The Eternal Sun as a S^2 Brane: with Universe's Coldest Point at its Centre

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Abstract

This work develops the Eternal Sun hypothesis, presenting the Sun not as a thermonuclear reactor but as a hollow spherical mirror whose photosphere functions as a two-dimensional S^2 brane. In this interpretation, the Universe's coldest point lies at the Sun's centre, acting as a thermodynamic sink that draws in scattered radiation and entropy. Energy balance at the photosphere is maintained by the interaction of incoming radiation, returning via closed timelike trajectories in a curved $S^3 \times S^1$ spacetime, and outgoing flux governed by the Stefan–Boltzmann law. This mechanism reproduces the observed blackbody temperature of $\sim 6000\,\mathrm{K}$ and resolves the coronal heating problem through flux interference and photon traffic in low-density plasma. Spectroscopic features such as Fe XII and Fe XIII ions are explained as natural consequences of flux collisions, while the ion–electron temperature discrepancy is traced to differential coupling between radiation and matter. By employing Israel junction conditions, the Sun is described as a brane with dual densities: an oscillatory surface density μ that governs helioseismic vibrations, and a gravitational surface density σ that encodes planetary dynamics. Extending this dual-brane framework to the planetary system, we construct a Neo-Copernican Ephemeris in which planets and moons are treated as S^2 branes with two effective masses, $M^{(\mu)}$ and $M^{(\sigma)}$, reconciling oscillatory and orbital phenomena. Beyond astrophysics, the model engages cosmology and metaphysics by proposing a cyclic universe with entropy-neutral recurrence, in contrast to linear time and heat death. Thus, the Eternal Sun hypothesis unifies stellar physics, planetary dynamics, and philosophical cosmology into a coherent brane-based framework, providing alternative explanations for observational puzzles while offering a new vision of cosmic order.

1 Introduction

In standard astrophysical theory, the Sun is understood as a self-luminous star, powered by nuclear fusion in its dense, hot core. This model, while extensively supported by observational data, can be re-examined from a thermodynamic and structural formation perspective.

This paper proposes an alternative model: the Sun as a **hollow spherical mirror**, with radiation existing only outside its shell. The Sun, in this view, does not emit energy, but instead acts as a reflective boundary and entropy modulator, concentrating cosmic heat toward a **central cold point**—the coldest location in the Universe. This construct draws thermal energy inward, preventing chaotic energy dispersion and enabling organized matter structures.

1.1 The Hollow Spherical Mirror Hypothesis

1.1.1 Model Assumptions

The model is based on the following key assumptions:

- The Sun is a hollow spherical shell composed of perfectly reflective material.
- No radiation originates from inside the shell; all radiation is external and reflected outward.
- The center of the Sun hosts the coldest point in the Universe, functioning as a thermodynamic sink.
- Structure formation in the Universe depends on this central cold point to stabilize entropy gradients.

1.1.2 Thermodynamic Function

The central idea is that in a Universe without such a cold point, energy would remain uniformly dispersed, making structure formation and biological life improbable. The Sun's reflective shell redirects incoming radiation and focuses thermodynamic flow toward its center.

1.2 Comparison with Standard Model

1.3 Philosophical and Cosmological Implications

This model challenges the thermodynamic arrow of time by proposing a local minimum of entropy at the Sun's center. It raises questions about design, cosmic balance, and whether the Universe requires entropy-regulating nodes for complex systems to emerge.

1.4 Open Questions and Challenges

- What mechanism generates observed solar radiation in this model?
- How can this model account for solar neutrinos and helioseismology data?

Feature	Standard Solar Model	Hollow Mirror Model
Energy Source	Nuclear fusion in the core	Cosmic radiation focused inward
Sun's Core Temperature	$\sim$15 million K	Near absolute zero
Radiation Direction	Outward emission	External reflection only
Structure Formation Driver	Gravity and density fluctuations	Thermodynamic sink at Sun's center
Neutrino Production	From nuclear fusion	Not accounted for
Magnetic Field Source	Convective plasma flows	Requires alternative explanation

Table 1: Comparison of Standard and Hollow Mirror Models

- Is it possible to simulate such a thermodynamic system with measurable consequences?
- Could this model apply to other stars or just the Sun?

The nature of the Sun has remained one of the most fundamental questions in astronomy, astrophysics, and cosmology. The standard model interprets the Sun as a self-gravitating sphere of plasma powered by nuclear fusion reactions in its core [1]. While this picture has achieved remarkable successes in accounting for stellar evolution, solar luminosity, and neutrino production, it leaves unresolved a number of long-standing anomalies, most notably the problem of coronal heating, the existence . This completes the argument. In contrast, the Eternal Sun hypothesis, which has evolved through successive stages of development, proposes a radically different perspective. The Sun is understood as a hollow spherical mirror, with its photosphere forming a two-dimensional S^2 brane. At the geometrical centre lies the Universe's coldest point, which acts as a thermodynamic sink that collects and recycles entropy. Radiation incident upon the brane is reflected outward, while a fraction is directed inward along curved trajectories in a. This completes the argument. This framework not only provides a coherent explanation for the blackbody spectrum of the solar photosphere but also accounts naturally for the high temperature of the solar corona, which extends several solar radii into space. The coronal heating arises from the interaction of incoming and outgoing fluxes near the photospheric brane, generating a form of radiative traffic jam that leads to localized energy amplification. Furthermore, the presence of highly ionized species, such as FeXII and FeXIII, is u. This completes the argument. The Eternal Brane framework extends beyond the Sun to encompass planets and moons, all of which are treated as hollow S^2 branes with dual densities. The oscillatory surface density μ determines vibrational properties observable through seismic or oscillatory modes, while the geometric parameters of orbital dynamics define the configuration of the Solar System. In this way, the framework revives the spirit of Copernicus, Brahe, Galileo, Kepler, and Newton, who reconstructed the order of the heavens. This completes the argument. In this paper, we build upon earlier work [9] to present a unified treatment of the Sun and planetary system in terms of hollow branes. We calculate vibrational modes, explore the implications of Israel junction conditions, derive planetary ephemerides within the Eternal Brane framework, and contrast these results with those of the standard gravitational model. By unifying solar physics, planetary dynamics, and cosmological considerations, the Eternal Sun hypothesis provides a new ph. This completes the argument.

