Conceptual Evolution of How We Understand Gravity

> ### *Background — Understanding the Question of SpacePressure*

The previous chapter, *Einstein–Newton: United At Last*, introduced a simple but important possibility:

Newton may have described the experienced effect of gravity as a force, while Einstein described the deeper geometric structure behind that effect as curved spacetime.

At first, those two descriptions appear fundamentally different.

Newton speaks of attraction between masses.

Einstein speaks of geometry, curvature, and the paths followed through spacetime.

But if both descriptions continue to work, perhaps the real question is not whether Newton or Einstein was right.

Perhaps the deeper question is:

What physical behaviour lies beneath the mathematics of gravity?

The possibility of uniting Newton's force with Einstein's curved spacetime becomes easier to consider when we recognise that our understanding of gravity has never remained fixed.

Gravity has repeatedly changed its conceptual form.

It began as an unexplained tendency for objects to fall. Newton transformed it into a universal mathematical force. Einstein then transformed it again, superseding the Newtonian picture of gravitational attraction with a deeper geometric description of spacetime, while recovering Newtonian gravity in the appropriate limit.

Each step preserved what had already been shown to work while introducing a deeper way of understanding it.

SpacePressure asks whether another such conceptual step may be possible — not by replacing General Relativity, but by considering whether spacetime curvature may possess an additional physical interpretation involving compression, stored stress, and pressure-like response.

> **That is where this next stage of the journey begins.**
>
> **This chapter, Conceptual Evolution of How We Understand Gravity, is intended as the first background introduction to the SpacePressure question.**

- ✔ It does not attempt to prove SpacePressure.
- ✔ It does not alter General Relativity.
- ✔ It does not introduce new equations.

Instead, it follows the conceptual pathway that leads from Newton’s force, to Einstein’s curved spacetime, and then to one further question:

If gravity changes distances within space, what is physically happening to space itself?

And, more specifically:

Could some of those changes be understood as space being compressed?

This page is therefore best viewed as an orientation chapter.
It prepares the reader for the chapters that follow by showing how the SpacePressure interpretation arises from questions already suggested by the accepted language of modern gravity.

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Orientation

For more than a century, gravity has been understood most successfully through Einstein's General Relativity.

In that theory, mass and energy shape the geometry of spacetime, and objects follow the paths that geometry creates.

This description has proved extraordinarily successful.
General Relativity remains the accepted scientific framework for gravity. It explains planetary motion, gravitational lensing, black holes, gravitational time dilation, and the propagation of gravitational waves.

SpacePressure does not challenge that achievement. Instead, it asks whether the behaviour already described by General Relativity may also allow a small additional physical interpretation.

The core question is:

When spacetime curvature changes distances, might part of that behaviour be understood as a pressure-like response of space itself?

This is not a proposed replacement for Einstein's theory.

It is a proposed way of interpreting what the theory may be physically telling us.

1. The Question That Led to SpacePressure

The idea behind SpacePressure began not with advanced mathematics, but with a simple question.

Gravity is often explained using a familiar image: a heavy object placed on a stretched rubber sheet. The sheet curves downward, and smaller objects move towards it along the resulting paths.

