The Application of the Natural Inertial Progression Principle in Stellar Evolution

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Abstract

Regarding the nebular hypothesis concerning the origin and evolution of the solar system and the related issues that invalidate this hypothesis due to the mismatch between angular momentum and mass distribution, the theoretical foundation of the nebular hypothesis is the law of gravitation, whereas angular momentum distribution is based on the principle of angular momentum conservation in object motion, with the former primarily involving static processes of object mass and the latter involving dynamic processes of objects. Based on the argument of angular momentum conservation in curved spacetime from general relativity and employing the natural inertia evolution principle, we first obtain the equilibrium relationship between a planet (Earth) and its natural satellite (Moon) according to the equilibrium equation of the Earth-Moon system; after differentiating this equation, we obtain the extreme distance at which a natural satellite is merged by its planet, that is, the maximum value that the Moon can achieve to reach equilibrium with Earth, a value that is basically consistent with the Moon's current state. Secondly, using a similar method to analyze the relationship between a star (the Sun) and planets (the eight planets), we determine the extreme distance between Jupiter (which has the heaviest mass, fastest rotation, moderate distance, and an orbital period completely synchronized with the Sun among solar system planets) and the Sun based on the equilibrium equation; by comparing the current distance values of the eight planets with this extreme distance proportionally, we thus obtain the extreme distances for each planet, concluding that Mercury has already exceeded the extreme distance for being merged by the Sun (solar system), i.e., it is already in the pre-merger stage; Pluto is currently on the edge of being able to balance with the Sun (solar system); and we comprehensively provide the extreme eccentricity for determining the state of celestial bodies. Using the mass-energy equation and relevant characteristic data of solar system evolution, we illustrate that the celestial bodies in the solar system exhibit an angular momentum equilibrium relationship characterized by moment of inertia and constrained by inertia surge force bal-

ance. Based on two fundamental arguments—stellar radiative thermal energy and centripetal inertia surge rotational force—we elaborate on the energy source for galaxy formation and the equilibrium principle of galaxy development and merger. This method will have extremely high practical value for explorations in cosmic celestial bodies.

Full Text

Application of the Natural Inertial Evolution Principle in Astronomical Object Evolution

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Abstract

The nebular hypothesis of solar system origin and evolution has been widely accepted, yet it fails to explain the mismatch between angular momentum and mass distribution, inconsistent planetary axial tilts, and differences between solid and gaseous planet formation. The hypothesis relies primarily on gravitational law (a static mass process) while angular momentum distribution follows conservation principles (a dynamic momentum process). Drawing upon general relativity's argument for angular momentum conservation in warped spacetime and employing the natural inertial evolution principle, we first derive the equilibrium relationship between Earth and its natural satellite (the Moon) from the Earth-Moon system balance equation. By differentiating this equation, we obtain the extreme distance at which a natural satellite would be merged by its planet—the maximum distance the Moon can maintain equilibrium with Earth—a value that closely matches the Moon's current state. Second, we apply a similar method to analyze the relationship between the Sun and the eight planets. Using the balance equation, we calculate the extreme distance between Jupiter (the most massive, fastest-rotating planet with moderate distance and an orbital period synchronized with the Sun) and the Sun. By proportionally comparing each planet's current distance to this extreme value, we determine individual planetary extreme distances, concluding that Mercury has already exceeded its solar merging extreme distance (entering the pre-merger phase) while Pluto stands at the edge of solar system balance. We comprehensively provide eccentricity extremes for determining celestial body states. Using the mass-energy equation and characteristic solar system evolution data, we demonstrate that solar system bodies exhibit angular momentum equilibrium characterized by moment of inertia and constrained by inertial surge force balance, rather than gravitational relationships. Two fundamental arguments—stellar radiative thermal energy and inward inertial rotational force—explain in detail the energy source of galaxy formation and the equilibrium principles governing galactic development and merging. This method holds significant practical value for cosmic exploration.