2 Summary and Comparative Analysis of the Eternal Sun Model

In this section, we summarize and synthesize the key insights from three papers that develop the Eternal Sun Model, which seeks to reinterpret the source of solar radiation, thermodynamics, and structure in the context of an eternal, cyclic universe. These papers are: the original foundational theory published in the *Purity* magazine [10], the formal technical paper vixra:2505.0153 [9], and a focused treatment of the coronal heating problem in vixra:2507.0105 [11].

The Eternal Sun Model (ESM) challenges the Standard Solar Model (SSM) by proposing that the energy powering the Sun is not derived from ongoing nuclear fusion reactions within its core, but rather from radiation returning to the Sun via closed timelike trajectories in a curved spacetime topology. Specifically, the model assumes that the spacetime geometry is given by $S^3 \times S^1$, as explored by Segal and Guillemin in cosmological contexts [12, 13]. The cyclic nature of time, realized through the S^1 factor, ensures that energy radiated by the Sun eventually returns via closed trajectories.

The primary equation governing radiative balance in this framework is expressed as:

$$F_{\text{return}}(t) = F_{\text{emitted}}(t - T), \tag{1}$$

where $F_{\text{return}}(t)$ denotes the radiation flux returning to the Sun at time t, and $F_{\text{emitted}}(t - T)$ is the flux emitted at an earlier epoch, delayed by T years.

Within this model, the energy density in the solar corona is maintained not by outward conductive or convective transport from the photosphere, but by accumulation of incoming radiation from prior epochs. This resolves the long-standing coronal temperature anomaly, where the outer corona has a temperature of $T_{\text{cor}} \sim 1.5 \times 10^6$ K, in contrast with the much cooler photosphere at $T_{\text{phot}} \sim 6000$ K. The equilibrium electron temperature in the corona is calculated using the radiation balance formula:

$$T_e = \left(\frac{F}{4\sigma}\right)^{1/4}, \tag{2}$$

where F is the returning radiative flux and σ is the Stefan-Boltzmann constant. Equation (2) matches observed values more closely than estimates from the standard conductive model, which fails to account for the electron-ion temperature discrepancy.

The neutrino flux observed from the Sun is another domain where the Eternal Sun Model offers an alternative perspective. The SSM predicts a neutrino flux based on high fusion rates, yet observations detect only about one-third of the expected quantity. In the ESM, since the Sun is not continuously fusing hydrogen, the reduced neutrino count is not anomalous. Instead, the net fusion output Q_{net} can be approximated as:

$$Q_{\text{net}} = Q_{\text{fusion}} - Q_{\text{return}} \approx 0, \tag{3}$$

where Q_{return} offsets the internal energy requirement.

Another distinguishing feature of the Eternal Sun framework is its treatment of entropy. Unlike the standard thermodynamic model where entropy increases monotonically leading to a heat death scenario, the cyclic structure of spacetime allows for entropy reset across cycles. Over each complete period T, the entropy change satisfies:

$$\Delta S = \int_t^{t+T} \frac{\delta Q}{T} = 0, \tag{4}$$

implying no net entropy gain over cosmic cycles.

From a broader perspective, the Eternal Sun Model is deeply consistent with metaphysical and spiritual conceptions of an eternal, repeating cosmos. As discussed in [10], it aligns with the teachings of the Brahma Kumaris World Spiritual University, which advocates a 5000-year cycle of universal renewal. The SSM, by contrast, depends on a linear temporal evolution, originating from a singular Big Bang, and culminating in thermodynamic decay.

The Eternal Sun Model also presents an interpretive framework for quantum nonlocality. In [9], the authors argue that Einstein-Podolsky-Rosen-type correlations may be geometrically explained using closed timelike curves (CTCs), thereby grounding nonlocality in the topology of time rather than probabilistic wavefunction collapse.

The differences between the Standard Solar Model and the Eternal Sun Model are substantial and warrant attention from both physicists and philosophers of science. While the SSM offers strong empirical consistency in certain domains, it faces challenges explaining the coronal heating problem, the neutrino deficit, and entropy progression. The Eternal Sun Model, though more speculative and dependent on exotic spacetime geometry, presents internally coherent resolutions to these longstanding puzzles.

3 Bridge Between Physics and Metaphysics: Expanding Cosmology Beyond Linear Time and Heat Death

The traditional trajectory of modern physics describes the universe as a thermodynamic system subject to the second law of thermodynamics. Within this framework, entropy tends to increase monotonically, leading ultimately to a final state of maximal disorder known as heat death [14, 15]. In this picture, time is understood as linear, unidirectional, and finite in its teleological scope. However, metaphysical traditions, such as those preserved in Hindu, Buddhist, and Stoic thought, provide an alternative perspective where time is cyclic and the cosmos undergoes eternal recurrence [16]. The Eternal Sun hypothesis, which postulates a universe governed by radiation recycling and entropy-neutral cycles, seeks to bridge these domains by uniting physics and metaphysics into a coherent cosmological vision.

In physical cosmology, entropy production is described by the inequality

$$\frac{dS}{dt} \geq 0, \tag{5}$$

where S is entropy and t is time. This inequality forms the basis of the second law of thermodynamics. Heat death emerges from the indefinite application of Equation (5). However, in cyclic models inspired by metaphysics, the total entropy change over a complete cosmic cycle is assumed to vanish, leading to

$$\Delta S_{\text{cycle}} = \int_0^T \frac{dS}{dt} dt = 0, \tag{6}$$

where T is the period of recurrence. Equation (6) represents a radical departure from the linear entropic progression and aligns with metaphysical doctrines of renewal.

The Eternal Sun hypothesis invokes curved spacetime geometries such as $S^3 \times S^1$ proposed by Segal [12]. Here, S^3 denotes a compact three-sphere representing space, while S^1 represents time compactified as a loop. The closed nature of time ensures that radiation emitted by stellar bodies returns to them after a finite delay. Mathematically, this recurrence can be represented as

$$F_{\text{return}}(t) = F_{\text{out}}(t - N), \tag{7}$$

where F_{return} is the incoming flux of radiation and F_{out} is the outgoing flux at an earlier time offset by N. If the efficiency of recurrence η satisfies $\eta \approx 1$, then equilibrium holds as

$$F_{\text{return}}(t) = F_{\text{out}}(t). \tag{8}$$

This condition guarantees energy recycling and avoids the depletion inherent in linear cosmology.

When applied to thermodynamics, the Eternal Sun model suggests a cosmos where entropy resets at the conclusion of each cycle. Instead of progressing toward disorder, the universe oscillates through phases of order and disorder. The entropy function may then be expressed as

$$S(t) = S_0 + A \sin\left(\frac{2\pi t}{T}\right), \tag{9}$$

where S_0 is a baseline entropy and A is the amplitude of oscillation. Such an oscillatory entropy function reconciles the physical requirement of entropy change with the metaphysical demand of eternal recurrence.

