The unsustainable resistance to disruptive physics and a new look at cosmology and thermodynamics

Original Research

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Abstract

This article performs a synthesis of two disruptive theories that seek to describe the ultimate nature of the universe. The first deals with the physical continuity of the expansion of the four-dimensional cosmic woof. The second describes the expansion energy of the continuum with the aid of a Lagrangian approach to the intrinsic thermodynamics assumed. The proposal intends to fill the gap between the continuous and discontinuous images of the universe, discussing topics as follows:
1. Continuity in physics; 2. Space-time; 3. Entropy; 4. Thermal expansion of the universe.

The explanatory content is organized like this:
1 Introduction — familiarization of the reader with the philosophy of the proposed theories and presentation of the general purposes;
2 How the expansion of the space-time continuum works — the theory of ever-expanding space-time (the continuous physic expansion of the cosmos), i. e., expanding regardless of the space-time scale considered, including in sub-Planckian domains;
3 Understanding entropy — entropy and its role in paralel with time; introduction of the Lagrangian formalism coupling time and energy;
4 The synthesis itself — the connection of the two theories and its structuring meaning.
5 Conclusion.

Keywords: Cosmology; Thermodynamics; Space-time; Scale; Energy; Entropy

1 Introduction

Science, by its very nature, must be disruptive whenever necessary, proposing unusual answers to hitherto unsuspected problems, or to questions left open either for convenience or for lack of knowledge yet to be obtained.

The stagnation of physics, at least in the last five decades, is an unquestionable fact, accompanying the decline of Western thought in general. With respect to observational cosmology, of which a great example is the recent work of Migkas (8), there is certainly some progress due to the broad technological resources, if only to rise more doubts than enlightenment. However, the most advanced research in astrophysical cosmology and gravitation has hardly moved theoretical physics (1; 4; 7; 10), even considering the confirmation of gravitational waves, a long-predicted phenomenon. Also, some authors such as Bejan, Norton, and myself with my colleagues brought theoretical approaches to thermodynamics which are more coherent with the world view we have today (2; 9; 13; 15; 16), but the discipline continues to be taught in books and classes as if we were in the days of Carnot and Clapeyron. Recent works have questioned the quality and relevance of the research currently carried out around the world for the progress of our civilization (3; 5; 6; 14; 15; 17), since the enormous amount of articles produced has added very little to knowledge. In addition, the confusion between scientific advancement and technological revamping is notorious in our time.

Collaborative work, essential for research, has lost the shine of the productive intellectual sum in face of the growing number of corporate teams with marketing purposes.These teams are committees subject to political whims, popular fads in topics, and the desire by committee members for prestige, paychecks, perks and public adoration. They are mostly government-funded, with universities and businesses making only a minor contribution monetarily.

We are basically living in a world of technological "collages"— whose true science behind them dates back to the first half of the 20th century — aimed at mere uncritical consumption, creating a passing illusion of progress and joy. As my colleague Richard Cathcart observed, "we are flabbergasted at the blatant (unhideable) cupidity and lack of discernment of too many of our younger students and collaborators". So, I believe this brief description of the discordant scenery present today in scientific activity will ask to inspire others to rejoin science with its real fundamental principles and purposes.

1.1 Fundamentals

My disruptive works are mainly about cosmology and thermodynamics, two disciplines that converge to build a more essential and less fragmented model of the universe. When everything started in 2016 as a large program of research, with the publication of a relativistic model describing space-time as a continuous expanding and constricting cosmic woof constituting the fourth interaction (11), the idea was to establish a kind of sub-Planckian mental construct — as it were a "quantum" of space-time —, from which the geodesics would be defined as one-dimensional replications of that quantum by arbitrary changes of scale. In other words, there are no actual chunks of space-time, just a scale-shifting continuum. This conception allowed the elucidation of an exact meaning of what continuity is in physics. Since then, the theory has evolved considerably in conceptual and semantic details with a strong appeal to thermodynamics and unusual application of classical field theory.

