ED and Gravity Waves: Curvature Adjustment as Propagating ED-Flow Dynamics

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Abstract
In the ED ontology, gravitational waves are not ripples in spacetime and not disturbances traveling through a medium. They are **propagating adjustments in ED-curvature** — the universe rebalancing its event-density structure after a violent rearrangement of high-ED regions. Curvature is the geometry of ED-flow, and a gravitational wave is the ED field updating that geometry at the maximum rate allowed by local becoming. The quadrupole nature of gravitational radiation follows from ED-content and ED-momentum conservation: monopole and dipole oscillations are structurally impossible, making quadrupole curvature reconfiguration the first allowed propagating mode. Interaction with matter is geometric rather than dynamical; objects follow the updated ED-flow rather than experiencing a force. Gravitational-wave "energy" is the ED-cost of curvature reconfiguration, not a substance carried by the wave. Strong-field phenomena — ringdown, quasinormal modes, black-hole mergers — emerge as the natural oscillation modes of ED-curvature settling into stability. GR captures these behaviors as geometric equations; ED provides the underlying mechanism. Gravitational waves do not decohere because they have no internal channel to fragment. In ED, they are **geometry correcting itself**.

1. Standard GR Background
In general relativity, gravitational waves are described as ripples in spacetime curvature produced by accelerating masses. When two massive bodies orbit one another, their changing quadrupole moment perturbs the geometry of spacetime, and this perturbation propagates outward at the speed of light. These waves stretch and squeeze distances transversely as they pass, altering the separation between freely falling objects without exerting a force. LIGO and Virgo have observed these distortions directly, confirming the existence of gravitational radiation and validating GR's predictions with remarkable precision.

The mathematical structure is elegant: linearized Einstein equations reduce to a wave equation for small perturbations of the metric, and the quadrupole formula predicts the amplitude and energy flux of the radiation. Inspiraling black holes and neutron stars lose orbital energy as gravitational waves carry curvature away, causing the orbit to shrink and the frequency to rise until merger.

But the conceptual picture is less clear. Several questions remain unresolved:

What is "curvature" physically?

- GR treats curvature as a geometric property of spacetime, but it does not specify the underlying mechanism that gives rise to this geometry.

What exactly is propagating?

- A gravitational wave is said to be a ripple in spacetime itself, but the theory does not identify a physical substrate or field whose configuration is changing.

Why does curvature propagate at all?

- GR provides the equations of motion but not the physical reason why distortions in geometry should behave like waves.

Why only quadrupole radiation?

- The absence of monopole and dipole gravitational radiation follows from conservation laws in the formalism, but the deeper structural reason is left implicit.

What is the relationship between gravitational waves and energy?

- GR assigns energy flux to gravitational waves, yet the localization of gravitational energy is notoriously ambiguous.

General relativity predicts gravitational waves with extraordinary accuracy, but it does so by treating geometry as fundamental and unanalyzed. The theory describes how curvature behaves, not what curvature *is*. As a result, gravitational waves appear as ripples in an undefined medium — a mathematically precise but ontologically opaque phenomenon.

In the ED ontology, curvature is not a property of spacetime. It is the geometry of **ED-flow**, and gravitational waves are **propagating adjustments in that flow**. They are not ripples in space but the universe rebalancing its event-density structure after a violent rearrangement of high-ED regions.

2. ED Ontology: The Relevant Components

Gravitational waves in ED do not require a new field, a new substance, or a new mechanism. They arise directly from the same structural elements that govern curvature, forces, and the geometry of becoming. Only a few components are needed, and each plays a precise, indispensable role.

(1) ED as the Activity Field Underlying Geometry

In ED, spacetime geometry is not fundamental. It is the macroscopic expression of the **ED-flow field** — the distribution and evolution of event density. Curvature is not a property of space; it is the geometry of how ED flows. When ED-gradients change, geometry changes. When ED-gradients propagate, curvature propagates.

GR describes the geometry.
ED provides the mechanism.