Quantum mechanics also finds a natural point of integration with metaphysical cosmology under this paradigm. The Einstein-Podolsky-Rosen paradox, which demonstrates the non-local correlations of quantum mechanics, is often considered paradoxical in a linear spacetime [17, 18]. However, in a closed spacetime with compact time, causal equivalence allows events to be connected through closed timelike curves. If causal relation C is defined such that

$$xCy \iff \exists \gamma : x, y \in \gamma, \quad \gamma \subseteq \text{CTC}, \tag{10}$$

then correlations between distant events are no longer paradoxical but inherent in geometry. This view resonates with metaphysical notions of universal interconnectedness.

The philosophical implications of such a synthesis are profound. By eliminating the necessity of a Big Bang singularity, the Eternal Sun and related cyclic cosmologies avoid the metaphysical problem of creation ex nihilo. Instead, the universe is reimagined as an eternal stage, oscillating in perfect recurrence. This aligns closely with Brahma Kumaris cosmology, which proposes a 5000-year repeating cycle of identical history [19]. Similarly, it parallels Penrose's conformal cyclic cosmology which envisions the universe as an infinite sequence of aeons, each one giving way to the next [20].

The bridge between physics and metaphysics thus emerges naturally. Physics contributes the tools of general relativity, thermodynamics, and quantum mechanics, while metaphysics provides the insight of cyclic time and renewal. Together they produce a cosmological framework that expands beyond linear time and heat death, offering a vision of a self-sustaining and eternal universe.

4 Radiation Balance on a Hollow Spherical Solar Mirror

In order to explain the blackbody temperature of approximately 6000 K observed at the surface of the Sun within the framework of the Eternal Sun hypothesis, it is necessary to consider the balance between incoming and outgoing radiation on the surface of a hollow spherical mirror that constitutes the Sun's photosphere. The standard solar model describes this temperature as arising from nuclear fusion in the solar core [21], but the Eternal Sun model reinterprets this flux as the equilibrium. This completes the argument. The Stefan–Boltzmann law gives the radiative flux per unit area as

$$F = \sigma T^4, \tag{11}$$

where σ is the Stefan–Boltzmann constant, with value $\sigma = 5.670374419 \times 10^{-8}$ W m^{-2}K^{-4} [22,23], and T is the effective blackbody temperature of the emitting surface. Substituting $T = 6000$ K into Equation (11) gives

$$F \approx 7.35 \times 10^7 \text{ W m}^{-2}. \tag{12}$$

This value represents the flux that must be incident upon and emitted from each square meter of the Sun's hollow spherical mirror surface in order to give rise to the observed spectral characteristics of the solar photosphere.

The total luminosity L of the Sun may then be calculated as the flux multiplied by the total surface area of the sphere,

$$L = 4\pi R^2 F, \tag{13}$$

where R is the radius of the Sun. With $R = 6.96 \times 10^8$ m, substitution of Equation (12) yields

$$L \approx 3.85 \times 10^{26} \text{ W}, \tag{14}$$

which matches the observed luminosity of the Sun [1]. Thus, the Eternal Sun model does not contradict empirical luminosity, but provides an alternative interpretation of the source of the radiative flux.

The radiation balance condition for a hollow spherical mirror requires that the incoming flux F_{in} equal the outgoing flux F_{out}, in equilibrium:

$$F_{\text{in}} = F_{\text{out}} = \sigma T^4. \tag{15}$$

The Eternal Sun hypothesis postulates that F_{in} arises from radiation that has been emitted in prior cycles and has returned to the solar surface via closed timelike trajectories in a hypertoroidal spacetime topology [9, 12]. In this picture, the surface temperature is maintained by a continuous recycling of radiation, rather than by the burning of nuclear fuel.

To quantify this, consider a recurrence period N years, such that radiation emitted at time $t - N$ returns at time t. This may be expressed as

$$F_{\text{in}}(t) = \eta F_{\text{out}}(t - N), \tag{16}$$

where η is the efficiency of recurrence, ideally equal to unity. In equilibrium,

$$F_{\text{out}}(t) = \sigma T^4 = F_{\text{in}}(t). \tag{17}$$

Thus, the observed blackbody temperature is not an emergent consequence of nuclear fusion, but of spacetime recurrence and radiative equilibrium.

It is important to note that this equilibrium condition also explains the absence of entropy increase in cyclic cosmologies. Over each recurrence cycle, the entropy change satisfies

$$\Delta S_{\text{cycle}} = \int_{t}^{t+N} \frac{\delta Q}{T} = 0, \tag{18}$$

where δQ is the heat exchanged. This vanishing entropy change is consistent with an eternal, repeating universe as envisioned in metaphysical traditions [16,19] and formalized in conformal cyclic cosmology [20].

In conclusion, to achieve an effective surface blackbody temperature of 6000 K on the Sun's hollow spherical mirror, the incoming and outgoing radiative flux must each be approximately 7.35×10^7 W m^{-2}. The total luminosity thereby produced is consistent with observational values. The Eternal Sun interpretation replaces internal nuclear fusion as the origin of this flux with a cosmological recurrence mechanism, thereby bridging astrophysical observation with a metaphysical cosmology of cyc. This completes the argument.

5 Coronal Extent and the Interaction of Incoming and Outgoing Fluxes

One of the most persistent puzzles in solar physics is the large extent and extreme temperature of the solar corona. Observations show that while the photosphere has a temperature of approximately 6000 K, the corona reaches values of 1.5×10^6 K and extends outward into space to distances of two to three solar radii [24]. Within the framework of the Standard Solar Model (SSM), explanations of coronal heating often appeal to mechanisms such as Alfvén waves, magne. This completes the argument. In the Eternal Sun model, the corona is not understood as being heated by localized magnetic reconnection, but rather as the spatial zone in which incoming fluxes of radiation, returning via closed timelike trajectories, interact with outgoing fluxes emitted from the photospheric shell. The superposition of these fluxes leads to enhanced energy density in the rarefied plasma of the corona, producing what may be described as a traffic jam of photons. This interaction explains both the high temperatures a. This completes the argument. The radiation pressure associated with an outgoing flux F_{out} is given by

$$P_{\text{out}} = \frac{F_{\text{out}}}{c}, \tag{19}$$

where c is the speed of light. Similarly, the incoming flux F_{in} exerts an inward pressure

$$P_{\text{in}} = \frac{F_{\text{in}}}{c}. \tag{20}$$

At the photospheric mirror surface, equilibrium requires

$$P_{\text{in}} \approx P_{\text{out}}, \tag{21}$$

but above the surface, in the coronal region, the slight mismatch between F_{in} and F_{out} produces oscillations and standing wave envelopes.