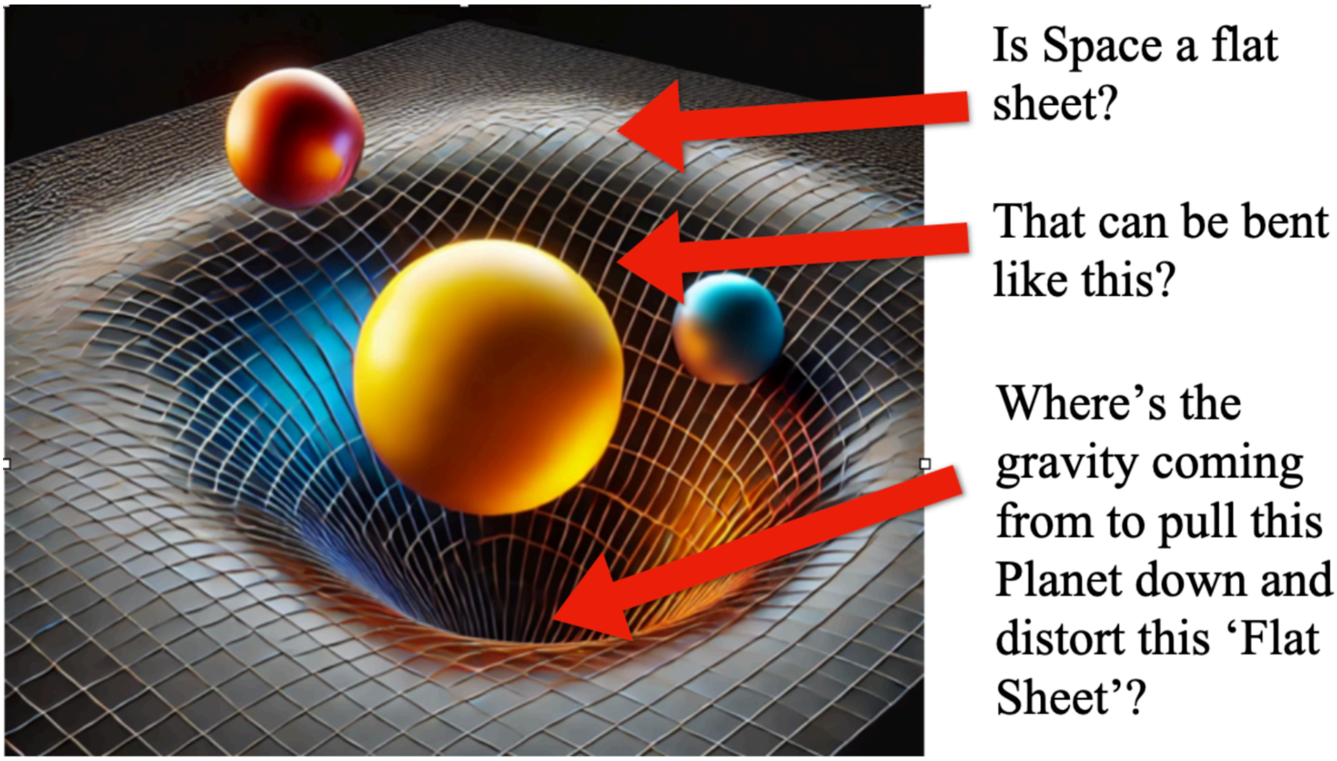
This analogy is useful. It helps us imagine how mass influences spacetime and how motion can follow curved geometry. But the analogy also raises a subtle question.

If space behaves like a stretched surface, what exactly is being stretched?

And, more importantly:

What is the physical nature of that response?

This question does not challenge General Relativity itself. The theory remains one of the most successful frameworks in science. The question arises from looking carefully at how gravity is commonly explained and visualised. If space can bend, curve, stretch, and transmit gravitational waves, it is natural to ask whether space may also undergo something resembling compression.



Why Compression Instead of Stretching?

To explore this possibility, consider a familiar physical system. Imagine a large block of soft foam rubber. When you press your hand into it, the foam compresses and forms a dent. The material is forced into a smaller volume as its internal structure is pushed closer together. When you remove your hand, the foam rebounds towards its original shape.

This illustrates an important physical principle:

> ***Compression produces a restoring response.***

The material resists deformation and tends to return towards equilibrium.

