ISSN: 2834-4928

Review Article

Journal of Electrical Electronics Engineering

What Caused the Big Bang?

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Submitted: 2024, May 01; **Accepted:** 2024, May 28; **Published:** 2024, Jun 20

Citation: Luo, Y. (2024). What Caused the Big Bang? *J Electrical Electron Eng, 3*(3), 01-03

Abstract

The real number system is incomplete. The point at infinity seems to be just a tiny point, but there are infinitely many infinite sets at infinity. The point at infinity is incomplete from the perspective of the real number system, so infinitely many infinite sets describing infinity are also incomplete from the point of view of the real number system. The undecidability of the continuum hypothesis in the Zermelo-Fraenkel set theory with the axiom of choice reflects the incompleteness of infinitely many infinite sets. The undecidability of the continuum hypothesis implies that there exists an uncountable proper subset of the set of transcendental numbers, and whether its cardinal number is the cardinal number of the set of real numbers or between the cardinal number of the set of natural numbers and the cardinal number of the set of real numbers is undecidable. This means that it is the incompleteness of the point at infinity and infinitely many infinite sets describing infinity, which may be embodied in the undecidability of the uncountable proper subset of the set of transcendental numbers, that led to the Big Bang some 13.8 billion years ago that eventually gave rise to us.

Keywords: Infinity, Continuum Hypothesis, Axiomatic System, The Real Number System, Incomplete, Big Bang

1. Introduction

The origin, evolution, and nature of the universe have fascinated and confounded humankind for centuries. Over the past century, rooted in the theory of general relativity, cosmology has developed a very successful physical model of the universe: the Big Bang model. According to the Big Bang theory, the universe was born as an infinitesimally small singularity, a point of infinite denseness and heat. What caused the Big Bang?

2. Exploring Infinity

The ancients abstracted natural numbers such as 1, 2 and 3 from the perspective of measurement and counting, and all natural numbers constituted the set of natural numbers. By defining addition and subtraction on the set of natural numbers, we can extend the set of natural numbers to the set of integers. Defining multiplication and division on a set of integers can also extend the set of integers to a set of rational numbers. Any irrational number can be approximated by a sequence of rational numbers, so the set of rational numbers can be extended to the set of real numbers by means of limits. You can extend the set of real numbers to the set of complex numbers if you allow negative numbers to take the square root.

In the expansion process of the above number system, the expansion process of the real number system is very special, which obviously involves the limit process, while the expansion process of other number systems obviously only involves the algebraic operation of addition, subtraction, multiplication, division and square root. The set of real numbers is also a real number line, which can extend infinitely along both sides, and the point at infinity is at the end of this infinite extension. So what does infinity look like? It seems to be just a tiny point.

However, the real number system is incomplete [1]. The point at infinity is necessary and important, but it is independent of the real number line, and it is incomplete from the perspective of real number system.

The set of natural numbers, the set of integers, the set of rational numbers, and the set of real numbers all contain infinitely many numbers and can extend infinitely along the real number line. When you consider an infinite set as a whole, infinity is hard to ignore! When you suddenly look back at infinity, the whole set of natural numbers appears, otherwise you can't meet the whole set of natural numbers.

Georg Cantor (1845-1918) proposed the concept of set equivalence based on the principle of one-to-one correspondence. Cantor defines two sets as equal cardinality if and only if there is a one-to-one correspondence between the two sets. In this sense, a way of comparing "how many" between two infinite sets is described. The set that corresponds one-to-one to the set of natural numbers is a countable set, and the set that corresponds one-to-one to the set of real numbers is an uncountable set.

Power set is the set of all the subsets of the given set. Cantor's theorem states that given any finite or infinite set A, the power set of A has strictly larger cardinality (greater size) than A.

The two roots of the equation $(x-a)^2+b^2=0$ and the two points a±bi on the complex plane form a one-to-one correspondence. The geometric meaning of the solution to the equation $(x-a)^2+b^2=0$ lies in the intersection of the parabola $y=(x-a)^2+b^2$ and the real number line. When $b \neq 0$, $(x-a)^2+b^2=0$ has no solution on the real axis, that is, no intersection, but has two complex roots on the complex plane, which should be understood as the intersection of the parabola $y=(x-a)^2+b^2$ and the real axis at infinity. Therefore, the non-real part of the complex plane corresponds to the point at infinity of the real axis. These points at infinity are almost everywhere from the perspective of the complex plane. Both the complex plane and the non-real part of the complex plane, that is, the set of imaginary numbers, are equivalent to the set of real numbers.

