

**THE PREHISTORY OF THE  
STEADY STATE THEORY  
By Robert Temple**

Astronomers and cosmologists may well assume that the controversy between adherents of the steady state and the big bang theories of the Universe is a modern one. However, it has a prehistory. Of course, this prehistory is not formulated in the same terms. It goes back to ancient times when little was understood about the true nature of the stars or of the cosmos. But the underlying question is the same, which comes down to this: Did the Universe come into existence, either by spontaneous generation or creation, or has it always existed? And of course, the question that goes with this is: Will the Universe ever cease to exist, or will it go on existing forever?

Who was it who first suggested that the Universe might always have existed, and indeed might always go on existing without end? It was the philosopher Aristotle, who died in 322 BC at the age of 63. We all know that Aristotle was a remarkable man. He founded the sciences of modern logic, zoology, anatomy, political science, and psychology, while he co-founded with his colleague Theophrastus the science of botany. He also discovered the Eustachian Tubes of the human ear 1900 years before Bartolommeo Eustacchi, known as Eustachius (1520-1574), in the sixteenth century. He scientifically dissected more than 300 species of creatures including humans, he collected 158 constitutions of states as part of his project for comparative political science studies (and he even wrote a new constitution for his home town), he attempted to reduce all of the data of the world of sense into comprehensible and ordered form and to formulate the principles of both logic and thought in order to deal with it coherently. He carried out scientific experiments of an early sort, however much they may have fallen short of our standards of today. He accepted nothing on trust and challenged all fixed ideas. In 1970 an article in *Scientific American* by Imre Toth revealed that Aristotle was a forerunner of non-Euclidian geometry because he had overtly challenged the parallel postulate in geometry. The prehistory of Riemann, Lobachevski and the others, thus lies with Aristotle, though it was not carried further from the fourth century BC until the nineteenth century AD.

But for us here today, the most remarkable thing is that Aristotle was the first person to challenge the theory that the Universe had come into being at all. He makes this absolutely clear in the First Book of his work *De Caelo*, 'On the Heavens', when he says: 'That the world was generated all are agreed.' (Aristotle, 1970, 279b13). By 'all', he means all who preceded or were contemporary with him. He then proceeds to distinguish between two schools of thought: 'having been generated, however, some say it is eternal, others say that it is destructible like any other natural formation'. He opens his lengthy discussion about the eternity of the Universe by saying, in his typical way, 'Let us start with a review of the theories of other thinkers ...' (Aristotle, 1970, 279b6). Aristotle always did this, including in all of his fundamental arguments a historical survey of variant opinions. In this, too, he behaved as a true scientist.

There is no need for us to survey all of the views summarized by Aristotle. He makes mincemeat of them. He says, for instance, that 'to assert that the Universe was generated and yet is eternal is to assert the impossible; for we cannot reasonably attribute to anything any characteristics but those which observation detects in many or all instances. But in this case the facts point the other way: generated things are seen always to be destroyed.' (Aristotle, 1970, 279b18-21). And so on. He proceeds to demolish the views of his teacher Plato, who held this position.

Aristotle's own views are strikingly and vividly maintained: 'the word "duration" possessed a divine significance for the ancients, for the fulfilment which includes the period of life of any creature, outside of which no natural development can fall, has been called its duration. On the same principle the fulfilment of the whole heaven, the fulfilment which includes all time and infinity, is "duration" – a name based upon the fact that it *is always* – duration immortal and divine. From it derive the being and life which other things, some more or less articulately but others feebly, enjoy.'

In lengthy and painstaking arguments, Aristotle demolishes the arguments that the Universe could ever have come into being at all, or ever can cease to exist. In his famous and widely published work 'On Philosophy', which was the best known of his writings for the public during his lifetime, and which has been partially pieced together from numerous surviving fragments, Aristotle strongly advocated his theory of what is generally translated as 'the Eternity of the World', but which was really the Eternity of the Universe. His views thus became widely known throughout the Greek world of his day. (Aristotle, 1952).

The later writer Philo says in his own treatise 'On the Eternity of the World': 'Aristotle was surely speaking piously and devoutly when he insisted that the world is ungenerated and imperishable, and convicted of grave ungodliness those who maintained the opposite ... he used to say in mockery (we are told) that in the past he had feared lest his house be destroyed by violent winds or storms beyond the ordinary, or by time or by lack of proper maintenance, but that now a greater danger hung over him, from those who by argument destroyed the whole world.' (Aristotle, 1952, Fragment 18 of *On Philosophy*, pp. 88-9).

