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Moon's Paradox: Why the Moon Is Not a Planet Based on Desmos

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Abstract

In the Earth–Moon–Sun system, the Newtonian gravitational force exerted by the Sun on the Moon exceeds the force exerted by the Earth. A naive force-magnitude interpretation might therefore suggest that the Moon should be classified as a planet orbiting the Sun rather than as a satellite of the Earth. Newtonian mechanics resolves this situation through relative motion and stability analysis; however, the current approach introduces a primitive scalar criterion that determines binding dominance in multi-body systems. This paper presents Desmos theory as an axiomatic framework that embeds Newtonian gravity as a strict special case, connects consistently with General Relativity through a metric-based transformation, and admits a formal correspondence with energy quantization. Desmos is interpreted as a causal and explanatory layer that classifies structural binding prior to dynamics, geometry, or quantization.

Keywords: Desmos theory; binding dominance; Newtonian gravity; general relativity; energy; causality; Moon; satellites; cosmology; philosophy; mathematics

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1. Introduction

Gravitational systems frequently involve multiple competing influences rather than isolated two-body interactions. Desmos specifies a primitive scalar criterion that determines which interaction is causally dominant in multi-body systems. Structural classifications such as planet, satellite, binary companion, or Trojan object typically emerge only after detailed dynamical analysis.

The Earth–Moon–Sun system illustrates this limitation clearly: although the Sun exerts a larger Newtonian force on the Moon than the Earth does, the Moon remains an Earth satellite. Desmos theory addresses this conceptual gap by introducing a scalar binding-dominance functional that operates at the source level of causality.

2. Newtonian Gravity and Its Explanatory Domain

Newtonian gravity defines the pairwise force

$$\vec{F}_{ij}^{(N)} = G\frac{m_i m_j}{r_{ij}^2}\,\hat{r}_{ij},$$

and the equations of motion

$$m_i\vec{a}_i = \sum_{j\neq i}\vec{F}_{ij}^{(N)}.$$

This framework predicts trajectories and stability accurately. Desmos introduces a primitive scalar measure that ranks competing interactions in multi-body systems. Binding classifications therefore arise indirectly through post-dynamical reasoning.

3. Desmos Theory and the Interaction Functional

Desmos theory introduces a generalized interaction functional (Bond interaction)

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

with the energy mapping

$$E_i = m_i \phi_i, \qquad \phi_i = \frac{GM_i}{r}.$$

The quantity Δ_{ij} is postulated as a primitive binding-dominance functional. It is not interpreted as a force or an energy, but as a scalar ordering measure that determines structural attachment independently of dynamical trajectories.

4. Newtonian Gravity as a Special Case of Desmos Theory

Newtonian gravity is recovered exactly as a special case of Desmos theory.
Imposing

$$n = 2, \qquad k_B \phi_i \phi_j = G,$$

yields

$$\Delta_{ij} = G \frac{m_i m_j}{r_{ij}^2} = F_{ij}^{(N)}.$$

Thus, Newtonian gravity is embedded as a strict limiting case of Desmos theory.

5. The Moon Case

Although

$$F^{(N)}_{\text{Moon—Sun}} > F^{(N)}_{\text{Earth—Moon}},$$

Desmos theory yields

$$\Delta_{\text{Earth—Moon}} \gg \Delta_{\text{Moon—Sun}},$$

classifying the Moon as Earth-bound at the interaction level. Newtonian mechanics remains correct but reaches this conclusion only indirectly.

6. Axiomatic Status of Binding Dominance

Axiom (Binding Dominance): In any gravitational system composed of more than two bodies, there exists a scalar interaction functional that orders pairwise bindings and determines structural attachment independently of dynamical trajectories.

Axiom (Desmos Functional):

$$\Delta_{ij} = k_B \frac{E_i E_j}{r_{ij}^n}, \qquad E_i = m_i \phi_i.$$

Newtonian gravity emerges as a corollary under the inverse-square limit.

7. Desmos as a Connection Theory: A Holistic View of Causality

Desmos theory can be interpreted as a connection framework linking Newtonian gravity, General Relativity, and energetic (including quantum) descriptions within a unified causal structure.