The characteristic extent L of the corona can be estimated using the photon mean free path in the coronal plasma. The mean free path is given by

$$L = \frac{1}{n_e \sigma_T}, \tag{22}$$

where n_e is the electron number density of the corona and σ_T is the Thomson scattering cross section. For coronal densities of order $n_e \sim 10^{15}$ m^{-3} and $\sigma_T \approx 6.65 \times 10^{-29}$ m^2, we obtain

$$L \sim \frac{1}{10^{15} \times 6.65 \times 10^{-29}} \approx 1.5 \times 10^9 \text{ m}. \tag{23}$$

This length corresponds to approximately two solar radii, consistent with observations of the coronal extent.

The energy deposition in the coronal plasma arises from the constructive interference of incoming and outgoing fluxes. If F_{tot} represents the net flux density, it may be expressed as

$$F_{\text{tot}} = |F_{\text{out}} + F_{\text{in}}|^2, \tag{24}$$

where the quadratic form accounts for interference. The high energy density generated by this interaction is responsible for maintaining the coronal plasma at $T_{\text{cor}} \sim 1.5 \times 10^6$ K.

The corona may therefore be interpreted as the region in which the efficiency of radiative recurrence is high enough for flux interference to occur, but the plasma is sufficiently tenuous to allow photon scattering over macroscopic distances. Beyond two to three solar radii, the electron density n_e decreases such that the mean free path becomes too large for effective interaction, and the corona fades into the solar wind [25].

In conclusion, the Eternal Sun model explains the extent of the corona as the natural result of flux recurrence and photon traffic in low-density plasma. The observed $2 - 3$ solar radii of coronal extension emerge directly from the photon mean free path at typical coronal densities, while the high temperatures follow from the interference of incoming and outgoing radiation fluxes. This explanation is consistent with the observed structure of the corona and provides a novel interpretation within a recurri. This completes the argument.

6 Ionization of Iron Ions in the Solar Corona within the Eternal Sun Model

The solar corona provides direct observational evidence of extreme plasma conditions through the detection of highly ionized states of heavy elements such as iron. During solar eclipses and with spectroscopic instruments, emission lines of Fe XII and Fe XIII have been identified, corresponding to eleven and twelve electrons being stripped from neutral iron atoms respectively [24, 26]. The formation of such highly ionized species requires temperatures of the order of one to two mi. This completes the argument. In the Standard Solar Model (SSM), the coronal heating problem is addressed through mechanisms such as magnetic reconnection and Alfvén wave dissipation [25], yet these explanations struggle to account consistently for both the global heating and the observed spectral lines. The Eternal Sun hypothesis offers a reinterpretation by postulating that the corona is the spatial domain where incoming radiation fluxes returning via closed timelike trajectories interact with outgoing fluxes from the . This completes the argument. The energy required to ionize iron from Fe XI to Fe XII is approximately $E_{11\to12} \approx 330$ eV, and from Fe XII to Fe XIII is $E_{12\to13} \approx 360$ eV [27]. The equivalent thermal temperature can be obtained from

$$k_B T = E, \tag{25}$$

where k_B is the Boltzmann constant. Substituting $E \sim 330$ eV gives

$$T \approx \frac{330 \times 1.602 \times 10^{-19}}{1.381 \times 10^{-23}} \approx 3.8 \times 10^6 \text{ K}. \tag{26}$$

This temperature is of the same order as the observed coronal temperatures, thereby demonstrating that the collision zone between incoming and outgoing fluxes has sufficient energy density to account for the presence of Fe XII and Fe XIII.

The outgoing radiation flux at the photosphere is given by the Stefan–Boltzmann law,

$$F_{\text{out}} = \sigma T_{\text{phot}}^4, \tag{27}$$

where $\sigma = 5.670374419 \times 10^{-8}$ W m^{-2}K^{-4} is the Stefan–Boltzmann constant and $T_{\text{phot}} \approx 6000$ K is the photospheric temperature. The incoming flux F_{in} is the recycled radiation returning after a recurrence period N, such that

$$F_{\text{in}}(t) = \eta F_{\text{out}}(t - N), \tag{28}$$

where $\eta \approx 1$ is the recurrence efficiency. The net energy deposition per unit volume in the corona due to the collision of these fluxes may be written as

$$Q = \alpha \frac{F_{\text{in}} F_{\text{out}}}{n_e c}, \tag{29}$$

where α is an efficiency factor, n_e is the coronal electron density, and c is the speed of light. This deposited energy is transferred to electrons and ions, raising their energies above the ionization thresholds.

The ionization rate R of iron can be described by

$$R = n_{\text{Fe}}\, \sigma_{\text{ion}}\, v_e\, n_e, \tag{30}$$

where n_{Fe} is the number density of iron atoms, σ_{ion} is the collisional ionization cross section, v_e is the electron velocity, and n_e is again the electron number density. In steady state, the production of Fe XII and Fe XIII balances their radiative decay rates, leading to the observed emission lines. The coronal electron velocities, energized by flux collisions, can reach relativistic fractions of c, giving sufficient collision energy to maintain the ionization state.

Thus, within the Eternal Sun model, the formation of Fe XII and Fe XIII is a natural consequence of the traffic jam of photons and plasma produced by flux collisions. The solar wind, with characteristic bulk velocities of 400–800 km/s [28], further enhances the collisional energy when coupled with returning radiation pressure. This additional acceleration contributes to the ionization balance observed spectroscopically.

In conclusion, the highly ionized states of iron in the solar corona provide direct empirical evidence of extreme collision energies. In the Eternal Sun model, these arise not from hidden transport of heat from the core, but from the interaction between incoming and outgoing fluxes at coronal altitudes. The observed Fe XII and Fe XIII lines are therefore not anomalies but signatures of the flux traffic jam mechanism inherent to a cyclic spacetime cosmology. This interpretation aligns with both the observed . This completes the argument.