The colleague and immediate successor of Aristotle as head of his school at Athens was Theophrastus. He also wrote a treatise on the Eternity of the Universe, which contained painstaking analyses and dismissals of the contrary arguments, which he attributes to unnamed people whom he calls 'the sophists'. He was very worried about the reading public being persuaded of a created Universe, and said: 'It is necessary to counter so much special pleading, in case anyone who lacks experience should submit to its authority', and he calls the arguments of these 'sophists' an actual 'deception'. (Theophrastus, 1992, pp. 342-57). So as we can see, the debate was already pretty hot within the generation immediately after Aristotle, at the end of the fourth century BC.

The debate continued to rage throughout the following centuries. The Stoic School of philosophy was pretty passionately in favour of a strange theory that the Universe was periodically destroyed and recreated, which is not unlike one of our modern theories today. Opponents argued that this was logically indefensible, because the fire into which the Universe was said to be dissolved continued to exist, so that the Universe didn't really end after all. And then how could it be recreated only from fire? It is therefore not surprising that two prominent Stoic philosophers dissented from their School's doctrine, and supported the theory of an uncreated and unending Universe. The earliest of these was Boethus of Sidon, in the third century BC, who was a translator of Aristotle despite being a Stoic, and later the much better known Stoic thinker Panaetius of Rhodes, who lived c. 185 - c. 109 BC. They said that if the Universe were created and destructible, we would then have something created out of the non-existent, and that that was preposterous. They also said that 'there is nothing outside the Universe except possibly a void,' and no cause existed either within or without the Universe to destroy it. 'And if it were to be destroyed without a cause, clearly the origin of the destruction will arise from what does not exist,' and this any reasonable person must reject as absurd. (Philo, 2001, 15-16, pp. 239-241).

Another important treatise in the prehistory of the Steady State Theory is called ‘On the Nature of the Universe’, and it was attributed to an early Pythagorean philosopher of the 5<sup>th</sup> century BC called Ocellus Lucanus. However, it was really written by a later Pythagorean or Aristotelian in the second or first century BC. This treatise advocates an eternal Universe in very strong terms. The anonymous author states: ‘It appears to me that the Universe is indestructible and unbegotten, since it always was, and always will be ... there is not anything external to the Universe, since all other things are comprehended in the Universe, and it is *the whole* and *the all*. ... the Universe is without a beginning, and without an end ...’ (Ocellus Lucanus, 1831, pp. 1-2).

There is a close affinity between this famous treatise and one written by Critolaus of Phaselis, who was Head of the Aristotelian School at Athens in the second century BC., and it may be that he was the true author of the treatise attributed to Ocellus. Like his predecessor Theophrastus, Critolaus was worried about the public being misled, and he boasts of having refuted ‘those who strengthen falsehood against truth’. He insists that ‘the Universe must surely be uncreated and therefore is indestructible’. He also echoes the founder of his school, Aristotle, who had criticized ‘those who would destroy the world’ by expressing the same sentiments exactly in attacking ‘those who propound the destruction of the world’. (Philo, 2001, 14-15, pp. 233-8). We thus see that, for centuries, the Aristotelian School argued with great passion about this subject, just as their founder had done.

A lengthy treatise ‘On the Eternity of the Universe’ was written by the author Philo the Jew of Alexandria, who was born in 20 BC. He actually wrote two separate treatises on this subject, and the only translation of both of them appeared in 1855 and has never been reprinted (Philo, 1855A and 1855B), but the main one is readily available in translation today (Philo, 2001). He surveys the entire debate from Aristotle’s day to his own time. Philo, as a pious Jew, strongly maintained that although the Universe had been created by God, it would never end. Fred Hoyle was aware of the general trend of this historical debate, because he specifically stated in 1965 in his book *Galaxies, Nuclei, and Quasars*: ‘... the concept of a world with beginning but without end is a part of Judaism and of the derivative Christian culture.’ (Hoyle, 1966, p. 88) Fred was not a historian of science, as he was too busy with other things, and so I do not find any mention anywhere in his books of any of these ancient authors specifically. But it is important for us to realize that Fred was always aware of the wider philosophical context of his work.

The Roman author Cicero also entered into the debate, and wrote (in *Lucullus*), in commenting on the Stoic views that the Universe had been created: ‘When your wise Stoic has said all these things to you syllable by syllable, Aristotle will come with the golden flow of his speech, to say that the Stoic is talking nonsense; he will say that the world never came into being, because there never was a new design from which so noble a work could have taken its beginning, and that it is so well designed in every part that no force can effect such great movements and so great a change, no old age can come upon the world by lapse of time, so that this beautiful world should ever fall to pieces and perish.’ (Aristotle, 1952, Fragment 20 of *On Philosophy*, pp. 92-3).

