Gravitational Waves Are All You Need

A Causal Reversal of Gravity and Matter

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Claim

The cause and effect of gravity is actually the opposite of what we currently believe. Matter does **not** cause spacetime to curve — rather, the curvature of spacetime is what gives rise to matter.

Gravity → **Matter**, not Matter → Gravity.

(Here, I'm using "gravity" loosely. What I mean by it is spacetime curvature — but the dynamic kind. Think: gravitational waves.)

You might think that flipping causation doesn't change much — but you'd be surprised.

The Power of Reframing

Imagine the geocentric model of the cosmos back in the day. How did people calculate the orbits of planets then? It was tedious. Each planet had to be treated separately with complex epicycles. The whole system was bloated and over-complicated.

Now, imagine someone comes along and shifts the narrative: "The planets orbit the Sun."

Suddenly, everything simplifies. Each planet's motion follows a common rule, enabling more straightforward predictions and guiding further discoveries. This example suggests that adopting a simpler explanatory framework can bring us closer to fundamental truths.

The simpler the system of thinking, the closer it tends to be to the truth.

Let’s Build a Universe from Scratch

Since this is a bottom-up approach, we’ll start from nothing.

We have two choices:
• The universe behaves based on rules.
• Or it doesn’t.

If it doesn’t follow any rules, you might say, “With infinite time, randomness might produce something complex anyway — like a monkey on a typewriter eventually writing Nietzsche.”

But hold on — if there are no rules, then there’s no reason. And without reason, you can’t even reason about anything — not even that statement.

So let’s go with the first option: the universe behaves based on rules.

Rules Alone Are Not Enough

We know from from computational theory — Turing machines, and cellular automata — that the **specific** rules don’t necessarily matter — simple systems can create infinite complexity.

But there’s a catch.

Take Conway’s Game of Life. It’s Turing complete. It can create all kinds of complexity. But… it’s fragile. Most starting configurations fizzle out into noise or stillness. It doesn’t necessarily evolve.

So we need a system that not only follows rules, but also encourages persistent interaction.

Let’s Add Space

Let’s throw in something — call it **Space**.

This “space” is made of something unknown, but we know it can ripple and create waves. Let’s say those waves follow the same basic rules that observable waves follow today.

I don’t know how these waves were created in the first place. Nobody does — Not knowing how these waves are created is the same thing as saying “I do not know how the big bang happened” in the Standard Model. But we know they exist. So let’s continue.

Now here's the question: "Do we need anything else to recreate the universe as we know it?" Surprisingly, maybe not.

Matter and Mass: Stable Wave Structures

I propose that particles are stable wave patterns — like resonance inside a drum or a photon bouncing inside a mirrored box.

So instead of matter bending space… "**Matter is space — trapped in a certain vibration.**"

Quantitatively, the invariant mass (m) that emerges from such a system of confined waves can be understood through the relationship between the waves' internal momenta and the system's total momentum:

$$m = \frac{1}{v_{\text{wave}}} \sqrt{\left(\sum_i p_i\right)^2 - |\boldsymbol{P}|^2}$$

In this equation:

1. m represents the invariant mass of the composite system (the "particle").
2. p_i is the magnitude of the momentum of an individual constituent wave within the system.
3. $\sum_i p_i$ is the scalar sum of the magnitudes of these internal momenta.
4. $\boldsymbol{P}$ is the vector sum of the momenta of all constituent waves ($\boldsymbol{P} = \sum_i \boldsymbol{p}_i$), representing the total momentum of the system as a whole.
5. v_{wave} is the characteristic propagation speed of these fundamental waves (or spacetime fluctuations).

Notice that when the system is observed **at rest**, its total momentum $\boldsymbol{P}$ is zero. In this specific, simplified case, the invariant mass becomes:

$$m_{\text{rest}} = \frac{\sum_i p_i}{v_{\text{wave}}}$$

This form highlights a core idea of this framework: invariant mass arises directly from confined internal **movement**. The term $\sum_i p_i$ quantifies this total internal movement (sum of momentum magnitudes).

It's often said that substituting 'Energy' with '**Movement**' makes more physical intuition. In this view, the concept of 'Energy' itself is perhaps unnecessary or doesn't represent a fundamental physical quantity. Standard physics uses $m = \frac{E}{c^2}$, relating mass to Energy. However, this framework suggests it's more fundamental to see mass (m_{rest}) as directly proportional to the total internal **movement** ($\sum_i p_i$) scaled by the fundamental wave speed (v_{wave}). Mass is inertia, and inertia is resistance to changes in movement, so it arguably makes more sense that it originates from internal movement rather than an abstract concept called 'Energy'.

This form makes it easier to see the direct relationship between the internal "agitation" (represented by $\sum_i p_i$) and the resulting rest mass. It also provides a clear parallel to Einstein's $m = \frac{E}{c^2}$: in this framework, the sum of internal momentum magnitudes takes the place conceptually similar to internal energy (E), and v_{wave} is the relevant fundamental speed.

A key point here is the nature of v_{wave}. While current physics, particularly relativity, identifies the speed of light (c) as the maximum speed for energy/information transfer (and the speed of gravitational waves), this framework defines v_{wave} as the inherent speed of the waves constituting matter. If experiments confirm gravitational waves travel at c, then v_{wave} would equal c. However, the framework itself defines mass in terms of **whatever this fundamental wave speed is**, without **a priori** requiring it to be exactly c.

This model explains:
1. **Why mass distorts spacetime**: mass is simply spacetime structure itself.
2. **Why matter appears stable**: stable resonance patterns.

Matter Is an Ecosystem

Matter in this view is an ecosystem. It cannot exist in isolation; matter can't exist in a vacuum. It requires an environment — a wave ecosystem that sustains its structure. Just like humans need Earth's biosphere to survive, matter needs the right "wave biosphere" to exist. This perspective leads naturally to explanations of matter–antimatter asymmetry and dark matter.

Why Matter and Not Antimatter? Why Dark Matter?

If each particle depends on a very specific wave ecosystem, then it makes sense that only some types of particles are common in our region of space.

This also hints at what dark matter might be: “Matter with a different wave ecosystem — one that doesn’t interact electromagnetically with ours, but still curves space… so we notice its gravity.”

Radioactivity: Pressure from Frequency Mismatch

Let’s say a stable wave pattern (a “particle”) lives in harmony with its environment. But what if its internal frequency gets thrown out of sync?

Now the inner wave pushes harder than the environment can contain — just like a balloon losing air. The particle “leaks” energy, re-stabilizing itself by ejecting part of the wave. That’s radiation.

This model gives us a reason for radioactive decay: instability caused by mismatched wave frequencies in a confined system.

Addressing Objections: Michelson-Morley

The Michelson-Morley experiment aimed to detect a stationary “ether” — an invisible medium for light. It found none.

But general relativity already reinterprets space as dynamic — and does not require a preferred reference frame.

If light is a wave of space itself, the assumption of a static background was flawed from the start.

So no — Michelson-Morley does **not** disprove this theory. It never asked the right question.

Uses

Just like the shift from the geocentric to the heliocentric model opened the door to better predictions and discoveries, this model could do the same — but for physics.

If we understand how matter actually forms — not as a separate thing, but as a product of space itself — then we can start reverse-engineering the functionality of particles. Not just understanding the ones we know, but maybe even discovering new ones… or building them from scratch.

Same way you can't write good code unless you know how the CPU works — you can't fully unlock physics unless you understand what matter really is.

Future Directions

This framework, proposing matter arises from dynamic spacetime (Gravity $\rightarrow$ Matter) based on 'Movement' rather than 'Energy', requires significant further development. Key next steps include:

- Develop a rigorous mathematical formalism for the "Gravity $\rightarrow$ Matter" mechanism. This likely requires equations fundamentally different from the standard Einstein Field Equations (EFE), which describe the reverse causality (Matter $\rightarrow$ Gravity).
- Define a "Stress-Movement Tensor" ($T'_{\mu\nu}$) derived solely from momentum concepts (internal p_i, external $\boldsymbol{P}$, emergent m) within this framework, replacing the standard energy-reliant stress-energy tensor $T_{\mu\nu}$ as the source term in adapted gravitational equations.
- Clarify the role and value of the fundamental wave speed v_{wave} within adapted relativistic equations (both gravitational and quantum), and determine its relationship to c and other constants like G and potentially Λ'.
- Reformulate quantum dynamics based on 'Movement' principles, replacing the foundational role of 'Energy' (and the Hamiltonian) in governing time evolution, interactions, and quantization.
- Develop a quantum model where particles are represented as confined wave structures consistent with the emergent mass definition $m = \frac{1}{v_{\text{wave}}}\sqrt{\left(\sum_i p_i\right)^2 - |\boldsymbol{P}|^2}$. This model must explain quantized properties like spin and charge from the dynamics of these waves.

- Establish quantitative criteria for the stability of these wave structures and link their properties (e.g., resonance lifetimes) to observed particle characteristics.
- Identify unique, observable predictions or experimental signatures that could distinguish this framework from standard General Relativity and the Standard Model of particle physics.
- Investigate plausible mechanisms for the initial generation and conditions of the fundamental spacetime waves proposed by this model.

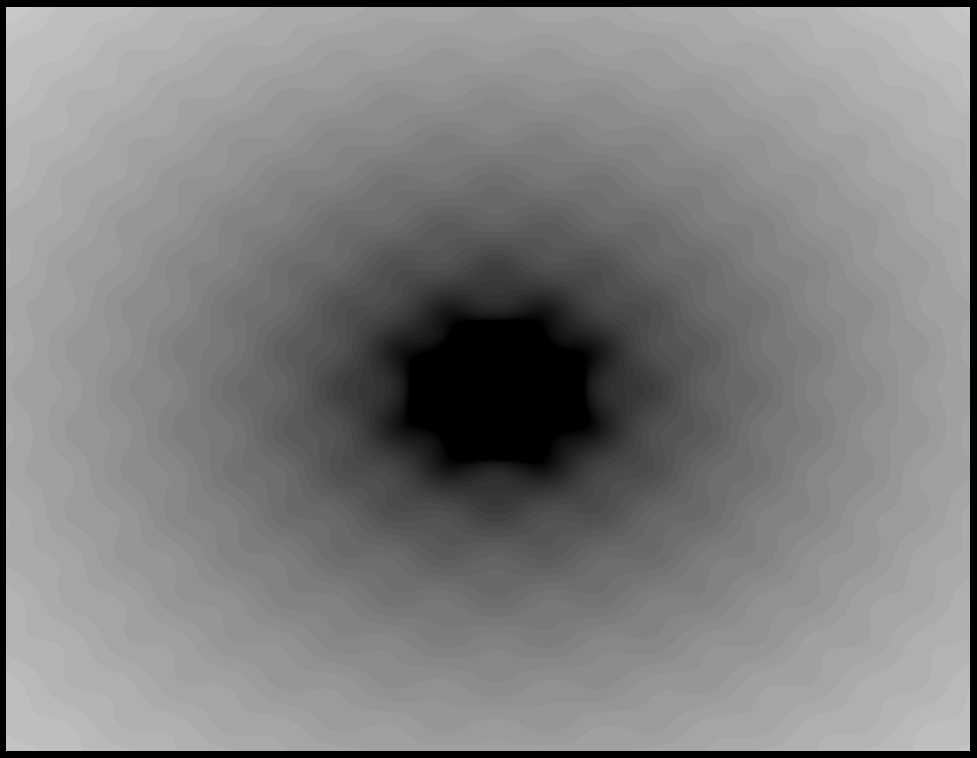

Figure 1: Particle illustration in 2D

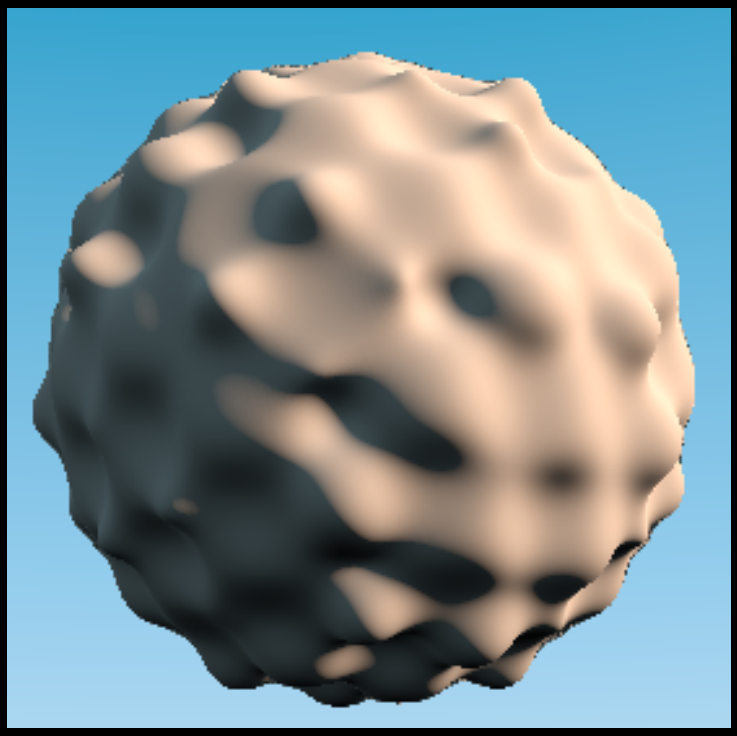

Figure 2: Particle illustration in 3D

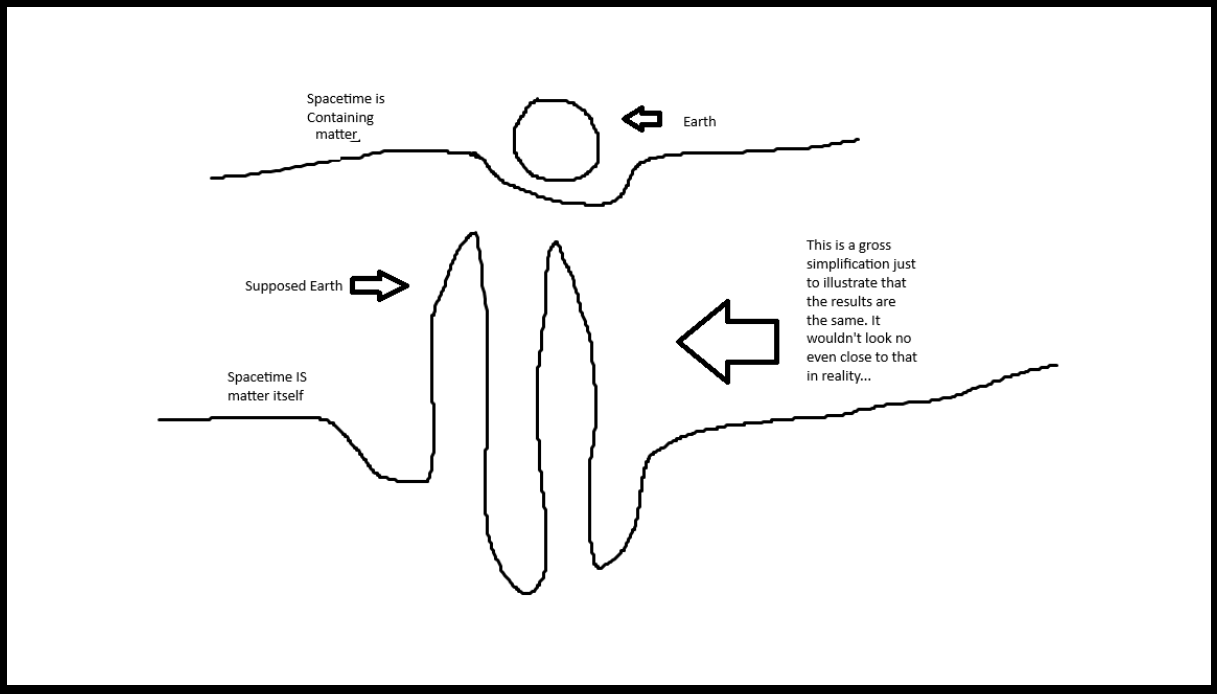

