = 12 A 7) indicates the subject of Anaximander's book, not its title.

<sup>35</sup> *De elem. ex Hipp.* I, 9: τὰ γὰρ τῶν παλαιῶν ἅπαντα Περί φύσεως ἐπιγράπται; cf. *In Hipp. de nat. hom.* I, 5: τοιαῦτα δὲ εὗροις ἂν ἅπαντα τὰ Περί φύσεως ἐπιγεγραμμένα βιβλία τῶν παλαιῶν φιλοσόφων, Ἐμπεδοκλέους Παρμενίδου Μελίσσου Ἀλκμαίωνος Ἡρακλείτου. Elsewhere Galen renders Prodicus' title as Περί φύσεως ἀνθρώπου (*De virt. phys.* II, 9 = 84 B 4).

reflects the tradition of the third-century Alexandrian librarians.<sup>36</sup> There is no firm evidence for this, and much of what we know about the Presocratic titles contradicts this assertion. Thus, the unanimous tradition from Aristotle (*Mete.* 382a1) to Simplicius calls Empedocles' physical poem Φυσικά, whereas the stereotypic Περί φύσεως in Diogenes Laertius (8, 77, cf. 60) goes back to the title Περί φύσεως τῶν ὄντων given to this poem by Lobon of Argos (third century BC), notorious for his fabrications about Greek verse writers.<sup>37</sup> This title is neither Empedoclean, nor Alexandrian. The only other Hellenistic evidence, that on Xenophanes' Περί φύσεως (21 B 30), derives from Crates of Mallus (mid-second century BC), a grammarian who worked in Pergamum (cf. 21 B 38, from Pollux). The very existence of such a poem by Xenophanes is highly doubtful.<sup>38</sup>

Egidius Schmalzriedt's study on the early history of the title Περί φύσεως showed that it became possible only in the last quarter of the fifth century B. C., which matches with the history of the word φύσις.<sup>39</sup> But his further conclusions that earlier the works of the Presocratics did not have any titles and that the generic title *On Nature* was given to all of them retrospectively in the Lyceum<sup>40</sup> raise serious doubts. Indeed, the first Presocratic book titles appear in the generation of Empedocles and Ion of Chios, who were born around 490–485 BC, and conspicuously these titles were not Περί φύσεως.<sup>41</sup> Ion called his philosophical treatise Τριαγμός (36 A 1, B 2), and this unique word guarantees the authenticity of the title. One of Empedocles' poems is known in the manuscript tradition under the title Καθαρμοί, another as Φυσικά. Leucippus' Μέγας διάκοσμος and Democritus' Μικρὸς διάκοσμος (D. L. 9, 46) were obviously entitled by the authors. Archytas' book titles were Ἀρμονικός, Περί μαθημάτων, Διατριβαί.<sup>42</sup> What is decisive is that Schmalzriedt didn't offer a single example that Aristotle, Theophrastus or other members of the Lyceum ever called a Presocratic book or, for that matter, any other book Περί φύσεως. C. W. Müller noting this in his review suggested the Alexandrian library as the place where the scrolls of early Greek natural philosophers were inscribed Περί φύσεως, in line with the terminology of the Lyceum (Aristotle often called them οἱ περὶ φύσεως).<sup>43</sup> Theoretically this seems possible yet Müller also didn't attempt to substantiate his claim with any concrete evidence, whereas the material considered above strongly suggests a gap of more than 400 years between Callimachus' *Pinakes* and Galen's statement that writings of all the ancient philosophers were entitled Περί φύσεως. (Incidentally, it is more plausible that Galen became acquainted with these works in or via the library of his native Pergamum than in Alexandria.) Be that as it may, we do not find traces of a widespread Hellenistic custom originated in Alexandria to entitle the Presocratic books Περί φύσεως. Philolaus remains a special case, which increases the weight of Demetrius' report.

Admittedly, Demetrius' account in itself does not guarantee the authenticity of Philolaus' title but only that his book figured in the Alexandrian catalogue as Περί φύσεως.

<sup>36</sup> Thus Schmalzriedt 1970, 111–112; Müller 1978, 631–632; Kirk, Raven, Schofield 1983, 101; Huffman 1993, 95.

<sup>37</sup> 31 A 1 (DK I, 282.15 and 33); Kroll 1922; Primavesi 2013, 680–682.

<sup>38</sup> Schirren 2013, 342, 358–360.

<sup>39</sup> See above, 52.

<sup>40</sup> Schmalzriedt 1970, 83–107.

<sup>41</sup> The fact that Ion was a dramatic poet and Empedocles wrote *two* poems in hexameter must have facilitated their decisions to name their works, for epic and dramatic poetry had titles long before.

<sup>42</sup> 47 B 1, 3, 4; cf. Huffman 2005, 30–32.

<sup>43</sup> Müller 1978, 631–632.

Philolaus' title, however, is corroborated by two further facts. First, this is the opening of the treatise that introduces *physis* as its subject matter: ἡ φύσις δ' ἐν τῷ κόσμῳ ἀρμόχθη ἐξ ἀπείρων τε καὶ περαινόντων (B 1). Secondly, this is the formula περὶ φύσεως, where φύσις is used non-attributively: περὶ δὲ φύσιος καὶ ἀρμονίας ὥδε ἔχει (B 6). It is in this fragment that αὐτὰ μὲν ἡ φύσις becomes a subject of epistemological considerations. Both the combination of these features and each of them is unique for the Presocratic writings. Schmalzriedt conceded that among the Presocratics Philolaus alone may have written a book with a *Titelersatz* Περί φύσεως, provided that the book is authentic and the fragment B 6, not B 1, opened it.<sup>44</sup> But since he was not sure of either of these premises he treated Philolaus mostly in the footnotes, as a figure distorting his perspective. There is no need, however, to disprove Demetrius' report as "ein schlampiges Zitat", assuming that B 6 is more suitable as *incipit* than B 1.<sup>45</sup> As Burkert aptly noticed, "a δέ in the first sentence, connecting it with the title, is found in several prose works of the fifth century (Her. B 1, Ion B 1); and this feature guarantees the title Περί φύσιος" that came after the author's name in the introductory sentence, for example, Φιλόλαος Κροτωνιάτας περὶ φύσιος ὥδε λέγει.<sup>46</sup> Indeed, Schmalzriedt's view of the title as only a formal ἐπιγραφή given by the author is too narrow for the fifth century BC; a thematic keyword or a clear indication of the subject matter in the opening sentence can easily fulfil the same function.<sup>47</sup>