Christians did not at all like an eternal Universe, as it was against their religion. The Christian bishop Lactantius (in his *Institutes*, Book II) wrote in the third century AD: ‘If the world can perish as a whole because it perishes in parts, it clearly has at some time come into being; and as fragility proclaims a beginning, so it proclaims an end. If that is true, Aristotle could not save the world itself from having a beginning.’ (Aristotle, 1952, Fragment 20 of *On Philosophy*, p. 93).

A very lengthy account of Aristotle's theories of the eternity of the Universe were preserved by the late Greek philosopher Proclus in the fifth century AD (Proclus, 1820, Vol. I, pp. 246-9), but these texts have been left out of the standard collections of Aristotelian fragments, and no attempt appears ever to have been made to integrate them into a reconstruction of the lost work 'On Philosophy'. Here some work may be left to do by classicists. One key observation made by Proclus about Aristotle's theory is the statement that according to him 'eternity is stable infinite power'. (*Ibid.*) Although this falls far short of any notion of continuous creation, it is clear that the reason why no continuous creation was ever postulated by Aristotle was his total ignorance of the fact that the Universe is expanding. If he had known of the expanding Universe, I have no doubt that he would have postulated continuous creation to go on filling it up forever as it expanded forever. All of his ideas point to this. Because the concept of expansion was lacking, stability was thought to prevail. If Aristotle were alive today, he would realize that stability can be achieved in an expanding Universe through continuous creation. Indeed, it is the only way to have stability in the long term. He would have jumped at the idea.

In 'On the Heavens', Aristotle states: 'Anything which always exists is absolutely imperishable. It is also ungenerated, since if it was generated it will have the power for some time of not being.' (Aristotle, 1970, 281b26-27). But Aristotle was thinking of the whole. In an expanding Universe, Aristotle would have wished to preserve the whole as having been ungenerated and eternal, and would have come to the concept that the parts must be generated and perishable, in the same way that individual beings like humans and animals are. As a modern cosmologist, Aristotle would have grasped very quickly the notion that a star and a man are not that different except in scale, as both are transients in an eternal Universe.

To conclude, then, Aristotle's views on the eternity of the Universe are expressed very clearly in the first sentence of Book Two of 'On the Heavens': '... the heaven as a whole neither came into being nor admits of destruction, as some assert, but is one and eternal, with no end or beginning of its total duration, containing and embracing in itself the infinity of time ...' (Aristotle, 1970, 283b26-30).

More than eight hundred years later these views were to be rebutted with ferocious intensity by the Christian philosopher Johannes Philoponus, in the sixth century AD. He wrote a treatise, substantial fragments of which survive, entitled 'Against Aristotle on the Eternity of the World'. (Philoponus, 1987). Philoponus was absolutely determined to have a Creator God, and he wrote his gigantic work (which his opponents claim defeated all attempts to read it because of its great length, its verbosity and its mock-profundity) in order to defend his God against the outrageous suggestion by Aristotle that there might never have been a Creation of the Universe. The bulk of the comments preserved, as well as many of the arguments used by Aristotle himself, are extremely tedious and of no real interest to us today, dealing as they do with the nature of the supposed perfect circular movements of stars and so forth. There is no need for us to survey such details in our brief survey.

A very strenuous rebuttal of Philoponus's attack on Aristotle was made by another philosopher of the sixth century AD, Simplicius. He was an Aristotelian, and his work was called 'Against Philoponus on the Eternity of the World'. He ridiculed Philoponus for being long-winded and having feeble arguments. This work is lost but also survives in fragments. Simplicius criticised Philoponus by saying that he 'regarded it as a matter of great importance if he could entice large numbers of laymen to disparage the heavens and the whole world as things that are just as perishable as themselves. ... this gentleman not only dared to write against Aristotle's arguments in the first book of "On the Heavens" concerning the eternity of the heavens and the world – without

understanding what the text says, as I have attempted to demonstrate ... He also opposed the arguments at the beginning of Aristotle's 'Physics', Book 8, which show that motion and time are eternal; his objections are beside the point, as one can clearly grasp from my replies to him.' (Simplicius, 1991, pp. 107-8).