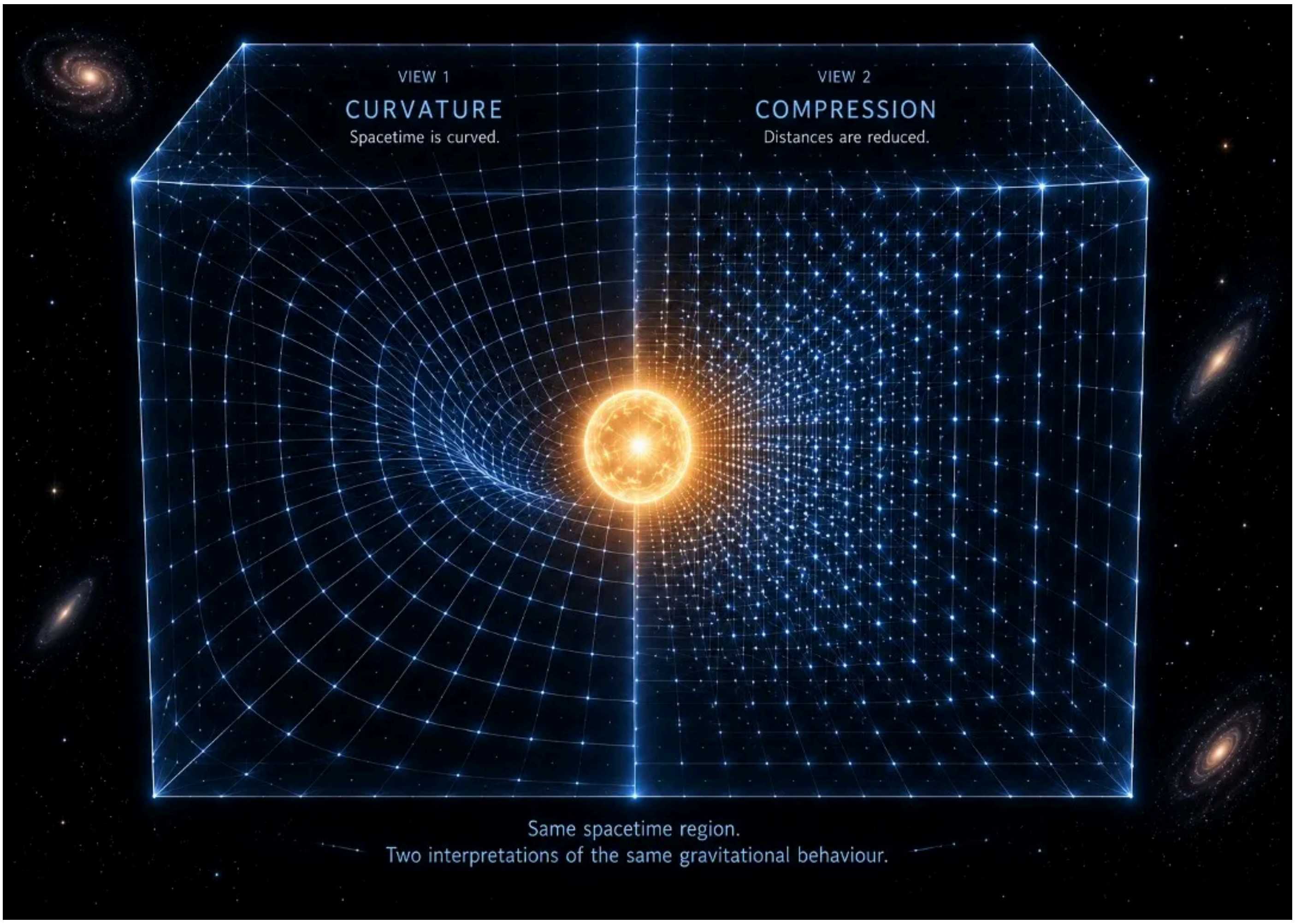
Now imagine a small balloon embedded within the foam. As the balloon expands, it compresses the surrounding material outwards in every direction. The foam resists that change, producing pressure as it attempts to restore balance.

This provides a useful analogy.
Instead of imagining a planet stretching space downward like a weight on a sheet, we might ask whether mass could compress the surrounding structure of space, producing a pressure-like response throughout the region.

This is only an analogy.
Space is not foam.
Spacetime is not known to be a mechanical material.

But the analogy helps introduce the central question:

> ***If mass changes the structure of space, could that change be interpreted as compression rather than only as curvature?***



A Different Way to Visualise Gravitational Behaviour

Traditional explanations of General Relativity often rely on the image of a curved surface. This is helpful, but it can also be misleading. It can make gravity look like motion into a depression. In reality, spacetime is not a two-dimensional sheet. It is dynamic, four-dimensional, and deeply connected to the behaviour of matter, energy, light, and time.

If space responds to mass by changing its geometry, then the behaviour we observe — including falling, orbiting, lensing, and tidal effects — may be understood in terms of how spacetime adjusts to the presence of mass and energy.

Within this context, compression becomes a possible conceptual tool.
It does not replace curvature.
It asks whether curvature may have a deeper physical interpretation.

From Question to Concept

From this perspective, gravity may be understood not only through geometry, but also through an added interpretive picture.

