The Roles of Laws and Information in Physics (Plus Wave Relativity)

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A Comment on the Closer To Truth (Instagram) reel:
Physicist Juan Maldacena discusses what makes up our universe (Sep 10, 2023)
https://www.instagram.com/reel/Cw_WVA6P37h/?igshid=MzRlODBiNWFlZA==

RLK: *"The alternative argument is… that at the most fundamental level, the information is creating the laws."*

The niftiest trick of the deep universe is its enabling of "certainty," which comes at a very high cost and is never perfect. The deepest, least-varying level of certainty in our universe is the particle suite of the Standard Model. That's why electrons look precisely the same throughout our conspicuously vast universe. Less than half of that motley crew, the rest-mass or "matter" fermions, enable a little thing called causality. That's where things start to get interesting.

Much-vaunted spacetime seems an afterthought, not much more than a handy little Rolodex app for tracking and organizing causality within the locally bound clusters of matter that we call "inertial frames." Over-assuming the applicability of these multi-scale but finite apps is like assuming that your desktop Rolodex supersedes those of every other Rolodex in the world. It's a hilariously effective source for almost limitless mathematical and philosophical noise and confusion.

We still have much work to do on the certainty and structure of those laws. For example, did you know special relativity is an expanding wave equation?

Well, half of it, at least. There is a simpler algebraic subset that folks pounced on due to its almost classical simplicity and regular structure. (Fig. 1-c). Alas, the sad truth is that every occurrence of x', y', z', t' in a physics textbook is a mathematical error whose full resolution requires adding the messier wave component. For example, the formal resolution of twin paradoxes requires getting your hands dirty and adding in the much messier wave part (Fig. 1-b). On the bright side, the wave component also provides a better bridge to quantum mechanics that similarly relies on wave equations.

Binary-style bits — what we usually consider "information" — are latecomers. This level of (almost) perfectly either-or certainty, multiplied and cascaded into orderly, space-like strings and lattices, requires local-only x, y, z, t apps even to get off the ground, e.g., in DNA. So, Robert Lawrence Kuhn, the answer to your question about whether information is more fundamental than "laws" is a definite no: Binary information is the last innovation to show up, not the first. Fortunately, it showed up at least a few billion years ago as DNA. It would be challenging to have this discussion if that had not happened.

On the other hand, since mathematics is a late-emerging application created by over-generalizing the perfection of bits — Goedel had that part right, not Hilbert — it's not very accurate to say that *mathematical* laws are more "fundamental" than bits. Those are even later latecomers than the bits, which have a multi-billion-year head start via DNA.

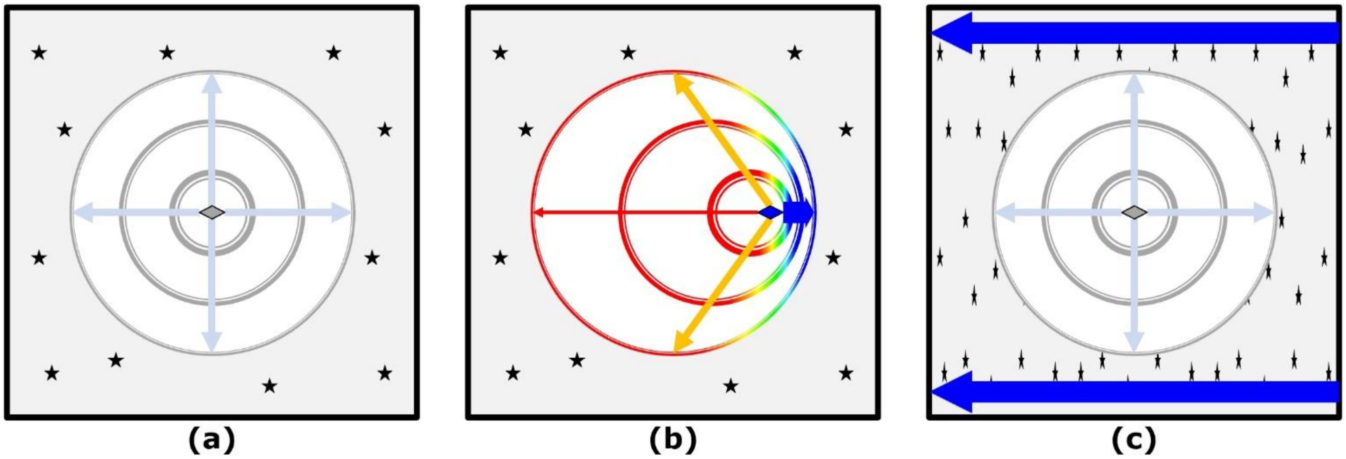

FIG. 1. Frame types: (a) Mature, (b) SAL, and (c) Traveler view.

(a) ***Mature frame.*** *Stable indefinite-size frame space with an unmoving central system (gray diamond). Circles indicate isotemporal spherical surfaces where all observers in the frame see the same central system time instant. Gray arrows indicate queues of causally irreversible state data (e.g., photon emissions) with the 1-to-1 time density of a mature, non-distorted inertial frame.*

(b) ***SAL.*** *A rapid acceleration of the central system to near lightspeed breaks the mature fame into two parts: Sea and Lagoon. The sea consists of the distant parts of the original frame not yet aware of the acceleration event due to finite light speed. The lagoon is a shockwave distortion created within the original indefinite-size frame (sea) by a recent rapid acceleration of the central system to a velocity near lightspeed, such as in particle physics. Only rapid acceleration produces this sharp lagoon boundary, meaning realistic accelerations produce more complicated and dynamic wave effects. The cone-like displacement geometry of the distortion is scale-invariant, meaning this figure describes the SAL relationship at any scale until measurable comparisons (pre-existing clocks around the central systems) are exhausted by inclusion in the lagoon. Notice that embedding the lagoon in the sea makes the SAL topology non-relative. That is, it makes time dilations within the lagoon absolute relative to clocks in the sea. The new frame view becomes causally real after reaching the boundaries of the original frame sea. However, unless active adjustments occur, this distribution does not change the distribution of matter and ages in the original frame. This indifference of the embedding sea to the new central systems view means that in most small accelerated systems, such as particles and spaceships, a more helpful view is that the central system remains "embedded" in its original frame. Embedded systems always experience slower time relative to the central system. Finally, short, broad blue arrows indicate high time densities in the data queues (faster time), while long, thin red arrows indicate low time densities (slower time). Disregarding the mostly photon wave fronts as "only" data leads to paradoxes since, in any physical merger of two systems, the final physical time delta between systems is always the integral of all mutually observed time queues.*

(c) ***Traveler view.*** *The traveler's view is the original algebraic special relativity with one crucial correction: The central system observes not only compressed lengths but also Doppler-compressed time data queues in the forward direction. In the non-wave formulation of special relativity, traveling faster through external time becomes the traveler's age gradient addition* $\alpha_{+} = \frac{\beta}{c\sqrt{1-\beta^2}}$ *to Einstein's algebraic special relativity.*