Gravity as a Flux-Area Law (Updated v 1.2)

Version 1.2 (Updated)

This version introduces a minimal width model, adds the scaling relation r0~sqrt(M), and develops an angular constraint interpretation of channeling. Summary has been updated with more detailed explanations. A previous typographical error in the width expression has been corrected.

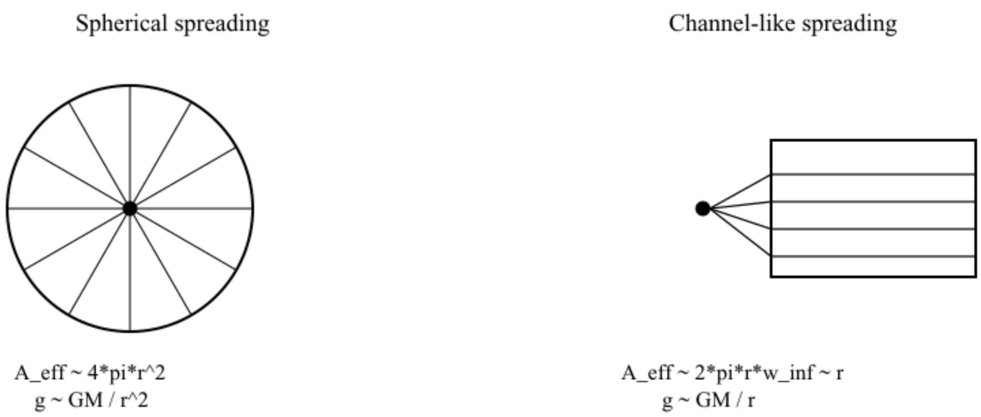
Introduction

The present framework is partially motivated by an intuitive picture in which gravitational influence at galactic scales may be viewed as propagating over a finite time depth. In this interpretation, the outer regions of a galaxy can be seen as reflecting earlier states of the central region, naturally leading to a cone-like propagation geometry.

This perspective provides a natural geometric intuition for the emergence of a cone-like propagation structure, which serves as a guiding visualization for the flux–area formulation.

Abstract.

This note reorganizes the model around a single principle: gravity is not fundamentally an inverse-square law, but a flux-density law. The inverse-square form appears when gravitational flux spreads over a spherical effective area. At galactic scales, if the propagation geometry transitions from spherical spreading to channel-like spreading, then the effective area can grow more slowly than r^2, producing non-Newtonian behavior without changing the Newtonian framework itself. In this picture, dark-matter-like behavior is reinterpreted as a consequence of flux concentration caused by channel formation. The narrative is organized around propagation dimension transition, effective flux area, width saturation, and an umbrella-like geometric analogy.



1. From inverse-square law to flux law.

The ordinary Newtonian law can be read in two different ways. In the usual reading, gravity is a force law of the form **$g \sim GM / r^2$**.
In the geometric reading adopted here, the same law is a consequence of flux conservation over a spherical surface. If total gravitational flux is conserved, then the local field strength is determined by the area over which that flux is distributed. For a sphere, **$A_{eff} \sim 4\pi r^2$**, and therefore **$g \sim GM / r^2$**. The key step of the present model is to treat the area law as fundamental and the inverse-square law as a special geometric case.

Core law: **$g(r) = G M / A_{eff}(r)$**.

2. Propagation-dimension transition.

Let **$n(r)$** denote the effective propagation dimension in the sense of area scaling. Then the effective area may be written schematically as **$A_{eff}(r) \sim r^{(n(r))}$**. When $n = 2$, flux spreads over a sphere-like area and Newtonian behavior is recovered. When **$n = 1$**, flux is distributed over a channel-like area and the field scales approximately as **$1/r$**. This directly produces flat outer rotation curves because **$v^2 = r g$** then approaches a constant. In this language, the central problem is not 'why gravity changes,' but 'why the effective flux area changes.'

Dimension picture:
$n = 2$ -> spherical spreading
$n = 1$ -> channel-like spreading
$n < 1$ -> stronger concentration at larger scales

3. Width saturation and galactic rotation curves.

A useful way to express the channel picture is to define an effective width **$w(r)$** and write the area as **$A_{eff}(r) \sim 2\pi r w(r)$**. In the inner region, **$w(r)$** grows approximately like **r** and the area behaves like **r^2**. In the outer region, if **$w(r)$** saturates to a finite width **w_{inf}**, then **$A_{eff}(r) \sim 2\pi r w_{inf}$**, so **$g(r) \sim GM / r$** and the rotation speed becomes approximately constant. The flattening of the rotation curve is therefore identified with width saturation, not with the introduction of extra unseen mass.