To justify Philolaus' title some scholars cite as a parallel the title of Gorgias' treatise Περί τοῦ μὴ ὄντος ἢ Περί φύσεως preserved by Sextus Empiricus (*Adv. math.* 7, 65 = 82 B 3). This is usually seen as a parody of Melissus' book Περί φύσεως ἢ περὶ τοῦ ὄντος.<sup>48</sup> Schmalzriedt took Gorgias' title as authentic but was indecisive about Melissus, for the latter does not fit his general conclusion that the formula περὶ φύσεως originated with the Sophists.<sup>49</sup> But since Gorgias' title is hardly conceivable without that of Melissus, they stay or fall together, and there are plenty of reasons to regard them both as inauthentic, as Gottfried Heinemann persuasively argued.<sup>50</sup> Gorgias' title is attested late, Melissus' very late; in neither case is there any certainty that they go back to the Hellenistic tradition of the Alexandrian library, let alone to their authors. To Galen both works were known as Περί φύσεως, Olympiodorus also referred to Gorgias' treatise as Περί φύσεως (*In Plat. Gorg.* p. 112 = 82 B 2), which makes it plausible that *On Nature* was in both cases an *alternative* title, not a part of the *bipartite* title. Now, Gorgias' treatise could well be called Περί τοῦ μὴ ὄντος either by the author or by readers, for this is his first and central argument,<sup>51</sup> disregarding whether Melissus' book, against which it was allegedly directed, had a title Περί τοῦ ὄντος (as the *Suda* reports: 30 A 2) or not (which is more plausible). Being is the main topic of Melissus, whereas φύσις in the Eleatic tradition belongs to the realm of becoming. Thus, it is hard to assume both that Περί φύσεως first occurred as a part of the

<sup>44</sup> Schmalzriedt 1970, 85 n. 7, 126.

<sup>45</sup> Cf. Mansfeld 1997, 757 n. 2.

<sup>46</sup> Burkert 1972, 252 and n. 68. Cf. Alcmaeon B 1 (below, 60, n. 70). Huffman 1993, 95 remarks that δέ "at best only guarantees some sort of introductory sentence".

<sup>47</sup> Thus Müller 1978, 634. "Sieht man die Titelfrage unter sachlich-funktionalem Aspekt, so ist der Eingangssatz oder das Proöm Träger der Informationsfunktion des ‚Titels‘, der in seiner verselbständigten späteren Form nicht selten der Themaangabe des Anfangssatzes entnommen ist" (*ibid.*, 633).

<sup>48</sup> *Simpl. In Phys.* 70.16; *In De caelo* 557.10 = 30 A 4. See e.g. Kirk, Raven, Schofield 1983, 102 n. 1; Huffman 1993, 95; Sedley 1999, 125.

<sup>49</sup> Schmalzriedt 1970, 71–72, cf. 128. For criticism of this conclusion, see: Müller 1978, 630–631.

<sup>50</sup> Heinemann 2011/2012, 209–212.

<sup>51</sup> τρία κατὰ τὸ ἐξῆς κεφάλαια κατασκευάζει, ἐν μὲν καὶ πρῶτον ὅτι οὐδὲν ἔστιν (82 B 3).

composite title *Περὶ φύσεως ἢ περὶ τοῦ ὄντος*, or alternatively that Melissus followed an earlier work entitled *Περὶ φύσεως*, for whose work could it be?<sup>52</sup>

#### 4. φύσις in Philolaus

Moving from the authenticity of Philolaus' title to the meaning of φύσις in B 1, let us quote it again in full:

ἀ φύσις δ' ἐν τῷ κόσμῳ ἀρμόχθη ἐξ ἀπείρων τε καὶ περαινόντων, καὶ ὅλος <ὁ> κόσμος καὶ τὰ ἐν αὐτῷ πάντα.

"The nature in the world-order was constructed from unlimiteds and limiters, both <the> whole world-order and everything in it" (Tr. D. Graham).

Philolaus opens his book with an emphatic ἀ φύσις, 'the nature in the world-order',<sup>53</sup> which does not occur with an article in earlier philosophical texts, though often in dramatic poetry and history.<sup>54</sup> In combination with an absolute usage of φύσις (both are repeated in B 6: αὐτὰ μὲν ἀ φύσις) this makes it an independent entity existing in the world-order and spatially limited by it (ἐν τῷ κόσμῳ), and not the nature of something else. Heidel's suggestion to delete ἐν and take φύσις attributively with a Doric genitive, ἀ δὲ φύσις τῷ κόσμῳ = κόσμος, is unnecessary and did not find much support;<sup>55</sup> later he returned to the manuscript reading.<sup>56</sup> If Philolaus' *kosmos* and everything in it was constructed, literally 'fitted together', from unlimited and limiting things, then the 'nature' in the *kosmos* designates all that this *kosmos* contains, the plenitude of what became and exists in it. This is picked up in B 2: δῆλον τὰρα ὅτι ἐκ περαινόντων τε καὶ ἀπείρων ὁ τε κόσμος καὶ τὰ ἐν αὐτῷ συναρμόχθη, which confirms that Philolaus distinguished between the *kosmos* as the world-order and (all) that has become and exists in it. Indeed, several commentators concur that under φύσις in B 1 Philolaus meant 'all that exists', as Burkert renders it, "the totality of ἔοντα".<sup>57</sup> τὰ ἔοντα, mentioned at the beginning of B 2 (ἀνάγκα τὰ ἔοντα εἶμεν πάντα ἢ περαινόντα ἢ ἄπειρα ἢ περαινόντά τε καὶ ἄπειρα) denote existing things, as in B 3 (πάντων ἔόντων) and again in B 6 (τὰ ἔοντα καὶ γινωσκόμενα ὑφ' ἀμῶν), not elemental powers, as Huffman proposed,<sup>58</sup> for there are not traces of such powers in Philolaus' text. Burkert refers to Holwerda, according to whom φύσις is used here in its concrete collective sense and its meaning is close to that πᾶν τὸ ὄν.<sup>59</sup> Holwerda,

<sup>52</sup> Heinemann 2011/2012, 211–212.

<sup>53</sup> "Durch den bestimmten Artikel erhält Physis einen besonders vollen und bedeutenden Klang; sie erscheint als selbständige GröÙe und Macht.... Besonders bezeichnend hierfür ist der Umstand, dass sie als regierendes Subjekt von Verben erscheint", notes Mannsperger 1969, 55 in respect to Plato.

<sup>54</sup> Soph. *Philoct.* 873; Eur. *Ion* 642, fr. 264a Snell; Hdt. 3, 109; Thuc. 3, 64, 4.

<sup>55</sup> Heidel 1907, 79; Beardslee 1918, 89; Nussbaum 1979, 94. Cf. Burkert 1972, 252 n. 58, who adduces parallels from Anaxagoras, τὰ ἐν τῷ ἐνὶ κόσμῳ (B 8), and Diogenes of Apollonia, τὰ ἐν τῷδε τῷ κόσμῳ ἔοντα (B 2); Huffman 1993, 99–100.

<sup>56</sup> DK I, 407 not. According to Kranz, Diels "zweifelnd vermutete" ἀ φύσις <ἀ> ἐν τῷ κόσμῳ, but this did not get into his text. Cf. Timapanaro Cardini 1961, 397 n.

