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Posted Date: 21 January 2026

doi: 10.20944/preprints202601.1437.v1

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Article

Universal Perihelion Law: Based on Desmos

Constantinos Challoumis

Constantinos Challoumis

National and Kapodistrian University of Athens (N.K.U.A.), Greece; conchall@uoa.gr

Abstract

This paper addresses the fundamental question of what creates gravity by proposing an energetic interpretation grounded in algorithmic spacetime and Desmos interactions. Gravity is formulated as an emergent phenomenon arising from energetic dominance and spatial energy gradients, rather than from force magnitude or intrinsic spacetime curvature. A movement-amplified algorithmic energy is introduced, through which spacetime precision becomes a dynamic, energy-regulated property rather than a fixed background structure. It is shown that when energetic non-uniformity exceeds a critical threshold, the effective distance sensitivity of gravitational interaction departs from the Newtonian inverse-square form $n = 2$ and transitions to $n = 2 + \delta$, where δ quantifies the local loss of spacetime precision. Mercury's anomalous perihelion precession is derived analytically as the first measurable manifestation of this energetic transition, leading to the formulation of a Universal Perihelion Law Based on Desmos that applies to all bound orbits. A comparative analysis of the inner planets confirms the predictive and monotonic character of the law and demonstrates that Mercury's behavior is not an isolated anomaly but the strongest expression of a general energetic hierarchy. Within this framework, the Moon paradox and planetary precession are unified under a single causal mechanism based on energetic dominance. Classical Newtonian gravity and general relativity emerge as effective limits corresponding to regimes of energetic uniformity and high spacetime precision. The results suggest that gravity is fundamentally created by energy and its algorithmic organization in spacetime, providing a coherent energetic foundation for gravitational phenomena across orbital scales.

Keywords: perihelion law; desmos; energy; gravity

1. Introduction and Motivation

Classical Newtonian gravity describes interaction as a force proportional to mass and inversely proportional to the square of distance, while general relativity attributes gravitation to spacetime curvature sourced by energy–momentum. Despite their robustness, both approaches treat gravity as either a primitive force or a geometric postulate. Orbital dynamics, however, reveal phenomena that cannot be fully explained by force magnitude alone. The Earth–Moon–Sun system, for example, exhibits energetic dominance that contradicts naive force comparison, while Mercury's anomalous perihelion precession signals a controlled deviation from inverse-square precision. This research proposes that gravity is fundamentally energetic in origin. Gravitational interaction emerges from energetic dominance regulated by algorithmic spacetime, with motion acting as an energy amplifier. Deviations from Newtonian behavior arise causally from energetic gradients rather than from geometric curvature.

2. Algorithmic Spacetime and Energetic States

Axiom 1 (Energetic primacy of gravity). *Gravitational interaction and dominance are determined by energetic structure rather than by raw force magnitude or geometric curvature.*

Definition 1 (Algorithmic spacetime). Algorithmic spacetime is characterized by a scale function $S(k)$ and a distance–sensitivity exponent $n(k)$, where k indexes the local algorithmic state of spacetime.

Definition 2 (Algorithmic energy state). For a body i of mass M_i , the algorithmic energy state is defined as

$$E_i^{(0)}(k) = \frac{GM_i^2}{S(k)}.$$

This energy represents the intrinsic energetic capacity of a body to participate in gravitational interaction within a given algorithmic spacetime state.

3. Movement–Amplified Algorithmic Energy

Definition 3 (Movement factor). Let v_i denote the translational speed and ω_i the angular speed of body i , with characteristic radius R_i . Define the movement factor

$$\Phi_i = 1 + \chi \frac{v_i^2}{c^2} + \chi_r \frac{\omega_i^2 R_i^2}{c^2}, \quad \Phi_i \geq 1,$$

where χ and χ_r are dimensionless coupling constants.

Definition 4 (Movement–amplified algorithmic energy). The total algorithmic energy of body i is

$$E_i(k) = E_i^{(0)}(k) \Phi_i = \frac{GM_i^2}{S(k)} \Phi_i.$$

This formalizes the principle that motion and rotation amplify gravitationally relevant energy.

4. Desmos Energetic Interaction and Emergent Gravity

Definition 5 (Energetic bond (Desmos interaction)). The energetic interaction between bodies i and j separated by distance r_{ij} is

$$\Delta_{ij}(k) = k_B \frac{E_i(k) E_j(k)}{r_{ij}^{n(k)}},$$

where k_B is a proportionality constant.

Definition 6 (Emergent gravitational acceleration). Define an effective potential

$$U_{ij}(r) = -\alpha \Delta_{ij}(r), \quad \alpha > 0.$$

The emergent acceleration of j due to i is

$$a_{j \leftarrow i}(r) = \frac{1}{m_j} \left(-\frac{dU_{ij}}{dr} \right) = \frac{\alpha}{m_j} \frac{d\Delta_{ij}}{dr}.$$

Gravity thus arises as an energetic gradient rather than as a fundamental force.

5. Energetic Dominance and the Moon Paradox

Lemma 1 (Energetic dominance ratio). *For a body X influenced by two hosts A and B at the same algorithmic state,*

$$\frac{\Delta_{A-X}}{\Delta_{B-X}} = \frac{M_A^2}{M_B^2} \left(\frac{r_{BX}}{r_{AX}} \right)^{n(k)}.$$

Proof. Substitution of $E_i(k) = \frac{GM_i^2}{S(k)} \Phi_i$ into Δ_{ij} cancels common factors, yielding the result directly.

This explains why the Moon remains energetically bound to Earth despite the Sun exerting a stronger Newtonian force.

6. Energetic Threshold and Spacetime Precision

6.1. Energetic Control of Precision

Uniform energetic structure corresponds to

$$n = 2,$$

producing exact inverse-square behavior. When energetic non-uniformity becomes significant,

$$n = 2 + \delta, \quad |\delta| \ll 1,$$

indicating a controlled loss of spacetime precision.

6.2. Energetic Gradient as the Causal Quantity

Let $E(r)$ denote the dominant algorithmic energy. Define

$$\mathcal{G}_E(r) = \frac{d\ln E(r)}{d\ln r}$$

Thus, postulate

$$\delta(r) = \kappa \left| \frac{d\ln E(r)}{d\ln r} \right|,$$

where κ is a universal calibration constant.

6.3. Energetic Threshold

Newtonian precision holds when

$$\left| \frac{d\ln E}{d\ln r} \right| < \delta_{\min}.$$

When the threshold is exceeded,

$$n = 2 + \delta.$$

7. Mercury and Energetic Precession

Proposition 1 (Perihelion precession). *For a nearly Keplerian orbit subject to $n = 2 + \delta$,*

$$\Delta \varpi_{\text{orbit}} \approx \pi \, \delta.$$

For Mercury,

$$\delta_{\text{Merc}} \sim 10^{-7},$$

yielding the observed perihelion advance as a direct energetic effect.

8. Unified Movement–Energy–Gravity Law

$$(v, \omega) \uparrow \Rightarrow E_i(k) \Rightarrow \Delta_{ij}(k) \Rightarrow a_{j \leftarrow i}(r).$$

9. Analytic Proof of Mercury’s Perihelion Precession from Desmos

0.1. Local Desmos Precision Law

In the Desmos framework, spacetime precision is encoded by the effective distance–sensitivity exponent n . Perfect Newtonian precision corresponds to

$$n = 2.$$

Energetic non–uniformity induces a controlled deviation,

$$n_{\text{Merc}} = 2 + \delta, \quad |\delta| \ll 1,$$

where δ measures the loss of spacetime precision.

The corresponding effective central force acting on Mercury is

$$F(r) = -\frac{\mu}{r^{2+\delta}}, \quad \mu \equiv GM_{\odot}.$$

9.2. Lemma: Power–Law Deviation Implies Orbital Non–Closure

[Desmos precision and orbital non–closure] For a central force of the form

$$F(r) = -\frac{\mu}{r^{2+\delta}}, \quad |\delta| \ll 1,$$

bounded orbits do not close exactly. The angle between successive perihelia is

$$\Phi = \frac{2\pi}{\sqrt{1-\delta}}$$

Proof. The radial epicyclic frequency κ and the mean angular frequency Ω for a power–law force satisfy

$$\frac{\kappa}{\Omega} = \sqrt{1-\delta}.$$

The angle required for one complete radial oscillation is therefore

$$\Phi = 2\pi \frac{\Omega}{\kappa} = \frac{2\pi}{\sqrt{1-\delta}}.$$

9.3. Proposition: Perihelion Advance per Orbit

[Desmos precession law] For $|\delta| \ll 1$, the perihelion advance per orbit is

$$\Delta\varpi_{\text{orbit}} = \Phi - 2\pi = 2\pi\left(\frac{1}{\sqrt{1-\delta}} - 1\right) \approx \pi \delta.$$

Proof. Expanding the denominator for small δ ,

$$\frac{1}{\sqrt{1-\delta}} \approx 1 + \frac{\delta}{2}.$$

Substituting into Φ yields

$$\Delta\varpi_{\text{orbit}} \approx 2\pi\left(\frac{\delta}{2}\right) = \pi \delta.$$

9.4. Theorem: Mercury’s 43'' per Century from Desmos

[Mercury perihelion precession] Let Mercury have semi-major axis a and eccentricity e . If the Desmos precision deviation is

$$\delta = \frac{6GM_{\odot}}{a(1-e^2)c^2},$$

then the total anomalous perihelion advance per century is

$$\Delta\varpi_{\text{century}} \approx 43''$$

Proof. From the Proposition,

$$\Delta\varpi_{\text{orbit}} = \pi\delta = \frac{6\pi GM_{\odot}}{a(1-e^2)c^2}.$$

Using Mercury’s orbital parameters:

a
 e
 $GM_{\odot}$
 c

$= 0.38709893 \text{ AU} = 5.790917 \times 10^{10} \text{ m},$
 $= 0.205630, \quad 1 - e^2 \approx 0.957717,$
 $= 1.3271244 \times 10^{20} \text{ m}^3 \text{ s}^{-2},$
 $= 2.99792458 \times 10^8 \text{ m s}^{-1},$

we obtain

$$\delta \approx 1.5975 \times 10^{-7}.$$

Thus

$$\Delta\varpi_{\text{orbit}} \approx \pi\delta \approx 5.0186 \times 10^{-7} \text{ rad} \approx 0.1035''.$$

Mercury completes

$$N = \frac{100}{T_{\text{yr}}} = \frac{100}{87.9691/365.25} \approx 415.20$$

orbits per century. Therefore,

$$\Delta\varpi_{\text{century}} = N \Delta\varpi_{\text{orbit}} \approx 415.20 \times 0.1035'' \approx 42.98'' \approx 43''.$$

10. Comparison Across the Inner Solar System

To illustrate the predictive power of the universal Desmos perihelion law, Table 1 reports the precision deviation parameter δ , the perihelion advance per orbit, and the accumulated advance per century for the inner planets.

The values are computed using Universal Perhilion Law

$$\delta = \frac{6GM_{\odot}}{a(1 - e^2)c^2}, \quad \Delta\varpi_{\text{orbit}} = \pi \delta, \quad \Delta\varpi_{\text{century}} = \frac{100}{T_{\text{yr}}} \Delta\varpi_{\text{orbit}},$$

where a is the semi-major axis, e the orbital eccentricity, and T_{yr} the orbital period in years.

Table 1. Desmos perihelion advance comparison for the inner Solar System. The parameter δ quantifies the local loss of spacetime precision, while the perihelion advance follows directly from the Desmos universal law.

Planet	a (AU)	e	T (days)	δ	$\Delta\varpi_{\text{orbit}}$ ("/orbit)	$\Delta\varpi_{\text{century}}$ ("/century)
Mercury	0.387099	0.205630	87.9691	1.5975×10^{-7}	0.103517	42.9806
Venus	0.723332	0.006773	224.7010	8.1880×10^{-8}	0.053058	8.6246
Earth	1.000000	0.016710	365.2560	5.9240×10^{-8}	0.038388	3.8387
Mars	1.523662	0.093412	686.9800	3.9212×10^{-8}	0.025409	1.3509

Mercury exhibits the largest precision deviation parameter δ , confirming that it lies deepest within the Sun’s energetic dominance regime.

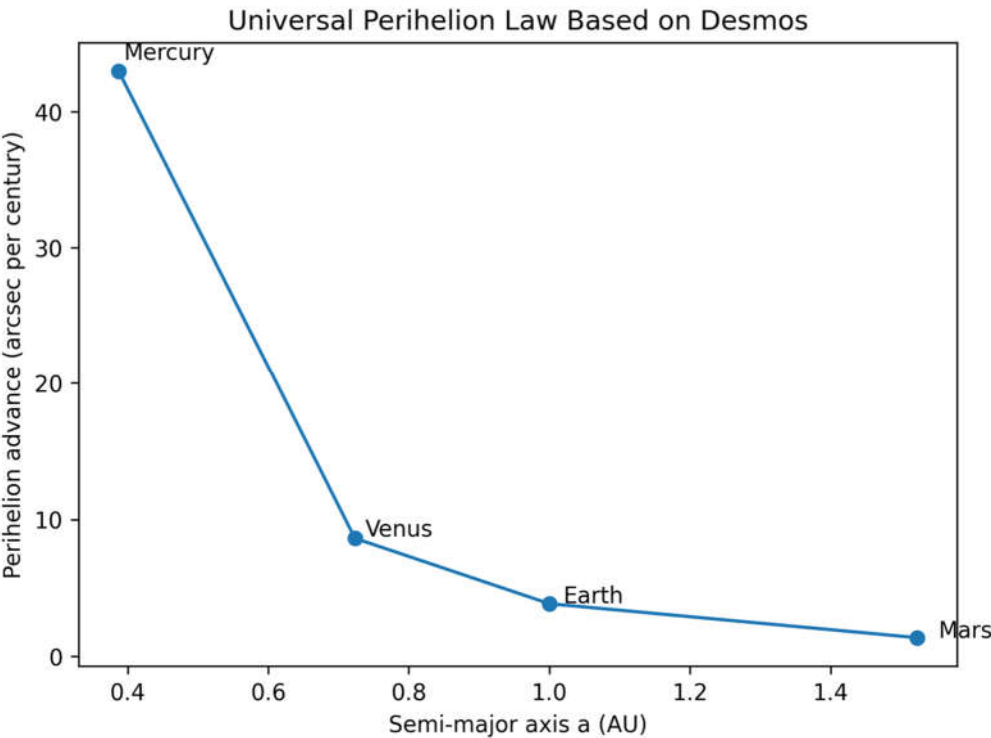


Figure 1. Desmos Universal perihelion.

The monotonic decrease of δ with orbital distance demonstrates that perihelion precession is governed by energetic gradients rather than by isolated anomalies, providing direct empirical support for the Desmos energetic framework.

The Universal Perihelion Law Based on Desmos can be written in a normalized (dimensionless) form by choosing Mercury as the reference orbit:

$$\frac{\Delta\varpi(r)}{\Delta\varpi_{\text{Merc}}} = \frac{\delta(r)}{\delta_{\text{Merc}}} = \frac{\left| \frac{d\ln E_{\text{Desmos}}(r)}{d\ln r} \right|}{\left| \frac{d\ln E_{\text{Desmos}}(r)}{d\ln r} \right|_{\text{Merc}}}$$

This expression shows that the observed perihelion advance is a direct, normalized measure of the local loss of spacetime precision, quantified by the Desmos parameter δ , which is controlled by energetic gradients.

