Why Backward Time Travel Is Not Possible

Ken Krechmer[1]

1 University of Colorado at Boulder

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.

Abstract

Backward time travel in a vector space is not possible because prior positions are given by an irrational (i.e., square root) vector magnitude which introduces restrictions on the precision of the position and makes a sufficiently exact determination of position impossible.

Ken Krechmer[1]

[1] *University of Colorado, Boulder, CO, USA*

As a thought experiment, consider a time machine that moves (or assembles) a multi-point physical structure (e.g., all the sub-atomic particles of a molecule) in a four dimension vector space (spacetime) at a prior time without changing the initial physical characteristics of the molecule except its location in spacetime.

The time machine changes the molecule to a prior time by determining the new vector magnitude of each point of the molecule in four dimensions. How the time machine might accomplish the move or assembly is not addressed. Assuming only that spacetime is a vector space, such a movement or assembly at a prior time is not possible, without causing physical change of the molecule, because each point's prior spacetime location is not known numerically.

The vector magnitude of each point's spacetime location is determined by the square root of the sum of the four squares of each dimension's magnitude in appropriate units. However, the magnitude of almost all square roots is irrational.

Irrational numbers (not a ratio of integers) do not terminate, nor do they repeat, i.e., they do not contain a sub-sequence of digits, the repetition of which makes up the tail of the representation.[1] Each location of one point in spacetime is a square root of the sum of four squares, which is highly likely to be an irrational number. An irrational vector magnitude is not known with exact numerical accuracy.

In addition, the time machine's setting of each prior location's vector magnitude will have a precision which at the limit is a Planck, *h* (the smallest possible resolution). As example, if the time machine's location precision is +/- 0.01 units and one point's spacetime location vector magnitude is 1.3251.... (an irrational number) of units, the time machine's setting of the vector magnitude could be either 1.31, 1.32 or 1.33, none of which are the exact vector magnitude.

In the case of measuring the present location of each point, averaging would improve the result, but in the case of each point's prior-in-time location, averaging is not possible. Then the molecule's physical change due to the error in one point's vector magnitude is increased by all the other point's vector magnitude errors.

Practically, this thought experiment does not require exact vector magnitudes, only an exact enough vector magnitude that the molecule does not change any physical characteristics except its location in spacetime. However, *h* is also the minimum physical change of a sub-atomic particle. A change of +/- *h* of a particle is a very small change in a physical characteristic of an associated molecule.

At the finest precision of the time machine, which will be larger than*h*, each point's vector magnitude location varies even more. Thus it is not possible to move a multi-point molecule unchanged to a location at one prior time. Therefore time travel of even a molecule, maintaining the initial physical characteristics of the molecule, is not possible.

The significance of precision to any measurement is more formally developed in the paper Relative Measurement Theory[2], which identifies that the limit of precision in experimental measurements is the cause of uncertainty in quantum mechanics.

References

1. ^*From https://en.wikipedia.org/wiki/Irrational_number#Transcendental_and_algebraic_irrationals April 14, 2023.*
2. ^*Measurement, Volume 116, February 2018, Pages 77–82, http://www.sciencedirect.com/science/article/pii/S0263224117306887 April 14, 2023*