<sup>57</sup> Burkert 1972, 250 n. 58, 274.

<sup>58</sup> Huffman 1993, 103–106.

<sup>59</sup> Holwerda 1955, 78.

in turn, approvingly cites Patzer, who in the section devoted to φύσις as 'Art' or 'allgemeines Wesen', briefly comments on Philolaus B 1:

"A passage in Philolaus focuses on the content, explaining the necessary order of φύσις, <...>; κόσμος denotes the ordered structure of the world, while φύσις is the entity filling this structure. Thus, *physis* is here not, as was up to this point usually the case, an abstract concept, but denotes in concrete fashion all things that have come into being (φύεσθαι in its wider sense) taken together in their entirety <...>. This shift in meaning can explain the later very common usage of φύσις as 'the being in its entirety', 'the universe', although then normally a qualifying adjective is added that hints at the universality of φύσις, like ὅλος, πᾶς..."<sup>60</sup>

Carl Huffman in his fundamental study of Philolaus considered this understanding of *physis* mistaken. He suggested, with reference to Geoffrey Kirk and Charles Kahn, that φύσις means here 'nature' or 'real constitution', adducing as a good parallel Heraclitus' famous dictum "φύσις loves to hide" (22 B 123).<sup>61</sup> To this it should be objected that Kirk and Kahn discussed not Philolaus but Heraclitus, and if they (partially) agreed that φύσις in Heraclitus, who twice employs the locution κατὰ φύσιν (B 1, 112), means 'nature' or 'real constitution' of a thing or individual things (Kirk), or "the essential character of a thing as well as the process by which it arose" (Kahn),<sup>62</sup> nothing suggests that this meaning would suit Philolaus, for his *physis* is universal, not particular, and denotes a collective whole arising in the process of cosmogony. Huffman's internal argument that if *physis* is "all that exists," then the sentence becomes intolerably repetitious, is again not convincing: the second part of the sentence, καὶ ὅλος ὁ κόσμος καὶ τὰ ἐν αὐτῷ πάντα, can be very well understood as an exegetic apposition to the first part,<sup>63</sup> where καὶ τὰ ἐν αὐτῷ πάντα chiasmatically refers to the φύσις.<sup>64</sup>

Philolaus' *physis* is not eternal. It comes into being in the process of the fitting together of two principles, unlimiteds and limiters, by *harmonia* (B 6). Philolaus nowhere explains what his principles are, but insists they are absolutely necessary for the formation of the world-order. Unlimiteds and limiters are eternal, they pre-exist the *kosmos* and the *physis*, which emerge from their interaction. The *physis* clearly demonstrates its coming to be, yet the cosmogonic process by which it arose is no more like organic growth. Due to the peculiar, rather abstract character of Philolaus' principles, differing from the organic elements and powers of earlier Presocratics, he repeatedly resorts to technological rather than organic metaphors: ἀρμόχθη (B 1), συναρμόχθη (B 2), κοσμηθῆναι, συγκεκλεισθαι (B 6), τὸ ἀρμooσθέν (B 7).<sup>65</sup> The first thing that emerged in the process of cosmogony, Hes-

<sup>60</sup> Patzer 1993, 66–67, tr. Karla Pohlmann.

<sup>61</sup> Huffman 1993, 96–97. See also Nussbaum 1979, 94–95: "real nature", "essence as revealed in process", but she followed Heidel 1907, 79 and took φύσις τῷ κόσμῳ as "the kosmos in its essential nature".

<sup>62</sup> Kirk 1954, 42, 228–230; Kahn 1960, 201–202. In a footnote Kirk mentions that the meaning of φύσις in Philolaus' B 1 and 6, which he considered spurious, "may be the same as for the Presocratics" (230 n. 1), that he believed was 'real constitution'. Unlike Kirk, Kahn stressed the dynamic character of *physis*.

<sup>63</sup> Timpanaro Cardini, 1961, 397 n.; Nussbaum 1979, 94 n. 77. Philolaus' repetitiveness is notorious (Burkert 1972, 252).

<sup>64</sup> His second internal argument (Huffman 1993, 97) is that in B 6 φύσις is paired with "the being of things" as being beyond human knowledge and thus cannot mean "the totality of things". However, in the commentary to B 6 he insists that αὐτὰ μὲν ἡ φύσις is *not* the same φύσις in the world-order as in B 1 (Huffman 1993, 125, 132–133), which, if true, undermines the validity of the original argument. See below, 59.

<sup>65</sup> Empedocles employed ἀρμόζειν and ἀρμooνία in regard to the process of mixing four elements (31 B 23, 71, 107).

tia (Central fire), was fitted together in the same way as the *physis*: τὸ πρᾶτον ἀρμοσθέν, τὸ ἔν, ἐν τῷ μέσῳ τᾶς σφαίρας ἐστία καλεῖται (B 7). The very name of Hestia implies that it is made, not grown.

Fragment B 6 clarifies Philolaus' views of *physis*, especially of its knowability. Here it occurs twice, first at the very beginning of the fragment, which indicates the change of the topic: περὶ δὲ φύσιος καὶ ἀρμονίας ὥδε ἔχει. To be sure, what follows is only partially new, for Philolaus insistently repeats things already said in B 1-2: everything in the world-order came into being from unlimiteds and limiters ordered by *harmonia*.

περὶ δὲ φύσιος καὶ ἀρμονίας ὥδε ἔχει· ἃ μὲν ἐστὼ τῶν πραγμάτων αἰδῖος ἔσσα καὶ αὐτὰ μὲν ἃ φύσις θεῖαν γὰ καὶ οὐκ ἀνθρωπίνην ἐνδέχεται γνῶσιν πλάν γὰ ἡ ὅτι οὐχ οἶόν τ' ἦν οὐθενὶ τῶν ἐόντων καὶ γιγνωσκομένων ὑφ' ἀμῶν γὰ γενέσθαι μὴ ὑπαρχούσας τὰς ἐστοῦς τῶν πραγμάτων, ἐξ ὧν συνέστα ὁ κόσμος, καὶ τῶν περαινόντων καὶ τῶν ἀπειρῶν. ἐπεὶ δὲ ταὶ ἀρχαὶ ὑπάρχον οὐχ ὁμοῖαι οὐδ' ὁμόφυλοι ἔσσαι, ἤδη ἀδύνατον ἦς κα αὐταῖς κοσμηθῆναι, εἰ μὴ ἀρμονία ἐπεγένετο ᾧτινῶν ἄδε τρόπῳ ἐγένετο. τὰ μὲν ὧν ὁμοῖα καὶ ὁμόφυλα ἀρμονίας οὐδὲν ἐπεδέοντο, τὰ δὲ ἀνόμοια μὴδὲ ὁμόφυλα μὴδὲ † ἰσοταχῇ ἀνάγκα τὰ τοιαῦτα ἀρμονία συγκεκλεισθαι, οἷαι μέλλοντι ἐν κόσμῳ κατέχεσθαι.