Figure 3: Ilustration on why matter and space being the same explains Earth’s gravity

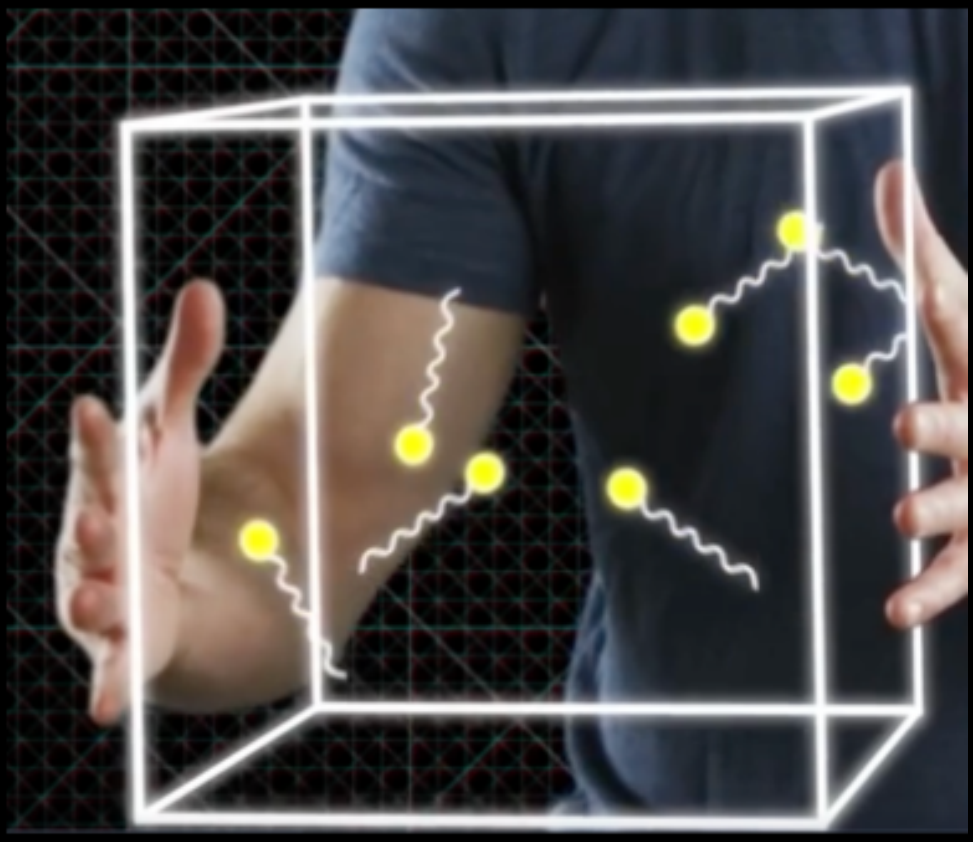

Figure 4: How you can create something massive out of something massless (PBS Spacetime: The True Nature of Matter and Mass)