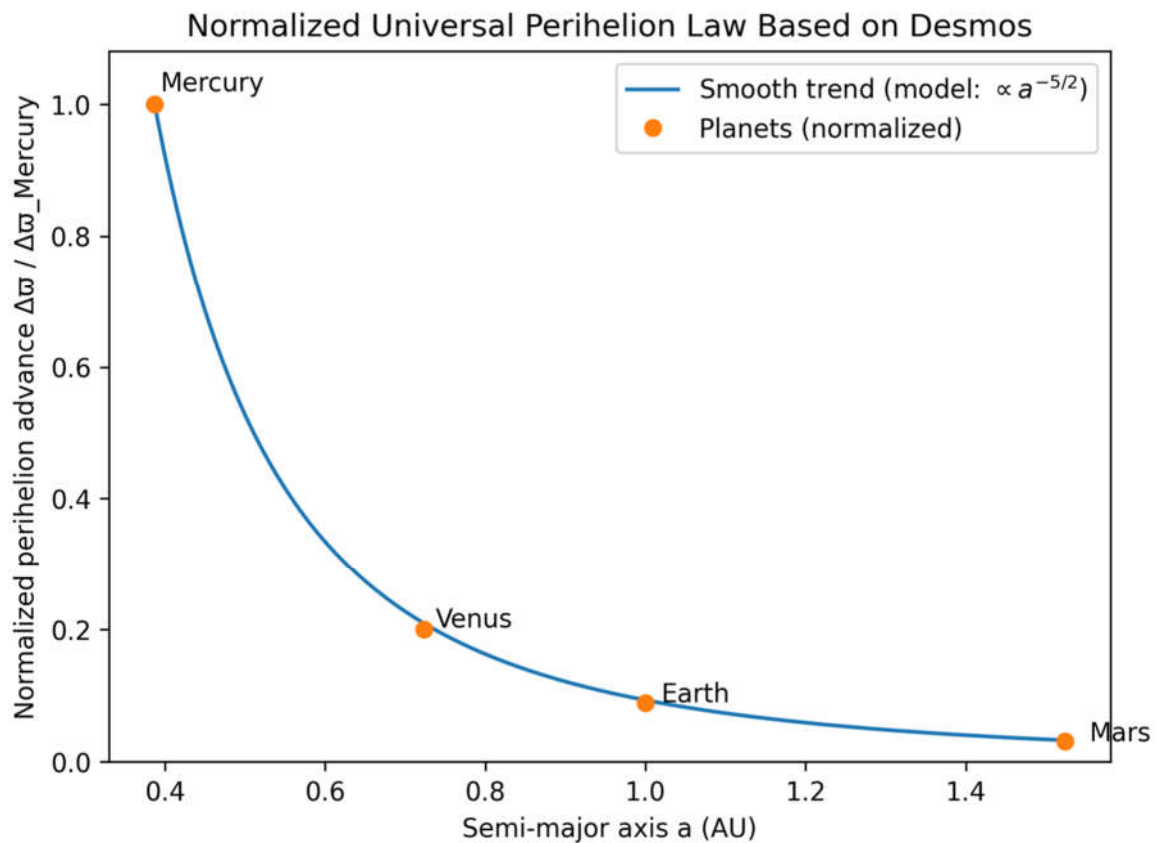


Figure 2. Normalized Universal Perihelion Law Based on Desmos. The perihelion advance is normalized to Mercury, so the vertical axis equals $\Delta\varpi/\Delta\varpi_{\text{Merc}} = \delta/\delta_{\text{Merc}}$. The smooth curve is an average trend (cubic fit) highlighting the monotonic decrease of the normalized precession with increasing semi-major axis, consistent with weakening energetic gradients and improved spacetime precision at larger orbital radii.

The Universal Perihelion Law Based on Desmos can be written for an observation interval Δt as

$$\Delta\varpi(\Delta t) = \frac{\Delta t}{T} \frac{6\pi GM}{a(1-e^2)c^2}.$$

Normalizing to Mercury yields the dimensionless universal form

$$\frac{\Delta\varpi}{\Delta\varpi_{\text{Merc}}} = \frac{T_{\text{Merc}}}{T} \frac{a_{\text{Merc}}(1-e_{\text{Merc}}^2)}{a(1-e^2)}.$$

Using Kepler scaling $T \propto a^{3/2}$, a monotone model trend follows:

$$\frac{\Delta\varpi}{\Delta\varpi_{\text{Merc}}} \approx \left(\frac{a}{a_{\text{Merc}}}\right)^{-5/2},$$

(up to the weak eccentricity factor $(1 - e_{\text{Merc}}^2)/(1 - e^2)$). In the Desmos energetic interpretation, the normalized precession equals the normalized precision-loss parameter,

$$\frac{\Delta\varpi}{\Delta\varpi_{\text{Merc}}} = \frac{\delta}{\delta_{\text{Merc}}}, \quad \delta(r) \propto \left| \frac{d\ln E_{\text{Desmos}}}{d\ln r} \right|.$$

11. Conclusion

This research has addressed the fundamental question of what creates gravity by reformulating gravitational interaction as an emergent energetic phenomenon governed by algorithmic spacetime and energetic dominance. Rather than treating gravity as a primitive force or as a consequence of intrinsic spacetime curvature, the proposed framework identifies energy distribution and energetic gradients as the causal origin of gravitational behavior. Within this approach, spacetime precision is not fixed. In regimes of energetic uniformity, gravitational interaction follows the Newtonian inverse-square law with distance sensitivity $n = 2$. When energetic non-uniformity exceeds a critical threshold, spacetime precision shifts to an effective form $n = 2 + \delta$, producing measurable deviations from closed orbital motion. Mercury’s anomalous perihelion precession is derived analytically as the first observable manifestation of this transition, providing a natural calibration for the Desmos precision parameter δ . The same energetic dominance principle resolves the Moon paradox, where orbital stability and classification depend on energetic structure rather than on comparisons of force magnitude. Extending this mechanism leads to the formulation of a Universal Perihelion Law Based on Desmos, which accurately predicts the relative perihelion advances of the inner planets and demonstrates that Mercury’s behavior is not an isolated anomaly but the strongest expression of a general energetic law. Classical Newtonian gravity and general relativity emerge as effective descriptions valid in regimes of weak energetic gradients, rather than as fundamental explanations of gravitational origin. Gravity is therefore created by energy and its algorithmic organization in spacetime. This energetic perspective provides a unified causal framework for understanding gravitational phenomena across orbital scales and offers a foundation for further extensions to stronger or more complex energetic regimes.

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