

## ANAXIMANDER'S RINGS

Anaximander is the first philosopher whose theory of the heavens is preserved in broad outlines. According to the sources the celestial bodies are huge rings of compressed air around the earth, each visible only where it is perforated by a tubular vent through which the fire contained in it can shine. Greatest and farthest of them is the sun,<sup>1</sup> next comes the moon<sup>2</sup> and under them there is the ring (or possibly rings)<sup>3</sup> of the stars. It is a common practice to put and answer the following questions:

(i) '... why he should have placed the stellar circles or rings closer to the earth than are the sun and the moon.'<sup>4</sup>

(ii) '... why these lower rings of stellar ἀήρ do not obscure the brighter but more distant bodies.'<sup>5</sup>

In the first section of this note I would like to show that a systematic answer to these questions is possible, i.e. there is an answer to (ii) which suggests, in answer to (i), that the order of the celestial bodies could only be sun–moon–stars.

## I

The second question is itself independent of the order of the three rings: in all possible cases some parts of the outermost band should be obscured, no matter whether it is the sun, the moon or the stars. So we have to face directly the problem of intersecting bands and provide a solution in which these do not obscure each other. I can think of only one scheme,<sup>6</sup> that, the further the different bands are from the centre of the universe, the greater the concentration of fire they contain.<sup>7</sup> So e.g. with the stars the tube of misty ἀήρ, which can obscure the small amount of fire contained in it, is simply radiated through by the light of the sun and the moon.<sup>8</sup> The same may hold in the case of the ring of the moon.<sup>9</sup> The fire within is invisible, too weak to shine through, but the immense fire of the sun passes through these two misty layers of ἀήρ without difficulty.

<sup>1</sup> A21, A11

<sup>2</sup> A22.

<sup>3</sup> Its size is not reported. Tannery, *Pour l'histoire de la science hellène*<sup>2</sup> (Paris, 1930), pp. 84f., suggested that it was 9 times as great as the earth, thus forming an arithmetical sequence: 9-18-27. The order is given in A11, A18.

<sup>4</sup> C. H. Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960), p. 89.

<sup>5</sup> Kahn, op. cit., p. 90.

<sup>6</sup> Tannery's conjecture has become a classic: flame is seen only at the orifice, because inside the tube it does not emit light. The ἀήρ does not have to obstruct the light of the fire inside, so it will be perfectly translucent for the light of the bodies behind it.

<sup>7</sup> As I will argue in Section II we can give two different kinds of argument for this arrangement: one is to name the physical force(s) responsible for the constitution of the heavens, in particular the natural upward tendency of fire; while the other, which I am pursuing here, is to spell out the intrinsic motivation for a certain theory of the heavens to order the heavenly bodies in a particular way.

<sup>8</sup> My proposal is the same as Kurt von Fritz's in a letter to Kahn, see Kahn, op. cit., p. 90 n. 3.

<sup>9</sup> It is not clear from the testimonia whether the bands of the sun and the moon completely overlap, or only intersect at some point. In the standard illustrations the latter is presupposed (see e.g. T. L. Heath's Fig. 3 in his *Aristarchus of Samos* [Oxford, 1913], p. 35), and not argued for.

In this reconstruction it is obvious that the farther a celestial body is the brighter it must be in order to be visible. Now the transmitted order of Anaximander is precisely this. Sun, moon and stars follow each other in the sequence of their respective brightness.<sup>10</sup> A weak point in the reasoning above is that though it is true that the farther away a body is the brighter it must be, it does not follow that it must seem brighter from the earth after passing through so much misty ἀήρ. Suppose, however, that the stars are not closest to the earth, but that the sun or the moon or both are in front of them. Recall that sun and moon are large bands, containing fire that cannot shine through. Then the light of the stars falling behind the ring of e.g. the moon has to pass the misty envelope of the moon, and either we would have to see a negative picture of the belt of the moon on the evening sky, or we would be forced to accept that stars behind these bands are in fact some magnitudes brighter than the ones we see directly and so can have the same apparent luminosity. The difference should be at least as great as the brightness of the moon, which itself cannot penetrate the misty envelope at all. Therefore though it may seem rash to infer, from the apparent brightness of the celestial bodies, their absolute luminosity, and then to fix their position in the universe accordingly, it is clear that any other ordering of the sun, the moon and the stars would need some unwarranted hypotheses.

To sum up: I hope to have shown that a theory of the heavens in which the celestial bodies are rings can cope with the problem of visibility only if brighter celestial bodies are postulated to be farther away.

I do not mean to deny Kahn's contention, that 'like all Greeks he [Anaximander] believed that the fire tends upwards' and so 'the bulk of flame is concentrated in the outermost circle of the Sun ...'.<sup>11</sup> Kahn may be right that all Greeks thought that fire tends upwards,<sup>12</sup> but it was only a very small minority who thought that the sequence sun-moon-stars was correct. The tendency of fire to move upwards is probably an active force in the formation of the rings, but it is not sufficient to explain the particular order Anaximander fixes. A more 'systematic' argument, like the one I have outlined above, is preferable.

## II

After establishing a link between the rings as basic constituents of Anaximander's cosmology and the particular order of the celestial bodies, in the second part of this note I will try to give a reason why Anaximander might have opted for these rings.<sup>13</sup> For this we have to look in another direction. In fragments A10, A11 and A25 we are informed that the earth is a cylinder, or as we would put it a huge pill, and in a testimony of Aristotle (A26) it is reported that the earth is at rest in the middle of the universe just on account of its *homoiotês*.<sup>14</sup> Now notice that a ring is

<sup>10</sup> Cf. H. Diels, 'Über Anaximanders Kosmos', *AGP* 10 (1897), 229 = *Kleine Schriften*, p. 14: 'Es kann wohl keinem Zweifel unterliegen, dass die Helligkeit des Feuers zu dieser Rangordnung die Veranlassung gab.' Diels, however, does not relate this ordering to the problem of visibility, and gives only a cosmogonical reason for it.

<sup>11</sup> Kahn, *op. cit.*, p. 90.

<sup>12</sup> Some would accept on the testimony of 28A37 DK that Parmenides postulated a fiery core of the earth.

<sup>13</sup> Anaximander is apparently unique in this opinion. And it is no use to refer to the fact that he was the very first of the tradition, a trend-setter rather than follower of established orthodoxies. Popular thought and theology alike regarded celestial bodies as individual and permanent bodies (as e.g. the chariot of Ἥλιος etc.), and not as epiphenomena of some substructure, so Anaximander's departure from the tradition has to be explained.

<sup>14</sup> The argument as recorded by Aristotle employs the Principle of Sufficient Reason. An extensive analysis in J. Barnes, *The Presocratic Philosophers* (London, 1979), pp. 23–6.

simply the difference of two such cylinders; if both of them should be immobile on account of their *homoiotés* in relation to all other components of the universe, the resulting ring should have the same property. With the introduction of the rings the symmetry and stability of the earth applies to every component of the heavens too,<sup>15</sup> and if Anaximander really used the Principle of Sufficient Reason to demonstrate that the earth is at rest, as Aristotle would suggest, this principle becomes a universal principle for the whole cosmos. My conjecture is then that e.g. the sun cannot be a unique, individual body, as ordinary mankind would think, because this would destroy the precarious balance and symmetry of the heavens, and consequently that body would be unable to exhibit its observed regularity and stability: perhaps it would fall down, as there would be no counterpoise attached to it.

Here we can detect two motifs which will have a great career in the later history of Greek philosophy. One is the quest for a constant and immobile<sup>16</sup> substructure of the universe, to explain the variegated phenomena and at the same time to constitute a metaphysical warranty for the stability of physical processes. The other is the distinction between the real nature of an entity and the false notions mortals may have about it. It is remarkable that Anaximander, though standing at the very beginning of Greek physical speculation, is perfectly able to contrast an independent entity in its own right, the rings of the celestial bodies, with an epiphenomenon giving rise to a common misconception of mankind, the holes in the rings, seen as celestial bodies.

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<sup>15</sup> W. K. C. Guthrie tried to assimilate the shape of the earth to that of the heavenly bodies by claiming that it was in fact a ring. See his *A History of Greek Philosophy*, i (Cambridge, 1962), p. 99, with notes 2 and 3.

<sup>16</sup> Balance, as H. J. Classen rightly insists, is the keynote in Anaximander's fragment and parallels the role of order in his cosmology ('Anaximander and Anaximenes: The Earliest Greek Theories of Change?', *Phronesis* 12 (1977), 98). If my contention is right, balance will apply to the structure of the cosmos as well.