Keywords: Solar System; Nebular Hypothesis; Conservation of Angular Momentum; Moment of Inertia; Equilibrium Equation; Theorem of Gravitation; Inertial Surging Force

2. Inertial Surge Force and Inertial Equilibrium Equation

General relativity posits that the rotation of small-mass objects in space is a geometric effect caused by massive objects warping spacetime. This presupposes that space possesses considerable medium density, enabling objects to achieve rotational balance while distorting surrounding spacetime to establish equilibrium correlations with other planets. Warped spacetime represents an abstract explanation of momentum; its essence is the directional air vortex (inertial surge force) generated by objects rotating through space. For Earth (a planet), this inertial surge force manifests as its rotating atmospheric layer, with maximum intensity at the "blackout zone." For the Sun (a star), it appears as an extremely dense gas vortex layer from nuclear fusion, with maximum intensity where light deflection is strongest—the Einstein ring. This torque is characterized by the balance equation between two (or multiple) bodies, whose solutions reflect the degree of torque correlation. The Earth-Moon balance equation has already calculated gravitational (acceleration) values for both bodies, values that essentially match measured results, thereby disproving the existence of gravity. This equation is a quadratic equation; its extreme values yield the merging extreme distance between two celestial bodies, providing a sample for obtaining extreme distances throughout the solar system.

[Figure 1: see original paper]

Let the masses of two celestial bodies be M and m, as shown in Figure 1. Based on the solid sphere moment of inertia formula and the parallel axis theorem, the balance equation between the two bodies is:

$$\frac{2}{5}MR^2 + MH^2 = \left(\frac{2}{5}mr^2 + mh^2\right)\frac{t \times j}{T \times J}$$

where M and m are the respective masses; H and h are the distances from each body to the equilibrium point d; T and t are the angular values rotated by each body within a measured period; and J and j are functions of each body's rotation axis angle relative to the normal of the plane formed by the line connecting them. Substituting the known proportional values M = x × m, R = y × r, and Z = T × J / (t × j) yields:

$$2mr^2 + 5mh^2 = 2Z(x \times m)(y \times r)^2 + 5Z(xm)H^2$$

$$2r^2 + 5h^2 = 2xZ(y \times r)^2 + 5xZH^2$$

Substituting H = p - h (where p = h + H is the average distance from M to m) and expanding the brackets gives:

$$5(1 - xZ)h^2 + 10xZph + 2r^2(1 - Zxy^2) - 5Zxp^2 = 0$$

This is a quadratic equation with parameters:

$$a = 5(1 - xZ)$$

3. Extreme Distance Between Planet and Satellite

Three-quarters of solar system planets possess natural satellites. The Moon provides the most detailed data with the smallest satellite count, making the Earth-Moon system ideal for determining planet-satellite extremes.

[Figure 2: see original paper]

Using the inertial equilibrium equation from the previous section, for Earth (mass M, radius R) and the Moon (mass m, radius r) with average distance P = H + h and current perigee distance hj, we have (data from the National Earth System Science Data Center; distances in km, masses in kg):

$$x = M/m = 81.3, \quad y = R/r = 3.66, \quad p = 384,044, \quad r = 1,737, \quad hj = 363,300$$

Earth and Moon rotate through angles T = 27.32 × 2π and t = 2π within one month. The intersection angles between their rotation axes and the normal to the line connecting them are 28° and 3°, giving J = 1/cos(28°) and j = 1/cos(3°). Thus:

$$Z = \frac{J \times T}{t \times j} = \frac{\cos(3°) \times 27.32}{\cos(28°)} = 30.8994$$

Let f(h) represent equation (3). Since a = 5(1 - xZ) with x = 81.3 and Z = 30.9, we have a < 0, indicating equation (3) has a maximum value. Differentiating f(h):

$$\frac{df(h)}{dh} = 2ah + b$$

Setting df(H)/dh = 0 yields the maximum (substituting the relevant data):

$$h_{\max} = -\frac{b}{2a} = -\frac{10xZp}{2 \times 5(1 - xZ)} = \frac{xZp}{xZ - 1} = \frac{81.3 \times 30.9 \times 384,404}{81.3 \times 30.9 - 1} = 384,557$$