(2) ED-Gradients as the Source of Curvature

Curvature arises wherever ED-gradients are uneven. High-ED regions create steep gradients; low-ED regions create shallow ones. The geometry we call "gravity" is the way ED-flow organizes itself around these gradients. A gravitational wave is therefore not a ripple in spacetime but a **propagating adjustment in ED-gradients** after a violent rearrangement of high-ED structure.

(3) Local Becoming Sets the Propagation Speed

The ED field does not update instantaneously. Its evolution is constrained by the local rate of becoming — the same structural limit that produces the speed-c constraint for all interactions. When ED-gradients change, the adjustment propagates outward at the maximum rate allowed by local becoming. GR encodes this as "gravitational waves travel at c." ED explains why.

(4) High-ED Regions Are Stiff Curvature Sources

Massive, compact objects — neutron stars, black holes — correspond to regions where ED is extremely dense and tightly organized. Their ED-gradients are steep and stiff. When such regions accelerate or merge, they cannot

instantly reconfigure their ED-structure. The mismatch between the old and new ED-geometry launches a propagating adjustment: a gravitational wave.

(5) ED-Flow Seeks Smoothness
The ED field has a natural tendency toward smooth, stable configurations. Sharp distortions in ED-gradients are energetically costly and dynamically unstable. When a system violently rearranges its ED-structure, the resulting curvature imbalance must be exported. The universe smooths itself by sending out propagating ED-adjustments — the phenomenon GR calls gravitational radiation.
These components are sufficient to reinterpret gravitational waves as **propagating curvature adjustments in the ED field**. Their speed, polarization, and quadrupole nature all follow from the structure of ED-gradients and the dynamics of becoming.

3. Gravity Waves as ED-Curvature Adjustments

In the ED ontology, a gravitational wave is not a ripple *in* spacetime. It is a **propagating adjustment in the ED-gradient field** — the universe rebalancing its curvature after a violent rearrangement of high-ED structure. When massive, compact systems accelerate or merge, their ED-gradients cannot instantly settle into the new configuration. The mismatch between the old curvature and the new one launches a traveling correction: a wave of ED-flow smoothing itself across the surrounding region.

3.1 Not Ripples in Space

General relativity describes gravitational waves as oscillations of the metric. ED reframes this: the metric is the macroscopic shadow of ED-flow geometry. What oscillates is not space but the **pattern of ED-gradients** that defines how distances and trajectories are realized. A gravitational wave is the ED field updating its curvature structure as quickly as the local rate of becoming allows.

Space does not ripple.
The **rules that define space** adjust.

3.2 Curvature as ED-Flow Geometry

Curvature in ED is the geometry of how event density flows around high-ED regions. When two massive bodies orbit one another, their ED-gradients twist and shear the surrounding field. As the configuration changes, the ED-flow must reorganize. But ED-flow cannot update everywhere at once. The reorganization propagates outward as a wave — a moving front of curvature adjustment.

This is why gravitational waves stretch and squeeze distances.
They are not pushing matter.
They are **redefining the geometry that matter follows**.

3.3 Why They Travel at c

The propagation speed of a gravitational wave is not an arbitrary constant. It is set by the **local rate of becoming** — the maximum rate at which ED-flow can update its structure. This is the same structural limit that governs the propagation of all ED-mediated interactions. GR encodes this as “gravitational waves travel at the speed of light.” ED explains why: the ED field cannot reorganize faster than the universe can instantiate new events.

The wavefront is the boundary between the old curvature and the new one.
Its speed is the speed of becoming.

4. Why Only Quadrupole Radiation

In general relativity, gravitational waves arise only from changes in a system's **quadrupole moment**. Monopole and dipole radiation are forbidden. The formalism explains this through conservation laws, but it does not explain *why* the underlying geometry behaves this way. In ED, the quadrupole nature of gravitational radiation follows directly from the structure of the ED-gradient field and the constraints on how curvature can change.

A gravitational wave is a **propagating adjustment in ED-curvature**. For such an adjustment to exist, the ED-gradient field must be reconfigured in a way that can propagate outward without violating the fundamental conservation of ED-content and ED-momentum.

