The Cyclic Universe: Some Historical Notes

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Abstract

The cyclic model of the universe has an old history in India. It has held the preëminent position regarding the origins of the universe, and it is described in astronomical texts, Purānic encyclopaedias, and philosophical literature. Within its current cycle, which is supposed to have begun several billion years ago, are smaller cycles of pole changes and extinctions on earth. Salient features of the cyclic universe model are presented here.

Introduction

With the renewed interest in the cyclic and the quasi-steady state cosmological models, it seems appropriate to look at the early history of such ideas. In this paper, we look at the conception of cyclic universes in the Indic tradition. The development of this conception in India owes to three fundamental notions that are come across in the earliest texts: (i), time is endless and space has infinite extension; (ii), earth is not the center of the universe; and (iii), laws govern all development, including the creation and destruction of the universe.

Astronomy was a very highly valued science in India. It was believed that there were connections between the physical and the psychological worlds, and an equivalence between the outer cosmos and the inner cosmos of the individual. This is expressed in the famous sentence; yat pinda tad brahma, “as in the cell so in the universe”. This belief may have
contributed to a generalization from the cyclic nature of human life into a corresponding theory about the cosmos.

Since thought and speculation have played a large role in the development of Indic ideas, the cyclic model may be taken to provide the philosopher’s conception of the universe, complementing the other ten conceptions that Fred Hoyle described in his popular book, *Ten Faces of the Universe* [2].

The Indian cyclic model assumes the existence of countless island universes, which go through their own periods of development and destruction. The conception of cyclicity is taken to be recursive.

For an early exposition of Indic astronomical and cosmological ideas, one may like to read al-Bīrūnī’s classic history of Indian science, composed in 1030 A.D. [3], keeping in mind that al-Bīrūnī did not correctly understand all Indian material; for an even earlier, popular, view of Indian ideas, see the Yoga Vāsiṣṭha [15, 5]; for a review of the birth and development of early Indian astronomy, see [6, 7]; for a broad overview, see [8].

1 **Cycle periods.** The aspect of the Indian cyclic model that astrophysicists are most familiar with is a cycle called the *kalpa*, the “day” of Brahmā, which is 4.32 billion years long. There is an equally long “night”, and 360 such “days” and “nights” constitute a year of Brahmā. The life of Brahmā is 100 such years, which is thus 311,040 billion years long.

Then there exist longer periods in an endless process. Al-Biruni [12] lists longer periods going to $10,782,449,978,758,523,781,120 \times 10^{27}$ kalpas, which is called *trutī*.

2 **Sub-periods.** Within the *kalpa* are fourteen cycles of local creation and destruction, called *manvantaras*, each lasting 306.720 million years. Each of these periods is to be taken to be a period of local destruction (extinction) and subsequent regeneration on the earth. Within each manvantara are 71 smaller cycles, called *mahāyugas*.

These periods are described by Āryabhaṭa, the great astronomer born in 476 A.D., in his *Āryabhaṭīya* [13]. As is well known, Āryabhaṭa presented the rotation information of the outer planets with respect to the sun, meaning that his system was partially heliocentric; furthermore, he considered the earth to be rotating on its own axis.
In another version, described in the Śūryasiddhānta and the Purāṇas, each kalpa equals 1,000 yugas of 4.32 million years.

Yoga Vāsiṣṭha 6.1.22[15] says that directions depend on the position of the poles, the movements of the stars, the sun, and the moon, and that the directions change from one sub-period to another.

3 Ideas related to time. Al-Bīrūnī says this about India ideas on time[12]:

The Hindus have divided duration into two periods, a period of motion, which has been determined as time, and a period of rest, which can only be determined in an imaginary way according to the analogy of that which has first been determined, the period of motion. The Hindus hold the eternity of the Creator to be determinable, not measurable, since it is infinite.

They do not, by the word creation, understand a formation of something out of nothing. They mean by creation only the working with a piece of clay, working out various combinations and figures in it, and making such arrangements with it as will lead to certain ends and aims which are potentially in it (page 321, vol. 1).