3.1 Minimal width model

$$\boxed{w(r) = \frac{r}{1 + \frac{r}{r_0}}}$$

This width function interpolates between two regimes.
At small radii r≪r0, it gives

w(r)≈ r

so the propagation remains effectively spherical.

At large radii r≫r0, it approaches

w(r)→r0

which represents width saturation and the onset of channel-like propagation.

$$\boxed{A_{\text{eff}}(r) \sim 2\pi r\, w(r)}$$

The effective flux area is written as the circumference 2πr times the effective transverse width w(r).
When w(r)~r, this reproduces an area scaling like r^2.
When w(r)→r0, the area grows only linearly with r, corresponding to channel-like spreading.

$$\boxed{v^2(r) = r\, g(r) \sim \frac{GM}{2\pi\, w(r)}}$$

Using the flux-area law g(r)~ GM/Aeff(r), the rotation speed is controlled directly by the effective width.
In the inner region, w(r)~r, so Newtonian-like behavior is recovered.
In the outer region, w(r)→r0, so v^2(r) tends toward a constant, naturally producing flat rotation curves.

4. Transition radius and mass scaling

The width-saturation picture naturally raises the question of how the saturation scale is determined. In particular, if the effective width approaches a finite value **w∞**, then the transition from spherical spreading to channel-like spreading must occur near a characteristic radius **r0~w∞**.

(1) Start from flux conservation

$$\Phi \sim GM$$

As in the flux-area formulation, the total gravitational flux is proportional to the mass.

(2) Channel capacity argument

$$\Phi \sim \rho_\Phi \, w_\infty^2$$

If the outer region behaves like a channel, then the flux must pass through an effective transverse cross-section. A natural assumption is that the carrying capacity of the channel scales with its cross-sectional area.

(3) Scaling result

$$w_\infty^2 \propto M \quad \Rightarrow \quad \boxed{w_\infty \propto \sqrt{M}}$$

(4) Transition radius

$$\boxed{r_0 \sim w_\infty \propto \sqrt{M}}$$

The transition radius is therefore not an independent parameter, but is directly set by the total flux generated by the source.

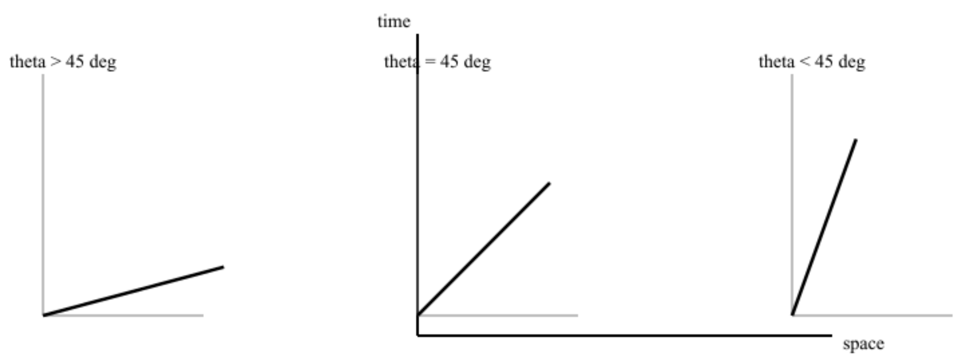
(5) Physical meaning

Larger masses generate larger total flux, and therefore require wider effective channels to accommodate that flux. As a result, the onset of channel-like propagation is pushed outward for more massive systems.

5. Umbrella interpretation.

The umbrella analogy is more precise than the parachute analogy because it explicitly contains structure lines (ribs), baseline tension, and a controlled opening angle. The ribs represent propagation paths. The basic tension of the umbrella corresponds to the baseline spreading tendency of spacetime. Mass does not need to be interpreted as a new independent 'force'; instead, mass acts as the agency that gathers the ribs, reducing the freedom of transverse spreading. In this sense, gravity may be understood as a flux-density increase caused by geometric reorganization of propagation paths.