4.1 Monopole Radiation Is Impossible

A monopole gravitational wave would require the total ED-content of a region to oscillate. But ED-content is conserved: the universe cannot create or destroy event density. A monopole oscillation would imply the ED field "breathing" in and out — a global expansion and contraction of ED-content. Such a configuration cannot exist because it would violate the structural conservation of ED itself.

Monopole radiation is forbidden because **ED-content cannot oscillate**.

4.2 Dipole Radiation Is Also Impossible

A dipole gravitational wave would require the center of ED-momentum to oscillate. But ED-momentum is conserved: the ED-flow cannot spontaneously shift its global center. A dipole oscillation would imply that the entire ED-gradient field is being dragged back and forth without an external cause. This is structurally impossible. The ED field cannot "shake" itself.

Dipole radiation is forbidden because **ED-momentum cannot oscillate**.

4.3 Quadrupole Radiation Is the First Allowed Mode

The quadrupole moment is the first configuration of ED-gradients that can change without violating conservation laws. It represents a **redistribution** of ED-curvature rather than a creation, destruction, or translation of it. When two massive bodies orbit one another, their ED-gradients twist and shear the surrounding field in a way that preserves ED-content and ED-momentum but still produces a propagating curvature imbalance.

Quadrupole radiation is therefore not a special feature of GR.
It is the **first structurally allowed mode** of ED-curvature reconfiguration.

4.4 GR's Quadrupole Formula as a Shadow of ED Geometry

General relativity encodes the quadrupole nature of gravitational waves in the linearized Einstein equations. ED explains why the mathematics takes this form: the quadrupole is the lowest-order ED-gradient pattern that can propagate without violating the structural constraints of the ED field.

The GR formula is the macroscopic shadow of a deeper ED truth:
only quadrupole curvature adjustments can travel.

5. How Gravity Waves Interact with Matter

In the ED ontology, a gravitational wave does not push, pull, shake, or accelerate objects. It does not act *on* matter

at all. Instead, it updates the **ED-gradient geometry** that defines how matter moves. Objects respond passively because their trajectories are determined by the ED-flow they inhabit. When a gravitational wave passes through a region, the ED-gradients that define distances and geodesics are temporarily reconfigured. Matter simply follows the updated flow.

The interaction is therefore not dynamical.
It is **geometric**.

5.1 No Force, No Medium, No Displacement

In GR, gravitational waves are often described as "stretching and squeezing space." ED reframes this: the wave is a **propagating correction to ED-curvature**, and the apparent stretching is the local expression of that correction. Objects do not move because something pushes them. They move because the ED-geometry that defines their separation has changed.

A gravitational wave does not act on matter.
It **redefines the distances matter already follows**.

5.2 Matter Follows the Updated ED-Flow

Every object, from a test mass to a black hole, follows the ED-flow determined by local gradients. When a gravitational wave passes, the ED-flow is momentarily reshaped. The object's worldline adjusts automatically because the geometry that defines it has changed. This is why LIGO's mirrors move relative to one another: not because they are shaken, but because the ED-geometry between them has been re-written.

The mirrors do not respond to the wave.
They respond to the **new geometry** the wave leaves behind.

5.3 The Stretch/Squeeze Pattern as Curvature Rebalancing

The characteristic transverse pattern of gravitational waves — one axis stretched while the perpendicular axis is squeezed — is the signature of a **quadrupole ED-adjustment** passing through a region. The ED-gradients that define distances along one axis are temporarily relaxed, while those along the perpendicular axis are tightened. As the wave passes, the pattern reverses, reflecting the oscillatory nature of the curvature correction.

Nothing is being stretched.
Nothing is being squeezed.
The **rules that define stretching and squeezing** are oscillating.

5.4 No Medium Required

Because ED-geometry is the substrate of spacetime, gravitational waves do not propagate *through* a medium. They propagate *as* the medium updating itself. There is no ether, no fabric, no substance that ripples. The ED field is not embedded in anything. It is the structure that everything else is embedded in.

A gravitational wave is the ED field correcting itself.
Matter simply follows the corrected field.

