On the Origin of Space

Part 1: A Continually Self-Renewing Universe

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Abstract
Einstein emphasized in his lectures that space has physical properties; i.e. gravitational force was attributed to a space metric. Following that line, we introduce a “density” in order to characterize the nature of space, space being a superposition of electromagnetic entities tied to “islands of matter” far apart from each other. The density of a given space then enters in the description of the complete dynamics between that space with its matter, and other space-matter systems. A continuity equation covering such an extended dynamics is envisioned to complement Einstein’s, allowing to describe rationally an universe energetically self-renewing on a continual basis.

Keywords: space, matter, dynamic equilibrium, continuity equation, Einstein, Everett, AGN
Introduction – The assumptions of General Relativity

A previous article has described the need to use conscious experience in order to advance scientific knowledge.[1] How did Einstein describe his experience of space being bent by matter to Marcel Grossman in order to develop a rational experience out of his initial conscious experience? We do not have a record of such a discussion, and we will never know its key details. Here we will attempt to develop this kind of scientific communication starting as a base from a lecture Einstein gave in 1920 about the meaning of space in his theory, and compare the assumptions he advanced for his rationalized theory with the facts as we know them now. [2]

Before his work, we were accustomed to see (as a consciously experience) space being “just there,” a mathematical entity, a “form” as Plato would have qualified it. Einstein saw it instead as a physical entity, as this entity generates an attracting force between elements of matter by being bent by them, a force called gravitation. A dynamical equilibrium between space and matter was then rationally expressed through his famous equation.

Later, Einstein looked at the sky and saw a non-zero even average density of matter everywhere. Combined with the idea existing in his time that electromagnetic fields do not exist everywhere, contrary to matter, his rational conclusion was that space, even though infinite, had to be bounded, with essentially the topology of a ball.

Since then, new facts came to light that are going against these assumptions. First, we recall that, in his time, galaxies as “islands of matter” in the Universe were unknown, and were still called “nebulae” by the time of his death, as they were dimly seen in the sky back then. (Their name was taken from Latin describing a “vague” object.) There was then no appreciation for the enormous distances between such objects. We found since that our own “nebula” was merely one among a fantastic number of others spread as far as our telescopes can see to this day, and at enormous distances between each other compared to their size.

With respect to the electromagnetism assumption, the “zero-point energy” of “empty space” was not understood until Quantum Electrodynamics (QED) became a solid theory, a scientific advance that happened only within the time of Einstein’s death. The electromagnetic nature of such energy is indubitable as atomic
nuclei do not enter into it, the area of space under consideration being by definition “empty,” i.e. a vacuum.

Finally, Einstein pointed out in 1920 the fact we could not “assign the concept of motion to space.” (This was a remark related to the impossibility to measure a “wind” for that space vs. the motion of Earth.) There we have to be careful, as within such a quote space is understood as all-encompassing. This is another key assumption of General Relativity, as Einstein expressed it again in his referenced lecture then. There was indeed only one space in his mind. But, about such an assumption, we have also acquired quite a different conscious experience: By 1957, merely two years after his death, a graduate student named Everett envisioned our world to be in fact a “many-worlds” through the rationally experienced message of Quantum Mechanics.[3] He pointed out that the Schroedinger equation tells us that there are many superposed matters (realities) for each element that we can observe. This new view has been the base to construct “Quantum Cosmology” thirty years ago. With this in mind, if we include the prior conscious experience by Einstein of space as a physical entity, we have to add to Everett’s discourse the conscious experience of many spaces containing the many-matter he saw.

A new picture of space and matter

The sum of all the above deviations from the basis of General Relativity leads us to a fundamentally different picture of reality. The key deviation we are going to discuss is that space and matter are two forms of the same elements of our reality that can transform into each other, something that Einstein saw later in his life through a 1930 lecture, [4] and as such space and matter must be related in their existence via another equation expressing the conservation of these elements during such transformations, in other words, a continuity equation. This is in reference to Euler’s equation in Hydrodynamics, while Einstein’s equation is Poisson’s equation for space and matter. [5] Such an equation is yet to be found as we don’t have the mathematical tools at this point to construct it.

