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Conjectures on SpaceTime

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Introduction

The current description of SpaceTime follows Quantum Mechanics principles at the smallest scales, while it is commonly associated to General Relativity in cosmological terms. The opposite perspectives eventually differ in terms of discrete *versus* continuum analysis.

Time seems *vanishing* in the latest formulations of Quantum theories (Loop Quantum Gravity), as a static spin-foam that describes spatially entangled loops and *forgets* the importance of *Memory*. On the other hand, Time is described in relativity terms as a *continuum existing block*, of which we perceive instants that are part of an always existing word-line, like *worms* in a 4D-pancake with the tail on the birth and the head on the last instant of existence.

It seems that our latest descriptions of Time point at *everything* (in relativity) or *nothing* (in quantum) but still strive to understand entanglement, coherence and eventually evolution in Time.

Recently, several efforts have been done to reestablish a more *natural perspective* on Science, able to better face not only SpaceTime fabric description, but also debate on deeper *philosophical questions* concerning Time and its role in the Universe.

An extended review of the importance of Time in elementary physics, as well as in many other disciplines, is given by Lee Smolin in [1].

The coming ideas follow a similar path, trying to continue the effort towards a physical description of Space-Time that seems to *frame better* quantum and cosmological scales with natural evolution.

Abstract and Summary

The aim of this contribution is to propose new conjectures on SpaceTime variables and their description, through the concepts of *network*, *entropy* and *coherent decoding* (borrowed from Information Theory and quantum computation) and to offer a possible wider perspective on SpaceTime fabric and evolution.

Given the *unnatural physical existence* of a *Real continuum* and consequent *infinities*, in the context of a discrete universe on space and even time on a Planck scale (as discussed in [2]), starting from the definition of a *new reference frame* based on an Absolute Time $T[k]$, an imaginary time ict and on the relative *momenta*, a possible interpretation of AdS/CFT correspondence, SpaceTime fabric and elementary particles behavior is proposed.

The Absolute Time is described in the *AdS bulk* of the Maldacena correspondence. It is represented as *entangled memory links* (between imaginary points on the surface) that develop highlighting *surface correlation* in a wavelet decomposition of the local pulse (phase shift info in respect to the Absolute Time reference pulse).

The memory links are described as well as a *deep neural network* (growing in $T[k]$) that *stores and project* the evolving surface information, as discussed in [3]. The information stored and projected through the Absolute Time is interpreted in the context of SpaceTime fabric as the *most efficient quantum computation network*, as proposed also in [4], [5] and [6].

Imaginary time, following Hawking intuition, maps the *surface* of the AdS/CFT correspondence to a *diffusive space distance* in a relativistic and flat space, in coherence c with the pulse of $T[k]$. It defines, at any given k (*Now*), the full *current 3D space*, from $-\infty@T[k-1]$ to $+\infty@T[k+1]$.

In an evolving 4D-SpaceTime, the perceived 3D Space is interpreted as *emerging*, in each *current Now*, as the current configuration of *SpaceTime information*. It is distributed on the Universe *Surface of Existence* along *ict*

at a given k, giving 2 probabilistic Real degrees of freedom in each surface bit and the correlation derived on the memory-links, entangled along the past instants in the Absolute Time.

The *momenta* involved represent the *phase variations* (along both times in respect to the relative *reference of coherence*) and develop as in a logarithmic spiral, following a relativistic description of the *information space* and *coherent time* on the surface of the bulk.
A mathematical description of the mentioned momenta in relativistic terms is proposed.

Bosons are described as *single qubits of information* and *elementary vibrating strings*, flowing with no *inertia* on the surface defined by the imaginary time.
Matter elementary particles, as *Entities* in SpaceTime, are described as *Networks* of imaginary points sharing a *common beat* (decoding as a *coherent-Self* in T[k]). They emerge from the entanglement in the Absolute Time of surface strings, that reduce their local degrees of freedom to become *interconnected in the bulk*, pulsing as a single, persisting Self (debated in [7], [8]).

Following the conjectures proposed and the parallel with *information encoded* in the entanglement of surface strings in T[k], the Dirac equation is mapped to Shannon *Entropy*, as a *summary* of the information content *shown on the surface*, mathematically expressed as the sum of the information derived over the variations along the *past loopy ticks* of the Absolute Time.
The geometry proposed is then applied to Dark Matter, interpreted as diffusive *wrinkles* in the local fabric, and to Black Holes, as coherent Self and quantum networks showing maximum surface entropy at current T[k].
Black holes are described, on the horizon, as *1 tick away* from the *coherent Now* (as a result of the *SpaceTime decoding algorithm* local computation on both *momenta*).
The horizon results *too out of phase* in the local *current T[k] coherence* to be *decoded* in the surrounding 3D local space (consequently with very little chance of receiving, on the outside, any information).
Further reasoning on SpaceTime *info compression algorithm* and relative computational efficiency as a quantum computer are presented in the context of fabric entanglement (as *living memory-roots* through past events) and maximum entropy on the surface (as equivalent to Shannon max *info compression*).

To illustrate possible wider similarities and consequences of the proposed conjectures, the *Evolution* of Network-Entities and of information is described as cycles of transformation in *ict* and new gained persistence in T[k], in a growing of global surface entropy and local complexities, levels of abstraction, efficiency in equilibrium and Self-gained emerging properties.
Finally, a possible interpretation of the *Origin* is proposed, rewinding back both times, in the context of Absolute Time and imaginary time emerging from a *no-boundary* alike model (Hartle and Hawking).

Further developments on the proposed conjectures are still required.
A wider mathematical and physical analysis is suggested to extend the comprehension of information in SpaceTime and to evaluate the implications on telecommunication and energy production.
A deeper philosophical understanding is expected.

The full paper is available at [9].

References

[1] L. Smolin, Time Reborn: From the Crisis in Physics to the Future of the Universe, 2013.
[2] C. Rovelli and M. Christodoulou, "On the possibility of experimental detection of the discreteness of time" arXiv:1812.01542v2, 2018.
[3] X.-L. Qi, "Exact holographic mapping and emergent space-time geometry" arXiv:1309.6282v1, 2013.
[4] L. Zhou and X. Dong, "Geometrization of deep networks for the interpretability of deep learning systems" arXiv:1901.02354v2, 2019.
[5] L. Zhou and X. Dong, "Spacetime as the optimal generative network of quantum states: a roadmap to QM=GR?" arXiv:1804.07908v1, 2018.
[6] P. Caputa and J. M. Magan, "Quantum Computation as Gravity" PHYSICAL REVIEW LETTERS, pp. 122, 231302, 2019.
[7] G. Jaroszkiewicz and J. Eakins, "Particle decay processes, the quantum Zeno effect and the continuity of time" arXiv:quant-ph/0608248, 2006.
[8] T. Ullrich, D. Kharzeev and Z. Tu, "The EPR paradox and quantum entanglement at sub-nucleonic scales" arXiv:1904.11974, 17 May 2019.
[9] A. Capurso, "Conjectures on SpaceTime"
Available: http://www.tempiodicrono.net/download/Capurso-Conjectures_paper.pdf.

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