Substituting hmax into equation (2) gives Earth's orbital equilibrium value H:

$$H^2 = \frac{2r^2 + 5h^2 - 2xZ(y \times r)^2}{5xZ} = 42,700,834.39$$

As shown in Figure 2, the distance from hmax to Earth is:

$$Hh_{\max} = h_{\max} - (H^+) = 384,557 - 6,534.58 = 378,022$$

The difference between this value and the measured current lunar perigee distance is:

$$\Delta = Hh_{\max} - hj = 378,022 - 363,300 = 14,722 \text{ km}$$

As Figure 2 illustrates, Δ represents the extreme distance the Moon can maintain equilibrium in its current state. When $\Delta < 0$, the Moon will be completely controlled by Earth's inertial surge force until eventual merging. Analysis of the Moon's current orbital data indicates it is in the later stage of relative stability, with moderate eccentricity (0.0549) but synchronized rotation and revolution. From a systemic perspective, inner solar system planets like Venus and Mercury have no satellites, suggesting Earth will eventually merge with the Moon. The merging process is detailed in Section 5.

4. Extreme Distance Between Star and Planet

The solar system's eight planets occupy non-fixed orbital positions, raising angular momentum distribution questions that can be resolved through inertial equilibrium relationships. These planets maintain relatively fixed distances from the Sun. We identify a typical planet to form a binary system with the Sun, analogous to the Earth-Moon model, and use similar equilibrium relationships to determine extreme distances. Jupiter serves this role: positioned centrally in the solar system, it is the most massive and fastest-rotating planet with moderate distance and an orbital period synchronized with the Sun. This synchronization and large momentum indicate that the Sun primarily balances inertial surge forces with Jupiter. Therefore, the Sun-Jupiter balance equation matches the two-body form from Section 2, and the extreme distance method follows Section 3's Earth-Moon approach.

Table 1 provides solar system planetary parameters, using AU units for distance and Earth-parameter multiples for all values except inclination and eccentricity.

From equation (1), we determine:

$$x = \frac{M}{m} = \frac{\text{Solar mass}}{\text{Jovian mass}} = \frac{332,946}{317.94} = 1,047$$

$$y = \frac{R}{r} = \frac{\text{Solar radius}}{\text{Jovian radius}} = \frac{108.968}{11.209} = 9.721$$

$$p = \text{Jupiter-Sun average distance} = 5.2{\times}1\ \text{AU} = 5.2{\times}149,597,870 = 777,908,924$$

$$r = \text{Jovian radius} = 11.209 \times \text{Earth radius} = 11.209 \times 6,387 = 71,591$$

Jupiter's revolution and rotation periods around the solar system balance point are 11.86 years and 0.375 days, respectively, while the Sun's are 11.86 years and 25.38 days. Thus, Jupiter rotates (11.86 years / 0.375 days) × 2π times in 11.86 years, while the Sun rotates (11.86 years / 25.38 days) × 2π times:

$$T = \frac{11.86 \text{ years}}{25.38 \text{ days}} \times 2\pi, \quad t = \frac{11.86 \text{ years}}{0.375 \text{ days}} \times 2\pi$$

$$j = \text{Jovian inclination function} = 1/\cos(3.13^\circ), \quad J = \text{solar inclination function} = 1/\cos(0^\circ)$$

$$Z = \frac{T \times J}{t \times j} = \frac{\cos(3.13^\circ) \times 0.375}{\cos(0^\circ) \times 25.38} = 0.0147534$$

Equation (3) represents the standard two-body inertial equilibrium equation—a quadratic equation:

$$ah^2 + bh + c = 0$$

where:

$$a = 5(1 - xZ), \quad b = 10xZp, \quad c = 2(1 - Zxy^2)r^2 - 5Zxp^2$$

Since a = 5(1 - xZ) < 0, the quadratic equation has a maximum value. Solving as in Section 3:

$$h_{\max} = -\frac{b}{2a} = -\frac{10xZp}{2 \times 5(1 - xZ)} = \frac{xZp}{xZ - 1} = \frac{1,047 \times 0.0147534 \times 777,908,924}{1,047 \times 0.0147534 - 1} = \frac{12,016,386,005.134}{14.447} = 831,$$