"Concerning nature and harmony the situation is this: (1) the being of things, which is eternal, and nature itself admit of divine and not human knowledge, except that it was impossible for any of the things that are and are known by us to have come to be, if the being of the things from which the cosmos came together, both the limiters and the unlimiteds, did not preexist. (2) But since these beginnings preexisted and were not alike nor even related, it would have been impossible for them to be ordered, if a harmony had not come upon them, in whatever way it came to be. Like things and related things did not in addition require any harmony, things that are unlike and not even related nor of [? the same speed], it is necessary that such things be bonded together by this kind of harmony, if they are going to be held in an order."<sup>66</sup>

Having promised to explain φύσις and ἀρμονία which occur again, respectively, in the first and the second part of his argument, Philolaus introduces a new concept, the being of things (ἃ μὲν ἐστὼ τῶν πραγμάτων), that also needs explication. In a manner typical of post-Eleatic ontology, he distinguishes between eternal (αἰδῖος) being and preexisting principles, on the one hand, and generated things, such as the *kosmos* and τὰ ἐόντα καὶ γιγνωσκόμενα ὑφ' ἀμῶν, on the other. Where does αὐτὰ μὲν ἃ φύσις (again used absolutely) belong? If this is the same *physis* as in B 1, which is conceived as the totality of ἐόντα comprising τὰ ἐν αὐτῷ (πάντα) (B 1-2), then it must belong to the realm of generated things, the more so as αἰδῖος ἔσσα distinctly refers only to the being of things, not to the *physis*. Unlike other commentators, who treat *physis* in B 1 and B 6 as one and the same concept, Huffman takes "*physis* in the cosmos" (B 1) and "*physis* in itself" (B 6) as two different kinds of *physis* referring to different levels of reality. "Nature in itself", which is paired with eternal being, relates not to the "things in the natural world themselves, but rather to the ultimate reality or being that underlies the world-order."<sup>67</sup>

It is true that both eternal being and αὐτὰ μὲν ἃ φύσις admit only of divine knowledge, but does it follow that Philolaus "discusses nature (φύσις) in the sense of 'being'

<sup>66</sup> I reproduce Huffman's text and translation, except for "nature in itself" in the second line (see below, 59) and τὰ τοιαῦτα ἀρμονία in the penultimate line. ἀρμονία figuring in fragment B 6a is not a cosmic principle, but a musical interval octave, so that τὰ τοιαῦτα ἀρμονία implies a different ἀρμονία.

<sup>67</sup> Huffman 1993, 125–127; 132–133.

(ἐστῶ)”, thus assimilating it to the ultimate reality?<sup>68</sup> Philolaus’ words remind us of the opening of Alcmaeon’s treatise that was certainly known to him:<sup>69</sup> “Of things invisible, as of mortal things, the gods have certain knowledge; but to us, as men, (only) inference from evidence (is possible)...”.<sup>70</sup> The closeness of their epistemological positions is obvious: for Alcmaeon certain knowledge of things both unseen and mortal is available only to the gods, for Philolaus both the eternal being of things and perishable *physis* admit only divine knowledge. Therefore, there is no need either to postulate two different kinds of *physis* or to duplicate ἃ μὲν ἐστὼ τῶν πραγμάτων by putting “essential nature” next to it, for being of things *is* the essence of πραγμάτων. By τὰ πράγματα both times not the ordinary things (τὰ ἐν αὐτῷ πάντα, τὰ ἐόντα) are meant, but their constituents, ἀπειρα and περαίνοντα. Although αὐτὰ μὲν ἃ φύσις shares with the being of things one epistemological attribute, being (fully) available only to the gods, this does not make it the Kantian ‘Ding an sich’, as Nussbaum thought.<sup>71</sup> It is the same *physis* as in B 1, only emphatically underlined: “and the *physis* itself”, “and the very *physis*”.<sup>72</sup>

What Philolaus wanted to say was that the *physis* itself, that is the totality of ἐόντα, is available for human cognition only under certain conditions, which are partly ontological, partly epistemological. First, we are to recognize that no existing and knowable things would have come into being if a) the being of the principles did not preexist and b) these opposing principles were not fitted together by harmonia. Secondly, none of all existing things (πάντων ἐόντων) would have been knowable, if they were only unlimiteds: ἀρχὰν γὰρ οὐδὲ τὸ γνωσούμενον ἐσσεῖται πάντων ἀπείρων ἐόντων — “There will be nothing knowable at all, if all things are unlimited” (B 3).<sup>73</sup> B 3 seemed to serve as a link between Philolaus’ epistemology and ontology; partly repeating what has been already said in B 1-2, it adduced an additional argument from cognition. Thirdly, existing things are known to us to the extent that they have number, that is, are countable, measurable, etc.:

καὶ πάντα γὰρ μὲν τὰ γινωσκόμενα ἀριθμὸν ἔχοντι· οὐ γὰρ ὅτιων ὁλίῳ τε οὐδὲν οὔτε νοηθῆμεν οὔτε γνωσθῆμεν ἄνευ τούτου.

“And indeed all the things that are known have number. For it is not possible that anything whatsoever be understood or known without this” (B 4, tr. C. Huffman).

<sup>68</sup> Huffman 1993, 126, 131.

<sup>69</sup> For Alcmaeon’s influence on Philolaus, see Zhmud 2012, 367, 389–390, 393.

<sup>70</sup> Ἀλκμαίων Κροτωνιῆτης τάδε ἐλεξε Πειρίθου υἱὸς Βροτίνῳ καὶ Λέοντι καὶ Βαθύλλῳ· περὶ τῶν ἀφανέων, περὶ τῶν θνητῶν σαφῆνειαν μὲν θεοὶ ἔχοντι, ὥς δὲ ἀνθρώποις τεκμαίρεσθαι καὶ τὰ ἐξῆς (D. L. 8, 83 = 24 B 1, tr. R. Hicks, the parentheses are mine). Huffman 1993, 126 mentions only “things unseen”, leaving out “mortal things”, which gives a very different sense to the fragment. Before Diels scholars like Zeller, Cobet and Gomperz considered περὶ τῶν θνητῶν an interpolation, but after his Vorsokratiker (“Alkmaion gibt gleich am Anfang sein Thema an, er handelt sowohl über ἀφανῆ wie über θνητά, DK I, 214 not.) overwhelming majority of scholars accepted the manuscript reading. Gemelli Marciano 2007, 18–22, gives a different meaning to περὶ τῶν θνητῶν.

<sup>71</sup> Nussbaum 1979, 102.

<sup>72</sup> Thus Graham 2010, 493: “... the essence of things, being eternal, and nature itself admit of divine but not human knowledge”; Laks, Most 2016, 157, D5: “... the being of things, which is eternal, and nature itself admit knowledge that is divine and not human”.

