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Kosmos: aliens in ancient Greece

On our way we passed many countries and put in at the Morning Star, which was just being colonised. We landed there and procured water. Going aboard and making for the Zodiac, we passed the Sun to port, hugging the shore. We did not land, though many of my comrades wanted to; for the wind was unfavourable. But we saw that the country was green and fertile and well-watered, and full of untold good things.

Sailing the next night and day we reached Lamp-town toward evening, already being on our downward way. This city lies in the air midway between the Pleiades and the Hyades, though much lower than the Zodiac. On landing, we did not find any men at all, but a lot of lamps running about and loitering in the public square and at the harbour. Some of them were small and poor, so to speak: a few, being great and powerful, were very splendid and conspicuous. Each of them has his own house, or sconce, they have names like men, and we heard them talking. They offered us no harm, but invited us to be their guests. We were afraid, however, and none of us ventured to eat a mouthful or close an eye. They have a public building in the centre of the city, where their magistrate sits all night and calls each of them by name, and whoever does not answer is sentenced to death for deserting. They are executed by being put out. We were at court, saw what went on, and heard the lamps defend themselves and tell why they came late. There I recognised our own lamp: I spoke to him and enquired how things were at home, and he told me all about them.[1]

Lucian, *A True Story*, trans. A. M. Harmon, parallel English and Greek

The war of the worldviews

Astrobiology has some backstory.

The tale of our changing view of the possibility of life beyond the Earth is one that begins in ancient times, during the grandeur that was the ancient Greek

world. In fact, the intellectual and cultural brilliance of the Greeks will have a profound effect on the rest of our narrative. But exactly what historical root does the plurality of worlds debate have in antiquity? What precursors in philosophy and literature, what flights of imaginative phantasy in fact and fiction? And what bearing did these ideas have on the science and culture of 'astrobiology' that was to develop over the coming millennia? Such are the questions that this first chapter seeks to address.

We shall discover the way in which philosophies of the classical world influenced succeeding ages, especially in relation to the natural sciences of astronomy and biology. The worldviews that shape our narrative are not dreamt up, out of thin air. So we shall be careful to trace the relevant movements in philosophy, culture, economy, and society for our story. For we need to know what prevailing conditions of culture and economy, of people and politics, led to such a remarkable history. Moreover, as it is the classical Greek world we have to thank for the conscious and unbroken thread of rational thinking, why *then*? Why in ancient Greece does such a reasoned philosophy develop, one so truly modern that its implications for life in the universe seem so contemporary?

The modern study of astrobiology makes use of many disciplines. As its main mission is to try explaining the origin, evolution, and distribution of life in the universe, its history often brings other fields into sharp focus. A history of astrobiology – naturally we have not always referred to the subject as such – must study advances in philosophy, physics, astronomy, cosmology, biology, and geology, among others, as rational speculation on extraterrestrial life has mostly concerned itself with hypotheses that fit firmly into existing scientific paradigms. So, the work of philosophers and scientists, especially astronomers, deserves special attention in this history, as their ideas about extraterrestrials have often had a strong influence on others.

The other primary goal of this book is to outline a history of fictional ideas about intelligent extraterrestrial life. As eminent writers are also intellectuals in the human family, their creative morphing of scientific ideas into symbols of the human condition

> is often an unconscious and therefore particularly valuable reflection of the assumptions and attitudes held by society. By virtue of its ability to project and dramatise, science fiction has been a particularly effective, and perhaps for many readers the only, means for generating concern and thought about the social, philosophical and moral consequences of scientific progress.[2]

Learning how poets react to extraterrestrial life, in other words, can teach us much about humanity.

Finally, there is the war of the worldviews. We shall discover that, throughout the ages, an evolving battle has played out between conflicting philosophies. At times of scientific revolution, this conflict peaks with great drama, such as the clash between Galileo and the Inquisition, and the controversy between Darwin and the creationists. But the schism is ancient in origin. Even in the ancient Greek world we find thought diverged into two paths, one materialist, one idealist.

And so to the ancient world, where we meet the first materialists in the Atomists, and the first idealists in Plato and Aristotle. With the Atomists we shall find a body of work that divines the shape of things to come: a worldview that embraced evolution, an atomic world of matter in motion, with no God. And with idealist thinkers Plato and Aristotle we encounter a philosophy of reaction, one developed out of the chronic fear of change when the strong slave-owning city-state of Athens was brought under the iron fist of Sparta.