To find H, substitute hmax into equation (2):

$$H^2 = \frac{2r^2(1 - xZy^2) + 5(h_{\max})^2}{5xZ} = \frac{2 \times (71,591)^2(1 - 1,047 \times 0.014753 \times (9.721)^2) + 5(831,756,489)^2}{5(1,047 \times 0.014753)} = 44,7$$

$$H = \pm 211,632,200$$

Following Section 3, the distance from hmax to the Sun is:

$$Hh_{\max} = h_{\max} - (H^+) = 831,756,489 - 211,632,200 = 620,124,288.788$$

Converting Hhmax (Jupiter-Sun extreme distance) to AU:

$$Hh_{\max} = \frac{620,124,288.788}{149,597,870} = 4.14527485$$

Define:

$$Kj = \frac{\text{Jupiter-Sun extreme distance}}{\text{Planet X's perihelion distance}} = \frac{Hh_{\max}}{\text{X.perihelion}}$$

$$Kp = \frac{\text{Jupiter-Sun average distance}}{\text{Planet X's average distance}} = \frac{\text{Jupiter's average distance}}{\text{X's average distance}}$$

where Kj represents Planet X's extreme intensity from the Sun, and Kp represents its average intensity.

Let Δ be the extreme increment. Using the Jupiter-Sun extreme as a standard, we obtain the ratio between Planet X (one of the eight planets) and Jupiter:

$$\frac{Hh_{\max} + \Delta}{\text{Planet X's perihelion distance}} = \frac{\text{Jupiter-Sun average distance}}{\text{Planet X's average distance}}$$

$$\Delta = Kp \times (\text{Planet X's perihelion distance}) - Hh_{\max}$$

Δ directly yields the distance (in AU) from Planet X's current position to its extreme point, with three cases: - $\Delta > 0$: Distance from Planet X to its extreme point - $\Delta = 0$: Planet X at critical extreme point, about to be merged by the Sun - $\Delta < 0$: For planets between Jupiter and the Sun, indicates exceeding the extreme point and being in solar merging state (larger values indicate stronger merging); for bodies beyond Jupiter, indicates exceeding the extreme point for solar system balance (larger values indicate greater loss of control)

Using Table 1's known data (inputs), we calculate and fill in the corresponding outputs. For Mercury:

$$Kp = \frac{5.2}{0.387} = 13.436692506$$

$$Kj = \frac{4.14527485}{0.307499} = 13.480612457$$

$$\Delta = 13.4366925 \times 0.307499 - 4.14527485 = -0.013505$$

These Kj and Δ values are entered into Table 1 for Mercury. Similar calculations for other planets, Pluto, and Halley's Comet populate the remaining columns. The resulting extreme intensities match the current solar system ordering. Mercury's $\Delta < 0$ indicates it exceeds the near-Sun critical point, while Pluto exceeds the far-Sun critical point. Table 1 shows Mercury is being merged by the Sun, whereas Pluto remains near but currently outside the Sun's inertial equilibrium range. Conclusions are detailed in the following section.

[Figure 3: see original paper]

As Figure 3 illustrates, the air vortices surging from Sun-centered bodies (from system core to edge) naturally rotate inward around the balance point. These vortices maintain solar system equilibrium while continuously surging outward as gaseous return flows into extremely cold regions beyond the solar system (the solar system's ice condensation zone), forming ultra-cold gases. The energy originates from the mass and velocity of natural inertial motion, characterized by the moment of inertia that bodies possess from birth and gradually strengthen. Inter-body constraints are determined by the inertial equilibrium equation. A planet and its satellite form a centripetal inertial rotation subsystem. As planets gradually merge their satellites to gain energy, they spiral inward toward the solar system core. The Sun, compressed by centripetal rotational forces from system planets (including air vortices), gains energy through nuclear fusion and radiates thermal energy outward. This centripetal force derives from the inertial surge forces of both stars and planets; planets closer to the solar core exert stronger compression. When planets approach the Sun, they are merged, continuously increasing solar energy. Beyond the solar system (the ice condensation zone), radiant energy creates temperature differences that gradually transform ultra-cold gaseous matter into icy objects. Simultaneously, the solar system edge's inertial surge force (edge vortex) slowly draws these icy objects with weak inertial equilibrium into the system. Upon entering, icy planets evolve from ice to gas and finally to rocky planets before being gradually merged by the Sun. This cyclical process maintains system energy balance, evolving the diverse forms of solar system bodies through a complete energy equilibrium cycle.