What the above program intends to show is 1) that a complete unification of known interactions may be impossible due to the consideration of a space-time continuum that exhibits gravity, whose nature differs completely from the other interactions and appears as the backbone of everything that exists, contradicting the corpuscular framework of all other known forces; 2) that time, along with its eternal companion "entropy,"has a greater physical reality than previously thought; and 3) that energy and time are coupled in such a way as to define a true space-time thermodynamics.

1.2 General purposes of this article

This article presents the current state of the research program as of 2016, mentioned in subsection 1.1, bringing the most recent improvements to the theory. It would be very difficult to reproduce here all the details and findings documented over six years of intensive work, so that I will dwell primarily on the novelties of the theory at the moment, directing the reader to the relevant open access literature whenever required. As pointed out in the abstract, the end goal is to reconcile the continuous and discontinuous images of the universe, with thermodynamics coming into being inherent in the expansion of space-time.

It is important to highlight the contributions of all the colleagues who appear as co-authors in my publications. They have always shown a disruptive and innovative spirit.

2 How the expansion of the space-time continuum works

The use of singularity functions in the representative differential structure of the theory allows the introduction of very small intervals of space-time expansion which are finite, so that, by arbitrary change of scale, it can be deduced, given the continuous character of the expansion, how a geodesic behaves in an expanding universe. In my previous works, those intervals were sometimes described as "quanta" of space-time, but nowadays I prefer to refer to *scalons*, mental constructs that do not represent constitutive elements, but rather any imaginary pieces of space-time, chosen at random only to realize that whatever the physical "look"—- the scale we want to adopt —-, we will always be seeing the same thing, the same continuous expanding process, regardless of the order of magnitude. At first, the quadratic arc element of a geodesic as a function of the intervals above described was given by

$$ds^2 = g_{\mu\nu} d\langle x_\mu - \varepsilon_\mu \rangle^1 d\langle x_\nu - \varepsilon_\nu \rangle^1, \tag{2.1}$$

where ε_μ and ε_ν are any fixed points that establish markers from which the expansion of space-time in a sub-Planckian region is evaluated. For simplicity, we can omit the unit exponents and place the indices to the bottom right of the kets, so that

$$ds^2 = g_{\mu\nu} d\langle x - \varepsilon \rangle_\mu d\langle x - \varepsilon \rangle_\nu. \tag{2.2}$$

Figure 1 shows an illustrative artwork of the stretching sequence of a time-like interval in a luminous metric simulated with laser beams on moving crystals. As the sub-Planckian intervals have arbitrarily small but finite sizes, I insist on repeating they are not constitutive elements in the strict sense, since any space-time interval is expanding, and within these there are expanding intervals, and so on, as in an infinite mirror effect (17). This is what features the physical continuity of the expansion process, so that it becomes necessary to improve the symbology to understand that the very small intervals in brackets are taken on an arbitrary scale. So, I introduced the symbol $\langle \forall |$ (whatever the scale considered), and the first and second forms of the geodesic equation are rewritten as

$$\frac{\partial g_{\mu\nu}}{\partial \langle \forall | \, x - \varepsilon \rangle_k} \frac{d \langle \forall | \, x - \varepsilon \rangle_\mu}{ds} \frac{d \langle \forall | \, x - \varepsilon \rangle_\nu}{ds} - 2 \frac{d}{ds} \left(g_{\mu k} \frac{d \langle \forall | \, x - \varepsilon \rangle_\mu}{ds} \right) = 0, \tag{2.3}$$

and

$$\frac{d^2 \langle \forall | \, x - \varepsilon \rangle_\xi}{d\tau^2} + \Gamma^\xi_{\mu\nu} \frac{d \langle \forall | \, x - \varepsilon \rangle_\mu}{d\tau} \frac{d \langle \forall | \, x - \varepsilon \rangle_\nu}{d\tau} = 0, \tag{2.4}$$

with the affine connection given by

$$\Gamma^\xi_{\mu\nu} = \frac{\partial \langle \forall | \, x - \varepsilon \rangle_\xi}{\partial \chi^\eta} \frac{\partial^2 \chi^\eta}{\partial \langle \forall | \, x - \varepsilon \rangle_\mu \partial \langle \forall | \, x - \varepsilon \rangle_\nu}. \tag{2.5}$$