6. Gravity Waves and Energy

In general relativity, gravitational waves are said to "carry energy away" from a system. Inspiraling binaries lose

orbital energy as the wave propagates outward. But GR also teaches that gravitational energy cannot be localized, that it has no stress–energy tensor, and that its definition depends on coordinate choices. The mathematics works, but the ontology is opaque.

In ED, the picture becomes simple and inevitable.
A gravitational wave does not *carry* energy.
It **represents the ED-cost of reconfiguring curvature**.

6.1 Energy Is the Cost of ED-Reconfiguration

Energy in ED is not a substance. It is the **amount of ED-flow required to reorganize a system's gradient structure**. When two massive bodies accelerate or merge, their ED-gradients must be updated. This reconfiguration has a cost: the ED field must redistribute curvature in a way that preserves global ED-content and ED-momentum.

The "energy" of a gravitational wave is the **accounting of this redistribution**.

Nothing is transported.
Something is **rebalanced**.

6.2 Waves Export Curvature Imbalance

When a system violently rearranges its ED-structure, the surrounding ED-gradients become inconsistent with the new configuration. The universe cannot tolerate this mismatch. The ED field must smooth the inconsistency by exporting the curvature imbalance outward. The propagating adjustment — the gravitational wave — is the mechanism by which the ED field restores global coherence.

The inspiral loses orbital energy because the ED field is **paying the cost** of smoothing curvature.

6.3 No Localizable Energy Density

In GR, gravitational energy cannot be localized because the metric is not a physical field — it is the geometry of spacetime itself. ED makes this inevitable: the ED field is not embedded in anything. It is the substrate. A gravitational wave is not a thing in space; it is **space's update rule propagating**. There is no location where "the energy is stored" because the energy is not a substance. It is the **global cost of curvature correction**.

This is why GR's pseudotensors are coordinate-dependent.
They are bookkeeping devices, not physical densities.

6.4 Inspiral Energy Loss as ED-Flow Smoothing

As a binary system spirals inward, its ED-gradients become increasingly dynamic. The ED field must constantly reconfigure to keep up. The inspiral accelerates because the ED field is exporting curvature imbalance faster and faster. The system is not radiating energy into space. It is **shedding curvature debt** into the surrounding ED-flow.

The wave is the universe settling its geometric accounts.

7. Gravity Waves in Strong-Field Regimes

In the ED ontology, strong-field gravitational waves are not a different phenomenon from weak-field waves. They are the same structural process — **ED-curvature rebalancing itself** — expressed in a regime where ED-gradients

are extremely steep and tightly constrained. Near black holes and neutron stars, the ED field is dense, rigid, and highly structured. When such regions are violently disturbed, the resulting curvature mismatch is enormous, and the ED field must settle into a new configuration through a sequence of natural oscillation modes.

These modes are what GR calls **quasinormal modes**.
In ED, they are the **ringing frequencies of curvature itself**.

7.1 Steep ED-Gradients and Curvature Rigidity
A black hole corresponds to a region where ED is maximally concentrated and the surrounding ED-gradients are extremely steep. This steepness makes the curvature rigid: small disturbances cannot be absorbed locally. When the system is perturbed — by merger, collapse, or violent acceleration — the ED field cannot instantly settle into the new configuration. The mismatch between the old and new ED-geometry launches a strong-field curvature adjustment.

The ED field rings because it cannot relax all at once.
It must shed curvature in discrete, stable modes.

7.2 Ringdown as ED-Curvature Settling
After a merger, the newly formed black hole is not immediately stable. Its ED-gradients are distorted, twisted, and out of equilibrium. The ED field must smooth these distortions, and it does so by emitting a sequence of damped curvature adjustments. Each mode represents a particular way the ED-geometry can relax while preserving ED-content and ED-momentum.

GR describes this as ringdown.
ED describes it as **curvature settling into its minimal ED-configuration**.

7.3 Quasinormal Modes as Natural ED Oscillations
Quasinormal modes are not arbitrary. They are the **allowed oscillation patterns** of ED-curvature around a compact, high-ED region. Each mode corresponds to a specific way the ED field can redistribute curvature without violating its structural constraints. The frequencies and damping times predicted by GR emerge naturally from the ED-geometry of the system.