Instead we are going to describe the conscious experience of a cosmological phenomenon that comes out of the astronomical pictures obtained in recent years, a phenomenon which was utterly unknown in the lifetime of Einstein. We
will advance that such a phenomenon is in fact the process permitting space and matter to transform into each other, thereby allowing the Universe to renew itself energetically on a continual and permanent basis. This will in effect overturn Clausius’ 19th century view of a universal “heat death” coming through the view of classical mechanics and its thermodynamics.

An overwhelming image appears from this phenomenon: Gigantic jets of matter and radiation come out perpendicular to the center of spiral and elliptic galaxies, processes called “Active Galactic Nuclei,” or AGNs, as well as from systems that are forming stars and planetary systems. These jets have been seen as including blobs of matter emitted in spurts (“blazars”), with the possibility of even having new galactic systems generated under the term of “quasars.”[6]

If we were dealing with a hydrodynamic system, we could say that we have like a hurricane in space. As a matter of fact, the galactic shape is close to a logarithmic spiral; assuming such a property, a simple calculation shows that space has to be somehow disappearing at a constant rate through the center. Then, what is happening in the eye of that hurricane? Where is space itself going?

Here is first why we can see different spaces moving vs. one another instead of seeing an all-encompassing space, which is the space of General Relativity. We are going to picture the area containing a galaxy as being a space of its own, infinite but bounded, and with a definite boundary. How can we get to such a picture? Further, how could a space be moving versus another one?

The quantum mechanical notion of superposed spaces

When we look at the sky at night, we consciously experience this entire sphere of stars as rotating versus us. For centuries now, we are in fact accustomed to see us rotating versus it, and this from the knowledge of our place in space since Galileo. Now let’s put ourselves at the “edge” of our galaxy, and look at the sky there. The “celestial” sphere at that location is half filled with brilliant stars, and the other half is basically dark. Do we see these stars rotating versus us? Or do we see the distant galaxies rotating? If we take Newton’s pail, will it rotate with the stars, or with the far galaxies? We will bet here that it is standing still, as the galaxies are standing still. The reason is simple: If it was rotating with the stars it would continue to do so until we reach an-
other galaxy's edge, and then it would rotate according to the stars in that galaxy. There has to be a point where the pail no longer follows the first galaxy. Here we have to admit that only the solid angle of view through which we see the galaxy will dictate the influence on the rotation. But what is this “solid angle of view” but the electromagnetic flux from the galaxy, and nothing else?

Then we can picture at last celestial spheres as electromagnetic entities, physical things, no longer what Mach (and everyone else in his time) understood as “empty space,” somehow transmitting the orientation of space via the far presence of “distant stars,” a weird effect-at-a-distance made well-known by Newton through his pail experiment to show the value of his absolute space vision, a vision that General Relativity never could really incorporate, except via hand-waving arguments.

The existence of electromagnetic phenomena everywhere, coupled with the bounded extent of galactic islands of matter, leads then to the conscious experience of galaxies having indeed an electromagnetic space of their own superposed onto spaces of the same nature belonging to a countless number of other galaxies.

The “hole problem” of GR that Einstein had to solve between 1914 and 1916 addressed the very fact that his theory cannot assign a definite metric to a vacuum, showing then that space is mathematically treated in his theory as a non-physical entity, contrary to his original conscious experience. Einstein published in spite of that lack of determination in the rational formulation of his theory, but this remained a fundamental problem for him, as QM later became.

[7] There, Everett’s conscious experience comes to the rescue, and confirms that the space containing a galaxy, an “island of matter,” can only remain superposed to the spaces generated by other galaxies, as there cannot be a “wave function collapse” of the electromagnetic spaces that could combine them into one quantum entity since the space in-between is void of any matter that could effect such a collapse. The space metric is then confirmed to remain physically undetermined, as matter waves are in quantum mechanics in-between observations by matter.

A key observational fact supporting this understanding has been identified only in the past thirty years after Einstein’s lifetime (too many references exist on this matter; we will not mention any here): Stars and gases in spiral galaxies
display a very odd rotation, acting as if these galaxies were rotating solid plates close to their center, with the speed of rotation being rather constant after a short distance out of the center. Of course, if the plate was behaving entirely as a solid, the speed of the stars would quickly reach light speed, and we know that they don’t. We will not address here the rational experience that comes a priori to mind, namely that this behavior must be coming from unseen matter; this will be because the required “non-baryonic matter” in such an hypothesis remains only a view of the mind to this date, as particle physics could not identify anything of that sort in the ensuing 25 years after the hypothesis was formulated, and in spite of all the efforts spent in that direction since. We will rather keep on using our conscious experience about the nature of space itself, as it leads to a wider understanding of reality.

