So You Think You Know Gravity?

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The Knob That Doesn't Turn

We are all taught a polite lie about the universe. It goes like this: Physics is a set of laws, and those laws have constants—numbers like the speed of light (c) or the gravitational constant (G). We imagine these constants are like knobs on a mixing board. You could turn c up, and light would be faster. You could turn G down, and gravity would be weaker.

And naturally, you assume you could turn G to the *left*.

You assume you could make gravity repulsive. Why not? Electrons repel each other. Magnets push. Why couldn't mass push mass? You picture a universe where apples fall up, where planets scatter like frightened birds, where you need a roof to keep your furniture from floating into space. A weird universe, sure. But still a *universe*.

Here is the thing that turns my stomach, the thing that nobody—not even the best textbooks—will tell you explicitly:

There is no such universe.

If you flip that sign, you don't get a strange world. You get a mathematical corpse. You get a geometry that forbids the existence of anything—including the existence of *you* wondering about it.

The Silence of the Canon

I've looked. I've checked the bibles of general relativity—Wald, Misner-Thorne-Wheeler, Hawking & Ellis. They are thousands of pages of dense, beautiful mathematics. They derive black holes, gravitational waves, the expansion of the cosmos.

But do you know what they don't do? They never stop to say: "By the way, if you make gravity repulsive, this entire book catches fire."

They treat attractive gravity as an *observation*. A data point. "We see things fall, so G is positive." They act like it's a choice nature made, a coin flip that came up heads.

It wasn't a choice. It was a hostage situation.

The Newtonian Murder

You don't need Einstein to see the horror. Newton is enough.

In Newton's world, gravity is a potential well. A hole in the energy landscape that you can fall into and get stuck. That's what an orbit is: getting stuck in a hole ($E < 0$) but moving too fast to hit the bottom.

$$E = \frac{1}{2}mv^2 - \frac{GMm}{r}$$

The minus sign is the well. It makes bound states ($E < 0$) possible.

If you make gravity repulsive ($G \to -G$), the potential flips:

$$V(r) = +\frac{|G|Mm}{r}$$

There are no holes. There are only hills.

Everywhere is a hill.

Imagine trying to play golf on a course where every hole is inverted into a mound. The ball doesn't roll in; it rolls away. Always. Everywhere.

In a repulsive universe, there are no local minima. That means there are no stable orbits. No solar systems. No bound atoms. You can't just "have" a planet; the planet itself would explode because its own gravity is trying to tear it apart.

The universe becomes a *Universal Solvent*. It dissolves structure. It doesn't just push things apart; it forbids them from ever having been together.

The Raychaudhuri Filter

If you go deeper, to the real geometry of Einstein, it gets worse.

Einstein taught us that gravity isn't a force; it's curvature. But what *kind* of curvature?

There is an equation called the **Raychaudhuri equation**. It is the geometric instruction manual for how bundles of paths—"congruences"—behave in spacetime. It has a term for gravity.

$$\frac{d\theta}{d\tau} = -\frac{1}{3}\theta^2 - \sigma_{\mu\nu}\sigma^{\mu\nu} + \omega_{\mu\nu}\omega^{\mu\nu} - R_{\mu\nu}u^\mu u^\nu$$

Looking at the terms:

- $-\frac{1}{3}\theta^2$: Expansion always tries to slow itself down.
- $-\sigma^2$: Shear (distortion) always causes contraction.
- $-R_{\mu\nu}u^\mu u^\nu$: This is the gravity term.

When gravity is attractive ($G > 0$), this last term is negative. It says: *focus*. It says: *converge*. It tells worldlines to come together, to crisscross, to interact. It creates "caustics"—points where paths meet to form an image or a structure.

Focusing is the prerequisite for structure. You need focusing to form a star. You need focusing to form a lens that focuses light on your retina. You need focusing to have a past that influences a future.

If you flip the sign, the universe becomes a **Defocusing Engine**. The term becomes positive.

The geometry itself creates a kind of repulsive pressure that expands the space between all trajectories. It is an active destruction of history. Nothing can ever meet. Nothing can ever bind. The universe becomes a lonely, scattering shout into the void.

The Atomic Dissolution

"But surely," you say, "chemistry would still work! Atoms are held by electromagnetism, not gravity."

Are they?

We assume spacetime is a passive stage where atoms dance. But if spacetime is fundamentally defocusing, there is no "stage." The background metric is expanding everywhere, ripping apart the delicate quantum superpositions required for stable electron shells.

In a repulsive universe, the local inertial frames diverge. You cannot define a stable rest frame for a nucleus and an electron simultaneously for long enough to establish a ground state.

It's subtle, but fatal. Without the focusing property of the background geometry, the "binding energy" concept loses its footing. The Universal Solvent dissolves the atom, too.

The Thermodynamic Death

And then there is entropy. We need low-entropy states (clumps of energy like stars) to drive the universe. Life is just riding the flow from high concentration to low concentration.

In a repulsive universe, you cannot form the clumps.

Energy density wants to smoothe out. Gravity (attractive) fights this smoothing, pulling gas into stars, creating hot spots in a cold sky. That temperature difference (T_{star} vs T_{space}) is what powers everything—photosynthesis, solar panels, weather, you.

Repulsive gravity *helps* the smoothing. It accelerates the Heat Death. It creates a universe that starts at maximum entropy and stays there.

No gradients. No flow. No work. No life.

The Anthropic Hammer

This is why the textbooks are silent. The alternative is too terrifying to contemplate, so we just assume it away.

We think we observe attractive gravity because we are scientists doing an experiment. But that's backward.

We observe attractive gravity because **it is the only kind of gravity that allows observers to exist.**

To be an observer, you need a brain. A brain is a bound state of atoms. Use repulsive gravity, and your atoms fly apart before you can have a single thought.

To be an observer, you need a memory. Memory requires information storage. Information storage requires localized energy. Repulsive gravity forbids localization.

To be an observer, you need time. You need to persist from one moment to the next. In a defocusing spacetime, the very concept of a persistent "object" dissolves.

So, when you see that apple fall, don't think, "Oh, gravity is pulling it."

Think: "The geometry of the universe is frantically knitting itself together to allow me to see this moment."

The Inevitability

That knob on the wall? It's welded shut. Not by a welder, but by logic itself.

Nature didn't choose attractive gravity. Logic demanded it. Attractive gravity is the price of admission for existence. It is the structural spine that holds the very concept of "reality" upright.

Without it, you don't have a different physics. You have the total absence of physics.

And that, perhaps, is why we don't talk about it. It's not a law of nature. It's the precondition for having laws at all.