In ED, quasinormal modes are not properties of spacetime.
They are the **eigenmodes of ED-curvature**.

7.4 Nonlinearity as ED-Gradient Saturation
Strong-field gravitational waves are highly nonlinear because the ED-gradients near compact objects are saturated. Small changes in ED-structure produce large changes in curvature. The ED field cannot respond linearly because the underlying geometry is already near its structural limits. This is why black-hole mergers produce waveforms with sharp transitions, amplitude growth, and rapid frequency evolution.

Nonlinearity is not a complication.
It is the signature of **ED-gradients operating at full capacity**.

7.5 ED–GR Agreement in the Strong-Field Limit
General relativity predicts the ringdown spectrum with extraordinary accuracy. ED does not alter these predictions. Instead, it **explains** them. GR's quasinormal modes are the macroscopic shadow of ED-curvature

oscillations. The agreement is not a coincidence. It is the natural consequence of GR capturing the geometric limit of ED-flow in a regime where the ED field is tightly constrained.

GR describes the ringing.
ED explains why the universe rings at those frequencies.

8. Gravity Waves and the ED–GR Bridge

General relativity describes gravitational waves with extraordinary precision. It predicts their speed, their polarization, their quadrupole nature, and their waveform structure. But GR does so by treating geometry as fundamental and unanalyzed. It tells us how curvature behaves, not what curvature is. ED completes the picture by providing the underlying mechanism: curvature is the geometry of ED-flow, and gravitational waves are propagating adjustments in that flow.

GR is the macroscopic geometry.
ED is the microscopic ontology.

8.1 GR as the Geometric Limit of ED-Flow

When ED-gradients are smooth and slowly varying, their evolution can be captured by a geometric description. In this limit, the ED field behaves like a differentiable manifold with a metric that encodes the local structure of ED-flow. The Einstein equations emerge as the macroscopic constraints on how ED-curvature must behave to preserve ED-content and ED-momentum.

GR is not replaced.
It is derived as the large-scale, smoothed-out limit of ED dynamics.

8.2 Linearized GR as Small ED-Curvature Perturbations

In weak-field regimes, ED-curvature adjustments are small. The ED field is nearly uniform, and the curvature mismatch produced by accelerating masses is slight. In this regime, the ED-flow equations linearize, and the resulting curvature adjustments propagate as waves. GR captures this perfectly with its linearized metric perturbations.

The wave equation of GR is the shadow of ED-flow smoothing itself.

8.3 Nonlinear GR as Large ED-Gradient Reconfiguration

In strong-field regimes — near black holes, neutron stars, or violent mergers — ED-gradients are steep and saturated. The ED field cannot respond linearly because the underlying geometry is already near its structural limits. GR's nonlinear wave behavior emerges naturally from the ED requirement that curvature adjustments must preserve ED-content and ED-momentum even when gradients are extreme.

Nonlinearity is not a complication.
It is the signature of ED-curvature operating at full capacity.

8.4 Why GR Has No Mechanism

GR does not specify what curvature is made of because it treats geometry as primitive. It does not explain why curvature propagates, why it propagates at c, or why only quadrupole radiation is allowed. These features are built into the equations but not explained by them.

ED provides the missing mechanism:

Curvature is the geometry of ED-flow.

Propagation speed is set by the local rate of becoming.

Quadrupole radiation is the first ED-gradient pattern compatible with conservation.

Ringdown modes are the natural oscillations of ED-curvature settling.

GR describes the behavior.
ED explains the behavior.

8.5 Why the Two Theories Agree So Precisely

The agreement between ED and GR is not a coincidence. GR captures the geometry of ED-flow in the limit where ED-gradients are smooth enough to be treated as a differentiable manifold. In this regime, ED and GR must agree because they are describing the same structure at different levels of abstraction.

GR is the large-scale map.
ED is the terrain.

9. Why Gravity Waves Don't Decohere

In quantum systems, decoherence occurs when a fragile, low-channel identity interacts with a high-channel environment. The system's internal ED-structure fragments, proliferates, and becomes entangled with countless external degrees of freedom. The result is classical behavior emerging from the loss of coherent participation pathways.

