

The Impossibility of an Infinite Number of Elapsed Planck Times

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Abstract

This note briefly discusses the observation of elapsed time in a flat universe while exploring the argument of past-eternal time versus emergent time in cosmology. A flat universe with an incomplete past forever has a finite age. Despite an infinite number of Planck time coordinates independent of phenomena and endless expansion, a flat universe never develops an age with an infinite number of Planck times. This observation indicates the impossibility of infinitely elapsed time in the future or past, which limits acceptable scientific models of cosmology.

Note

Observation indicates that a flat universe with an incomplete past (1) begins, (2) endlessly expands, and (3) forever develops a finite age. Nothing ever binds the continuous aging of a flat universe while the universe endlessly develops a finite age. Despite an infinite number of Planck time coordinates independent of phenomena, an infinite number of Planck times will never elapse in a single lineage. Likewise, an infinite number of Planck times have never elapsed in a single lineage. Time and the universe could not have been past eternal.

Imagining time travel to any past event in a world with an eternal past also helps to explain the impossibility of infinitely elapsed time. For example, if a time traveler in a world with an eternal past could survive a two-minute journey in a wormhole to any past event, then the time traveler could never possibly travel an infinite number of Planck times but only possibly travel to time coordinates with real values. The apparent unlimited time travel ability would never cover an infinite number of Planck times.

The observations of limits for the elapse of time in time travel and the aging of a flat universe exclude the possibility of all cosmology models with a past infinite number of Planck times. For example, Mithani and Vilenkin [1] recently refuted three categories of models with an eternal past: (1) past eternal inflation, (2) cyclic evolution, and (3) emergence from eternal static seed. Apart from reasons supported by Mithani and Vilenkin, those models also fail on the grounds that infinitely elapsed time is impossible.

Susskind [2] responded to Mithani and Vilenkin by arguing that the universe is past eternal. He supported his argument by using an analogy of a semi-infinite one-dimensional landscape with an incomplete past and an infinite population size of people. However, Susskind's semi-infinite landscape falsely analogizes a universe/multiverse with an incomplete past except for a multiverse with at least one node that simultaneously branches into an infinite number of branches, which Susskind does not model. Apart from the respective exception, an indefinitely branching multiverse with an incomplete past will never have a landscape with a semi-infinite size. Susskind's assumption of a semi-infinite landscape is invalid.

In sum, any scientific model of cosmology must have an incomplete past: that is, a beginning. And all apparent merits in cosmology models that include an infinite elapse of time are futile unless the merits are transferable to models with an incomplete past.

References

[1] A. Mithani and A. Vilenkin, "Did the universe have a beginning?," arXiv:1204.4658 [hep-th]

[2] Leonard Susskind, "Was there a beginning?," arXiv:1204.5385 [hep-th].