The Hubble constant

Abstract

This article refers to and is at the same time a supplement to the work *The Cold Big Bang Model*, hereafter called MBBR or the basic work, which was printed by the Tribuna Economică publishing house, in the year 2021, with ISBN 987-973-688-429 -0; work is also listed at: https://bigbangdigitalmodel.com/en/

In the present study we derive a MBBR-compatible formula for the Hubble constant.

Starting from the formula for calculating the gravitational constant, a formula specific to this work, we deduce the average density of the Universe.

1. INTRODUCTION

Obviously, for the very early universe it is premature to discuss redshift, the expansion of the Universe and the Hubble constant. All we want to prove is that, under the conditions of the mathematical formalism of the *Cold Big Bang Model*, the Hubble constant, defined below, is inversely proportional to the age of the Universe.

To perform the calculations, I will use the following elements as they were defined in the CBBM: click here to see them.

2. CONTENTS

Either:

(x-2) $H = \sqrt{\frac{8 \cdot \pi \cdot K \cdot \delta}{3}}$, where K is the gravitational constant and δ is the average density of the universe.

I recall two formulas from the basic work: $\delta = M_{tot} / N_{tot}$ where M_{tot} is the total *energy-mass* of the Universe and N_{tot} is the total number of cells of the quantum space and:

(x-1) $K = (\pi^2 \cdot \delta \cdot T_{total}^2)^{-1}$, where T_{total} is the age of the Universe (v. MBBR §Gravitational constant);

Correlating these two formulas results:

(x) $H = T_{total}^{-1} \sqrt{\frac{8}{3 \cdot \pi}}$, or $T_{total} = H^{-1} \sqrt{\frac{8}{3 \cdot \pi}}$

and found the formula for Hubble time. I think it is obvious that H cannot have the same value throughout the period from the Big Bang to the present.

According to formula (x), for T_{total} = 13.8 billion years, it results in H = $2.1156 \cdot 10^{-18}$ Hz.

Based on the formula (x-1), for the current value of the gravitational constant K = $6.386840 \cdot 10^{-11}$ $\left[\frac{m^3}{kg \cdot s^2}\right]$ comes out as δ= 4.7848$\left[\frac{protons}{m^3}\right]$

Using this value, let's check the consistency of this data using the formula (x-2); result:

$$H = \sqrt{\frac{8 \cdot \pi \cdot 6.674 \cdot 10^{-11} \cdot 4.7848 \cdot 1{,}673 \cdot 10^{-27}}{3}} = \sqrt{\frac{8 \cdot \pi \cdot 6{,}674 \cdot 4.7848 \cdot 1{,}673}{3}} \cdot 10^{-19} = 2.1156 \cdot 10^{-18} \text{ Hz} =$$

$$= 2.1156 \cdot 10^{-18} \cdot 3.08568025 \cdot 10^{19} \left[\frac{\text{km}}{\text{s}}/\text{Mpc}\right] = 65.28\left[\frac{\text{km}}{\text{s}}/\text{Mpc}\right]$$

The interesting part of the agreement of these results is that the first two formulas come from profoundly different theoretical considerations: while in the equation (x-2) H is the Hubble constant for a particular case (k=0) of a Friedmann equation derived from the context of general relativity, i.e. from a model based on the arithmetic continuum, more precisely a geometric model of the space-time continuum, in the equation (x-1), K is a variable of the *trigonometric quantum gravity* of the MBBR model which is a theory of the discontinuous *space-time-energy-mass*. However, the above results show perfect agreement between the three formulas.

Let's summarize what we obtained: if we start from the hypothesis that the age of the universe is 13.8 billion years, then it follows:

- the average density of the universe is δ= 4.7848 $\left[\frac{protons}{m^3}\right]$;
- Hubble constant is H = $2.1156 \cdot 10^{-18}$ Hz = 65.28 km/s/Mpc

$\overset{formula\ (x)}{\Longleftrightarrow}$age of the universe = 13.8 billion years

In 2019, astrophysicists presented new measurements of the expansion rate of the universe between 69.8 and 76.5 km/s/Mpc.

According to the formula (x):

1. 69.8 km/s/Mpc = 69.8 · 0.32407764868 · 10^{-19} Hz = 2.262 · 10^{-18} Hz $\overset{formula\ (x)}{\Longleftrightarrow}$ age of the universe = 12.906 billion years
2. 76.5 km/s/Mpc = 76.5 · 0.32407764868 · 10^{-19} Hz = 2.4792 · 10^{-18} Hz $\overset{formula\ (x)}{\Longleftrightarrow}$ age of the universe = 10.85 billion years