5.1 Source of Kinetic Energy

Spatial objects evolve through natural inertial motion. From the moment they possess mass, internal mass imbalances initiate inertial motion and outward air vortex emission. These vortices create external spatial imbalances, causing objects to naturally adapt and form their own balanced orbits. The kinetic energy source is thus self-generated inertial motion and external air vortices. The theoretical basis extends the mass-energy equation $E = MC^2$ to $E = MV^2$, establishing equivalence between E and MV^2: any massive object (M) in motion (V) possesses energy ($E = MV^2$ kinetic energy). This energy enables centripetal rotation for self-balance while emitting inertial surge vortices that accelerate centripetal rotation, continuously drawing in external objects. Through increasing moment of inertia, this intensifies centripetal compression, causing central bodies to radiate light energy. Previous work has proven that celestial body gravity (acceleration) arises from correlated inertial motion. We now present the inertial equilibrium relationships for solar system bodies:

1) A body's kinetic energy naturally accumulates through rotation, forming powerful centripetal vortices characterized by its moment of inertia. As shown in Figure 3, this inertial motion represents centripetal acceleration (astronomically slow rotation) that gradually draws in external objects (including air), maintaining spatial balance while compressing toward the central balance point.

2) The Earth-Moon system forms a binary system rotating about their common inertial balance point. The solar system is a multi-body system where Sun and planets rotate about their shared balance point. The solar system's inertial rotational force similarly draws external objects (including air) into the system, maintaining spatial balance and centripetal rotation. As captured bodies spiral inward, planets evolve through icy (Neptune, Uranus), gaseous (Saturn, Jupiter), rocky (Mars, Earth, Venus, Mercury), and luminous (Sun) states. Planetary satellites are gradually merged during this process. In the solar system, planets with greater extreme intensity generally have fewer satellites and higher density, clearly demonstrating this centripetal vortex compression process.

[Figure 4: see original paper]

5.2 Inertial Merging of Celestial Bodies

Planetary satellites naturally spiral toward the system's balance center. When a satellite exceeds the extreme distance (maximum inertial rotational capacity), it gradually loses inertial balance with its planet, exhibiting weakened rotation and increased orbital eccentricity that creates elongated orbits—satellite loss of control. Due to increased eccentricity, the satellite experiences abrasive collisions with planetary inertial surge forces at perigee in a positive feedback loop. Each collision causes mass loss to planetary absorption while the satellite is accelerated outward by reduced mass. Meteor showers represent manifestations of planetary satellite merging. This gradually increases planetary mass (and moment of inertia) while the satellite's decreasing mass evolves its orbit into a solar system asteroid beyond the original planetary system. With minimal mass and severe loss of control, orbits become chaotic. Stellar planetary merging follows a similar process, differing only in mass and distance scales. The Sun's powerful inertial surge rotational force causes merged planets to evolve into comets beyond the solar system. Specific examples:

1) As discussed in Section 3 and Figure 2, Δ = 14,734 km represents the distance from the Moon's current state to its extreme value. The Moon is in the later stage of relative stability (on astronomical timescales) with moderate average eccentricity (~1/18) but weakened rotational capability, always facing the Sun with synchronized rotation and revolution. If eccentricity increases and the orbit elongates such that $\Delta < 0$, Earth will merge with the Moon. Astronomically, the Moon will evolve into the next asteroid generated from the Earth-Moon system; indeed, current Earth-orbiting asteroids represent previous moons gradually ground away by Earth's strengthening inertial surge force until complete dissolution. The span depends on planetary inertial surge intensity, generally within solar system range. Wandering asteroids are planetary remnants being spiraled in. Specific eccentricity thresholds for reaching extremes are detailed in Section 5.3.