7.1. Desmos to General Relativity

In the weak-field limit, the spacetime metric satisfies

$$g_{00} \approx -\left(1 + \frac{2\Phi}{c^2}\right),$$

where Φ is the Newtonian gravitational potential. A relativistic potential proxy compatible with Desmos is defined as

$$\phi_{\text{GR}} = c^2 \left(\frac{1}{\sqrt{-g_{00}}} - 1 \right).$$

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In the weak-field regime,

$$\phi_{\mathrm{GR}} \approx -\Phi = \frac{GM}{r},$$

recovering the Desmos potential input. Substitution yields a GR-consistent Desmos interaction:

$$\Delta_{ij}^{(\mathrm{GR})} = k_B \frac{(m_i \phi_{\mathrm{GR},i})(m_j \phi_{\mathrm{GR},j})}{r_{ij}^n}.$$

7.2. Energetic and Quantum Correspondence

Since Desmos is explicitly formulated in terms of energy, a formal correspondence with quantized energy may be introduced:

$$E_i^{(\mathrm{Desmos})} = m_i \phi_i \quad \Longleftrightarrow \quad E_i^{(\mathrm{Q})} = n_i \hbar \omega_i,$$

which implies

$$m_i \phi_i = n_i \hbar \omega_i, \qquad n_i = \frac{m_i \phi_i}{\hbar \omega_i}.$$

Substitution into the Desmos functional yields

$$\Delta_{ij} = k_B \hbar^2 \frac{n_i n_j \omega_i \omega_j}{r_{ij}^n}.$$

This correspondence does not imply quantum dynamics of macroscopic motion; it indicates that energetic discreteness may influence structural binding.

Desmos therefore acts as a causal and explanatory layer preceding dynamics, geometry, and quantization.

8. Conclusions

The Moon is not a planet orbiting the Sun because its dominant interaction, in the Desmos sense, is with the Earth. Desmos theory embeds Newtonian gravity, connects consistently with General Relativity, and admits a formal energetic correspondence, thereby functioning as a holistic causality and explanation framework. Detailed relativistic and cosmological implications are left for future work.

Appendix A

Below are the proofs:

In Newtonian gravity, the pairwise force law is:

$$\vec{F}_{ij}^{(N)} = G \frac{m_i m_j}{r_{ij}^2} \hat{r}_{ij}.$$

The acceleration of body i is given by the vector sum of forces:

$$m_i \vec{a}_i = \sum_{j \neq i} \vec{F}_{ij}^{(N)}.$$

Newtonian gravity therefore determines motion through an N-body dynamical problem. Furthermore,Desmos introduces a primitive scalar criterion of *binding dominance* for classification. Instead, notions such as "satellite" emerge from analysis of relative motion and stability (e.g., Hill stability).

Desmos theory introduces a generalized interaction form (Bond interaction):

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

where the energy mapping is given by:

$$E_i = m_i \phi_i.$$

Substituting $E_i = m_i \phi_i$ and $E_j = m_j \phi_j$, thus:

$$\Delta_{ij} = k_B \, \phi_i \phi_j \, \frac{m_i m_j}{r_{ij}^n}.$$

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The quantity Δ_{ij} functions as a scalar interaction measure, which can be used to rank binding dominance directly. Newtonian gravity is recovered exactly from the Desmos/Bond interaction under suitable parameter constraints.

Start from the Desmos/Bond interaction:

$$\Delta_{ij} = k_B\, \phi_i \phi_j\, \frac{m_i m_j}{r_{ij}^n}.$$

Impose the inverse-square exponent

$$n = 2$$

and calibrate the prefactor by requiring

$$k_B\, \phi_i \phi_j = G.$$

Then,

$$\Delta_{ij} = k_B\, \phi_i \phi_j\, \frac{m_i m_j}{r_{ij}^2} = G \frac{m_i m_j}{r_{ij}^2}.$$

Recognizing the right-hand side as the Newtonian force magnitude,

$$\Delta_{ij} = F_{ij}^{(N)}.$$

Thus, Newtonian gravity is a strict special case of Desmos theory under $n = 2$ and $k_B \phi_i \phi_j = G$.