Gravity may reflect the way space responds to compression associated with mass and energy.

This line of thinking leads to the concept of SpacePressure.

SpacePressure is the idea that the gravitational behaviour already described by General Relativity may also be interpreted as a pressure-like response of space to compression.

> ***This interpretation does not replace General Relativity.***

The mathematical framework remains unchanged.

Instead, SpacePressure asks whether the behaviour described by Einstein's equations may also be understood through an additional physical perspective.

2. Is Space a Medium?

> ***Modern physics describes spacetime as more than a passive background.***

General Relativity treats spacetime as dynamic. It can curve, stretch, contract, and carry gravitational waves across vast distances. The direct detection of gravitational waves confirmed that spacetime can sustain propagating distortions.

In that limited sense, spacetime displays medium-like behaviour.

It is not empty nothingness.

It has measurable physical properties.

The detection of gravitational waves demonstrates that spacetime can support propagating disturbances, during which measured separations can:

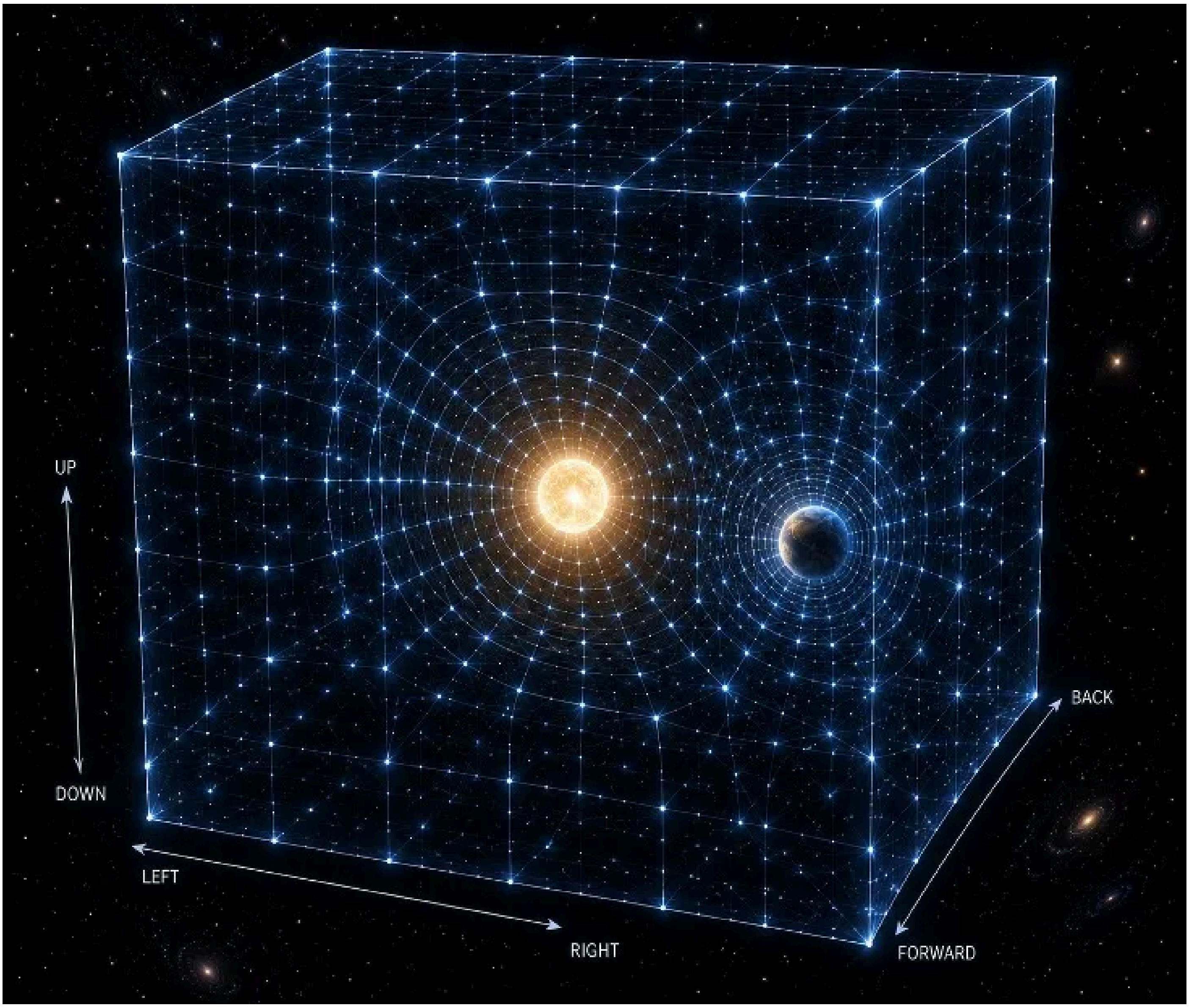
- increase;
- decrease;
- change directionally; and
- vary over time.