An extensive semantic discussion of this new symbology can be found in reference (17). The complete original formalism is found in reference (11), having been widely discussed with reviewers and

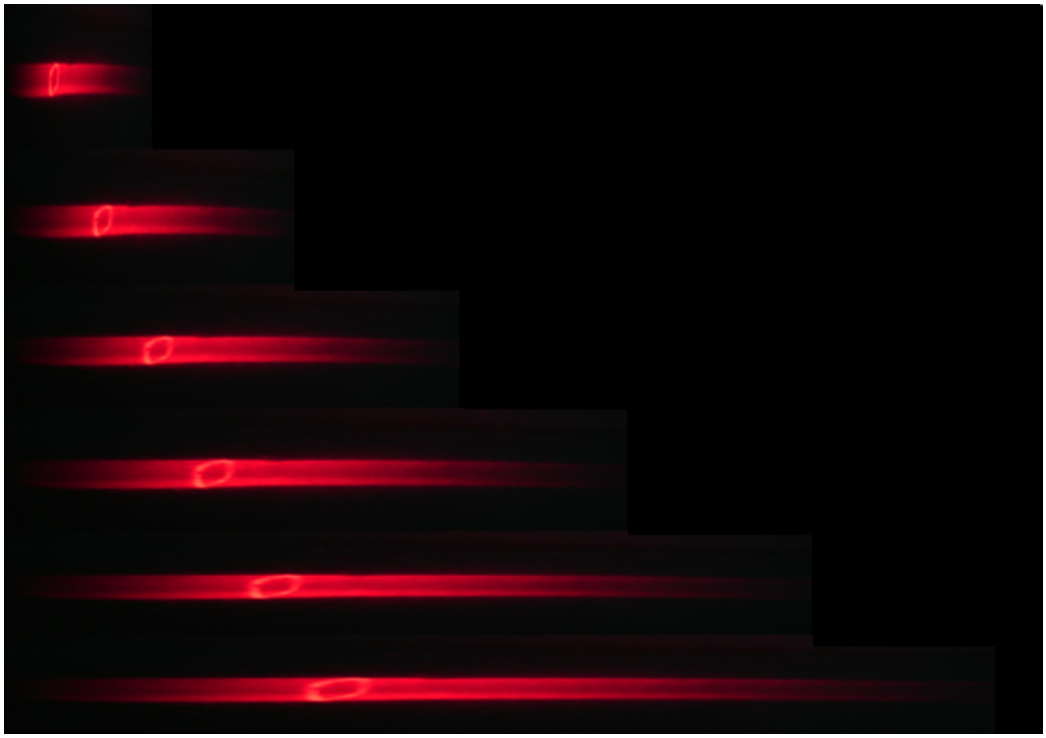

Figure 1: Stretching of a time-like geodesic interval $\langle\forall|\,\tau-\tau_0\rangle^1$ in a luminous metric. The mark τ_0 is represented by the small ring (author's laser art).

colleagues at the time of its acceptance for publication. Also, the same formalism was applied in Lyra geometry (12).

Further, one can explore only the temporal aspect of space-time by assuming the static gravitational field in space at a given moment, so that the affine conection reduces to

$$\Gamma^{\xi}_{00} = \frac{1}{2} g^{\xi\lambda} \left(\partial_0 g_{\lambda 0} + \partial_0 g_{0\lambda}\right). \tag{2.6}$$

Some additional cosmological and formal considerations led to establishing the expression of the invariant measure of the rate in which the arc element evolves, now in the new form, as the correlation function

$$\langle 0|g_{\mu\nu} d\,\langle\forall|\,x-\varepsilon\rangle_{\mu} d\,\langle\forall|\,x-\varepsilon\rangle_{\nu}|0\rangle = -d\,\langle\forall|\,t-\varepsilon\rangle_0^2 + R^2_{\langle\forall|\,t-\varepsilon\rangle_0} d\,\langle\forall|\,\vec{x}-\vec{\varepsilon}\rangle\, d\,\langle\forall|\,\vec{x}-\vec{\varepsilon}\rangle\,. \tag{2.7}$$

Thus, understanding the dynamics of the continuous expansion of space-time at any scale, it is possible to start the study of thermodynamics associated with the energy of expansion through the Lagrangian and Hamiltonian formalisms applied to heat. In addition, working with differential operations on intervals, it is possible to identify a physical character of creative fluxion that one cannot presume from ordinary differentials. It is the region demarcated by the bracket that is "fluxionant" per se, not dependent on something coming from outside; there is not merely a transfer from elsewhere.