Gravitational waves do not behave this way.
They do not decohere because they cannot decohere.

A gravitational wave is not a quantum object.
It is a global ED-curvature adjustment — a macroscopic, high-channel reconfiguration of the ED field itself. There is no internal identity to fragment, no participation rule to collapse, no channel to proliferate. A gravitational wave is the ED field updating its geometry. It is already classical because it is already structural.

9.1 No Internal channel

A gravitational wave has no internal ED-structure. It is not a particle, not a field excitation, not a localized object. It is a pattern in ED-flow, a propagating correction to curvature. Decoherence requires internal degrees of freedom that can become entangled with the environment. A gravitational wave has none. It is pure geometry.

There is nothing inside it that can decohere.
There is only the ED field adjusting itself.

9.2 No Environment to Entangle With

Decoherence occurs when a system interacts with an environment that has many degrees of freedom. But a

gravitational wave is the environment. It is the ED-geometry that everything else inhabits. It cannot entangle with the environment because it is the structure that defines what "environment" means.

A gravitational wave cannot lose coherence because it has no external system to lose it to.

9.3 Global Adjustments Cannot Fragment

A gravitational wave is a global ED-flow correction. It is not a local excitation that can split into branches. The ED field updates everywhere the wavefront passes, and the update is unified. Fragmentation is impossible because the ED-flow is a single, continuous structure. The wave is not a thing moving through space; it is the propagation of a global geometric update.

Decoherence requires fragmentation.
ED-curvature adjustments cannot fragment.

9.4 Why Gravitational Waves Remain Clean Over Cosmic Distances

Gravitational waves travel across billions of light-years with almost no distortion. They do not scatter, disperse, or decohere. In ED, this is inevitable: the wave is not a signal traveling through a medium. It is the medium updating itself. There is no noise to accumulate, no environment to disrupt it, no internal structure to degrade.

A gravitational wave is as clean after a billion years as it was at emission because it is the same ED-geometry continuing to update.

9.5 GR's "Classicality" Is ED's Structural Simplicity

General relativity treats gravitational waves as classical because the theory has no quantum degrees of freedom for geometry. ED explains why this works so well: gravitational waves are classical because they are too simple to be quantum. They have no channel, no identity, no internal structure. They are the universe correcting its curvature, not a system evolving within it.

Gravitational waves do not decohere because they are not quantum objects.
They are geometry correcting itself.

10. Summary

In the ED ontology, gravitational waves are not ripples in spacetime and not disturbances traveling through a medium. They are propagating adjustments in ED-curvature — the universe rebalancing its event-density structure after a violent rearrangement of high-ED regions. Curvature is the geometry of ED-flow, and a gravitational wave is the ED field updating that geometry at the maximum rate allowed by local becoming.

Their quadrupole nature follows immediately: monopole and dipole oscillations would require oscillations of ED-content or ED-momentum, both of which are structurally impossible. Quadrupole curvature reconfiguration is the first pattern compatible with ED conservation, and therefore the first pattern that can propagate. Their interaction with matter is geometric rather than dynamical: objects do not feel a force; they follow the updated ED-flow that defines their separation. The familiar stretch-and-squeeze pattern is the local expression of a passing curvature correction.

Gravitational-wave "energy" is not a substance carried by the wave. It is the ED-cost of reconfiguring curvature, the accounting of how much ED-flow must be redistributed to restore global coherence. Inspiraling binaries lose

orbital energy because the ED field is exporting curvature imbalance into the surrounding geometry. Strong-field waves — ringdown, quasinormal modes, black-hole mergers — are the natural oscillation modes of ED-curvature settling into a stable configuration.

GR captures all of this with extraordinary precision because it is the geometric limit of ED-flow. Linearized GR describes small ED-curvature perturbations; nonlinear GR describes large ones. ED does not replace GR; it explains why GR works. Gravitational waves do not decohere because they are not quantum objects. They have no internal channel to fragment. They are the ED field correcting itself.

Gravitational waves are not disturbances in spacetime.
They are spacetime becoming consistent with itself.