4 Island-universes. The universe is split up into many island-universes, as described in the Yoga Vasisththa 6.2.59[15]:

I saw countless creations though they did not know of one another’s existence. Some were coming into being, others were perishing, all of them had different shielding atmospheres (from five to thirty-six atmospheres). There were different elements in each, they were inhabited by different types of beings in different stages of evolution. Some there was apparent natural order in others there was utter disorder, in some there was no light and hence no time-sense.

5 Evolution. The idea of evolution is basic to all Indian thought. The Indian theory of evolution, which is supposed to apply both to the individual and the cosmos, is called Sāṃkhya. In it, the basic entities are pure consciousness and materiality (nature). Nature has three constituent qualities
(gunas) called sattva, rajas, and tamas, and as the balance between these three changes the universe evolves.

Out of the interplay of the five basic elements arise other principles (tattva): five subtle elements, five action senses, five senses of perception, mind, egoity, and intellect. The evolutionary sequence goes through many levels. The tattvas help in the emergence of life out of inert matter. The gunas are not to be taken as abstract principles alone. Indian thought believes that structure in nature is recursive, and the gunas show up in various forms at different levels of expression.

The texts imply that ingredients for the growth of life are available throughout the universe. Infinite number of universes are conceived, so each new one is created like a bubble in an ocean of bubbles. Indian evolution theory is like the neutral theory. If the gene function is seen through the agency of the three gunas, then evolution has a net genetic drift. The tattvas are not discrete and their varying expression creates the diversity of life in and across leading different species. Each sensory and motor tattva is mapped into a corresponding organ. Indian thought conceives of 8.4 million species, which number is impressive, considering that modern authorities (such as Graur and Li in their “Fundamentals of Molecular Evolution”, page 436) estimate the number of extant species to be 4.5 - 10 million.

Schrödinger thought\[10\] that the Sāmkhyan tattvas were the most plausible model for the evolution of the sensory organs.

A quote on evolution on earth from the Yoga Vasishtha (6.1.21)[15]:

I remember that once upon a time there was nothing on this Earth, neither trees and plants, nor even mountains. For a period of eleven thousand years (4 million Earth years) the Earth was under lava... [Later] apart from the polar region, the rest of the Earth was covered by water. And then forests enveloped the Earth, and great asuras (demons) ruled.

Then there arose great mountains, but without any human inhabitants. For a period of ten thousand years (almost 4 million Earth years) the Earth was covered with the corpses of the asuras (daityas).”

Indicating the presence of other animals while the giant asuras were on Earth, YV suggests that man arose later. YV also speaks of minor ages of destruction on Earth that correspond to the yugas.
6 **Size of island-universe.** It appears that the size of each island universe was taken to be equal to the distance that light would travel in twenty-four hours. The speed of light is taken in Indian texts is said to be 4,404 yojanas per nimesa, which is almost exactly 186,000 miles per second! The earliest mention of this is in texts that are more than six hundred years old.

To have chanced upon the correct number for speed of light, before it could have possibly been measured, is the most amazing coincidence in all of science. This coincidence is much more striking than the general correctness of the age of life on earth in the Indic view, and much more than the coincidences that are a part of the process of scientific discovery.

7 **Evolution of life.** The Indians believed that all life can be divided into three classes (Chāndogya Upaniṣad 6.3.1): “In truth, beings have here three kinds of seeds, born from the egg, born alive, and born from the germ.” Given that it is also affirmed that life on other planets exists and that there was a gradual rise of life on the earth, it would appear that this implied a belief in a panspermia theory.

8 **Inner cosmos.** In Indian mythology, the continents are in concentric circles. Wrongly applied to the outer cosmos, this Purānic cosmology represents the inner cosmos of the individual on a scale that equals the size of the universe. It, therefore, brings in outer astronomy only in an incidental fashion. The earth of the Purānas is the individual pictured as the plane that touches the navel. Below the navel are the underworlds; above the navel are the sun and the moon in the head, and beyond them the planets and the stars. The perceived dimensions of the sun and the moon in this conception relate to the inner cosmos.

9 **Another cyclic model.** I have developed a cosmological model inspired by Śāṅkhya ideas. Here two phases collide, where one collapses the quantum state of the other.

**Conclusions**

This brief note is an introduction to Indic cosmological ideas on a cyclic universe.
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