Review of: "On the cosmological arrow of time"

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Potential competing interests: No potential competing interests to declare.

Comment 1 (page 1, “Abstract” section, line 1)

You are writing: “The cosmological arrow of time is defined by the initial conditions of the Universe and its subsequent expansion.”

Could you clarify exactly what are the initial conditions of the Universe?

Comment 2 (page 2, left column, Eq. 1)

Eq.1 can be written as $L = \frac{1}{2}\partial_\psi\partial^\psi - U(\psi)$, where $\frac{1}{2}\partial_\psi\partial^\psi$ is a kinetic term and a combined potential $U(\psi) = \frac{1}{2}m^2\psi^2 + V(\psi)$ consisting on the quadratic potential $\frac{1}{2}m^2\psi^2$ and the $V(\psi)$ potential.

a. Could you please give the definition of the variable m in Eq. 1?
b. Could you please provide an explicit form of the $V(\psi)$ potential in Eq. 1?

Comment 3 (page 2, left column, Eq. 1)

Could you please present a transition from the single real-valued scalar field ψ to the vacuum expectation value of the ψ_c scalar field, that is a transition $U(\psi) \rightarrow V(\psi_c)$.

Comment 4 (page 2, left column, Fig. 1)

In Fig.1, you have taken a sketch of the “effective potential with two energetically distinct ground states.” Could you provide a formula for this effective potential with two local minima at $\psi_c = \pm a$, on the basis of which you have built this figure?

Comment 5 (page 5, left column, “Cosmological redshift” section, Fig. 3)

You write: "Consider a pair of galaxy clusters, Y and Z, with distances r_y and $r_z > r_y$, from an arbitrarily chosen galaxy

cluster X, which is to act as the 'coordinate origin', see Fig.3."

Remark 1 to the above your sentence and to Fig.3.

Arbitrarily chosen three clusters of galaxies in space usually form a triangle between them. Only with a certain chosen angle of view, with a certain projection onto the picture plane, can three clusters of galaxies (X, Y, Z) arbitrarily located in space, be represented as Fig. 3. **Could you please have mentioned this fact in the text? Also, could you please apply the modulus of the distance vectors** $|\vec{r}_y|$ and $|\vec{r}_z| > |\vec{r}_y|$ **and but not just** r_y and $r_z > r_y$.

You are considering not distances between the galaxy clusters in space, but projections of these distances onto the picture plane, and in reality, it may turn out to be the other way around and instead of $r_z > r_y$, it may be $r_z \leq r_y$. **Could you please have mentioned this fact in the text?**

Remark 2 to the above your sentence and to Fig.3.

In the above sentence, you mentioned: “from an arbitrarily chosen galaxy cluster X, which is to act as the 'coordinate origin', see Fig.3.”, i.e. you apply the terminology for a horizontal one dimensional Cartesian coordinate system with a center in the galaxy cluster X. According to this terminology, $\vec{r}_y$ has a negative absolute value and it is better to compare the modulus of the distance vectors, i.e. $|\vec{r}_z| > |\vec{r}_y|$. Could you please correct the Fig.3?

Grammar remarks.

Could you please fix throughout the whole text, "groundstate" on "ground state" and "groundstates" on "ground states"?

Syntaxes remarks.

Syntaxes remark 1 (page 6, left column, “Cosmological arrow of time” section, 5th line**.**

Could you put a comma before "i.e.”?

Syntaxes remark 2

Could you put a comma before "e.g."?

-page 1, left column, “Introduction” section, 4th line**;**

-page 2, left column, 3rd line**;**

-page 4, right column, “Frequency-shifted photons” section, 4th line**;**

-page 4, right column, “Frequency-shifted photons” section, 10th line**.**