3 Understanding entropy

The main point of disruption in thermodynamics is the banishment of the fanciful idea of reversibility. In fact, entropy never decreases; it can only slow down in its advance. Misconceptions that often occur in traditional literature, strongly supported by the industrialist's comprehension of thermodynamics prevalent in the 19th century, are due to the lack of discernment to realize that irreversibility creates, in certain particular circumstances, curious situations of organization associated with states of equilibrium that are just boundaries of irreversible sequences (9). In a nutshell, natural phenomena are irreversible, a fact that reflects the arrow of time, being reflected by the latter. Entropy expresses irreversibility as systems ever evolve from the past to the future. Anthropic interference can only simulate, by means of technical devices, a partial reversal of entropic processes, which, in the last analysis, is nothing more than a forced deceleration of the entropy advance.

In general, what matters is the rate of change of the entropy, and, as the entropy has the same direction as the time arrow, it is useful to establish a Lagrange functional as

$$\mathfrak{L} = \delta Q_{int}\dot{f}(H) + f(H)\frac{\delta Q_{ext}}{\tau_{ref}}, \tag{3.1}$$

where τ_{ref} is the characteristic transition time interval of the system, called "reference time", and $f(H)$ is a generalized coordinate given by the Heaviside function of the time interval

$$f(H) = (\tau - \tau_0)H(\tau - \tau_0), \dot{f}(H) = H(\tau - \tau_0),$$

which can be translated into Macaulay *kets* as

$$(\tau - \tau_0)\, H\,(\tau - \tau_0) = \langle \tau - \tau_0 \rangle^1 \rightarrow \langle \forall |\ \tau - \tau_0 \rangle^1,$$

with

$$H\,(\tau - \tau_0) = \frac{d}{d\tau}\langle \tau - \tau_0 \rangle^1 = \langle \tau - \tau_0 \rangle^0 \rightarrow \langle \forall |\ \tau - \tau_0 \rangle^0.$$

The Macaulay functions are used here to start a polynomial thermal loading at some time interval in the entropic evolution of the system. The connection with the theory presented in the previous section is already apparent at this point, since the same sub-Planckian time intervals can be considered here from the point of view of the energy they "encapsulate".

3.1 Entropy and evolution

Now, let us take the Euler-Lagrange differential equation for a non-dissipative situation,

$$\frac{d}{d\tau}\left(\frac{\partial \mathfrak{L}}{\partial \dot{f}(H)}\right) - \frac{\partial \mathfrak{L}}{\partial f(H)} = 0. \tag{3.2}$$

This implies that

$$\frac{d}{d\tau}\left(\delta Q_{int}\right) - \frac{\delta Q_{ext}}{\tau_{ref}} = 0 \therefore \tag{3.3}$$

$$\boxed{\delta \dot{Q}_{int} = \frac{\delta Q_{ext}}{\tau_{ref}}}. \tag{3.4}$$

For registration and further studies, the corresponding Hamiltonian expression is given by

$$\mathcal{H} = -\langle \forall |\ \tau - \tau_0 \rangle^1 \frac{\delta Q_{ext}}{\tau_{ref}}, \tag{3.5}$$

as expected, coupling the fluxion in time with the energy. In addition, we can interpret $\dot{Q}_{int}$ as the heat transfer interaction for the interior side of a border at temperature T [2], so that the entropy loaded in the variation of the phase path of the interaction is given by

$$\frac{\delta\dot{Q}_{int}}{T} = \frac{\delta Q_{ext}}{T\tau_{ref}}. \tag{3.6}$$

In this way, it is easy to interpret entropy as the very measure of the evolution of the system, being associated with the variation in the rate of diffusion of the expansion thermal energy. Note that energy couples to fluxion in time, but entropy does not.