<sup>73</sup> For τὸ γνωσούμενον, see Timpanaro Cardini 1961, 402; Huffman 1993, 116–120; Zhmud 2012, 402 n. 58.

Obviously, not τὰ ἔοντα πάντα are γινωσκόμενα by us: among existing things there are those which are unlimited and do not possess number; consequently, the 'nature' in its totality is not available to human knowledge.

The proclaimed epistemic modesty did not impede Philolaus to write a treatise, where he in a manner already traditional for the Presocratics proceeds from cosmogony and cosmology to physiology and medicine. Incidentally, he and his fellow Pythagorean Hippon are the only Presocratics, whose theories of medicine are outlined by the Peripatetic Menon in his medical doxography.<sup>74</sup> It is the conventional dualistic conception of Ionian study περὶ φύσεως vs. Pythagorean number metaphysics that still hinders recognizing Philolaus as the first philosopher who took *physis* as the main subject of his treatise. Meanwhile, even Aristotle admitted that the Pythagoreans, that is in the first place Philolaus, κοσμοποιοῦσι καὶ φυσικῶς βούλονται λέγειν (*Met.* 1091a20-21). Let us briefly recapitulate what is known about the *physis* from Philolaus' fragments.<sup>75</sup> He employs φύσις absolutely and speaks of it in a generalized collective sense as of everything that came into being and exists in the world-order (τὰ ἐν αὐτῷ πάντα). The *physis* is the entity generated or constructed from eternal limiters and unlimiteds fitted together by *harmonia*; to understand it one needs to know the way it arose. Philolaus shared with contemporary thought this dynamic perception of φύσις, whether general, as in the famous fragment of Euripides, "Blessed is he... who contemplates the ageless order of immortal nature, how it is constituted and when and why",<sup>76</sup> in the *Dissoi logoi*,<sup>77</sup> and Xenophon's *Memorabilia*,<sup>78</sup> or particular, as human *physis* in the Hippocratic corpus.<sup>79</sup> Unlike "the ageless order of immortal nature" in Euripides, ἄδιος in Philolaus is reserved only for the 'being of things'.<sup>80</sup> Since limiters, unlimiteds, and *harmonia* are not like organic elements and forces, the coming to be of the *physis* is described in technological terms, though the verb γενέσθαι is employed as well. The *physis* in Philolaus is passive, it does not figure as the subject of the active verbs, at least not in the preserved material. Finally, the 'nature' as the totality of ἔοντα admits only divine knowledge, and for human cognition it is available only under certain conditions set out in Philolaus' book.

## 5. φύσις in Archytas

An important source of Philolaus' epistemology were the exact sciences, the successes of which made highly attractive the methods of cognition adopted in them. Familiar with all the sciences of the Pythagorean mathematical quadrivium,<sup>81</sup> Philolaus became the first

<sup>74</sup> Huffman 1993, 289–306.

<sup>75</sup> Cf. Heinemann 2011/2012, 134–140.

<sup>76</sup> ὄλβιος ὅστις τῆς ἱστορίας ἔσχε μάθησιν, μήτε πολιτῶν ἐπὶ πημοσύνην μήτ' εἰς ἀδίκους πράξεις ὁρμῶν, ἀλλ' ἀθανάτου καθορῶν φύσεως κόσμον ἀγήρων, πῇ τε συνέστη καὶ ὅπῃ καὶ ὅπως (*Eur. fr.* 910).

<sup>77</sup> ... καὶ περὶ φύσιος τῶν ἀπάντων ὥς τε ἔχει καὶ ὥς ἐγένετο, διδάσκειν (*Dialex.* 8).

<sup>78</sup> οὐδὲ γὰρ περὶ τῆς τῶν πάντων φύσεως, ἥπερ τῶν ἄλλων οἱ πλείστοι, διελέγετο σκοπῶν ὅπως ὁ καλούμενος ὑπὸ τῶν σοφιστῶν κόσμος ἔχει καὶ τίσιν ἀνάγκαις ἕκαστα γίνεταί τῶν οὐρανίων (*Mem.* 1, 11).

<sup>79</sup> Τείνει δὲ αὐτέοισιν ὁ λόγος ἐς φιλοσοφίην, καθάπερ Ἐμπεδοκλῆς ἢ ἄλλοι οἱ περὶ φύσιος γεγράφασιν ἐξ ἀρχῆς ὃ τί ἐστὶν ἄνθρωπος, καὶ ὅπως ἐγένετο πρῶτον καὶ ὅπως ξυνεπάγη (*De vet. med.* 20). Φημί δὲ δεῖν τὸν μέλλοντα ὀρθῶς συγγράφειν περὶ διαίτης ἀνθρωπίνης πρῶτον μὲν παντὸς φύσιν ἀνθρώπου γνῶναι καὶ διαγνῶναι· γνῶναι μὲν ἀπὸ τίνων συνέστηκεν ἐξ ἀρχῆς (*De victu* 1, 2).

<sup>80</sup> For the destruction of the world, see A 18.

<sup>81</sup> Geometry (A 7a), arithmetic (A 13, B 4–5), astronomy (A 16–22, B 7), harmonics (B 6a).

Pythagorean and one of the first Presocratics to introduce *mathēmata* into a philosophical work and make its results and methods an object of discussion. This line was continued by his younger contemporary Archytas, an original thinker, brilliant mathematician and successful politician, seven times elected *strategos* in his native city. According to Eudemus of Rhodes' *History of Geometry* (fr. 133 Wehrli), Archytas was Plato's coeval, perhaps somewhat older than him, since Archytas' influence on Plato can be traced, but not the reverse.<sup>82</sup> He is mentioned in the *Seventh Letter* (350a) as a politician who helped Plato return from Syracuse, where he had been detained by Dionysius the Younger. Though Archytas does not figure in the Platonic dialogues, there is a reference to his work in the *Republic*,<sup>83</sup> and generally we can safely regard him as the author of the idea, so precious to Plato, of the beneficial effect of mathematics on the soul and thus on society. In the introduction to *Περὶ μαθημάτων* (B 3), Archytas relates to the discovery of calculation such important social changes as an increase of concord and an advance toward greater equality. Moreover, calculation proves capable of improving people's moral qualities, keeping them from greed and injustice or, at any rate, exposing these vices.<sup>84</sup>

As distinct from Philolaus, Archytas did not develop a doctrine of principles, and his epistemology was not constrained by metaphysical presuppositions. His philosophy, preserved very badly, looks rather like the philosophy of a scientist and a mathematician of the age of the Sophists. Archytas starts his *Harmonics* by praising his predecessors, οἱ περὶ τὰ μαθήματα, that is those concerned with astronomy, geometry, arithmetic, and harmonics, for their, one might say, great epistemological successes:

καλῶς μοι δοκοῦντι τοὶ περὶ τὰ μαθήματα διαγνῶναι, καὶ οὐθὲν ἄτοπον ὀρθῶς αὐτοῦς, οἷά ἐντι, περὶ ἐκάστων θεωρεῖν· περὶ γὰρ τὰς τῶν ὅλων φύσιος καλῶς διαγνόντες ἔμελλον καὶ περὶ τῶν κατὰ μέρος, οἷά ἐντι, ὀψείσθαι. περὶ τε δὴ τὰς τῶν ἄστρον ταχυτάτος καὶ ἐπιτολᾶν καὶ δυσίων παρέδωκαν ἀμῖν <σαφῇ> διάγνωσιν καὶ περὶ γαμετρίας καὶ ἀριθμῶν καὶ οὐχ ἥκιστα περὶ μωσικᾶς. ταῦτα γὰρ τὰ μαθήματα δοκοῦντι ἤμεν ἀδελφεά.