These behaviours suggest that space possesses physical qualities, even though it is not a substance in the traditional mechanical sense.
Albert Einstein himself made an important distinction. He rejected the old mechanical aether as a fixed substance through which light travelled, but he also recognised that spacetime is not simply nothing.

In modern physics, spacetime possesses structure, geometry, and physical influence.

This leads to an important conceptual position:

Space is not a classical medium like a fluid, gas, or material substance. But space is also not empty nothingness.



Instead, space exhibits certain medium-like behaviours without being a mechanical medium. This distinction is essential. The historical aether was imagined as a physical substance with motion, mechanical parts, and a preferred frame of reference. That model was discarded.

Modern spacetime is different.

It has no preferred frame. It is not known to be made of mechanical pieces. It does not behave like an ordinary material.

Yet it still influences how matter and radiation move.

This leads naturally to the next question:

If space can stretch and transmit waves, can it also compress?

SpacePressure arises as an interpretive response to this question.

It does not introduce a new substance.

It does not revive the mechanical aether.

It explores whether the already-established dynamical behaviour of spacetime may also be open to interpretation in terms of compression and pressure-like response.

3. Can Space Be Compressed?

> ***General Relativity describes gravity in a very specific way.***

Matter does not act through an invisible force pulling objects together across empty space. Instead, mass and energy change the geometry of spacetime, and objects follow the paths created by that geometry.

This geometric description has been extraordinarily successful.

Yet within this framework, a natural question arises:

> ***If gravity changes distances within space, could some of those changes also be understood as a form of spatial compression?***

One of the fundamental features of gravity is that nearby objects can move closer together even when no conventional force is acting directly between them.

This behaviour is described mathematically through geodesic deviation.
Geodesic deviation describes how neighbouring paths through spacetime can converge or diverge depending on curvature. When convergence occurs, separation decreases. In geometric terms, this is an effect of curvature.

In physical terms, the observable outcome is simple:

Distance is reduced.

This does not prove that space itself is compressed.
But it shows why the question may reasonably be asked.

If gravity causes neighbouring paths to converge, and if measurable separations decrease, then the language of compression becomes conceptually relevant.

Gravitational Waves: Stretching and Squeezing Space

Gravitational waves provide one of the clearest examples of changing distances within space.

As a gravitational wave passes, distances in one direction increase while distances in a perpendicular direction decrease. Half a cycle later, the pattern reverses. This behaviour has been directly measured as extremely small changes in distance caused by passing gravitational waves. Part of that cycle involves a temporary reduction in distance along one axis. That reduction resembles directional compression.

In standard physics, this is described geometrically. It is a change in the metric structure of spacetime. SpacePressure does not dispute that description.

It simply asks whether the same behaviour may also be interpreted physically as a compression-like response of space.

Gravitational Collapse

Gravity also shapes the large-scale structure of the universe.

Stars form when gas clouds collapse. Galaxies emerge as matter gathers into increasingly dense regions. Larger cosmic structures evolve through gravitational clustering. In each case, separations decrease over time. The accepted mathematical description remains geometric.

The observable outcome is consistent:
Matter converges, and distances between objects reduce relative to surrounding regions. Again, this does not require changing General Relativity.