We shall look now at what is spatially happening around and at the center of these quasi-plates so we can reach a communicable picture of the spatial phenomena at their center.

**A new space-matter system waiting to be born**

Since a space quantum-mechanically corresponds in effect to one of these islands of matter, what happens to the part of that space which no longer can communicate (electromagnetically or otherwise) with the rest of it? In that respect, “singularities” have been found inevitable in General Relativity when matter accumulates under the force of gravitation, creating an isolated part of that space called a “black hole.”[8] Couldn’t this rational consequence of GR allow in fact the birth of a completely separate space-matter system? On this subject, we have the prior experience of “neutron stars,” something our eyes have not seen, but our telescopes and other instruments told us exist. We know that atomic nuclei of the size of a large asteroid can exist. Here descriptions of particle physics told us that, in such nuclei, we have swirls of nucleons, each appearing as tiny **bound spaces**; such spaces must exist since their contents, quarks and gluons, cannot separate individually, only by splitting out in mesons, which are in that picture other bound spaces containing quarks. ([9] Section 15.3) We also know that such tiny spaces are NOT of electromagnetic origin. We are then led first to the picture of a system basically governed by interactions between nucleons creat-
ing (strong force-) bound spaces embedded in an a priori unbound electromagnetic space.

Now, how will such large nuclei evolve when electromagnetic space (the galax-
axy space) gets bent to the size of nucleonic spaces? This space then cannot con-
vey any more its own bending further than the typical extent of one nucleon. Quan-
tum Field theory here (with space being seen as all-encompassing) envisions 
the strength of all forces becoming equal at the mathematical spatial singularities obtained. What space do we have “between” nucleons if e-m space itself becomes as limited or bound as them? We are then forced to see the elements of both matter and space in effect prisoner of each other in their “monadic” relationships. The singularity found in mathematical spacetime will never be physically obtained since the space itself resolves into quantum elements before this singu-
larlarity is reached. [10] Where could an out, a “door” be for such a system through which the separated e-m space contained in the black hole could expand and develop into a full space of its own?

Certainly not within the original space, as black holes have “no hair” there, per a famous theorem in Modern Cosmology, but an out appears to be possible as a result of the geometry of spiral galaxy spaces: By being a disk rotating ver-
sus other spaces, such a spatial system must have a fixed point with respect to its celestial sphere (which, as we have seen, is made out of electromagnetic ele-
ments from other galaxies, thereby realizing its “zero point energy”). At that fixed point, we are going to see that the spatial system containing the galaxy must include that door.

A spatial sink-source system (4S)

Let’s now put ourselves at that fixed point. What do we see? We must be surrounded by darkness as the topology of the galaxy space forbids its electro-
magnetic elements to go to that fixed point. Observations of the center of the Andromeda galaxy for example have shown a complete void, attributed by the observers to an hypothetical “galaxy wind” going from the center. [11] Darkness is total except for two opposite points at infinity, that are fixed. In which space are we? Well, we cannot feel gravitation from that surrounding rotating dark sky, even though the stuff it is made of is mighty close to us. So we must be out of that stuff’s space, which is the space of the galaxy, and we must thus be
within the electromagnetic space of the two points we dimly see fixed at infinity. (Remember here the earlier pail experiment.)

What is then going to happen to a black hole that happens to come around us? Of course it is not “falling” to the fixed point as there is no force for doing so. Its motion is entirely governed by gravitation within the galaxy space, and that space does not reach the fixed point. Well, it will then have to “evaporate,” as the part of the galaxy space it was originally made of is becoming extremely “thick” here compared to the “outside” superposed space quantum mechanically reachable at that point. The elements of its contained space will then have to expand in order to balance this local differential in spatial density. Holes will appear at its horizon through which all the nucleons in it will at last leave. After all, there is no gravitation here except for within the space around the “singularity,” and these nucleons face only the repulsive pressure built by their accumulation in a black hole space which is now quickly expanding.