4 The synthesis itself

The fundamental idea is to associate the arbitrary geodesic arc element with the intrinsic thermal energy related to the expansion of space-time. Clearly, as can be deduced from the formalism presented in the previous section, entropy appears as the system's evolution equation itself. Note that reasoning in terms of an arbitrary scale makes it possible to understand the physical continuity of the expansion process.

Considering a time-like Lagrange function, we can write

$$\mathfrak{L}_1 = \alpha g_{00} \frac{d\left\langle\forall\right| \tau - \varepsilon\rangle_0}{ds} \frac{d\left\langle\forall\right| \tau - \varepsilon\rangle_0}{ds}, \tag{4.1}$$

which, in geometrized units, leads to

$$\mathfrak{L}_2 = \sqrt{\mathfrak{L}_1} = \alpha g_{00} \frac{d\left\langle\forall\right| \tau - \varepsilon\rangle_0}{ds} \frac{d\left\langle\forall\right| \tau - \varepsilon\rangle_0}{ds} ds = \tilde{\alpha}\left(\delta Q_{int}\left\langle\forall\right| \tau - \tau_0\rangle^0 + \left\langle\forall\right| \tau - \tau_0\rangle^1 \frac{\delta Q_{ext}}{\tau_{ref}}\right)\left[Gc^{-4}\right]. \tag{4.2}$$

The constants α and $\tilde{\alpha}$ are arbitrary. Thus, based on the correlation function (2.7), we can reasonably assume that the invariant measure of the energy rate of spacetime expansion in geometrized units at the interval $\left\langle\forall\right| \tau - \tau_0\rangle^1$ is expressed as

$$\begin{aligned} &\langle 0|\alpha g_{\mu\nu}\frac{dx_\mu}{ds}\frac{dx_\nu}{ds}ds\,|0\rangle = \langle 0|\tilde{\alpha}\left(\delta Q_{int}\langle\tau-\tau_0\rangle^0 + \langle\tau-\tau_0\rangle^1\frac{\delta Q_{ext}}{\tau_{ref}}\right)\left[Gc^{-4}\right]|0\rangle = \\ &= \frac{-d\langle\forall|\ t-\varepsilon\rangle_0^2 + R^2_{\langle\forall|\ t-\varepsilon\rangle_0} d\langle\forall|\ \vec{x}-\vec{\varepsilon}\rangle\, d\langle\forall|\ \vec{x}-\vec{\varepsilon}\rangle}{ds}. \end{aligned} \tag{4.3}$$

The complete cosmological foundation of the correlation function (2.7) can be found in reference (11).

5 Conclusions

The main findings of this work are as follows:

a The representation of an arbitrarily small time interval, *scalon*, was defined as finite and in continuous expansion, being valid for it the differential analytical operations as they are carried out under the Macaulay brackets.

[2] In his approach to entropic interactions, Bejan (2) underlines that each heat transfer interaction $\dot{Q}_i$ which crosses a border of a temperature system T_i carries with it the entropy interaction $\dot{Q}_i/T_i$; $\dot{Q}_i$ and $\dot{Q}_i/T_i$ are considered positive when they enter the system. It constructs an interaction vector $\dot{\mathcal{Q}}_i$ with components of energy interaction and entropy interaction, namely ($\dot{Q}_i$, $\dot{Q}_i/T_i$).

b Through the Lagrangian formalism, a more refined expression for entropy was reached, including the variation in the rate of thermal energy diffused by the system.

c The synthesis between the geometric and thermodynamic approaches to the space-time continuum in expansion was technically established by means of a correlation function.

d As we access the world of externalities, it has been demonstrated that there is a continuous physical representation of the universe beyond the apparent diversity.

The implications of current theory push us further away from the ideal of unification in the most literal sense of the word in current physics. Even so, if we abandon the stricto sensu, everything is unified at the most fundamental level of space-time. Of course, this choice in no way invalidates the successful models that we have and their many useful applications for humanity. But, it goes beyond the limits imposed by common understanding to consistently describe the essence of gravity as a consequence of the fluxionating nature of the *scalons,* which are everywhere, and allow everything we know to be created.

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