But it strengthens the conceptual question:

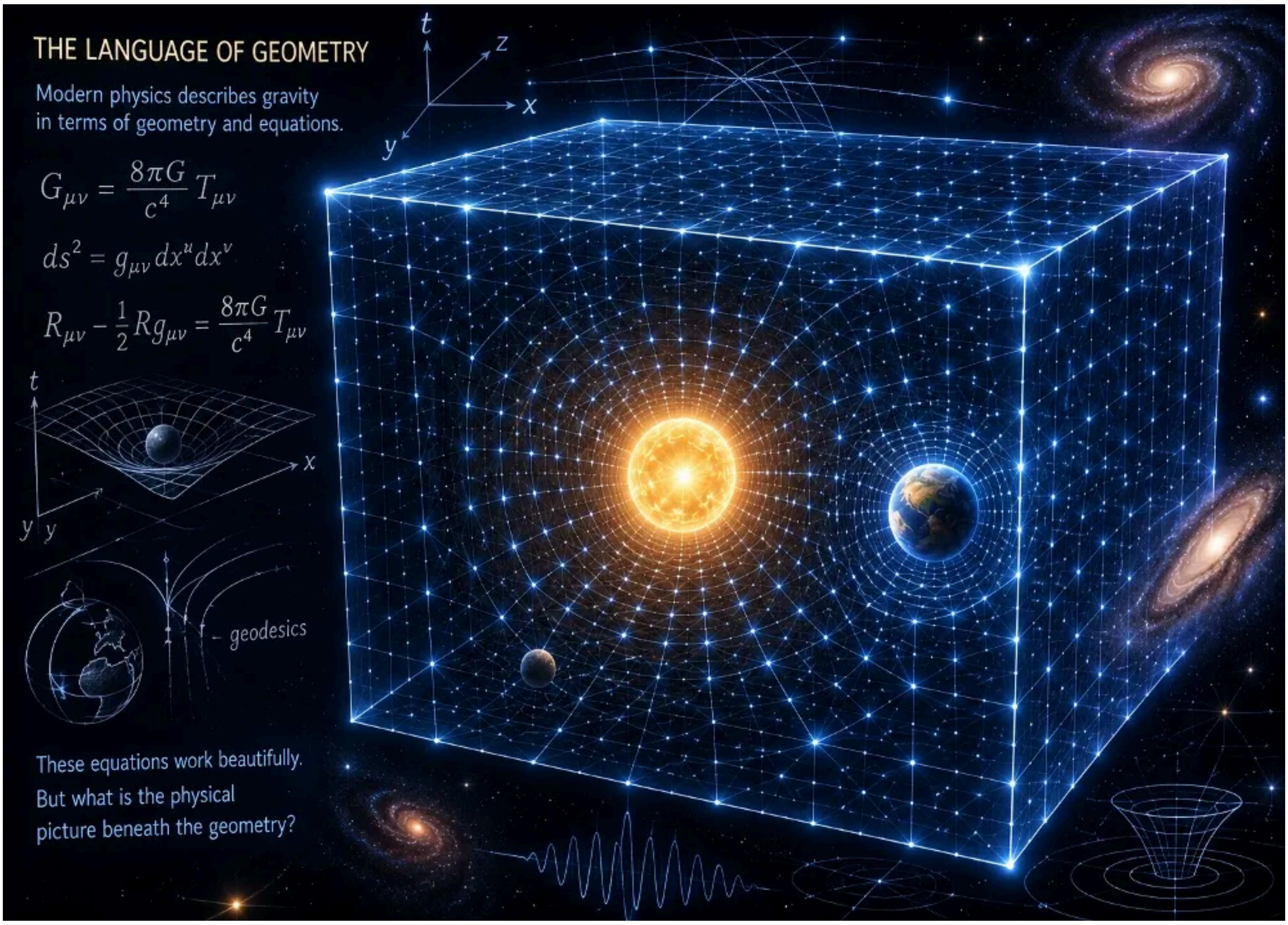
When gravity reduces separations, what physical interpretation should we place beneath that geometry?

A Matter of Interpretation

Physicists usually describe these effects using geometric language: curvature, metric change, geodesic behaviour, and spacetime structure. That language is correct. But the phenomena themselves involve measurable changes in distance, including reductions in separation.

This raises a reasonable interpretive question:
Could some gravitational effects be described, without changing the mathematics, as space undergoing directional compression in response to mass and energy?

That is the question SpacePressure explores.



4. Why Physicists Rarely Ask This Question

Since Einstein introduced General Relativity, gravity has been framed predominantly in geometric terms.