The real reasons for the flaring up of this debate in the early centuries of Christianity, and for Philoponus's attack on Aristotle, were probably to do with religious dogma interposing itself. Philoponus was a Christian. Christianity has no room for an eternal Universe, as it dictates as part of its dogma that there must be a Creator, and hence a Creation. For Christianity there is and can only be a Big Bang, the biggest possible bang, in fact, where God does his stuff in true Hollywood style and gives us the greatest production of all time, the Universe as we know it, to which trees, animals and man are added in swift array, so that what wasn't there a moment ago is suddenly there, and history can commence without an awkward development period.

We thus see that the debate over the eternity of the Universe commenced not in the 1940s, but more than 2300 years ago. This is the prehistory of the dispute. And I believe it helps to put the whole matter in some perspective. It also strengthens the suspicion which some have had that psychological attitudes are factors in the debate. It may be that there are some people who 'want' the Universe to end, who fear endlessness. On the other hand, people of an open disposition may hate the very idea of a Universe which is not open like themselves, which might end, or which might once not have existed. Whereas some people fear eternity, there are doubtless others who crave it. Do the former support the big bang and the latter support the steady state? This is an interesting field for study. I don't believe any psychological profiles have ever been prepared of the psychological types who take prominent positions on either side of the debate. Having a close acquaintance with two of the three founders of the Steady State Theory, I can call attention to the obvious by pointing out that both Fred Hoyle and Tommy Gold have long been renowned for their open, frank, and candid personalities. Is this a psychological profile of someone who wants an open-ended Universe? Some of the early supporters of the big bang theory at the time of the hot debates in earlier decades were noted for being what I can tactfully call 'less open' personalities. Does a cautious, inward-looking person tend to favour a Universe which will draw to an end? Does a retentive person want a retentive Universe? Can he not tolerate openness in the cosmos any more than he likes it in human beings?

Aristotle, who started all of this debate, was an open personality. This is clear in countless ways, and from what we know of his biography. I believe he would have had a lot in common with the man we have come here to celebrate, Fred Hoyle. Fred often spoke of the conflict between open and closed people, or what he called Type A and Type B personalities, so he was well aware of this very issue, and of how personality traits could dominate attitudes towards cosmology. They seem to have done so for nearly two and a half millennia, and they will doubtless go on doing so for as long as we perishable commodities known as human beings are allowed to go on existing in this Universe which may or may not end, depending on who or what is right, Aristotle or Philoponus, Steady State or Big Bang.

### References

Aristotle, 1952. *The Works of Aristotle* translated under the editorship of Sir David Ross, Vol. XII, *Select Fragments*, Oxford, 1952. The surviving fragments of *On Philosophy* are found on pp. 78-99.

Aristotle, 1970. *The Works of Aristotle* translated under the editorship of Sir David Ross, Vol. II, Oxford, 1970. *De Caelo (On the Heavens)* is contained within this volume, which also includes *The Physics* and *On Generation and Corruption*.

Hoyle, 1966. Fred Hoyle, *Galaxies, Nuclei and Quasars*, Heinemann, London, 1966.

Ocellus Lucanus, 1831. *Ocellus Lucanus On the Nature of the Universe, Taurus ... On the Eternity of the World, Julius Firmicus Maternus on the Thema Mundi ... Select Theorems on the Perpetuity of Time by Proclus*, translated by Thomas Taylor, London, 1831.

Philo, 1855A. 'A Treatise on the Incorruptibility of the World', in *The Works of Philo Judaeus*, translated by C. D. Yonge, Henry G. Bohn, London, 1855, Vol. IV, pp. 21-61.

Philo, 1855B. 'A Treatise concerning the World', in *The Works of Philo Judaeus*, translated by C. D. Yonge, Henry G. Bohn, London, 1855, Vol. IV, pp. 180-210.

Philo, 2001. 'On the Eternity of the World', in *Philo*, translated by F. H. Colson, Harvard University Press, USA, Vol. IX, 2001, pp. 172-291.

Philoponus, 1987. Johannes Philoponus, *Against Aristotle on the Eternity of the World*, translated by Christian Wildberg, Duckworth, London, 1987.

Proclus, 1820. Proclus, *Commentaries of Proclus on the Timaeus of Plato*, translated by Thomas Taylor, 2 vols., 1820.

Simplicius, 1991. *Place, Void, and Eternity: Philoponus: Corollaries on Place and Void* translated by David Furley, with *Simplicius: Against Philoponus on the Eternity of the World*, translated by Christian Wildberg, Cornell University Press, Ithaca, New York, USA, 1991.

Theophrastus, 1992. *Theophrastus of Eresus: Sources for His Life, Writings, Thought & Influence*, ed. by William W. Fortenbaugh, Part One, E. J. Brill, Leiden, Netherlands, 1991.