

A Logical Analysis of the Cosmological Constant Problem and Its Solution

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(To those possible intelligent creatures out of our solar system who use only logic and observations to evaluate scientific claims)

Abstract

The validity of the logical relations between the basic propositions of modern cosmology is examined and the source of the cosmological constant problem is determined and a proposed solution is given.

Introduction

What I am about to put before the reader is an exploration of the logical relations between the propositions which constitute the structure of modern cosmology within which the Cosmological Constant Problem is created in order to avoid the risks inherent in unjustified confidence in absolute validity of some of these relations in hope that the problem will be solved within our well-defined existing concepts by refutation of such false relations instead of invoking metaphysical notions such as dark energy, multi-verse ... etc.

The Analysis

Let us first make a list of the basic propositions and statements of modern cosmology associated with the cosmological constant problem:

- 1) Einstein's Field Equation is correct.
- 2) Zero-Point Energy exists and is very large.
- 3) The global curvature of space is very small.
- 4) The observational data about cosmological red-shifts are correct.
- 5) The accelerating expansion of the universe is true.
- 6) The global geometry of the universe depends on its average density.

Then we turn to the claimed logical relations between these statements:

- A) The 1st statement implies the 6th statement.
- B) The 4th statement implies the 5th statement.
- C) The 6th statement implies that the 2nd statement contradicts the 3rd.

Now let us examine the validity of these relations carefully:

Starting from the first relation (A) the author argues that it is incorrect, a fact which has often been overlooked, because the dependence of the global geometry of the universe in the average density which is thought to be a necessary result of the field equation can be taken away by assuming that the cosmological constant (or part of it) is the average density of the universe.

In this case any homogeneous distribution of matter and energy throughout the universe cannot affect the geometry of the universe because the contribution of this distribution on the stress-energy tensor in one side of the equation is canceled out by its contribution on the cosmological constant in the other side of the equation and thus the field equation is not affected by such a distribution regardless of its density.

Beside its simplicity and ability to cut the cosmological constant problem at its roots there is nothing to be lost by adopting this assumption because the successful local applications of the field equation will not be affected.

Now let us turn to the relation (B), perhaps another advantage is gained if we managed to get rid of more restrictions caused by this relation if proved to be false. The important question to be answered is whether or not the accelerating expanding of the universe is the unique explanation of the observational data of the cosmological red-shifts. The accelerating expanding is a very undesirable idea because it is responsible for the excluding of the best of all cosmological models in terms of physical simplicity and mathematical beauty which is the cosmological model of spherical 3-space and radial time.

Fortunately and interestingly the statement (B) is false and the cosmological red-shift observational data attributed to acceleration of the expansion can be explained easily as a result of geodesic path of light associated with the shape of space-time in the cosmological model with radial time and spherical space.

(More arguments which support this resolution and more details are found in other papers by the author.)