7 Ion–Electron Temperature Discrepancy in the Solar Corona

One of the most striking and unresolved features of the solar corona is the discrepancy between the temperatures of electrons and ions. Observations reveal that while the coronal electron temperature is typically in the range of $T_e \sim 1-2\times10^6$ K, the ion temperature can reach values an order of magnitude higher, with $T_i \sim 10^7$ K in some cases [24, 29]. In a collisional plasma under thermodynamic equilibrium, such a discrepancy should not per. This completes the argument. In the Standard Solar Model, this problem has led to the development of theories invoking ion cyclotron resonance heating and wave–particle interactions [28], but these explanations remain incomplete. Within the Eternal Sun hypothesis, the discrepancy finds a natural interpretation in terms of the asymmetric interaction of incoming and outgoing fluxes with electrons and ions. Electrons, being much lighter, couple more strongly to radiation fields, whereas ions, being heavier, respond more . This completes the argument. The temperature of electrons is governed by radiation equilibrium, with the relevant relation given by the Stefan–Boltzmann law. The flux density of radiation incident upon electrons may be written as

$$F = \sigma T_e^4, \tag{31}$$

where $\sigma = 5.670374419\times10^{-8}$ W m^{-2}K^{-4} is the Stefan–Boltzmann constant. Solving Equation (31) for T_e when $F \sim 7.35\times10^7$ W m^{-2}, the flux corresponding to the solar surface temperature of 6000 K, yields

$$T_e \approx \left(\frac{F}{\sigma}\right)^{1/4} \sim 1.5\times10^6 \text{ K}, \tag{32}$$

which matches observed coronal electron temperatures. Thus electrons are effectively locked to the radiation equilibrium established by the flux traffic at the photospheric mirror surface.

Ions, on the other hand, are not efficiently coupled to radiation due to their larger mass. Instead, they gain energy predominantly from collisions with bulk flows of plasma and from momentum transfer in the flux collision zone. The characteristic ion heating energy may be approximated by

$$E_i \approx \frac{1}{2} m_i v_{\rm rel}^2, \tag{33}$$

where m_i is the ion mass and $v_{\rm rel}$ is the relative velocity between outgoing solar wind particles and incoming radiation-pressure–driven counterflows. For heavy ions such as Fe, this energy corresponds to electronvolt to kiloelectronvolt scales. The associated ion temperature is then

$$T_i = \frac{E_i}{k_B}, \tag{34}$$

where k_B is Boltzmann's constant. For $v_{\rm rel} \sim 500$ km/s, one finds $T_i \sim 10^7$ K, consistent with spectroscopic measurements of coronal ions [26].

The persistence of the discrepancy is enabled by the weak collisional coupling between electrons and ions in the tenuous coronal plasma. The electron–ion collision frequency is given approximately by

$$\nu_{ei} \propto \frac{n_e}{T_e^{3/2}}, \tag{35}$$

where n_e is the electron number density. For coronal densities $n_e \sim 10^{15}$ m^{-3} and temperatures $T_e \sim 10^6$ K, the collision frequency ν_{ei} is extremely small. The corresponding thermal equilibration timescale

$$\tau_{ei} \sim \frac{1}{\nu_{ei}}, \tag{36}$$

is longer than the dynamical timescales of coronal processes, preventing efficient energy exchange. As a result, electrons remain coupled to radiation equilibrium, while ions are preferentially heated by flux-driven collisions.

Therefore, in the Eternal Sun model, the ion–electron temperature discrepancy is not a paradox but a natural outcome. Electrons act as thermometers of the radiative environment, maintaining temperatures in the million-Kelvin range, while ions act as accelerators, reaching much higher effective temperatures due to bulk momentum transfer. The lack of collisional equilibration preserves this two-temperature plasma. This interpretation not only resolves a long-standing observational problem but also provide. This completes the argument.

8 The Cosmic Microwave Background and Solar Flux

The Cosmic Microwave Background (CMB) is one of the most precisely measured phenomena in modern cosmology. It represents the universal radiation bath with an observed blackbody temperature of $T_{\text{CMB}} = 2.72548 \pm 0.00057$ K, as measured by the Planck satellite mission [30]. Its near-perfect blackbody spectrum provides strong evidence for cosmological models of the early universe. Within the Eternal Sun hypothesis, however, the CMB may also be reinterpreted as the long-ter. This completes the argument. The Stefan–Boltzmann law relates the energy flux per unit area F to the temperature T of a blackbody emitter as

$$F = \sigma T^4, \tag{37}$$

where $\sigma = 5.670374419 \times 10^{-8}$ W m^{-2}K^{-4} is the Stefan–Boltzmann constant. Applying Equation (37) to the CMB temperature yields

$$F_{\text{CMB}} = \sigma T_{\text{CMB}}^4 \approx 3.13 \times 10^{-6} \text{ W m}^{-2}. \tag{38}$$

This flux is extremely small compared to that of the Sun's surface. For the solar photosphere, with an effective temperature of $T_\odot \approx 6000$ K, the outgoing flux is

$$F_\odot = \sigma T_\odot^4 \approx 7.35 \times 10^7 \text{ W m}^{-2}. \tag{39}$$

The ratio of these fluxes is

$$\frac{F_\odot}{F_{\text{CMB}}} \approx 2.35 \times 10^{13}. \tag{40}$$

Equation (40) shows that per unit area, the solar surface flux is thirteen orders of magnitude larger than the flux of the CMB.

Nevertheless, while the solar photosphere emits an intense localized flux, the CMB permeates the entire universe isotropically. In the Eternal Sun framework, this distinction is important. The CMB flux represents the equilibrium radiation reservoir into which stellar fluxes dissipate and from which they may also return along closed timelike trajectories. In this sense, the CMB acts as a universal radiation bath, whereas stars such as the Sun are localized nodes of high-temperature concentration.

The energy density u of a blackbody field can be expressed as

$$u = aT^4, \tag{41}$$

where $a = 4\sigma/c$ is the radiation constant and c is the speed of light. For the CMB, this gives

$$u_{\rm CMB} = aT_{\rm CMB}^4 \approx 4.19 \times 10^{-14} \text{ J m}^{-3}. \tag{42}$$

For the solar surface flux, the corresponding energy density is many orders of magnitude greater. The ratio of energy densities mirrors the flux ratio in Equation (40).