The matter in this hole (which is now a white hole through the expansion of its space) may take a long while (from within the outside observing space) to completely evaporate if it is very large. Its demise may not be smooth as quantum fluctuations are bound to be amplified in this process. The matter and radiation in it may then split up in “blobs” as we can see from afar in the form of a “blazar,” or even be ejected almost as a whole, and be seen then as a “quasar.”

The black hole - white hole succession will be identified as a “spatial sink-source system,” or 4S for short.

The 4S energy transformation cycle

In 1930, in one of his lectures, Einstein expressed the conclusion that space appears to be the origin of matter, that space is primary reality and matter secondary reality. [4] Here is now this “space as matter” idea applied energetically to the above process.

According to the first law of thermodynamics one will say that, within a given space-matter system, energy cannot be created or destroyed; the sum of the energy of matter and the energy of its space must be always constant:

\[ E_{\text{matter}} + E_{\text{space}} = E_{\text{constant}}. \]
In the first moment after the start of a white hole, $E_m = 0$, $E_s = E_k$. In the subsequent moments, $E_s$ structures into $E_m$, and the transformation is over when $E_s$ and $E_m$ are balanced:

$$E_s = E_m \quad \text{(with } E_s = E_m = E_k /2).$$

With the formation of black holes, the transformation of $E_m$ into $E_s$ starts. In its “singularity” the energy of matter is transforming into the energy of space. $E_m$ is falling towards zero, while $E_s$ is rising towards $E_k$. When a black hole reaches the vicinity of the 4S fixed point, the energy of that space starts transforming back into the energy of matter, and thus becomes an expanding white hole again.

So 4Ses provide a self-regenerating process for the universe, generating new space-matter systems, with no foreseeable beginning or end for such a process. The conservation of energy within space-matter transformations by not having a universal scope, i.e. by being limited to a given system, could be described formally through a continuity equation with sinks and sources, thereby complementing Einstein’s equilibrium, which is addressing only “steady-state” space-matter systems (i.e. not including space-matter transformations).

**Conclusion and outlook**

The conscious experience we have described is showing us that we have to be careful with theories that are based on an experience limited by knowledge at the time of that experience. Rational experience appears not to be all-encompassing, as logical positivism, the basic philosophy of Science in the 20th century, made us believe. Einstein saw the universe as an all-encompassing space, and accordingly expressed the dynamics of matter and space within it. With the discovery of AGNs within islands of matter called “galaxies,” conscious experience must be changing, and now the overall universe appears as an infinite set of bounded space-matter systems, with new such systems inherently providing for a perpetual renewal of free energy.

We have not touched upon prominent effects experienced from Earth, such as the Hubble redshift and the cosmic microwave background. They are part of the basis of Modern Cosmology following the hypothesis of an all-encompassing space. Such effects can be incorporated within the experience described here by equating the universe with our galaxy, as Einstein originally (and unknowingly)
did, and by taking the Hubble effect as an energy “dilution” by photons traveling through the expanding electromagnetic space of our galaxy. This last process is the inescapable conclusion reached by reading recent NASA data on spacecraft trajectories across the outer parts of the Solar system. [12] In that new experience, there is no overall universe expansion, just an eternal, infinite, and continually self-renewing universe of electromagnetically expanding galaxy spaces.

We have also not touched upon the meaning of superposed spaces for General Relativity. One obvious consequence of this concept in that respect is that gravitation at a given point of the superposition comes from a sum of metrics weighted by the relative “thickness,” or density of the various spaces at that location. We have seen that gravitation disappears in a 4S as a result of a local boundary with another space; this “thinning” of space generalizes to the “edge” of a galaxy, but not in a local fashion as at the fixed point. There, through the concept of a celestial sphere being a physical entity, we can advance that, just outside a spiral galaxy, and especially on its plane, the celestial sphere becomes quickly filled in majority by the electromagnetic flux from outer galaxies. Gravitation from the nearby galaxy must then disappear accordingly. This is an effect which ought to be astronomically verifiable.

Finally, the differential between gravitational strength in the celestial spheres on the sides of the galaxy disk vs. the spheres at its edges must lead also to a fundamental stability for such disks, and this without recourse to unseen matter.

In a subsequent article we will investigate how the above conscious experience can be connected to a rational (mathematical) approach, and reconciled with well-known astronomical and astrophysical facts. [13] Separately, we will also look at processes other than cosmological ones in the light of the quantum mechanical aspect of space(s). [14]
References:


