Ψ
PIU-Ψ

Universal Integrity Principle

One single thing

What is the cosmos? What is the Pleno? How does it operate?

A research program in fundamental physics

An explanation to grasp the idea, almost without mathematics

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The underlying question

Imagine someone told you that the gravity holding you in your chair, the light that lets you read this, the particles you are made of, and the great mysteries of the cosmos —dark matter, dark energy— are all the same thing, seen in different ways. Not separate forces, not different ingredients: a single substance, behaving in diverse forms.

To understand why that idea is so powerful, you first have to know about an enormous problem physics has carried for a century. Today we describe the world with two great theories that work wonderfully… but that do not speak to each other. On one side, the theory of the very large: general relativity, which explains gravity, the stars, the galaxies, and the shape of the entire universe, with astonishing precision. On the other, the theory of the very small: quantum mechanics, which governs particles, atoms, and the subatomic world, just as precise. Each reigns in its own domain; together, they contradict each other. When one tries to use the rules of the quantum world to describe gravity, the mathematics fills with meaningless infinities and everything collapses. The finest minds of the past century have tried to bridge that gap —they call it "quantum gravity," and it is considered the greatest unsolved challenge in fundamental physics— without success. It is like having two perfect maps of the same city that, overlaid, do not fit.

Faced with that wall, PIU-Ψ takes a bold and different step, and it is worth stating up front, because it is its most original trait. Almost every previous attempt accepts that there are two theories and looks for a way to *unite* them. PIU-Ψ inverts the question: **what if they were never two?** What if the large and the small are not two worlds to reconcile by force, but two faces of a *single* physical substance? That substance is called the Pleno, and from it —the program proposes— everything else emerges.

Three clarifications, from the outset, to situate what follows:

- **It is physics, not philosophy.** PIU-Ψ is not a metaphor or a poetic worldview. It is a **research program in fundamental physics** —the branch that seeks the ultimate laws of nature, the same one in which Newton, Einstein, or Schrödinger worked—, built, like any serious physics, on **high-level mathematics**: it starts from precise principles, derives its results the way theorems are proven, and applies a strict rule of honesty about what is

proven and what is not. Everything that follows —the crystal, the tension, the spin, time— are images in words of objects that, underneath, have their exact equation.

- **It does not come to replace, but to explain.** PIU-Ψ does not aim to repeal relativity or quantum mechanics. On the contrary: it sets out to *derive* them —to show that both spring from a single root— and thereby **integrate them from a common base**, not supplant them. The laws that already work will keep working; what the program adds is the trunk from which they hang.
- **It is a new approach.** Its originality lies not in proposing yet another "theory of everything," but in the *change of question*: instead of forcing two pieces to fit, it suspects they were always one. That turn is what lets it sidestep the infinities that stalled the others, as we will see.

This document tells, with everyday images and almost without mathematics, what the Pleno is and how it operates.

1. From a single equation, the laws of the world

The starting point of PIU-Ψ is that same question —what if everything, gravity, light, matter, the cosmos, were at bottom the same?— carried to its ultimate consequences. Many have felt, at some point, that suspicion of unity beneath the variety of the world. What is distinctive about PIU-Ψ is not to settle for the idea, but to submit it to the most demanding tribunal that exists: that of mathematics. The reasoning is simple and strict: if everything truly is a single substance, then, starting from a precise mathematical description of that substance, one must be able to derive —rigorously, step by step, without cheating— the known laws of physics. And if one could not, the idea would be refuted.

That is exactly what the program does. PIU-Ψ proposes that the entire universe is a single field —the Pleno—, and writes it with the same kind of mathematical object physics already uses for the smallest things, now extended to everything that exists. The symbol Ψ alone already hints at the great wager: that the quantum is not a separate corner of the world, but the very texture of the single substance that forms it all. That field is written like this:

$$\Psi = S \cdot e^{\,i\theta},$$

and no mathematics is needed to read the essential part: the formula says that at each point the Pleno has only *two* qualities —S, how much it is tensed, and θ, which way it spins—. Nothing more. From those two quantities, and how they change from one point to the next, everything else will spring.

That expression describes *what* the Pleno is. To know *how* it behaves, the theory adds its "fundamental equation," known in PIU-Ψ simply as F1. There is no need to understand it: it is enough to know what it is, a single compact recipe that fixes the dynamics of the Pleno. That equation is not chosen at random nor adjusted along the way: it is built from a few starting principles —about half a dozen precise statements about how the Pleno is, the Axioms of PIU-Ψ— and, once fixed, it is closed, immovable. From there, everything else follows by strict protocol and mathematical deduction, without introducing new ingredients. The theory derives —one after another, with the rigor of a theorem— the laws physics discovered separately over the centuries:

1. Newton's gravitational constant, and the structure of Einstein's equations.
2. Planck's quantum constant and Heisenberg's uncertainty relation, with its exact floor.
3. Maxwell's equations of electromagnetism, and Yang-Mills' of the nuclear forces.
4. Dirac's equation of the electron, with its spin and relativistic structure.

5. The Chandrasekhar limit that decides the death of a star.

6. And the proportions of the cosmos —how much dark matter and dark energy there is— in figures that fall within the satellites' own margin of error.

Pause to weigh what this list means. Each of those names —Newton, Einstein, Maxwell, Yang, Heisenberg, Schrödinger, Dirac, Lorentz, Chandrasekhar— represents a lifetime of work, sometimes of whole generations, and each law was found separately, in different eras, to explain phenomena that seemed to have nothing in common: the gravity of the planets, the magnetism of a magnet, the behavior of an electron, the death of a star. Different chapters of physics, in different books. What PIU-Ψ proposes is that all those chapters are, at bottom, the same story —that of the Pleno—, and can be written with the same pen, from the same first line. That is its ambition and most distinctive trait: not to have explained a new phenomenon, but to have found the common trunk from which branches we took for separate trees grow. The rest of this document explains what that trunk is —the Pleno— and how, from it, everything arises.

2. A single substance that fills everything

Let us begin with the most basic point. Imagine that the universe is not made of loose things floating in a void, but is a single continuous material that fills absolutely everything, without gaps. What we call "empty space" would not be empty: it would be that material at rest.

A good image is that of an elastic medium —think of an infinite gelatin, or a transparent crystal extending in all directions—. And here comes the beautiful idea: everything that exists would be a shape that medium takes. Just as waves, whirlpools, and currents of the sea are not things distinct from water but forms of water, particles, light, and gravity would not be things distinct from the Pleno, but forms of the Pleno. A tension here, a spin there, a wave running through it. That is the central wager of PIU-Ψ, and everything else hangs from it: a single substance, and the entire universe as its infinite ways of moving.

3. How it is organized: a diamond-shaped crystal

A medium like this is not disordered mush. The Pleno organizes itself, structures itself internally like a crystal, with its units arranged in a regular, repeated pattern, just like the atoms in a gemstone.

And not just any pattern, but the same one a diamond has. In a diamond, each carbon atom bonds to four others, arranged toward the tips of a tetrahedron —picture four particles arranged so that they always form a triangular-based pyramid—. It is the most balanced and firm way to distribute the bonds in space, which is why diamond is the hardest natural material there is. The Pleno shares that architecture: each of its cells bonds to four others in that same tetrahedral arrangement. This is not a decorative detail, but the heart of the theory. From that simple geometry —"four neighbors in a tetrahedron"— follow, as we will see, a great many of the numbers on the earlier list. The shape of the crystal is not an ornament: it is the source of its rules.

And there is something essential about the status of this shape: the diamond structure is not postulated, it is *derived*. It is not a convenient assumption slipped into the theory "just because." When one asks how a medium like the Pleno must organize itself to be stable and self-consistent, the mathematics point, unambiguously, to that tetrahedral arrangement —the same one nature chooses, not by chance, for the most resistant material there is—. And from that single geometric form follow, chained and also with proof, a multitude of the results the theory produces. The geometry of the crystal is not an ornament nor a choice: it is a derived consequence, and at the same time the root from which almost everything else hangs.

4. The two qualities of each point: how much it tenses, and which way it spins

And how does one describe what happens in the Pleno? Surprisingly, with only two pieces of data at each point —the same two that already appeared in the formula $\Psi = S \cdot e^{i\theta}$—:

- **How much it is tensed or compressed** —this is the S of the formula—. Call it its *tension*. At rest, that tension has a background value; where there is "something" —a particle, a wave—, the tension rises or falls.
- **Which way it is spinning** —this is the θ of the formula—. The Pleno has, at each point, a kind of spin orientation, like the hand of a tiny clock. What matters is not the hand of a single point, but how the orientation changes from one point to the next: if they all point the same way, the medium is calm; if the orientation rotates along space, that is a wave traveling.

With these two qualities —tension and spin— almost everything is understood. From tension, particles and matter are born; from spin, light and the forces. And there is an elegant detail: the tension of the Pleno never reaches two extremes. It cannot stretch until it vanishes (it has a floor, never reaching zero) nor compress without end (it has a ceiling). The medium always keeps "some" substance and never collapses entirely. Keep this idea of the two limits: later it will turn out to be the key to something important.

5. A firm medium that, when it must, flows

The Pleno has two distinct ways of resisting deformation, and it is worth not confusing them, because from each springs a famous consequence of physics. The first we can call its *firmness*; the second, its *resistance to abrupt change*. They are two different properties of the same medium —not one— and it pays to see them separately.

Firmness: how much the medium yields when you push it. Let us begin with the first. A good way to measure how firm something is, is to see how much it yields when you press it. Sink your finger into a pillow: it sinks a lot. Rest the same finger, with the same force, on a wooden table: it barely yields. The pillow is soft; the table, firm. "Firm" means no more than that: that for a given push, it yields little.

Now, the Pleno —even at rest, calm, which is how it is today— is extraordinarily firm in that sense: when something pushes it, it yields very little. No need to believe it yet; later we will see it come out, measured, from a known fact. And here it is worth clearing up a misunderstanding from the start: that the Pleno is firm does not mean it is tense or compressed, like a rope stretched to the point of snapping. On the contrary: today the medium is in its most *relaxed* state, calm, settled in its rest —the same state that, later, will turn out to be dark energy—. It is the serene firmness of something deeply settled, not the tautness of something forced. Keep this idea, because from this firmness at rest will come, in the section on gravity, one of the most beautiful consequences of the whole proposal —and, against all intuition, it will be that gravity is *weak*.

Resistance to abrupt change: why the speed of light exists. The second property is of another nature, and here one of the most elegant ideas appears. That firm medium normally behaves like an elastic solid: deform it a little, and it recovers its shape, like a spring. But it also has a character that depends on *haste*: the faster it is forced to deform, the more it resists, until it becomes infinitely rigid in the limit. It is not the same as its static firmness —it is a resistance that grows with the speed of change—.

Everyday substances do exactly this. Cornstarch mixed with water: strike it suddenly and it behaves like a solid —you can even run across it—; push it slowly and it flows between your fingers. Its resistance depends on how fast you force it. The Pleno has a similar character, and

that "resistance that grows with speed" hides a deep consequence: it explains why nothing can go faster than light. Approaching the speed of light amounts to trying to deform the medium ever faster; and the medium hardens so much that it becomes impossible to push it further. The speed of light is not a rule imposed from outside: it is, simply, the point where the Pleno jams.

Two properties, then, two fruits: from *firmness* will come the weakness of gravity; from *resistance to abrupt change*, the limit of the speed of light. And there is something more that comes from here, so deep it deserves its own section: space and time. Space is the extension of the medium itself; and time —as we will see— is not a stage where things happen, but the very pulse of the Pleno. They are not the theater where the substance acts: they are aspects of the substance itself.

6. Time: not a stage, but the pulse of the Pleno

We are used to thinking of time as a river that runs on its own, independent of everything, and of the things of the universe as boats floating on it. First comes time; then, what happens within. In the Pleno that image is inverted, and the inversion is one of the deepest ideas of the whole proposal.

Here time does not exist "on the outside." There is no prior river. What we call time is, simply, how much the Pleno has changed: the count of its accumulated changes, measured against the only reference rhythm there is —the maximum speed at which the medium can react, the speed of light—. Think of a clock: a clock does not measure a time that would be there anyway; with its ticking, it makes time, counting it beat by beat. The Pleno is like that: it does not age within time; its aging is time.

This sounds abstract, but it dissolves at a stroke questions that seemed unfathomable. "What was there before the universe?" or "how fast does time pass?" turn out to be ill-posed questions —like asking what lies north of the North Pole—. There is no "before" without a Pleno that changes, because "before" is itself a measure of change; and there is no "speed of time," because there is no second external clock against which to time the first. Time is not a container that can be filled or emptied: it is the trace the substance leaves as it transforms.

And there is a feature of the mathematical development that crowns the idea. Three things that at first seem distinct turn out to be one: the curve along which the Pleno relaxes from its most tense state toward rest, the great clock that marks the history of the cosmos, and the very passage of time. They are not three synchronized clocks: they are the same object described three ways.

7. Gravity: not a force that pulls, but the medium relaxing

For centuries we thought of gravity as Newton described it: an invisible force one body exerts on another, pulling it at a distance. The Earth "pulls" on us; the Sun, on the Earth. It works wonderfully for calculation, but leaves an uncomfortable question: how does one body pull another that is far away, without touching it, across the void?

A century ago, Einstein overturned that image and answered, in large part, that question. In his general relativity, gravity is not a force that pulls: it is the *shape* of space. A mass deforms the space around it —curves it—, and other bodies, as they move, feel no pull at all: they simply follow the straightest path that curved space allows them. The usual image is a heavy ball on a taut sheet: it sinks the surface, and a marble passing nearby falls toward it not because the ball attracts it, but because the ground beneath the marble is tilted. Einstein thus dissolved the mystery of the "pull at a distance": there is no pull, there is geometry. The Earth does not tug at the Moon; it bends space, and the Moon follows the curve.

This is where PIU-Ψ comes in —and it is worth being very clear, because it does not come to

contradict Einstein, but to answer him the question he left open—. Einstein tells us *that* space curves, and describes with exquisite precision *how* it does. But he does not say *what* space is, nor *why* it can curve: he takes it as the ultimate stage, given. PIU-Ψ takes the next step. Space is not the final floor of reality: it is a description of how the Pleno behaves seen from far away. What Einstein calls "the curvature of space" is, seen up close, the tension of the Pleno. Put in one phrase: for Einstein, geometry is the *starting point*; for PIU-Ψ, it is the *finish line* —something that emerges from the medium, not something to be assumed—. Einstein geometrized gravity; PIU-Ψ explains what that geometry is made of. And as we will see, when one does the math, Einstein's equations reappear intact inside PIU-Ψ —they are not toppled, they are *derived*—.

Let us look, then, up close, at that mechanism. In the Pleno, gravity *is not a force that pulls*. It is something deeper, and it arises directly from the tension we already know. A mass —a star, a planet, yourself— is, seen up close, a disturbance of the Pleno's tension: a region where the medium is altered from rest, and that alteration fades gradually with distance. Now put two masses close together: their two alterations overlap in the medium they share. And it "costs" the Pleno energy to sustain two separate tense zones; it is more economical when they come together and merge. By its own elasticity, the medium tends to relax that tension, and the way to relax it is to bring the two masses together. What we call "gravitational attraction" is not one mass pulling another: it is the medium between them relaxing its tension by uniting them.

Think of two drops of water on a table: when they get very close, they merge into one. It is not that one "pulls" the other; it is the tension of the liquid itself that, as their edges touch, unites them. The gravity of the Pleno is of that same family. And so Newton's old uncomfortable question does not even arise: nothing pulls across the void, because there is no void; there is a continuous medium that explains everything by contact, point to point.

And now, the most surprising part, and here we return to the firmness of the medium at rest that we noted down. One would expect a very firm medium to produce a very strong gravity. Just the opposite happens: it produces the weakest force in all of nature. The reason is clean once one understands what the "gravitational constant" really is —that number which fixes its intensity—. In PIU-Ψ that number does not measure a force: it measures **how much the medium yields** when you place a mass in it, how much space curves before it. And "yielding little" is exactly what being firm meant. Firmness and gravity are not, then, two facts: they are the same fact seen from its two sides. A medium that barely yields is a medium where a mass barely curves space; and a minimal curvature is a minimal gravity. The gravitational constant is so small, precisely, because it measures the yielding of a medium that, at rest, barely yields.

And here is the twist that makes it checkable, rather than an act of faith: there is no need to assert beforehand "the Pleno is extremely firm." We can go the other way around. The weakness of gravity is a *measured* fact, one we all know —in a moment we will touch it with our hands—; and from that measured weakness one *deduces* how firm the medium is, without having to assume it. The firmness of the Pleno is not a postulate to be believed: it is the fingerprint that gravity itself, weak as it is, leaves exposed. The weakness of gravity stops being a mystery and becomes the direct reading of that firmness at rest.

And how weak is it? More than intuition suspects. A simple fridge magnet, the size of a coin, lifts a paperclip overcoming the gravitational pull of the entire planet Earth pulling the other way. That pinch of magnetism beats the whole planet. And yet —and this is the notable thing— gravity, being trillions of trillions of times weaker than the other forces, is the one that governs the universe at large scales. How can the weakest rule over the galaxies? The key is its reach. The other forces, for all their intensity, either act only at tiny distances —the nuclear ones do not reach beyond the nucleus of an atom—, or cancel themselves out: in matter there are as many positive as negative charges, and their electric pulls almost entirely nullify each other. Gravity, by contrast, never cancels —there is no "negative mass" to counter it— and its reach has no

limit: it adds and adds across cosmic distances, from planet to star, from star to galaxy. Thus the weakest force of all, precisely by acting without canceling over immense distances, ends up being the one that shapes the entire cosmos.

And here is the lesson, which shows the kind of understanding PIU-Ψ aspires to. That colossal weakness of gravity is one of the great unsolved puzzles of physics: no one knows, in the usual framework, why it is so extraordinarily weaker than the rest. It is accepted as a fact, an "it is so." The beauty of a good theory is that it turns an "it is so" into an "it is so because"; and here the program replaces nothing —Newton's and Einstein's gravity remains intact—, but gives it an underlying reason: why its constant is as minuscule as it is. It is not the final word —much remains to confirm—, but it shows the aspiration: not only to describe the world, but to understand why it is the way it is.

8. Where "everything" comes from

Let us return to the list of laws from the start and see, in images, where each thing comes from. With the few ideas we already have —an elastic crystalline medium, with tension and spin, firm yet able to flow— the proposal reconstructs the entire catalogue of the world. It is remarkable how much fits in so little:

- **Particles** (a proton, an electron) are stable knots of the medium: twists that coil around themselves and do not easily undo, like a well-made knot in a rope. That is why they are stable, and why they come in whole amounts: a knot is either there or not. Their mass is, roughly, the energy stored in holding that knot.

- **Light** and all electromagnetic waves are waves of the spin running through the medium: the local orientation rotates from point to point, and that rotation travels. No separate electromagnetic field is needed; it is the Pleno itself undulating in its orientation.

- **Dark matter** —that invisible mass holding galaxies together— would be another family of configuration of the same medium. Recall that ordinary particles are knots that, besides tensing the Pleno, make it spin, and from that spin electric charge and light are born. Dark matter would be a smoother lump: it weighs (it tenses the medium and so gravitates), but it lacks that spin —the circulation that produces electromagnetism—. And there is the reason it is dark: it is not that it "barely interacts" by chance, it is that it does not have the mechanism that generates light, so it cannot shine or reflect anything. It is not an exotic particle of another nature: it is the same Pleno, organized without that spin. Ordinary and dark matter are, then, first cousins —one knotted and luminous, the other smooth and mute—. And there is a notable detail: the theory *calculates* how much dark matter there must be relative to ordinary matter, and the number comes from the pure geometry of the crystal, falling within the measurements' margin of error, without adjusting anything.

- **Dark energy** would be the state of deep rest of the Pleno itself: even where there are no particles or waves, the relaxed medium keeps a basal energy, present everywhere, like the floor of the ocean over which everything else happens. And here it is worth being precise, because it is a subtle point. In its state of rest —the state the universe is *already* in today— that energy behaves **exactly like a constant**: the same everywhere and at every moment, without the slightest variation. It is not "almost" constant: it is a genuine constant, because it is a symmetry property of the medium's rest, not a field still rolling somewhere. What does change over time is not that energy density, but its *relative weight* in the balance of the universe: since matter dilutes as space expands and the dark-energy floor does not, the fraction dark energy represents grows little by little —up to a ceiling fixed by the geometry of the crystal—. That is why we see it dominate today: not because it increases, but because everything else thins out.

- And at the largest scale of all, **the entire universe could breathe**: compress and expand again in cycles. Since the medium cannot be compressed to infinity —recall its ceiling—, a collapse does not end in a dead-end catastrophe, but bounces and gives rise to a new expansion. And that bounce is not a distant detail: in the proposal it is the moment when everything else is born. As it decompresses and cools, the Pleno "sets" —like water turning to ice, forming crystals—, and in that setting the different configurations separate out and become fixed: the matter we see, dark matter, the dark-energy background, and even the few kinds of fundamental particles that exist. The bounce is, so to speak, the forge where the world's inventory was cast.

All of this, it bears repeating, with *a single substance*. There is no ingredient for gravity, another for light, another for dark matter. There is the Pleno, and its different ways of tensing, spinning, undulating, and flowing.

9. How the Pleno closes the gulf between the large and the small

Recall the great problem we began with: the very large (gravity, the cosmos) and the very small (particles, the quantum) are described by two theories that do not fit, and no one has managed to unite them in a century. Now we can see why the Pleno's proposal offers such a different way out.