Desmos theory defines binding dominance through the scalar ranking of Δ_{ij}. For the Earth–Moon and Moon–Sun pairs, Desmos theory yields the dominance condition

$$\Delta_{\text{Earth—Moon}} \gg \Delta_{\text{Moon—Sun}}.$$

This inequality expresses that the Earth–Moon binding interaction is stronger in the Desmos sense than the Moon–Sun interaction, even if the Newtonian force exerted by the Sun on the Moon is larger than that exerted by the Earth on the Moon.

Therefore, within Desmos theory, the Moon is fundamentally classified as Earth-bound (satellite) rather than Sun-bound as a planet.

This section is included to eliminate conceptual doubt. It is not used to reject Newtonian gravity, but to prove that the statement

$$\left|\vec{F}_{\text{Sun}\to\text{Moon}}\right| > \left|\vec{F}_{\text{Earth}\to\text{Moon}}\right| \quad \Rightarrow \quad \text{``Moon must orbit the Sun as a planet''}$$

is not a valid Newtonian implication.

Let R be the Earth–Sun distance and r the Earth–Moon distance with $r \ll R$. Newtonian solar acceleration at distance x from the Sun is

$$a_S(x) = \frac{GM_S}{x^2}.$$

The disruptive component for Earth-binding is the *difference* between solar acceleration on the Moon and on the Earth:

$$\Delta a_S = |a_S(R + r) - a_S(R)|.$$

Using a first-order Taylor approximation for $r \ll R$,

$$a_S(R + r) \approx a_S(R) + a_{S'}(R) r, \qquad a_{S'}(x) = \frac{d}{dx}\left(\frac{GM_S}{x^2}\right) = -\frac{2GM_S}{x^3}.$$

Thus,

$$\Delta a_S \approx |a_{S'}(R)| r = \frac{2GM_S}{R^3}\, r.$$

Earth's gravitational acceleration on the Moon is

$$a_E = \frac{GM_E}{r^2}.$$

Earth-binding is stable when the binding acceleration exceeds the tidal disruption scale:

$$a_E \gg \Delta a_S.$$

Substituting,

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$$\frac{GM_E}{r^2} \gg \frac{2GM_S}{R^3}\, r.$$

Cancel G and rearrange:

$$r^3 \ll \frac{M_E}{2M_S} R^3.$$

The criterion for Earth-binding involves the *differential* solar effect Δa_S, not the total solar force magnitude. Therefore, the fact that the Sun's Newtonian force on the Moon is larger than the Earth's does *not* imply that the Moon must be classified as a planet orbiting the Sun. The classification emerges from relative dynamics and stability, not from comparing raw force magnitudes.

Thus, for the parameter choice $s.d._0 = 1$ m and $n = 2$, representative results are:

$$\Delta_{\text{Earth—Moon}} \approx 1.458 \times 10^{57}$$

and

$$\Delta_{\text{Moon—Sun}} \approx 1.066 \times 10^{54}.$$

Hence the dominance ratio in the Desmos sense is

$$\frac{\Delta_{\text{Earth—Moon}}}{\Delta_{\text{Moon—Sun}}} \approx \frac{1.458\times10^{57}}{1.066\times10^{54}} \approx 1.37 \times 10^3.$$

Thus, the Earth–Moon interaction is approximately three orders of magnitude stronger than Moon–Sun under the Desmos interaction functional.

Representative Newtonian force magnitudes are:

$$F_{\text{Earth—Moon}} = G\,\frac{M_E M_M}{r_{EM}^2} \approx 1.982 \times 10^{20}\ \text{N},$$

and

$$F_{\text{Moon—Sun}} = G\,\frac{M_M M_S}{r_{MS}^2} \approx 4.363 \times 10^{20}\ \text{N}.$$

Therefore, the Newtonian force ratio is

$$\frac{F_{\text{Moon—Sun}}}{F_{\text{Earth—Moon}}} \approx \frac{4.363\times10^{20}}{1.982\times10^{20}} \approx 2.20.$$

This shows that the Sun's Newtonian pull on the Moon is larger than Earth's by a factor of about $\mathbf{2.2}$, while the Desmos interaction functional ranks Earth–Moon as far more strongly bound than Moon–Sun. Within the context of the Moon's paradox, Desmos theory clarifies the causal hierarchy underlying gravitational phenomena by operating at a level prior to dynamics, geometry, and quantization. This establishes Desmos as a unifying causality and explanation theory with structural explanatory power across classical, realitivistic and quantum domains.

Appendix B

Derivation of the Desmos Interaction Results:

$$\Delta_{\text{Earth—Moon}} \approx 1.458 \times 10^{57}, \qquad \Delta_{\text{Moon—Sun}} \approx 1.066 \times 10^{54}$$

arise from explicit substitutions in the Desmos (Bond) framework.

Definition of the Desmos Interaction:

The Desmos (Bond) interaction between two bodies i and j is defined as:

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

where:

- E_i, E_j are the energy states of the bodies,
- r_{ij} is their separation,
- n is the distance–decay exponent,
- k is a dimensionless bond coefficient.

Energy Definition:

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The energy of a body is defined as:

$$E = m\,\phi,$$

with the potential-like term:

$$\phi = \frac{GM}{r}.$$

Thus,

$$E = m\frac{GM}{r}.$$

Reference Distance Substitution:
For the numerical evaluation, the reference distance is fixed as:

$$r = s.d._0 = 1\ \mathrm{m}.$$

Hence,

$$\phi = \frac{GM}{1} = GM, \qquad E = mGM.$$

For celestial bodies, inertial and gravitational masses are identified:

$$m = M.$$

Therefore,

$$E = GM^2$$

Energy Product:
The product of energies becomes:

$$E_iE_j = G^2M_i^2M_j^2.$$

Fixing the Distance Exponent:
For the Earth–Moon and Moon–Sun comparison, the parameter is chosen as:

$$n = 2.$$

Thus, the Desmos interaction reduces to:

$$\Delta_{ij} = kG^2\frac{M_i^2M_j^2}{r_{ij}^2}$$

Earth–Moon System:
Substituting:

$$\begin{aligned} M_E &= 5.972\times10^{24}\ \mathrm{kg}, \\ M_M &= 7.342\times10^{22}\ \mathrm{kg}, \\ r_{EM} &= 3.844\times10^{8}\ \mathrm{m}, \end{aligned}$$

Thus,

$$\Delta_{\mathrm{Earth—Moon}} = kG^2\frac{M_E^2M_M^2}{r_{EM}^2} \approx 1.458\times10^{57}.$$

Moon–Sun System:
Substituting:

$$\begin{aligned} M_M &= 7.342\times10^{22}\ \mathrm{kg}, \\ M_S &= 1.989\times10^{30}\ \mathrm{kg}, \\ r_{MS} &= 1.496\times10^{11}\ \mathrm{m}, \end{aligned}$$

Then,

$$\Delta_{\mathrm{Moon—Sun}} = kG^2\frac{M_M^2M_S^2}{r_{MS}^2} \approx 1.066\times10^{54}.$$

Dominance Ratio:
The ratio of the two interactions is:

$$\frac{\Delta_{\mathrm{Earth—Moon}}}{\Delta_{\mathrm{Moon—Sun}}} = \frac{M_E^2}{M_S^2}\cdot\frac{r_{MS}^2}{r_{EM}^2} \approx 1.37\times10^{3}.$$

Although the Newtonian force exerted by the Sun on the Moon is larger than that exerted by the Earth, the Desmos interaction is governed by squared mass and squared distanse scaling. The much smaller Earth–Moon separation dominates the interaction, leading to a stronger Earth–Moon binding and justifying the Moon's classification as a satellite rather than a planet.

Appendix C

Energy Dominance over Mass in the Desmos Framework:

In the Desmos (Bond) formulation, interaction strength is governed by energy rather than by mass alone. This represents a fundamental departure from classical Newtonian gravity, where mass is the primary source of gravitational interaction.

The Desmos interaction is defined as:

$$\Delta_{ij} = k\frac{E_i E_j}{r_{ij}^n}.$$

Using the energy definition:

$$E = m\phi, \qquad \phi = \frac{GM}{r},$$

and fixing the reference distance $r = s.d._0 = 1$ m, then:

$$E = mGM$$

Identifying inertial and gravitational mass ($m = M$), the energy scales as:

$$E = GM^2$$

Therefore, the Desmos interaction becomes:

$$\Delta_{ij} = kG^2\frac{M_i^2 M_j^2}{r_{ij}^n}.$$

This result shows that the interaction scales with the square of the mass squared, i.e. M^4, rather than linearly with mass as in classical gravity.