The mathematics describes how spacetime is structured, not what spacetime is made of. As a result, physicists naturally speak in terms of curvature rather than physical mechanisms such as compression, pressure, stored stress, or restoring response.

This is not a weakness in General Relativity.
It is a consequence of the language and purpose of the theory.

The familiar rubber-sheet analogy reinforces this habit. It is visually effective, but it emphasises bending rather than physical response. At the same time, many accepted relativistic phenomena already involve stretching, squeezing, changing separation, and the transmission of disturbances.

Gravitational waves, tidal effects, and geodesic deviation are examples.
These behaviours are fully accepted within General Relativity. But because the framework is geometric, alternative descriptive language is rarely required.

Physicists generally do not need to ask whether space is being compressed, because the mathematics works without requiring that interpretation.

SpacePressure begins precisely there.

It asks whether a physical interpretation can be placed beneath the mathematics without disturbing the mathematics itself.

5. Curvature and Compression

This leads to a natural distinction.
Curvature describes how spacetime is geometrically structured.

Compression describes what happens when distances or volumes decrease within a physical system. Both ideas concern changes in separation, but they are not automatically the same thing.

In gravitational environments, changes in separation are often directional. Space may stretch in one direction and contract in another. Paths may converge. Measured distances may reduce. Matter may gather into increasingly dense regions.

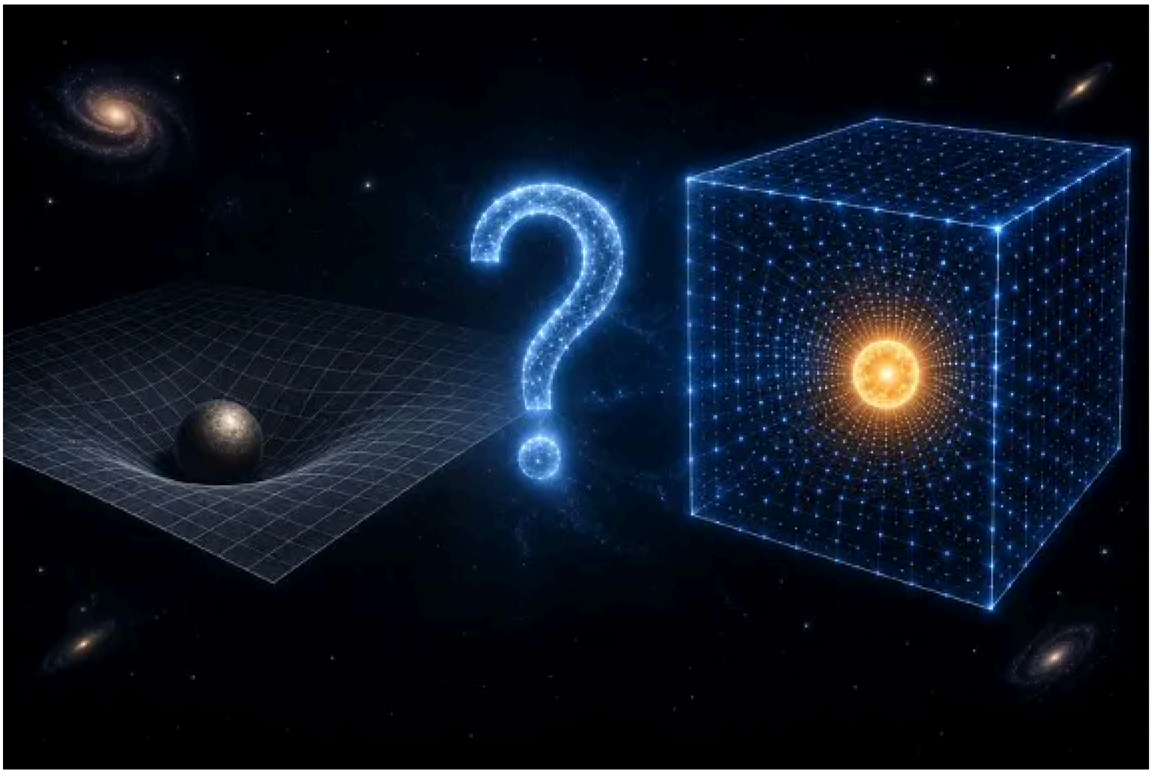
The accepted mathematical language is curvature. But some of the observable behaviour can resemble compression. This suggests that the difference may not necessarily concern the mathematical description. It may concern the physical interpretation placed beneath it.