"Those who concern themselves with the mathematical sciences seem to me to make distinction well, and it is not surprising that they think correctly, about each thing, how they are. For since they make distinctions well about the nature of the whole, they ought also to see well, about particular things, how they are. And certainly, about the speed of the heavenly bodies, their risings and settings, they have transmitted to us a clear distinction, and so too about geometry and numbers, and especially about music. For these sciences seem to be sisters."<sup>85</sup>

In his study of Archytas, Huffman argues that οἱ περὶ τὰ μαθήματα include both Pythagoreans and non-Pythagoreans such as Hippocrates of Chios.<sup>86</sup> The problem is that arithmetic and mathematical harmonics up to the very end of the fifth century remained a monopoly of the Pythagorean school; Hippocrates and other Ionian mathematicians did not study them, hence οἱ περὶ τὰ μαθήματα refers to Archytas' Pythagorean predecessors, who like Hippasus, Theodorus of Cyrene or Philolaus, dealt with the sciences of the

<sup>82</sup> Zhmud 2006, 92–94.

<sup>83</sup> Astronomy and harmonics are kindred sciences, as the Pythagoreans say, and we agree with them (*Res.* 530d), which corresponds to Archytas B 1.

<sup>84</sup> Zhmud 2006, 71–72, 110.

<sup>85</sup> Archytas D 14 Laks-Most = 48 B 1, tr. Laks-Most. Unlike Huffman, who retains σαφῇ omitted by Porphyry, Laks and Most print Porphyry's text but translate "clear distinction".

<sup>86</sup> Huffman 2005, 52.

quadrivium.<sup>87</sup> In his opinion, they showed true insight (καλῶς διαγνῶναι), and it is not strange that they have a correct understanding about particular things as they are. This is unusual for the Presocratic philosophers, who are known for their exceedingly critical attitude towards their predecessors, but Archytas was not a typical philosopher, and the *Harmonics* was not a philosophical treatise. Reliance on predecessors is essential for the scientific tradition, even if scientists do not state it as openly and generously as Archytas.<sup>88</sup>

It is in this context that φύσις appears in the *Harmonics*. Right at the beginning Archytas makes an important epistemological point: knowledge of particular things, such as the speed of the heavenly bodies or the pitch of the sound, depends on knowledge of the nature of the whole. If we take ἡ τῶν ὅλων φύσις as near equivalent to ἡ τῶν ἀπάντων φύσις, or to ἡ τοῦ ὅλου φύσις, for *neutrum pluralis* in Greek often substitutes collective notions, then Archytas meant by it the ‘nature of the universe’ or the ‘nature as a whole’ (cf. ὅλος ‘ὁ’ κόσμος in Philolaus B 1). In difference from τὸ πᾶν, τὸ ὅλον (τὰ ὅλα)<sup>89</sup> “designates not so much the all in its entirety as that which opposes all the partial experiences and embraces them”;<sup>90</sup> in our case, the latter are the discoveries made in each science. ἡ φύσις in this sense is the synonym and equivalent of τὸ ὅλον, which with ὁ κόσμος was a common designation of universal nature viewed as a whole. Thus, the author of the *Dissoi logoi*, where the Pythagoreans and Anaxagoreans figured as teachers of wisdom and virtue (DK 90, 6), tried to persuade his audience that an accomplished σοφιστής, who knows περὶ φύσιος τῶν ἀπάντων ὥς τε ἔχει καὶ ὥς ἐγένετο, will be able to act rightly in regard to everything (8).<sup>91</sup> Xenophon denied that Socrates had spoken περὶ τῆς τῶν πάντων φύσεως, σκοπῶν ὅπως ὁ καλούμενος ὑπὸ τῶν σοφιστῶν κόσμος ἔχει (*Mem.* I, 1, 11).<sup>92</sup> Plato mentions in the *Lysis* οἱ περὶ φύσεως τε καὶ τοῦ ὅλου διαλεγόμενοι καὶ γράφοντες (214b5) and in the *Phaedrus* Phaedrus answers Socrates’ question “is it possible to reach a serious understanding of the nature of the soul without understanding the nature of the world as a whole” (τῆς τοῦ ὅλου φύσεως)<sup>93</sup> that, according to the Asclepiad Hippocrates, we will not understand even the body without this method (270c).

Indeed, in the Hippocratic Corpus correct knowledge of diseases or of the diet is often made dependent on the knowledge of the entire human *physis* or of *physis* in general. Thus, in *On Regimen*, the most philosophically influenced treatise of the Corpus, we read: “I maintain that he who aspires to treat correctly of human regimen must first acquire knowledge and discernment of the nature of man in general” (παντὸς φύσιν ἀνθρώπου γνῶναι καὶ διαγνῶναι), including his original constitution (τὴν ἐξ ἀρχῆς σύστασιν).<sup>94</sup> In the same section the whole universe (ὅλος ὁ κόσμος) appears among the factors considered by a doctor (I, 2), while further on it is stated that the human body is formed by imitation of the universe, ἀπομίμησιν τοῦ ὅλου (I, 10). The author of the *Epidemics* also goes

<sup>87</sup> Hippasus: 18 A 4, 12–15; Theodorus: 43 A 2–5; Philolaus: see above, 60, n. 81.

<sup>88</sup> Cf. [Hipp.] *De victu* 1, 2.

<sup>89</sup> For ὅλα see, e.g.: συλλάψεις ὅλα καὶ οὐχ ὅλα, συμφερόμενον διαφερόμενον, συνᾷδον διαῖδον, ἐκ πάντων ἔν καὶ ἐξ ἐνὸς πάντα (Her. fr. 25 Marcovich = 22 B 10 DK); ἐκ τῶν ὅλων μέρηα διαίρεται, καὶ ἐκ τῶν μερέων συντιθεμένων ὅλα γίνεται ([Hipp.] *De victu* 1, 6, see also 15, 17); Xen. *Cyr.* 8, 1, 13.

<sup>90</sup> Bollack 1969, 14 n. 1.