Comparison with Newtonian Gravity. The classical Newtonian force between two bodies is:

$$F_{ij} = G\frac{M_i M_j}{r_{ij}^2},$$

which depends linearly on the product of masses.

Desmos interaction satisfies:

$$\Delta_{ij} \propto E_i E_j \propto M_i^2 M_j^2.$$

Thus, in Desmos theory:

• mass enters through energy,
• energy, not mass, is the fundamental carrier of interaction,
• distance modulates energy coupling rather than force magnitude.

This energy dominance explains why systems with smaller separation but lower total mass (such as Earth–Moon) can be more strongly bound than systems with larger mass but much greater separation (such as Moon–Sun). The interaction reflects a spacetime–energy bond rather than a purely attractive force.

Hence, Desmos gravity is an energy based theory of interaction, and furthermore a mass–based force law.

Appendix D

Table 1. Symbols, physical meaning, and SI units used throughout the paper.

Symbol	Physical meaning	SI unit
m_i, m_j	Mass of body i, j	kg
M_i, M_j	Source mass generating gravitational field	kg
r_{ij}	Distance between bodies i and j	m

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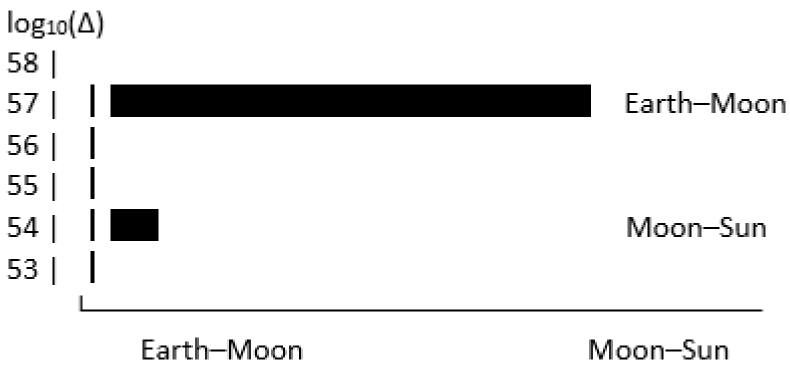
r	Radial distance from source mass	m
G	Newtonian gravitational constant	$M^3\ kg^{-1}\ s^{-2}$
c	Speed of light in vacuum	$m\ s^{-1}$
$\vec{F}_{ij}^{(N)}$	Newtonian gravitational force	$N\ (kg\ m\ s^{-2})$
$\vec{a}_i$	Acceleration of body i	$m\ s^{-2}$
Φ	Newtonian gravitational potential	$M^2\ s^{-2}$
ϕ_i	Desmos potential proxy ($\phi_i = \frac{GM}{r}$)	$M^2\ s^{-2}$
E_i	Desmos energy variable ($E_i = m_i \phi_i$)	$J\ (kg\ m^2\ s^{-2})$
Δ_{ij}	Desmos binding-dominance functional	$J^2\ m^{-n}$
k_B	Desmos interaction scaling constant	$M^n\ J^{-2}$
n	Desmos interaction exponent	dimensionless
g_{00}	Time–time metric component (GR)	dimensionless
ϕ_{GR}	Relativistic Desmos potential proxy	$M^2\ s^{-2}$
$\hbar$	Reduced Planck constant	J s
ω_i	Angular frequency (quantum correspondence)	S^{-1}
n_i	Quantum occupation number (formal correspondence)	dimensionless
$\Delta_{ij}^{(GR)}$	GR-consistent Desmos interaction	$J^2\ m^{-n}$

Appendix E

(A) Desmos Interaction Functional Δ:



Numerical placement:
$\log_{10}(\Delta_{Earth-Moon}) \approx 57.16$
$\log_{10}(\Delta_{Moon-Sun}) \approx 54.03$
Dominance:

$$\frac{\Delta_{EM}}{\Delta_{MS}} \approx 1.37 \times 10^3$$

(B) Newtonian Gravitational Force F:

Numerical placement:
$\log_{10}(F_{Earth-Moon}) \approx 20.30$
$\log_{10}(F_{Moon-Sun}) \approx 20.64$
Ratio:

$$\frac{F_{MS}}{F_{EM}} \approx 2.20$$

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