

Particle Physics and the Interchangeability of Space and Time

Terry Bollinger

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https://youtu.be/AZsmyTE3j9o?&lc=Ugy-g3qF_mKDm1ydHO94AaABAq

A Comment on the Big Think post:

The mind-bending physics of time | Sean Carroll (Jan 27, 2023)

<https://youtu.be/AZsmyTE3j9o?t=2m26s>

Thank you for a lovely overview of time and why life needs entropy. Folks forget that much as a mill needs flowing water for energy, life needs the flow of entropy to build complexity. [2:26](#) "There's no special direction in space." The more precise statement is that the universe kindly keeps all options open until we choose a direction of motion. Leaving our rest frame blends space and time in that direction, making the target distant not just in space but also in time. At close to lightspeed, the distance becomes almost purely one of time. Your particularly zippy spaceship might see only a few kilometers of Lorentz-compressed distance in its trip to the Andromeda galaxy, but in that brief trip, you see 5 million years of Andromeda time unfold. (If you heard Andromeda freezes in time during your trip, sorry, that's just not what happens. Age gradients are as much a part of Lorentz contraction as the contraction itself; the two are inseparable.)

Incidentally, the pre-acceleration openness of options we call space is possible only in systems containing particles or particle systems with rest mass, which means particles that bind chiralities via the Higgs mechanism of particle physics. It is a profound error to think that time and particle physics are separable components of physics. Entropy plays a vast role in time, but particle physics first makes space and entropy meaningful.

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