<sup>91</sup> On “the nature of the universe”, see Robinson 1979, 224–225.

<sup>92</sup> Cf. Σωκράτους δὲ περὶ μὲν τὰ ἠθικά πραγματευομένου περὶ δὲ τῆς ὅλης φύσεως οὐθέν (Arist. *Met.* 987b2).

<sup>93</sup> Tr. A. Nehamas. It is disputable whether τὸ ὅλον means “the whole world” or “the whole question”, see e.g. Joly 1961; Lloyd 1975/1991, 200–203. I prefer the first variant.

<sup>94</sup> *De victu* 1, 2, tr. W. H. S. Jones.

beyond human *physis*: “The following were the circumstances attending the diseases, from which I framed my judgments (ἐξ ὧν διαγιγνώσκομεν), learning from the general nature of all and the particular nature of the individual”, which, inter alia, includes learning “from the constitution, both as a whole and with respect to the parts, of the weather and of each region” (ἐκ τῆς καταστάσιος ὅλης, καὶ κατὰ μέρη τῶν οὐρανίων καὶ χώρας ἐκάστης).<sup>95</sup> The *Ancient Medicine* famously criticises those doctors and philosophers who assert “that it is impossible for anyone to know medicine who does not know what the human being is... Their account tends towards philosophy, just like Empedocles or others who have written about nature from the beginning”.<sup>96</sup> Denying this philosophical approach, the author, however, claims that knowledge of human *physis* can be acquired *only* “when one has correctly grasped medicine itself in its entirety” (αὐτέην τὴν ἱητρικὴν πᾶσαν). In view of these passages in philosophical and medical literature of Archytas’ time, his idea that correct understanding of particular things achieved in particular sciences depends on good knowledge of the *physis* as a whole looks widely accepted. Regrettably, he does not say what this latter knowledge consists of, so we can only make informed guesses about it.

One would expect that speaking of cognition Archytas would employ the verbs ἐπίσταμαι, as in his discussion of the cognitive method in B 3, or γινώσκω, as in Philolaus B 4 and 6, but his central epistemological term, as Huffman notes, is διαγιγνώσκω, “to discern, to distinguish”; it occurs three times in five lines.<sup>97</sup> Interestingly, the closest parallel to this is found not in a philosophical text, but in two above quoted passages from *On Regimen* and *Epidemics* that deal with *physis*. Especially often διαγιγνώσκω occurs in *On Regimen*, where it is employed alternatively and interchangeably with γινώσκω.<sup>98</sup> The same can be seen in Archytas B 1. When further on he speaks about bodies in motion which produce sounds, he again mentions *physis*, this time a particular human nature, and uses γινώσκω in the sense “to discern, to recognize, to perceive”:

Many of these sounds are not capable of being discerned by our nature (οὐκ εἶναι ἁμὼν τῇ φύσει οἷους τε γινώσκεσθαι), some because of the weakness of the impact, some because of the extent of their distance from us, and some even because of their excessively great magnitude.<sup>99</sup>

Thus, my impression is that praising the great advances in knowledge Archytas emphatically used διαγιγνώσκω to strengthen the potential of the root γνω- rather than to limit it to mere discernment or distinguishing between things.

<sup>95</sup> *Epid.* I, 23, tr. W. H. S. Jones. See also *De carn.* 1.

<sup>96</sup> *De vet. med.* 20, tr. M. Schiefsky.

<sup>97</sup> Huffman 2005, 151.

<sup>98</sup> 1) Φημί δὲ δεῖν τὸν μέλλοντα ὀρθῶς συγγράφειν περὶ διαίτης ἀνθρωπίνης πρῶτον μὲν παντὸς φύσιν ἀνθρώπου γνῶναι καὶ διαγνῶναι· γνῶναι μὲν ἀπὸ τίνων συνέστηκεν ἐξ ἀρχῆς, διαγνῶναι δὲ ὑπὸ τίνων μερῶν κεκράτηται· εἴ τε γὰρ τὴν ἐξ ἀρχῆς σύστασιν μὴ γνῶσεται, ἀδύνατος ἔσται τὰ ὑπ’ ἐκείνων γιγνόμενα γνῶναι· εἴ τε μὴ γνῶσεται (<δια>γνῶσεται: Joly) τὸ ἐπικρατέον ἐν τῷ σώματι, οὐχ ἱκανὸς ἔσται τὰ συμφέροντα τῷ ἀνθρώπῳ προσενεγκεῖν (1, 2, 122.22–26 Joly). 2) Δεῖ δὲ, ὡς ἔοικε, τῶν πόνων διαγινώσκειν τὴν δύναμιν... Ἄστρον τε ἐπιτολὰς καὶ δύσιας γινώσκειν δεῖ... Ταῦτα δὲ πάντα διαγινόντι οὐκ αὐτάρκες τὸ εὐρημά ἐστιν (1, 2, 124.9–10. 14–17). 3) ... ἐξ ὧν διαγινώσκειν χρὴ ψυχρὴν φύσιν καὶ ὑγρὴν (1, 32, 148.22); ... τοῖσδε γινώσκειν ὑγρὴν καὶ θερμὴν φύσιν (1, 32, 148.28–29). 4) εἴτε γὰρ τὴν ἐξ ἀρχῆς σύστασιν μὴ γνῶσεται, ἀδύνατος ἔσται τὰ ὑπ’ ἐκείνων γιγνόμενα γνῶναι (1, 2, 122.25–27). Περὶ μὲν οὖν φύσιος διαγνώσιος οὕτω χρὴ διαγινώσκειν τῆς ἐξ ἀρχῆς ξυστάσιος (1, 32, 150.9–10). 5) διαγινώσκειν (2, 37, 158.1); γινώσκειν (2, 39, 162.9–10). Cf. *Index Hippocraticus*: διαγιγνώσκω *discerno*, *cognosco*; διάγνωσις *cognitio* (Kühn, Fleischer 1989, 171).

<sup>99</sup> Tr. A. Barker. Cf. also οὐ μόνον δέ κα τούτῳ γινώμεν (B 1, l. 41)

A different interpretation of the beginning of B 1 was suggested by Huffman. Since Archytas refers to “wholes” in the plural (τῶν ὅλων) rather to the “whole” in the singular, he does not mean the whole universe and its parts. These “wholes” are “the universal concepts of the given science”, which is to say of astronomy or harmonics, and since they are carefully distinguished and defined by οἱ περὶ τὰ μαθήματα, scientists are “also able to understand the particular objects considered by the science”.<sup>100</sup> Thus, the fundamental concept (“the whole”) in harmonics is sound, and it is precisely from sound that his predecessors began; in astronomy such a concept is ‘motion’. Archytas is arguing that those concerned with the sciences are good at making distinctions, because making distinctions is a central activity of the sciences”.<sup>101</sup> This account makes Archytas a true logician and a predecessor of Aristotle, whose distinction between the universal (καθόλου) and particular (κατὰ μέρος) may have been, as Huffman believes, in part influenced by passages like Archytas B 1.