PIU-Ψ does not try to glue the two theories together: it starts from the premise that they were never two things. If everything —the large and the small— is the same Pleno, then gravity and the quantum are not two worlds to reconcile by force, but two behaviors of the same medium at different scales. At the small scale, the Pleno shows up as particles and quantum phenomena; at the large scale, as gravity and cosmology. There is no gulf to bridge, because beneath both lies the same substance.

And this explains, in passing, why PIU-Ψ sidesteps the jam of infinities that ruined all earlier attempts. That jam arises from treating gravity as a fundamental force and trying to "quantize" it. But in the Pleno gravity is not fundamental: it emerges from the medium at large scales, as we saw. There is no need to quantize it, just as we do not "quantize" the waves of the sea —we understand they are water—. And since the medium has a ceiling (it does not compress to infinity, that limit we asked you to remember), the infinities simply do not appear: the material itself sets the limit. That a single idea speaks naturally of both the cosmos and the atom does not solve the old problem at a stroke —work remains to be done—, but it does something more elegant: it dissolves it, showing that perhaps there were never two things to unite, but one seen from two distances.

10. Why this is science, and not a pretty tale

A beautiful story is not enough. What makes this a serious proposal and not an agreeable metaphor? That beneath every image in this document there is a formal research program, governed by the same demands as any professional physics. The Pleno is not described with words, but with **high-level mathematics**: it starts from precisely stated principles, derives its results the way one proves theorems, subjects every step to verification —even recomputing the numbers with independent tools— and disciplines every claim by its degree of certainty, without mixing the proven with the conjectured. That methodical honesty, that refusal to take anything for granted, is what distinguishes a scientific program from a good hunch. And with that apparatus, the theory does three things a mere speculation never could.

It reproduces laws we already know to be true. That long dozen of laws from the start are not guesses: the theory derives them —it does not adjust them, it derives them— from its single equation. And it is worth understanding what this means, because it is key: when PIU-Ψ reaches one of those laws, it is not proposing something new to check, but reaching by

another route a result already confirmed. And a validated law does not lose its validity for being reached from another starting point. This part of PIU-Ψ, therefore, rests on old, solid science, observed in thousands of experiments. **Its contribution is not to replace that science, but to integrate it**: to give laws that today live in separate books a single origin from which all of them follow.

It hits with a precision hard to attribute to chance. What PIU-Ψ computes matches observation by minuscule margins —the quantum constant to better than 0.1 %, gravity to three hundredths of one percent, the proportions of the cosmos within the satellites' margin of error— and, above all, *without free parameters*: no knobs to turn to make the accounts add up. The numbers are not forced to fit; they come out of the structure on their own, and they fit.

And it hits not once, but many times —and that changes everything. Reaching a known law from a new origin could be lucky chance. But PIU-Ψ reaches more than a dozen, toward phenomena with nothing to do with one another. Here the argument takes a leap: a key that opens one lock might have forced it by luck; but the same key that opens twenty different locks is no longer chance: the key is the right one. When a single idea reproduces the quantum world, the mass of the stars, electromagnetism, and the proportions of the cosmos, at some point it stops being reasonable to speak of coincidence or numerology. Scientists call this *unifying power*: the more unrelated phenomena fall under the same explanation, the harder it is to believe it is an accident. And it all rests on a telling fact: many of those numbers spring, inevitable, from the simple tetrahedral geometry of the crystal —the angle of the bonds, the number of neighbors—, not from a convenient adjustment.

And it is worth saying this with all clarity, without false modesty and without exaggeration: in PIU-Ψ there is not a single freehand claim. Each result —without a single exception— is developed with its explicit mathematics and carries, stated exactly, its degree of certainty: what is proven, what is a strong deduction, what is calibrated against a datum with its margin of error, and what is still a hypothesis to be closed.

The achievement, in numbers. From a single equation and six axioms, PIU-Ψ derives more than fifty results of physics —laws, constants, and predictions—, each with its status declared. Of these, **thirty-one fundamental quantities** —among them the gravitational constant G, Planck's quantum constant $\hbar$, the Chandrasekhar limit, the exact Heisenberg floor, and the proportions of dark matter and dark energy— are computed from first principles and verified numerically, with an **error below one part in a thousand** and without a single adjusted parameter. Where standard physics measures these constants and accepts them as data, here they come out computed from the structure of the medium.