SpacePressure does not claim that curvature is wrong.

It asks whether curvature may also be understood as the geometric expression of a deeper physical response.

In simple terms:

Einstein describes the geometry.
SpacePressure asks what that geometry may physically represent.



6. The Question That Follows

Across these sections, one observation remains consistent:
Gravity changes measured distances and the separation between paths through spacetime. When distances decrease and trajectories converge, the observable effect is a reduction in separation. In many familiar physical systems, such behaviour is associated with compression and response.

This does not replace the geometric framework of General Relativity.

But it raises a natural question:

What physical interpretation might be placed beneath these changes in distance?

If spacetime can stretch, contract, curve, and transmit waves, perhaps the behaviour we call gravity may also be understood as a pressure-like response of space to compression.

That possibility is the conceptual starting point of SpacePressure.

7. Conceptual Evolution

The progression can be summarised simply:

Newton described the effect.

Einstein described the geometry.

SpacePressure: gravity as geometry with a possible added physical interpretation

Or, in another form:

Force → Geometry → Physical Interpretation

What physical interpretation might be placed beneath these changes in distance?

Each step builds upon what came before.

Newton
Gave us the force law that allowed gravity to be calculated with extraordinary precision.

Einstein
Revealed that gravity is not adequately understood as a conventional force acting across space, but can instead be described as the geometry of spacetime.

SpacePressure
Asks whether Einstein's geometry may also carry a physical meaning beneath it: the possibility that mass compresses the surrounding structure of space, producing pressure-like gradients associated with gravitational behaviour.

This does not modify General Relativity.

- ✓ It does not alter the equations.
- ✓ It does not change the predictions.
- ✓ It asks whether the behaviour already described by those equations may allow an additional way of understanding gravity.

Closing Perspective

The discussion throughout this chapter has been guided by a single observation:

Gravity changes distances and separations within spacetime.

From that observation, a question follows:

Could some aspects of gravitational behaviour be understood as the response of space to compression?

Whether this added interpretation offers new physical insight, or ultimately proves to be only a more intuitive way of describing known behaviour, remains an open question.

But the conceptual pathway leading to it is clear:

From **Newton's** force…

to **Einstein's** geometry…

to the question of what spacetime curvature may physically mean.

That is the conceptual evolution this chapter is intended to introduce.

Closing Summary and Handover

The history of gravity shows that scientific progress does not always begin with new equations. Sometimes it begins with a new way of understanding equations that already work.

Newton did not cease to be useful when Einstein introduced General Relativity. Newton's description became part of a broader and deeper picture.

In the same way, a physical interpretation of spacetime curvature would not displace Einstein. It would attempt to reveal more clearly what Einstein's geometry may represent physically.

This is the conceptual opening in which SpacePressure sits.

It asks whether the curvature of spacetime may also be associated with the physical compression of space, and whether the resulting pressure-like gradients could provide an underlying picture connecting Einstein's geometry with the gravitational behaviour described by Newton.

But recognising that such an interpretation may be possible is only the beginning.
A scientific proposal must eventually move beyond imagery and analogy.
Its central ideas must be stated more precisely.

Its assumptions must be identified.
Its terms must be defined.
And its relationship to established mathematics must be made clear.

The next chapter therefore takes the first cautious step from conceptual possibility towards formal scientific definition.
It does not attempt to present a completed theory.
It asks a more immediate question:

❓

What would need to be defined, expressed, and eventually tested for SpacePressure to develop from an interpretive idea into a scientifically assessable proposal?

Continue the Journey: Starting the Formalising Process

Continue The Journey

The Book That Started the Journey

This journey began with the 2025 book One Small Change to Gravity – One Giant Leap for Science, the original published account of the SpacePressure idea: ***One Small Change to Gravity – One Giant Leap for Science.***

Purchase the Book


One Small Change to Gravity
One Giant Leap for Science
The claim in this book, that
Space does not merely Curve,
it is Compressed into a Curve
- Is not extreme -
What is Extraordinary is not the claim itself
but the implications that follow
- The Unification of Gravity -
There is only one Gravity
from the Cosmic to the Quantum
By Brian C Solomon