I do not find this interpretation convincing.<sup>102</sup> First, I do not think there is much difference between φύσις τῶν ὅλων and φύσις τοῦ ὅλου. As Holwerda noted, expressions such as ἡ τῶν ὅλων (or τῶν συμπάντων) φύσις often appear in the texts, normally referring to the whole nature or to the universe in general, as, for example, in Epicurus or Zeno of Citium.<sup>103</sup> Xenophon uses τὴν τῶν ὅλων τάξιν in the similar meaning (*Cyr.* 8, 7, 22). Secondly, though Archytas developed a kind of philosophy of science, there is nothing like a definition of “the universal concepts of the given science” in it. In the introduction to *Περὶ μαθημάτων*, where he lays out the major methodological principles of the sciences, no mention of ‘making distinctions’ is made. The key notions here denoting principal activities of the sciences in acquiring knowledge are μάθησις, ζήτησις and εὕρεσις:

“For it is necessary to arrive at knowing what you did not know either by learning it from someone else or by discovering it yourself. Now what one learns from someone else also belongs to another, while what one discovers oneself belongs to oneself as one’s own. But to discover without seeking is difficult and rare, while to do so by seeking is practicable and easy; but if one does not know (how) to seek, then to seek is impossible” (B 3).<sup>104</sup>

The independent discovery of new knowledge, says Archytas, is certainly preferable to learning from others, but to make such a discovery, and not an accidental find, a conscious search is needed, because one cannot research without knowing the method of research.<sup>105</sup> This reminds us of the argument made in B 1: to be effective in search of particular truths one needs to know something more general.

In Archytas’ view, both the universe in general and individual things are open to human cognition. Without setting any conditions or limitations to this process, as Philolaus

<sup>100</sup> Huffman 2005, 57–68, 149–152.

<sup>101</sup> Huffman 2005, 59.

<sup>102</sup> For its criticism, see Barker 2006, 302–308, 315–318.

<sup>103</sup> Holwerda 1955, 73. Ταῦτά σοι, ὦ Ἡρόδοτε, ἔστι κεφαλαιωδέστατα ὑπὲρ τῆς τῶν ὅλων φύσεως ἐπιτετημένα (*Epic. Ep. ad Her.* 82); τί οὖν ἔστι θεὸς καὶ τί φαντασία, καὶ τί ἔστι φύσις ἢ ἐπὶ μέρους καὶ τί ἔστι φύσις ἡ τῶν ὅλων (Zeno fr. 182 SVF).

<sup>104</sup> Tr. Laks–Most, slightly modified. Cf. Huffman 2005, 182–200; Zhmud 2006, 64–65; Barker 2006, 313.

<sup>105</sup> Cf. *De vet. med.* 2 on method of research: “But anyone who casts off and rejects all these things (i.e. previous discoveries), tries to investigate in another way and another manner, and says that he has discovered something, has been deceived and continues to deceive himself: for this is impossible” (tr. M. Schiefsky).

did, he reinforces the latter's declaration that "all the things that are known have number" (B 4) by making four *mathēmata* the principal cognitive tools for scientific enquiry into nature. This is not exactly the *περὶ φύσεως ἱστορία* that we, following Plato and Aristotle, used to associate with the Presocratics. Archytas' οἱ περὶ τὰ μαθήματα, having appeared earlier than Aristotle's οἱ περὶ φύσεως,<sup>106</sup> partly overlap with them, as astronomy and harmonics are based on an empirical foundation and deal with physical reality. We do not know, how, and if, Archytas perceived the difference between the sister sciences, yet he obviously did not know of Platonic division into intelligible and sensible reality. His astronomy is concerned with the motion of the visible heavenly bodies, not with the ideal kinematics of mathematical heavens, as Plato wanted it to have (*Res.* 529a–530c). According to Archytas, οἱ περὶ τὰ μαθήματα have already reached a correct understanding of these things and of nature as a whole, they did not need any intermediary to interpret the results of their scientific research. Plato, for his part, asserts that since the geometers and astronomers do not know how to make use of their discoveries, those of them who are not utter blockheads must hand these discoveries over to the dialecticians, who will find proper use for them (*Euthyd.* 290c). Does this not sound like a polemic with Archytas? Archytas' harmonic theory, Barker noted, "provides the impressions we receive in our musical experience with an intelligible basis in the world accessible to the quantifications and measurements of a physicist... [R]ather few of his successors seem to have followed him; most of them reverted to a more abstract approach, detached from the phenomena of musical experience... and heavily influenced by Plato".<sup>107</sup> Plato's reaction to Archytas' theory is well known: the true science of harmonics must measure mathematical and not audible consonances, which is exactly what the Pythagoreans fail to realize (*Res.* 531c). The fruitfulness of Archytas' approach was fully appreciated only in early modern science, with a growing awareness that the book of Nature is written in the language of mathematics (Galileo Galilei).

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<sup>106</sup> To be sure, οἱ περὶ φύσεως are first attested in Plato's *Lysis* (214b5).

<sup>107</sup> Barker 2007, 306.

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## **Physis в пифагорейской традиции**

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В статье обсуждается понятие *physis*, встречающееся во фрагментах пифагорейцев Филолая из Кротона и Архита из Тарента. Отталкиваясь от дискуссии о двух основных значениях *physis*, «росте» и «бытии», которая велась среди англоязычных (начало XX в.), а затем среди немецких (середина XX в.) исследователей античной философии (раздел 2), статья аргументирует, что Филолай был, вероятно, автором первого трактата Περὶ φύσεως, как об этом свидетельствует писатель I в. до н.э. Диоген из Магнезии. Остальные свидетельства о книгах досократиков, озаглавленных Περὶ φύσεως, являются поздними и ненадежными (раздел 3). Вопреки мнению издателя Филолая К. Хафмена, ἡ φύσις во фрагментах В 1 и 6, употребляемая неатрибутивно и с артиклем, обозначает все, что возникло из двух основных начал, *apeira* и *perainonta*, под воздействием *harmonia*, и существует в этом мироустройстве (В 2, 6). *Physis* не вечна и познаваема лишь частично (раздел 4). В отличие от Филолая, у Архита не было учения о началах, и его эпистемология не была ограничена метафизическими принципами. Архит рассматривает *physis* в космологическом и эпистемологическом плане как «природу целого», доступную человеческому познанию (В 1). Не ставя процессу познания каких-либо ограничений, как это делал Филолай, Архит подкрепляет заявление последнего о том, что «все вещи, которые нам известны, имеют число» (В 4), тем, что делает четыре *mathēmata* основным познавательным инструментом в научных исследованиях природы (раздел 5).

**Ключевые слова:** Филолай из Кротона, Архит из Тарента, пифагорейская традиция, *physis*.