Umbrella model: one baseline tension, two projections



6. One baseline tension, two projections.

A productive working hypothesis is that there is one underlying tension T, but its projection appears differently depending on direction. The time-directed component tends to concentrate propagation paths, while the space-directed component tends to spread them. If θ is the path angle, a natural first model is to resolve the same baseline tension into sin(θ) and cos(θ) components. Then the competition between spreading and concentration can be represented by a differential equation whose stable point lies near 45 degrees.
Angle-balance model: **dθ / dr = - k (sin(θ) - cos(θ))**
Near 45 deg, θ(r) approaches 45 deg exponentially. This yields a natural transition from n = 2 to n = 1 through **n(r) = 2 sin^2(θ(r))**

1. Gravity is fundamentally a flux-area law.
2. The inverse-square law is the spherical special case.
3. At galactic scales, the propagation dimension may change.
4. If the effective width saturates, then A_eff ~ r and outer speeds flatten.
5. Mass can be interpreted as the agent that gathers propagation paths and increases flux density.

In one sentence:

*****Gravitational anomalies may be understood not as a modification of force, but as a change in the effective area over which gravitational flux is distributed.*****

7. Why the inverse-square law was not enough.

The inverse-square form is extremely powerful and successful in systems where the effective area is genuinely spherical. The present proposal does not discard Newtonian mechanics. Instead, it keeps Newtonian reasoning but moves the focus from distance alone to flux density per effective area. In this reformulation, the same Newtonian logic can describe both ordinary gravity and galactic anomalies, provided that the propagation dimension is allowed to change with scale.

8. Summary of the model.

The narrative can be condensed into the following chain. First, gravity is fundamentally a flux law, not merely an inverse-square law. Second, the inverse-square form is recovered when flux spreads over a spherical effective area. Third, galactic anomalies appear when propagation paths reorganize into a channel-like geometry so that the effective area grows more slowly than r^2. Fourth, width saturation produces outer flat rotation curves. Fifth, mass is interpreted as the agent that gathers propagation ribs, increasing flux density by reducing transverse freedom.

(1) Core principle — Flux-area law

$$\Phi(r) \sim \frac{GM}{A_{\mathrm{eff}}(r)}$$

Gravity is interpreted as a flux-density law rather than purely a distance-based force law. The strength of gravity is determined by how the flux is distributed over an effective area.

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(2) Newtonian limit — Spherical spreading

$$A_{\mathrm{eff}}(r) \sim 4\pi r^2 \quad \Rightarrow \quad g(r) \sim \frac{GM}{r^2}$$

When the flux spreads over a spherical area, the inverse-square law is naturally recovered.

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(3) Minimal width model — Saturation

$$w(r) = \frac{r}{1 + \frac{r}{r_0}}$$

This expression provides a minimal interpolation between two regimes:

- For $r \ll r0$: $w(r) \sim r$ (free spreading)
- For $r \gg r0$: $w(r) \to r0$ (saturation)

This represents the suppression of transverse spreading at large scales.

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(4) Effective area — Channel-like geometry

$$A_{\text{eff}}(r) \sim 2\pi r\, w(r)$$

The effective area transitions from spherical scaling to a channel-like geometry. At large radii, the area grows linearly with r, rather than quadratically.

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(5) Gravitational acceleration

$$g(r) \sim \frac{GM}{A_{\text{eff}}(r)}$$

Combining with the effective area:

- Inner region:

$$g(r) \sim \frac{GM}{r^2}$$

- Outer region:

$$g(r) \sim \frac{GM}{r}$$

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(6) Rotation velocity

$$v^2(r) = r\, g(r) \sim \frac{GM}{2\pi\, w(r)}$$

Thus:

- Inner region:

$$v^2(r) \sim \frac{GM}{r}$$

- Outer region:

$$v^2(r) \sim \frac{GM}{r_0} = \text{const}$$

This naturally produces flat rotation curves at large radii.

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(7) Dimension relation

$$n(r) = 1 + \frac{d\ln w}{d\ln r}$$

This defines an effective propagation dimension:

- n=2: spherical spreading
- n=1: channel-like propagation

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(8) Angular interpretation

$$w(r) \sim r\,\Delta\theta(r)$$

$$\Delta\theta(r) \sim \frac{w_\infty}{r} \quad (r \gg r_0)$$

Channeling can be interpreted as a reduction in the available angular spread of propagation. At large distances, the allowed directions collapse toward a narrow range.

9. Practical position of this draft.

This model is exploratory, not final. It is intended to reorganize the discussion around one main spine: Newtonian mechanics can be retained if gravitational anomalies are reinterpreted as changes in flux density caused by propagation-dimension transition. The umbrella picture, tension language, and projection language are retained only as interpretive tools serving that central idea.

Changes in v1.2:

- Introduced minimal width model for $w(r)$
- Added derivation of transition radius scaling $r_0 \sim \sqrt{M}$
- Summary is updated with more detailed explanations.
- Added angular constraint interpretation of channeling
- Corrected typo in previous width expression
- Minor refinements