That verification is not asked for on faith. The computer program that recomputes each of those quantities from its first-principles formulas —with no preloaded values— is available for download on the project's website, so anyone can run it and check the numbers for themselves. And behind every claim there is a complete formal development: a corpus of nearly four hundred pages where each derivation is done step by step, and a mathematical compendium of about ninety pages that condenses the proofs and verifications. The invitation, as always in this program, is to verify.

11. The language in which the universe operates

That last fact —that the numbers are not arbitrary but spring from geometry— has a deep consequence. Taken together, all the numbers the theory produces form a single pattern: geometric ratios born of the crystal's shape, combined by fixed rules. Put another way, the apparatus of the program contains a kind of "language" with which the Pleno generates its magnitudes: a grammar, with its elementary words and combination rules, from which the values of the theory follow.

This is deeper than it seems. In ordinary physics, the constants of nature are measured and accepted as they are, without knowing why they are worth what they are. The language of the Pleno changes that relationship: it lets one read why a number is what it is, and even anticipate the value of a magnitude from its place in the grammar, before computing it another way. A grammar does not only describe sentences already written: it lets one write new ones. It is the difference between memorizing a list of constants and understanding the rule that produces them —between reading the universe and understanding the language in which it is written—.

12. The cosmic clock: reading the hour of the universe

There is a number astronomy measures with care: the speed at which the universe expands, known as the Hubble constant. In ordinary physics it is, once again, a datum that is measured and accepted —one more number in the list of "it is so"—. The Pleno's proposal offers a different and beautiful way to understand what that number is.

The key is an idea we already saw: in the Pleno, time is the pulse of the medium, counted in tiny "ticks" —the smallest physics knows, the so-called Planck ticks—. The theory shows that the expansion speed of the universe is not a fundamental ingredient, but something the theory *computes*. PIU-Ψ gives a closed formula for that speed, with three pieces: the geometry of the Pleno, the rhythm of the Planck tick, and the state the medium is in today. The first two come entirely from the theory; the third is the reading of the cosmic clock at this moment. And when that formula is evaluated, it gives the number: about **67 kilometers per second per megaparsec** —exactly the value the satellites measure—. It is not an adjustment nor a datum put in by hand: it is the result of a calculation, and the calculation is right.

One nuance is worth stating, because it is subtle and beautiful. That number is not an eternal constant engraved in nature, but the reading of a clock at a given instant —the "hour" of the cosmos—. Asking "why is the expansion exactly that and not something else?" is like asking a clock "why is it 3 and not 5?": the clock's mechanism is the theory's business, and the theory has it; the particular hour depends on where the universe is along its path. The whole curve is theory; the point on the curve, today, is what the clock reads now. This —subtle as it seems— defuses one of the greatest scandals of modern physics. There is a number famous for its absurdity: the vacuum energy that quantum theory predicts exceeds the observed one by a factor of one followed by *a hundred and twenty zeros*. It has been called "the worst prediction in the history of physics." Under the Pleno's reading, that monster is tamed: it is not an impossible fine-tuning, but, once again, the age of the universe in ticks, squared. A gigantic number, yes, but for an understandable reason and not a miraculous coincidence.

And from here comes a strong claim about a puzzle that vexes astronomers. Measuring the expansion speed two ways —one looking at the young, distant universe, the other at the near, present one— yields different numbers: about 67 in the first case, about 73 in the second. They call this discrepancy "the Hubble tension," and in the usual model no one knows how to explain it. PIU-Ψ says two things. **First**: the true background value of the universe is the low one, those 67 the theory already computed and that match what the satellites measure; the high value, 73, is ruled out as a background value —not by preference, but by an impossibility of the medium, which relaxes toward its rest always in the same direction, without going backward or putting on bursts of speed, and a background that high would demand precisely what is forbidden—. To be clear and avoid confusion: the 67 is not in doubt; it is a real number, the one the Pleno computes and the one observation confirms. What PIU-Ψ calls into question is not that value, but *that the two measurements should be incompatible*.

Second, and here is the program's own twist: that incompatibility —the "tension"— is not a physical anomaly demanding new matter or forces, but an *artifact of the measurement method*. When a medium like the Pleno is analyzed with the standard model's template —a template

that is not its own—, the two ways of measuring seem to clash even though the background is a single one: the gap between 67 and 73 appears because of the mold through which the data are read, not because the universe hides two competing rates of expansion. Put another way: what is real is the 67; the "tension" is the mirage. From that comes a falsifiable prediction —among the most valuable things a theory can offer—: that discrepancy must *dissolve* when the expansion is measured with methods that do not presuppose the standard model, leaving a single coherent value. If instead the gap persists in those clean measures, the Pleno's reading would be in trouble. The same holds for the "changing" dark-energy signal that surveys like DESI begin to hint at: the program holds that it is the same kind of mirage —the reflection of forcing a constant dark energy into a mold that expects a variable one— and that it will vanish in measures that do not presuppose the result.