The ancient Greek world

The central period of Greek thought hauls us into a history of the alien. With a history as glorious as the Greek, the puzzle is where to begin. But two crucial vectors make that choice a little easier. First is the dramatic rise of the city-state of Athens, and its associated empire. Second is the parallel development in philosophy. For in these two factors we can identify the beginning of a worldview that came to dominate the idea of life in the universe for two millennia.

The irresistible rise of Athens emerged after a Greek victory in the Persian Wars in 479 BC. The city burgeoned into the cultural and economic epicentre of the Greek world. With audacity and drive, the Athenians had fought off Persia's imperial aggression. Monetary and military savvy had proved priceless. Themistocles, the most prominent politician in Athens, had persuaded his fellow citizens to plough profits back into the push against the Persians. The coinage used to construct the city's commanding armada came from the Laurion silver mines, one of the chief sources of income for the Athenian state, and notorious for the treatment of the slaves who mined it. The poor powered the navy. This ensured victory for the city, and the support of the common people for its government.

Athens became a beacon. For the next hundred years, despite losing the war with Sparta, the city was the intellectual centre of the Greek world. Its fame was such that the literati flocked to the city. Artists and sculptors, philosophers and historians alike were drawn as scholars to the flame. Of the philosophers who came, we can identify two main tendencies of thought: those thinkers who believed in a worldview in which *matter* is primary, and those whose view was that *ideas* make up either all, or a major part of, the world of matter.

Table 1.1. *Two traditions: philosophy and science in the ancient Greek world*

		Philosophy and science	
Date	Social developments	Materialist tradition	Idealist tradition
600 BC	Age of tyrants	Influence of ancient learning	
		Thales, *Anaximander*, the Ionian materialist theory of nature	
	Persian conquest of Ionia	*Pythagoras*, maths and physical law	
		Heraclitus, philosophy of change	
	Liberation from Persians		
500 BC	Mining and metal-working	*Philolaus*, spherical Earth in orbit	
	Shipbuilding	*Empedocles*, four elements	*Parmenides*, change illusory
	Peloponnesian War	*Leucippus*, *Democritus*, atomic theory	
	Athenian democracy		
400 BC			*Socrates*, the dialectic method
	Defeat and reaction in Athens		*Plato*, Idealism
		Heraclides, nongeocentric cosmos	*Eudoxus*, heavenly spheres
	Triumph of Macedon		*Aristotle*, descriptive biology
	Alexander's conquests		
300 BC	Museum of Alexandria	*Epicurus*, atomic philosophy	
	Hellenistic influence spreads abroad		*Euclid*, geometry
	Wars with Carthage	*Aristarchus*, rotating Earth, heliocentrism	
200 BC	Great spread of slavery		*Hipparchus*, epicyclic cosmos
100 BC	Roman civil wars		
	Conquest of Gaul	*Lucretius*, atomic materialism	
0 BC	Jewish revolt	*Hero*, mechanics, steam engine	

Table 1.1. (cont.)

		Philosophy and science	
Date	Social developments	Materialist tradition	Idealist tradition
	Spread of Christianity		
AD 100	Marcus Aurelius, philosopher emperor		*Ptolemy*, descriptive astronomy
		Lucian, '*A True Story*' fiction	
AD 200	Decline of city economy and trade		
	Crises and barbarian invasion		

Curiously, both tendencies owed a major part of their roots to the tradition of Ionian philosophy, particularly Pythagorean astronomy. And both worldviews were set to the task that was to become the litmus of wisdom for the Athenian age: to explain the motions of the Sun, Moon, and planets that whirled above their empire and the rest of the ancient world. The imagined solutions to this task held implications for the prospects of life beyond the Earth.

Of the two main philosophical tendencies, the more enlightened belonged to the Atomists. They envisaged a world ruled only by matter in motion, a cosmos that evolved in time. Inspired by early notions of evolution, they imagined nothing but atoms and void, and, more than two millennia before H. G. Wells' *The War of the Worlds*, took life into deepest infinite space, in fact and fiction.

The other tendency was that of the philosophers of reaction, those who opposed the idea of a plurality of worlds. Led by Plato and Aristotle, this tradition of the idealist doctrine was to become the dominant worldview. For their teachings formed the basis of the European philosophical tradition, with philosophy becoming 'a series of footnotes to Plato',[3] and science 'a series of footnotes to Aristotle'.[4] And, in the hands of the medieval Church, their ideas were effectively used to hold back modern science, including astronomy and biology, for two thousand years.

