Further Remarks on the Oscillating Universe: an Explicative Approach

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ABSTRACT

The purpose of this paper fundamentally lies in bringing to the attention of the reader some interesting remarks concerning the evolution of our Universe, supposed as being cyclic. Several significant hypotheses, necessary to perform a simplified modelling of the Universe evolution, as well as some noteworthy positions, elsewhere used although not properly discussed, are herein qualitatively analyzed. The existence of at least a further spatial dimension is contemplated. The Universe we are able to perceive is to be imagined as evenly spread on the surface of a four-dimensional ball. However, the so called curvature parameter is to be set equal to zero since, taking into account the extra spatial dimension, the Universe in its entirety is to be considered as being flat. Coherently with the existence of the alleged Dark Energy, we have to take into consideration a Cosmological Constant, negative in this specific case. Time is considered as being absolute. It is fundamental to underline that the variations of the cosmological distances are to be meant as exclusively metric.

INTRODUCTION

Our universe is hypothesized as belonging to the so called oscillatory class [1]. Such a Universe, being involved in a cyclic evolution, cannot properly admit either a beginning or an end. Nonetheless, as later underlined, the beginning of a new cycle can be conventionally fixed. The existence of at least a further spatial dimension is postulated. Time is considered as being absolute.

We have to suppose that our Universe may oscillate following a simple harmonic motion. If we denote with R the radius of curvature, with R_m the amplitude of the motion (the mean radius), with H the Hubble parameter [2], and with c the speed of light, we can write, with obvious meaning of symbols and signs, the following:

$$R = R_m(1 - \cos\alpha) \quad (1)$$

$$\alpha = \omega t = \frac{ct}{R_m} \quad (2)$$

$$\cos\alpha = 1 - \frac{R}{R_m} \quad (3)$$

$$\dot{R} = \frac{dR}{dt} = c\sin\alpha \quad (4)$$

$$\ddot{R} = \frac{d\dot{R}}{dt} = c\omega\cos\alpha = \frac{c^2}{R_m}\left(1 - \frac{R}{R_m}\right) \quad (5)$$

$$H = \frac{\dot{R}}{R} = \frac{c}{R_m}\frac{1}{\tan\left(\frac{ct}{2R_m}\right)} \quad (6)$$

In our case, obviously, the beginning of a new cycle conventionally coincides with the point in correspondence of which the radius of curvature is equal to zero.