However, the point at infinity is incomplete from the perspective of the real number system, so whether there is an intersection at infinity is an incomplete problem. From the point of view of the real number system, infinitely many infinite sets describing infinity are also incomplete.

If a formal system within which a certain amount of elementary arithmetic can be carried out makes a judgment based on the countable sequence, the countable sequence will not describe infinity completely from the point of view of infinitely many infinite sets describing infinity. Therefore, there naturally exists Gödel's incomplete theorem.

Cantor tried to determine whether there was an infinite set of real numbers that could not be put into one-to-one correspondence with the natural numbers and could not be put into one-to-one correspondence with the real numbers. The continuum hypothesis is simply the statement that there is no such set of real numbers. What is the cardinal number of the set of all sets? Clearly it must be the greatest possible cardinal yet the cardinal of the set of all subsets of a set always has a greater cardinal than the set itself. It began to look as if Kronecker's constructive criticism might be at least partially right since extension of the set concept too far seemed to be producing the paradoxes. The 'ultimate' paradox was found by Russell in 1902 (and found independently by Zermelo). Zermelo–Fraenkel set theory, named after mathematicians Ernst Zermelo and Abraham Fraenkel, is an axiomatic system that was proposed in the early twentieth century in order to formulate a theory of sets free of paradoxes.

Gödel showed that no contradiction would arise if the continuum hypothesis were added to conventional Zermelo-Fraenkel set theory [2,3]. However, using a technique called forcing, Paul Cohen proved that no contradiction would arise if the negation of the continuum hypothesis was added to set theory [4,5]. Together, Gödel's and Cohen's results established that the validity of the continuum hypothesis depends on the version of set theory being used, and is therefore undecidable (assuming the Zermelo-Fraenkel axioms together with the axiom of choice).

Infinite sets of numbers can be divided into three types: countable infinite sets that know who the next (nearest and greater) one is, countable infinite sets that don't know who the next one is, and uncountable infinite sets. For an infinite set of numbers that knows who the next one is, there is either no other number or at least one other number between any two numbers. For an infinite set of numbers that do not know who the next one is, there is at least one other number between any two numbers. From the point of view, if the continuum hypothesis can be judged to be true or false under a certain axiom system for set theory, it seems that the continuum hypothesis can only be judged to be incorrect under this axiom system [6].

Generally speaking, the point at infinity seems to be just a tiny point, but there are infinitely many infinite sets at infinity. The point at infinity is incomplete from the point of view of the real number system, so infinitely many infinite sets describing infinity are also incomplete from the point of view of the real number system. The undecidability of the continuum hypothesis in the Zermelo-Fraenkel set theory with the axiom of choice reflects the incompleteness of infinitely many infinite sets.

3. What Caused the Big Bang?

Over the past century, rooted in the theory of general relativity, cosmology has developed a very successful physical model of the universe: the Big Bang model. According to the Big Bang theory, the universe was born as an infinitesimally small singularity, a point of infinite denseness and heat.

The discovery of non-Euclidean geometry opened up geometry dramatically. These new mathematical ideas were the basis of general relativity. The mathematical foundation of non-Euclidean geometry can be traced back to the fifth postulate of Euclidean geometry, which can be rephrased as follows: given a line and a point not on it, exactly one line parallel to the given line can be drawn through the point.

Since parallel lines never cross, then there can be no intersection of these lines. However, from the perspective of the set of real numbers, infinity is incomplete, so whether there is an intersection at infinity is an incomplete problem. From the point of view of the real number system, infinitely many infinite sets describing infinity are also incomplete. The undecidability of the continuum hypothesis in the Zermelo-Fraenkel set theory with the axiom of choice reflects the incompleteness of infinitely many infinite sets.

The undecidability of the continuum hypothesis implies that there exists an uncountable proper subset of the set of transcendental numbers, and whether its cardinal number is the cardinal number of the set of real numbers or between the cardinal number of the set of natural numbers and the cardinal number of the set of real numbers is undecidable. When this undecidable thing is assumed to be true, it is one state of the system, and when this undecidable thing is assumed to be false, it is another state of the system. When the system jumps between these two states, it also forms the fluctuation of the whole system. This means that it is the incompleteness of the point at infinity and infinitely many infinite sets describing infinity, which may be embodied in the undecidability of the uncountable proper subset of the set of transcendental numbers, that led to the Big Bang some 13.8 billion years ago that eventually gave rise to us.

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