It is worth separating, in all this, what is already firm from the one thing that remains open. Several pieces are *settled* —derived or strongly deduced— at once: that H_0 is the hour on a clock and not an eternal constant; the reformulation of that "one followed by a hundred and twenty zeros" as the age of the universe in ticks squared; the exclusion of 73 as the background; and that the time-stretching of distant supernovae comes out exactly as it should, confirmed by the data. All of that is what the standard model *cannot* do, and the Pleno can. The only thing that remains *open* is a fine, bounded piece: the exact form of a small correction to the expansion curve in its most extreme stretch —a loose end of calculation, not a crack in the edifice—. The reading of the clock, with that well-delimited reservation, is one of the most distinctive results of the whole program.

13. How far we have come, and how far we can go

Let us close with the same frankness with which we opened, because honesty is part of the beauty of this.

PIU-Ψ is the work of an independent researcher, a program still under construction, not yet a consensus of the scientific community, and one that openly acknowledges its open pieces and its loose ends. But to stop there would be as unfair as to exaggerate: this is not a loose speculation, but a mathematical edifice that already reproduces confirmed laws and already gets it right, with very high precision and without adjustments, wherever it can be compared with reality.

It is worth distinguishing what is firm and what is staked on the future. What reproduces already-validated physics is waiting for nothing: those laws are already true, and that PIU-Ψ reaches them by a new route does not put them in doubt —that base is solid today—. What time and data will confirm or refute are its own predictions —the proportions of the cosmos; dark energy as a genuine constant, whose relative weight grows toward a ceiling fixed by the geometry; and the reading of the Hubble tension and the DESI signal as method artifacts that must dissolve in clean measures, something the instruments and surveys of the coming years will be able to test— and, above all, its integral vision: that all those scattered laws are, in reality, faces of a single substance. That is the great wager. If it proves right, we will have discovered that the entire universe is a single substance tensing and spinning, and that the laws we believed separate were always the same. If not, its new predictions will fail and we will know —but the laws it already reproduces will remain true, because their validity never depended on PIU-Ψ—. In any case, it poses one of those questions worth asking, one that invites us to look at the sky and at matter with different eyes: what if everything —truly everything— were the same?

All together: an idea worth pursuing

Let us step back and look at the whole path. We began from an uncomfortable fact: physics, for all its triumphs, is still a puzzle with pieces that do not fit —the very large and the very small described by theories that contradict each other, and nearly 95 % of the universe made of

something we know is there but do not understand—. These are real, acknowledged gaps that have resisted for decades. And against them, PIU-Ψ dares a different question: what if they were not many badly-fitting things, but a single thing badly understood?

That audacity, on its own, would prove nothing. What makes PIU-Ψ worth attention is how it pursues that question: not with a comfortable tale, but with mathematics that reproduce already-confirmed laws, with high precision and no hand-tuned numbers, and exposing itself to refutation by the observations to come. This is exactly how science has taken its greatest leaps: someone dares to suspect that separate phenomena are manifestations of something deeper, and then submits it to the implacable test of the data. Newton united the apple and the Moon; Maxwell united electricity and light; PIU-Ψ attempts to unite, no less, the quantum and the cosmic under a single substance —not repealing Newton, Maxwell, or Einstein, but showing that all of them were writing, without knowing it, chapters of the same book—.

It is no accident, then, the name the program bears: *Universal Integrity Principle*. Each word says something. It is a *Principle* because everything springs from a single root —an equation, a starting point— from which the rest is deduced, rather than a catalogue of loose rules. It speaks of *Integrity* in its double, most beautiful sense: that of unity —a whole universe, entire, not fragmented into pieces that do not talk to each other— and that of coherence —an edifice that does not contradict itself nor break into infinities—. And it is *Universal* because it reserves no corner: it aspires to embrace all that exists, from the tiniest particle to the entire cosmos, with a single explanation. The name, in short, is not a label: it is the very motivation of the program made word —the search for the whole unity of all there is—. And the symbol Ψ that appears beside its initials recalls where everything starts: the Pleno, written as the wavefunction of a universe that pulses, at bottom, like a single thing.

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