Back to the Brotherhood

Our journey through a history of the philosophy and culture of Greek science must include a backstory: the rise of the Pythagorean Brotherhood. The very word 'philosophy' is Pythagorean in provenance. When we use the word

'harmony' in its broader sense, when we call numbers 'figures', we speak the language of the Brotherhood. And their approach was the dawning of a new era; through their application of mathematics to the human experience of the natural world, they were among the founders of what we understand today as science.

The Pythagorean Brotherhood was founded in that remarkable century of awakening, the sixth century BC. It was not only in Greece that such philosophers were to be found. Elsewhere in the world, the eruption of the Iron Age gave scope to men with similar imaginings and messages. The inspired spiritual teachings of Siddhārtha Gautama in ancient India led to the foundation of Buddhism. In Palestine were the prophets and the later authors of the Wisdom literature, such as Ecclesiastes and the book of Job. And the teachings of Chinese thinkers, such as Confucius and Lao-tze, had begun to deeply influence Eastern life and thought.

It was an interconnected world. Indeed, in Egypt Jeremiah may well have met with Thales, regarded by Aristotle and by Bertrand Russell alike as the first philosopher in the Greek (and Western) tradition. Thales had hailed from Miletus, an ancient city on the western coast of what is now Turkey. It was a seat of considerable learning, one that produced notable ancient philosophers. Here also was born the atheist Anaximander, the teacher of Pythagoras, who was himself born sometime between 580 and 572 BC on the Greek island of Samos, set in the North Aegean Sea, close to Miletus.

There is some dispute as to whether Pythagoras truly was an entirely legendary figure. But that need not concern us here. The Brotherhood that bore his name was to have a great influence on later Greek cosmology and thought, chiefly through its most prominent exponents, Plato and Aristotle, but also through their opponents, the Atomists. Pythagorean astronomy was part of an all-embracing philosophy. The Brotherhood tried to synthesise a holistic view of the universe, one that incorporated religion with science, medicine with cosmology, mathematics with music; mind, body, and spirit as one.

Very little biographical detail is known about Pythagoras. None of his writings survive. So it is not possible to say whether some aspect of the Pythagorean worldview was the work of Pythagoras himself, or that of one of the Brotherhood. Much of the philosophical thought associated with Pythagoras may have been those of his brothers or successors. And this is quite apt when you consider that for many Pythagoreanism was the first expression of collective, democratic thought. Nor is it entirely accurate to describe the School as a brotherhood. Women were given opportunity to study; though they were also encouraged to learn domestic skills as well as philosophy, as they were considered different from men, in good ways as well as bad.

In the West at least, Pythagoras appears to have been among the first to call himself a philosopher, a lover of wisdom. Around 530 BC, he travelled south from Samos to Croton, in southern Italy. There he founded a secret school of religious philosophy. His reputation seems to have preceded him. For soon after his arrival, the Brotherhood ruled the town, and presently dominated a major part of *Magna Grecia*. From the eighth century BC, this area of *Greater Greece* was the region in southern Italy and Sicily that was colonised by Greek settlers, who brought an enduring stamp of their civilisation. Alas, in the case of the Pythagoreans, their secular sway was fleeting. They were banished from Croton, their temples razed to the ground, and members of the Brotherhood butchered.

Both *mathematical* and *mystical*,[5] Pythagorean philosophy was a blend of two tendencies. Many are understandably sceptical as to whether Pythagorean mathematics was justly original. The famous theorem on the right-angled triangle, for example, was known to have served the Egyptians and Babylonians way before the Brotherhood was born. And there is evidence to suggest that the entire number theory of the Pythagoreans, in both its mystical and mathematical aspects, was drawn from Eastern thought. But synthesis was paramount. The Brotherhood created a fusion of mathematics and philosophy that has had a lasting influence on the development of science.

The cosmology of the Pythagoreans

The Brotherhood saw that numbers were the key to comprehending the cosmos. In this, it is vital to understand that they were not limiting, or reducing, the human experience. For them, philosophy began in wonder. It was the highest music, and the highest form of philosophy concerned itself with numbers, for ultimately numbers were at the root of all things. When all was told, when logical thought had done its best, the wonder would remain. Rather than mathematics reducing the human experience, it enriches it.

The Pythagorean idea of 'harmony' is a case in point, an example of the way in which the Brotherhood orchestrated a unified view of their universe. Numbers were not thrown into the world by chance. They were ordered, or ordered themselves, like a musical scale, like the structure of a crystal, according to the universal laws of harmony. This basic Pythagorean idea of *armonia* saw the human frame as a kind of musical instrument. Each string within must have the right tension, the correct balance, for the human soul to be in tune. And these musical metaphors are still used in medicine. We talk of 'tone' and 'tonic', of the body being 'well-tempered' – all part of our Pythagorean heritage.

This Pythagorean focus on *armonia* was projected from the body and soul of man, out to the stars that seemed to circle the Greek world. The ancient

Babylonians and Egyptians had thought of the universe as a kind of cosmic oyster. It was an ancient cosmology with water underneath, and water overhead, but supported by a solid firmament. And what the Egyptians and Babylonians began, the Greeks refined. With some finesse, they developed a rational, rather than mythological, cosmology.

So it was that Anaximander of Miletus, Pythagoras' teacher, and one of the foremost Ionian philosophers, had visualised one of the first mechanical models of the universe. Anaximander's cosmos was not the closed oyster of the ancients. It was a universe infinite in space and time. The matter of this universe was not ordinary material, but indestructible, and eternal. And out of this stuff, all things were made, and into it they returned, as if in some cosmic recycling scheme.

Anaximander set the Earth adrift. True, like the cosmologies of other ancient cultures, Anaximander's system was geocentric, or Earth-centred. But rather than picturing an earth-disc floating in water, Anaximander rather curiously considered the Earth to be a cylindrical column, adrift in space. It was a bold innovation. For he surrounded this cylindrical Earth with air, floating upright at the centre of the universe, without support or structure. And yet the Earth was not in freefall. Since it was at the centre of all things, it had no favoured way in which to fall. For its falling would upset the symmetry and balance of such an ordered cosmos.

The Earth became a sphere. The Pythagoreans transformed this cylindrical Earth of Anaximander's into an orb, and around this central Earth, moving in concentric circles, revolved the Sun, Moon, and planets. Each heavenly body was fixed to a sphere, and the fleet revolution of this ingenious system inspired a musical resonance of the air. And so, claimed the Brotherhood, each planet would hum with its own unique pitch, for its music would depend on the ratio of its particular orbit about the Earth. Like a huge and heavenly musical instrument, the orbiting planets too were subject to the universal laws of harmony.

The Pythagorean harmony of the spheres lives on to this day. In his *Natural History* (*circa* AD 77), the Roman scientist and nobleman Pliny the Elder told that the Pythagoreans considered the musical interval formed by the Earth and Moon to be a tone; Moon to Mercury, a semi-tone; Mercury to Venus, a semi-tone; Venus to the Sun, a minor third; Sun to Mars, a tone; Mars to Jupiter, a semi-tone; Jupiter to Saturn, a semi-tone; and Saturn to the fixed stars, a minor third. The 'Pythagorean Scale' created from this musical arrangement is still recognised. And Pliny's report reveals not only a heavenly musical scale, but also a cosmic architecture that was to have a profound influence on the history of astrobiology. The story goes that only the master, Pythagoras, was graced with the gift of actually hearing this harmony of the spheres.

The music was an integral part of a cosmology that the Pythagoreans had evolved from ancient and avid sky-watchers who had scanned the stars and mapped the heavens. From such ancient observations, the Pythagoreans inherited a firmament. The stars were fixed and stationary, like pinholes in a dark fabric through which a cosmic fire could be seen. Perhaps they derived a sense of safety and security from the dependability of such a heavenly system. Immutable and predictable through the ages, the stars in their fixed and imagined constellations must have contrasted greatly with the turbulent lives of the sky-watchers below.

The firmament was not the only fascination the Pythagoreans inherited from the ancients. A number of so-called vagabond stars had in equal measure beguiled and perplexed sky-watchers for many millennia. To the ancient eye, without the use of a spyglass, only seven of these 'wanderers', or 'planets' as they were known, could be seen among the thousands of lights that bejewelled the firmament. The 'wanderers' were different. True, like the fixed stars, the Sun, Moon, Mercury, Venus, Mars, Jupiter, and Saturn all seemed to revolve once a day around the Earth. But the planets also had a peculiar motion.

The seven planetary bodies wandered and drifted along the path they traced across the night sky. Yet they did not roam about the entire heavens. Their cryptic conduct was restricted to a narrow strip of sky, a belt that encircled the spinning globe of the Earth at an angle of about twenty-three degrees to the equator. This belt, the Zodiac, was diced up by the ancients into a dozen divisions, and each division named for the constellation of fixed stars in that region of the Zodiac. Along this belt the planets roamed.

For those skywatchers more mythologically inclined, the passing of a planet through a constellation of the Zodiac had a double meaning. It provided data for their exacting observations, but it also supplied symbolic messages of ritual significance. For the more rational Pythagoreans, with their rule of harmony and number, a structure of the universe emerged.

In the Pythagorean system, the planets sped in circular orbits about the central Earth, and with the same reliability as that of the rotating sphere of fixed stars beyond. This scheme gave good account of the Sun's behaviour on its yearly journey through the plane of the ecliptic, the seeming path of the Sun across the sky. The Pythagorean system also gave a reasonable account of the rather less regular motion of the Moon. But the plain circular orbits came nowhere near explaining the observed motions of the other five wandering planets, of which more later.

Finer details notwithstanding, once the position and shape of the orbits were established, an ancient Solar System emerged. Jupiter and Saturn sketched a slow motion across the sky, seeming to keep up with the fixed stars beyond.

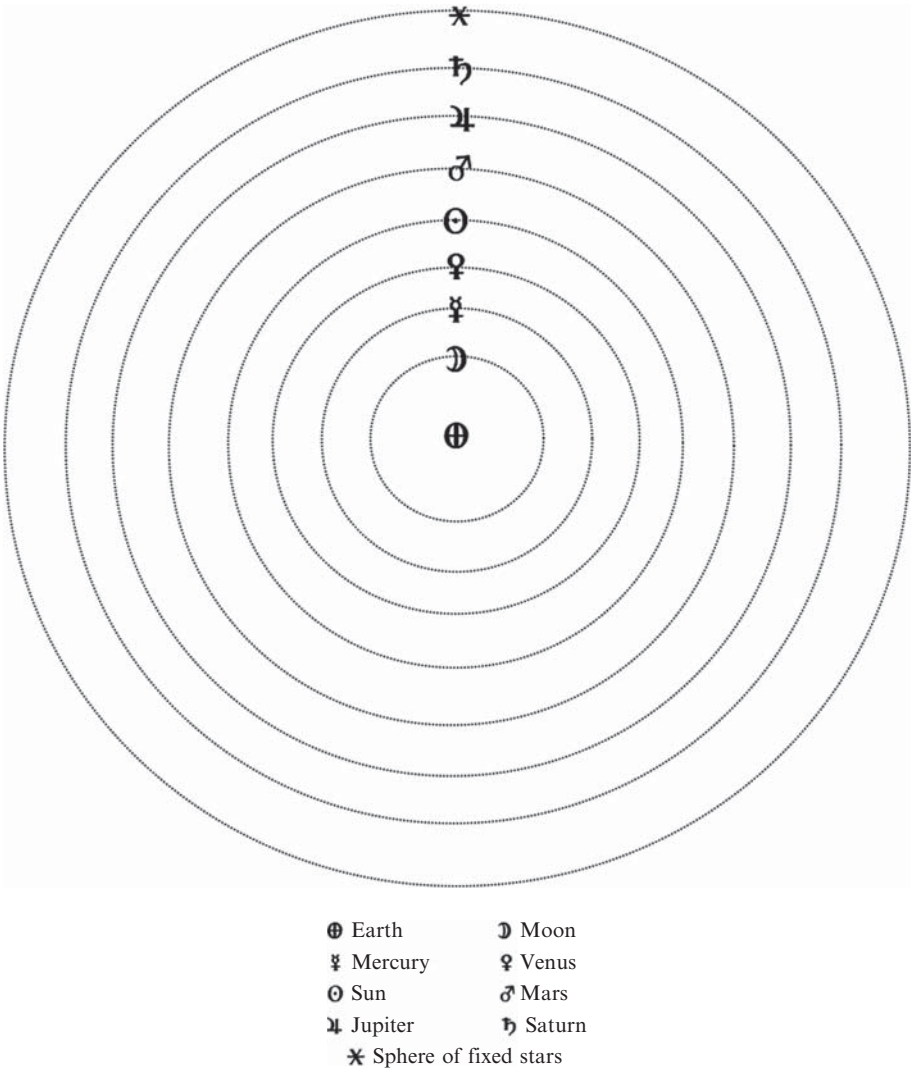

Figure 1 The classical geocentric sytem of the Pythagoreans; the spheres rotate counter-clockwise, as viewed from above.

Modern stargazers know that Jupiter takes roughly twelve years and Saturn thirty years to make a complete orbit about the Sun. To the ancient eye, since these planets kept pace with the stars, they were thought to be far from Earth, and close to the stellar sphere, which bounded their universe. At the other end of this heavenly scale was the Moon. Since our satellite loses twelve degrees each day in its apparent race with the stars, the Pythagoreans were justified in suggesting the Moon was close to Earth, which was thought stationary, and at the centre of the system.