2) As discussed in Section 4, Table 1, and Figure 4, Mercury's extreme increment Δ = -0.01350 AU has exceeded the zero critical point, entering the pre-merger phase with the Sun. Its eccentricity exceeds 1/5, losing rotational capability and entering precession, always facing the Sun with rotation unable to keep pace with revolution. Astronomically, Mercury will soon evolve into the next comet generated by the solar system; indeed, current solar system comets represent previous Mercuries gradually ground away by the Sun's inertial surge force until complete dissolution. The span depends on solar inertial surge intensity, generally exceeding solar system range. Currently active comets are planetary remnants being spiraled in by the Sun. Specific eccentricity thresholds are detailed below.

5.3 The Solar System

The fundamental property of celestial bodies is maintaining balance through natural centripetal rotation due to internal imbalances, relying on their own mass (moment of inertia). The fundamental property of star clusters is maintaining group balance through natural centripetal rotation due to external imbalances, relying on each body's moment of inertia. This constitutes a complete spatial object evolution process. Referring to Figure 3 and Table 1, we present a complete evolutionary chain for planets in the solar system:

1) **Planetary System Initial State:** In the extremely cold region beyond the solar system, weak solar thermal radiation causes ultra-cold air to slowly form icy objects that naturally rotate centripetally and compress into icy planets. Guided by the solar system's inward inertial rotational force, these icy bodies slowly spiral inward, possessing centripetal inertial properties. Icy planets gradually compact and enter the solar system, with inertial forces only weakly coupled to the solar system—pre-Pluto state (Δ = -0.19590).

2) **Planetary System Growth:** Upon entering the solar system, planets first exist in ice-condensed states with large volumes and low densities (Neptune: 1.29 g/cm^3, Uranus: 1.64 g/cm^3) and relatively many satellites (Uranus: 27, Neptune: 14). Next comes gas-condensed states with reduced volumes and still-low densities (Saturn: 0.69 g/cm^3, Jupiter: 1.33 g/cm^3) and numerous satellites due to large mass (Saturn: 62, Jupiter: 69). Finally, rocky states (terrestrial) exhibit high densities (Mars–Mercury: 3.95–5.43 g/cm^3) with few satellites (Mars: 2, Earth: 1). Solar core density may reach 160 g/cm^3. Clearly, planets nearer the Sun have higher densities. Table 1's extreme intensity expresses each planet's inertial balance relationship with the Sun.

3) **Planetary Decay:** Strengthening solar inertial surge forces gradually weaken planetary inertial surge forces, causing eventual stellar abrasion (merging) into comets and gradual demise.

4) **Inertial Balance Range:** Table 1 shows Mercury (Δ = -0.0135) and Pluto (Δ = -0.959) in merging and solar system escape states, with eccentricities of 0.2056 and 0.2488, respectively. Eccentricity e most clearly indicates body state, particularly near-Sun extreme eccentricity ej and far-Sun balance extreme eccentricity er. From equation (4), let eΔ be the eccentricity increment corresponding to Δ. For the perihelion direction:

$$\frac{e_{\text{Mercury}}}{Hh_{\max}} = \frac{e_{\Delta}}{|\Delta_{\text{Mercury}}|}$$

$$e_{\Delta} = \frac{0.2056 \times 0.0135}{4.14527485} = 0.00066958$$

$$ej = e_{\text{Mercury}} - e_{\Delta} = 0.20562 - 0.00066958 = 0.20495$$

For the aphelion direction:

$$\frac{e_{\text{Pluto}}}{Hh_{\max}} = \frac{e_{\Delta}}{|\Delta_{\text{Pluto}}|}$$

$$e_{\Delta} = \frac{0.2488 \times 0.1959}{4.14527485} = 0.0117579$$

$$er = e_{\text{Pluto}} - e_{\Delta} = 0.2488 - 0.0117579 = 0.2370$$

These extreme eccentricity equations ej and er are highly practical: measuring a body's eccentricity reveals its extreme state. They define the solar system's inertial balance range: planetary eccentricities between ej and er indicate equilibrium within the solar system.

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