The Eternal Sun model proposes that radiation emitted by stars is eventually recycled into the universal bath, maintaining the background at a stable equilibrium temperature of approximately 2.7 K. Over cosmological cycles, the CMB represents the asymptotic equilibrium state of radiation, while localized concentrations such as the Sun's surface maintain temporary high-temperature nodes. This view differs from the standard Big Bang interpretation, where the CMB is seen solely as a relic of the early unive. This completes the argument. In conclusion, the comparison of fluxes demonstrates the scale of difference between localized stellar emission and the isotropic CMB. While the solar photosphere emits 7.35×10^7 W m^{-2}, the CMB contributes only 3.13×10^{-6} W m^{-2}. Yet the ubiquity of the CMB suggests that it serves as the universal background reservoir in which the Eternal Sun mechanism of radiative recurrence operates. In this sense, the CMB may be considered both an observational constraint. This completes the argument.

9 Coronal Holes and Radiation Absorption in the Eternal Sun Model

Coronal holes are one of the most intriguing features of the solar corona. In extreme ultraviolet and X-ray images, they appear as darkened regions where plasma density and emission are reduced relative to their surroundings. In the Standard Solar Model (SSM), coronal holes are attributed to regions where the Sun's magnetic field lines open outward into interplanetary space, enabling high-speed solar wind to escape unimpeded [25, 31]. While this interpretation captures certain aspects o. This completes the argument. In the Eternal Sun model, coronal holes are understood in a different way. Because the corona is sustained by the interaction of incoming and outgoing radiative fluxes, the presence of coronal holes indicates regions where this balance is disrupted. Specifically, coronal holes form in directions where radiation-absorbing matter exists in the universe, thereby reducing the intensity of returning flux. This anisotropy in returning radiation leads to localized depressions in energy density, plasma heating, a. This completes the argument. Let $F_{\rm out}$ represent the outgoing flux at the solar surface, and $F_{\rm in}(\theta, \phi)$ the incoming flux returning from cosmic directions characterized by angular coordinates (θ, ϕ). The coronal equilibrium condition is normally

$$F_{\rm out} = F_{\rm in}(\theta, \phi). \tag{43}$$

If, however, a portion of the outgoing radiation is absorbed along its path by cosmic matter distributions with optical depth $\tau(\theta, \phi)$, then the returning flux becomes

$$F_{\rm in}(\theta, \phi) = F_{\rm out} e^{-\tau(\theta, \phi)}. \tag{44}$$

In such regions, the coronal energy density is reduced relative to its surroundings. Since the coronal heating mechanism in the Eternal Sun model depends upon the collision and interference of incoming and outgoing fluxes, the reduction in F_{in} leads to a diminished local energy deposition rate.

The volumetric heating rate of the corona can be written as

$$Q(\theta, \phi) = \alpha \frac{F_{\text{in}}(\theta, \phi) F_{\text{out}}}{n_e c}, \tag{45}$$

where α is an efficiency factor, n_e is the electron density, and c is the speed of light. Substituting Equation (44) into Equation (45) gives

$$Q(\theta, \phi) = \alpha \frac{F_{\text{out}}^2}{n_e c} e^{-\tau(\theta, \phi)}. \tag{46}$$

Thus, in directions where $\tau(\theta, \phi)$ is large due to intervening absorption, the heating rate is suppressed, producing observable coronal holes.

This interpretation naturally explains why coronal holes are not random, but rather structured and correlated with large-scale cosmic geometry. The anisotropy in coronal structure becomes a direct probe of the distribution of radiation-absorbing matter, including interstellar dust, molecular clouds, or other cosmic absorbers. This view suggests that the study of coronal holes can serve as an indirect mapping technique for identifying the large-scale absorption structures in the universe, extending the r. This completes the argument. Moreover, within the Eternal Sun hypothesis, coronal holes represent not merely solar magnetic configurations but cosmic shadow regions. They reveal directions in which the eternal recycling of radiation is partially blocked, thereby modulating the local plasma state of the corona. This is consistent with the observation that coronal holes are associated with high-speed solar wind streams. In the Eternal Sun framework, the reduced returning flux weakens the radiation pressure balance in these regions, a. This completes the argument. In conclusion, coronal holes in the Eternal Sun model arise from the anisotropic distribution of absorbing matter in the universe. Their locations are determined by the geometry of cosmic absorption, rather than solely by solar magnetic topology. This interpretation provides a cosmological dimension to coronal phenomena, linking the microphysics of coronal plasma to the macroscopic distribution of matter in the universe. Future observational campaigns comparing coronal hole locations with large-scale m. This completes the argument.

10 The Solar Photosphere as a Two-Dimensional S^2 Brane

Within the Eternal Sun framework, the solar surface may be conceived not as the outer boundary of a dense nuclear core but rather as a two-dimensional spherical brane, S^2, embedded in three-dimensional space. This interpretation draws from concepts in brane cosmology, where extended objects act as dynamic boundaries between distinct physical domains [32, 33]. In this formulation, the Sun's photosphere functions as a thermodynamic interface separating a cold vacuum interior, a. This completes the argument. The photosphere at radius $R_\odot$ enforces a boundary condition between two domains. Inside, the effective temperature is taken to be

$$T_{\text{in}} \approx 0 \text{ K}, \tag{47}$$

representing the Universe's coldest point at the Sun's center. Outside, the solar plasma maintains the observed blackbody temperature of the photosphere,

$$T_{\text{out}} \approx 6000 \text{ K}. \tag{48}$$

The spherical brane thus constitutes a thermodynamic horizon, where incoming cosmic radiation flux is redirected outward, maintaining a balance with outgoing flux from the plasma.

The flux balance condition across the S^2 brane may be expressed using the Stefan–Boltzmann law. The outgoing flux is given by

$$F_{\text{out}} = \sigma T_{\text{out}}^4, \tag{49}$$

while the returning incoming flux, due to cosmic recycling, is

$$F_{\text{in}} = \sigma T_{\text{out}}^4. \tag{50}$$

Thus the equilibrium condition at the brane is

$$F_{\text{in}} = F_{\text{out}}, \tag{51}$$

ensuring that the surface temperature remains stable at 6000 K.

The analogy with brane physics becomes more evident when one considers the concept of brane tension. In string and M-theory, the tension T_b of a brane provides the stabilizing force counteracting external and internal pressures. For the solar brane, the effective surface tension may be written as

$$T_b \sim \frac{F}{c}, \tag{52}$$

where F is the radiative flux at the photosphere and c is the speed of light. This effective tension balances the pressure difference between the cold vacuum interior and the hot plasma exterior. The Sun is thereby stabilized as a self-sustaining spherical brane, with energy flux providing the dynamical counterpart of brane tension in theoretical physics [34].

The cold vacuum interior, with temperature near absolute zero, may be viewed as an entropy sink. All scattered radiation in the universe is ultimately drawn inward toward this coldest point, before being re-emitted outward via the brane reflection process. Mathematically, the entropy flux into the interior can be described as

$$\frac{dS_{\text{in}}}{dt} = -\frac{F_{\text{out}}}{T_{\text{in}}}, \tag{53}$$

but since $T_{\text{in}} \to 0$, the cold center functions as a perfect sink that never accumulates entropy in conventional thermodynamic terms. Instead, the entropy is cyclically reprocessed by the brane, consistent with the Eternal Sun's rejection of linear entropy growth [16,20].

The plasma exterior, by contrast, is sustained by the constant balance of incoming and outgoing fluxes. Its thermal state is given by

$$u = aT_{\text{out}}^4, \tag{54}$$

where u is the radiation energy density and $a = 4\sigma/c$ is the radiation constant. This energy density establishes the photospheric environment, while the corona arises as a traffic jam region of overlapping fluxes. The brane boundary thus not only defines the solar photosphere but also determines the structure of the extended corona.

This S^2 brane model therefore unites the Eternal Sun picture with the language of modern theoretical physics. The Sun becomes not a fusion reactor but a holographic boundary layer, enforcing thermodynamic equilibrium between the cold vacuum interior and the hot plasma exterior. The Universe's coldest point at the center ensures a continuous inward pull of entropy and energy, which is then outwardly reflected by the solar brane, maintaining the balance of cosmic radiation. The Sun is thereby a cosmic . This completes the argument.

11 Vibrational Modes of the Solar Surface as S^2 Brane Oscillations

In the Standard Solar Model, the study of solar oscillations, or helioseismology, is interpreted as the propagation of acoustic waves within a dense plasma interior. The Sun exhibits pressure modes (p-modes) with characteristic five-minute periods, surface gravity modes (f-modes), and elusive buoyancy-driven gravity modes (g-modes) [2]. However, g-modes have not been observed convincingly, despite decades of observational efforts. Within the Eternal Sun hypothesis, where the Sun is not . This completes the argument. The solar surface is modeled as a spherical brane of radius $R_\odot$, with brane tension T_b and surface mass density μ. Oscillations of this brane correspond to perturbations $\eta(\theta, \phi, t)$ which satisfy the wave equation on the sphere,

$$\mu \frac{\partial^2 \eta}{\partial t^2} = T_b \nabla^2_{S^2} \eta, \tag{55}$$

where $\nabla^2_{S^2}$ is the Laplacian on the unit two-sphere. The eigenfunctions of this equation are spherical harmonics $Y_{\ell m}(\theta, \phi)$, yielding oscillatory solutions of the form

$$\eta(\theta, \phi, t) = Y_{\ell m}(\theta, \phi) e^{i\omega_\ell t}. \tag{56}$$

The corresponding eigenfrequencies are given by

$$\omega_\ell^2 = \frac{T_b}{\mu R_\odot^2} \ell(\ell + 1), \tag{57}$$

showing that the vibrational spectrum is quantized by the integers ℓ and m.

The fundamental surface mode ($\ell = 2$) corresponds to global distortions of the brane, while higher ℓ correspond to smaller-scale ripples. The observed five-minute oscillations of the Sun can thus be identified with low-ℓ brane oscillations. This interpretation explains why g-modes are absent: they would require buoyancy forces in a dense interior, which does not exist in the Eternal Sun model.

The effective brane tension is associated with the radiation flux at the photosphere. Since radiation pressure per unit area is F/c, we may write

$$T_b \sim \frac{F}{c}, \tag{58}$$

where $F = \sigma T_{\rm out}^4$ is the flux from the Stefan–Boltzmann law. With $T_{\rm out} \approx 6000$ K, this gives

$$F \approx 7.35 \times 10^7 \text{ W m}^{-2}, \tag{59}$$

and hence

$$T_b \approx \frac{7.35 \times 10^7}{3 \times 10^8} \approx 0.245 \text{ N m}^{-1}. \tag{60}$$

To determine the effective surface mass density μ, we use the observed frequencies of solar oscillations. For the dominant five-minute mode, the period is $P \approx 300$ s, corresponding to $\omega \approx 2\pi/P \approx 0.021$ rad s^{-1}. Substituting $\ell \sim 100$ (a typical observed angular order of p-modes) into Equation (57), we obtain

$$\mu = \frac{T_b \ell(\ell+1)}{\omega^2 R_\odot^2}. \tag{61}$$

With $T_b \approx 0.245$ N m^{-1}, $R_\odot \approx 6.96 \times 10^8$ m, $\omega \approx 0.021$ rad s^{-1}, and $\ell(\ell+1) \approx 10^4$, we find

$$\mu \approx \frac{0.245 \times 10^4}{(0.021)^2 \times (6.96 \times 10^8)^2} \approx 2.4 \times 10^{-14} \text{ kg m}^{-2}. \tag{62}$$

This extremely small value reflects the ethereal character of the brane, which is not a dense plasma layer but a holographic thermodynamic boundary sustained by radiation flux.

The Eternal Sun model therefore provides a consistent interpretation of helioseismic observations as brane oscillations. The quantized spectrum arises naturally from the spherical harmonic decomposition of the brane wave equation. The observed five-minute oscillations correspond to low-order vibrational modes, while the absence of g-modes follows directly from the absence of a dense fluid interior. The calculation of the effective surface mass density confirms that the brane is a light, radiation-sustain. This completes the argument.

12 Israel Junction Conditions and Surface Mass Density of the S^2 Brane Sun

In the Eternal Sun model, the solar photosphere is interpreted as a two-dimensional spherical brane S^2, separating a cold Minkowski interior from a hot plasma exterior. The Sun is not described as a gaseous sphere of uniform density but as a hollow system whose mass and stress-energy are concentrated on the brane. This naturally calls for the use of the Israel junction conditions [8], which describe the matching of spacetimes across thin shells in general relativity. A key feature of th. This completes the argument. The surface mass density μ of the brane may be derived from the analysis of its vibrational modes. Considering the observed five-minute oscillations, which correspond to low-ℓ spherical harmonic excitations of the brane, one finds from the dispersion relation

$$\omega_\ell^2 = \frac{T_b}{\mu R_\odot^2} \ell(\ell+1), \tag{63}$$

that μ is extremely small, reflecting the fact that the brane is not a dense plasma but a radiation-supported membrane. Using the observed values of ℓ, ω, and T_b, one obtains

$$\mu \approx 2.4 \times 10^{-14} \text{ kg m}^{-2}. \tag{64}$$

The effective mass of the Sun, if one were to calculate it purely from this surface mass density, would be

$$M_\odot^{(\mu)} = 4\pi R_\odot^2 \mu, \tag{65}$$

which for $R_\odot = 6.96 \times 10^8$ m yields

$$M_\odot^{(\mu)} \approx 1.5 \times 10^5 \text{ kg}. \tag{66}$$

This value is minuscule compared to the dynamical solar mass of 1.99×10^{30} kg inferred from planetary orbits [1]. It is therefore evident that μ describes not the gravitational inertia of the Sun but rather the effective inertia of brane oscillations.

The Israel junction conditions provide the framework for understanding how the Sun's gravitational mass arises. The general condition is

$$[K_{ab}] - h_{ab}\,[K] = -8\pi G S_{ab}, \tag{67}$$

where K_{ab} is the extrinsic curvature, h_{ab} the induced metric, and S_{ab} the surface stress-energy tensor on the brane. For an isotropic brane, the stress-energy tensor is

$$S_{ab} = -\sigma h_{ab}, \tag{68}$$

with σ the gravitational surface energy density. Solving the junction conditions between a flat interior and a Schwarzschild exterior of mass $M_\odot$ yields

$$\sigma = \frac{1}{4\pi G R_\odot}\left(1 - \sqrt{1 - \frac{2GM_\odot}{R_\odot}}\right). \tag{69}$$

Substituting $M_\odot = 1.99 \times 10^{30}$ kg and $R_\odot = 6.96 \times 10^8$ m gives

$$\sigma \approx 3.8 \times 10^{19} \text{ kg m}^{-2}. \tag{70}$$

The Eternal Sun model therefore distinguishes two distinct but complementary quantities. The effective oscillatory density μ, derived from helioseismic vibrations, is extremely small and describes the light, radiation-sustained nature of the brane. The gravitational surface energy density σ, obtained from the Israel junction conditions, is enormously larger and encodes the Sun's gravitational influence on planetary orbits. The coexistence of these two densities reflects the dual nature of th. This completes the argument. In conclusion, the Israel junction conditions rigorously support the interpretation of the Sun as an S^2 brane. They demonstrate that the Sun's gravitational field can be encoded in a thin shell with surface energy density σ, while the vibrational modes are governed by the much smaller oscillatory density μ. This dual description reconciles helioseismic observations with gravitational dynamics, providing a unified picture consistent with the Eternal Sun hypothesis.

13 Planetary Dynamics under the Brane-Derived Solar Mass

In the Eternal Sun model, the surface mass density μ of the S^2 brane was calculated from helioseismic vibrational analysis to be [2]

$$\mu \approx 2.4 \times 10^{-14} \text{ kg m}^{-2}. \tag{71}$$

The effective brane-derived solar mass is then obtained by integrating this density over the photosphere, giving

$$M_\odot^{(\mu)} = 4\pi R_\odot^2 \mu, \tag{72}$$

which, for $R_\odot = 6.96 \times 10^8$ m, yields

$$M_\odot^{(\mu)} \approx 1.5 \times 10^5 \text{ kg}. \tag{73}$$

This value is radically smaller than the dynamical mass of the Sun inferred from planetary orbits, which is $M_\odot \approx 1.99 \times 10^{30}$ kg [1]. It is therefore instructive to examine the consequences of adopting the brane-derived mass $M_\odot^{(\mu)}$ in orbital mechanics.

The orbital period T of a planet at radius r is given by Kepler's third law in Newtonian gravity,

$$T^2 = \frac{4\pi^2 r^3}{GM_\odot}, \tag{74}$$

where $G = 6.674 \times 10^{-11}$ m^{3}kg^{-1}s^{-2} is Newton's constant. If we demand that the Earth retains its orbital period of $T \approx 3.15 \times 10^7$ s, then substituting $M_\odot^{(\mu)}$ into Equation (100) gives

$$r = \left(\frac{GM_\odot^{(\mu)} T^2}{4\pi^2} \right)^{1/3}. \tag{75}$$

Numerically, this yields

$$r \sim 50 \text{ m}, \tag{76}$$

indicating that for the Earth to orbit a brane-mass Sun with its current period, it would have to orbit at a distance of only tens of meters, not at one astronomical unit (1.5×10^{11} m).

Conversely, if the current orbital radius $r = 1$ AU is maintained, then the orbital period follows from

$$T = 2\pi \sqrt{\frac{r^3}{GM_\odot^{(\mu)}}}. \tag{77}$$

Substituting values gives

$$T \sim 2 \times 10^{15} \text{ years}, \tag{78}$$

showing that Earth would take trillions of years to complete one orbit, rendering the Solar System effectively unbound.

The gravitational parameter of the brane-derived Sun is

$$GM_\odot^{(\mu)} \approx 10^{-5} \text{ m}^3\text{s}^{-2}, \tag{79}$$

which is utterly negligible compared to the Earth's own gravitational parameter,

$$GM_\oplus \approx 4 \times 10^{14} \text{ m}^3\text{s}^{-2}. \tag{80}$$

Thus, in this scenario, Earth itself would dominate the gravitational dynamics, and the Sun would not be capable of holding the planets in orbit. This makes it clear that $M_\odot^{(\mu)}$ does not represent the Sun's effective gravitational mass but only the inertia relevant to brane vibrations.

To recover planetary dynamics as observed, one must employ the Israel junction conditions [8], which yield the much larger surface energy density $\sigma \sim 10^{19}$ kg m^{-2}. This gravitational surface density produces an effective solar mass of 1.99×10^{30} kg, consistent with planetary motions. The Eternal Sun model therefore requires a dual interpretation of solar mass: the oscillatory brane mass $M_\odot^{(\mu)}$ relevant for helioseismic modes, and the g.

This completes the argument. In conclusion, the reworking of planetary data using the brane-derived solar mass demonstrates the impossibility of reproducing observed orbital radii and periods with $M_\odot^{(\mu)}$. The solar system would collapse into incoherence under such a small central mass. However, the Israel junction conditions restore consistency by providing the correct gravitational mass. The Eternal Sun model thus distinguishes between vibrational inertia and gravitational inertia, unifying them within the framework of t. This completes the argument.

14 Reconstructing Planetary Masses from Brane Dynamics: A Neo-Copernican Program

In the history of astronomy, the determination of planetary motions and masses was transformed by the works of Copernicus, Galileo, Brahe, Kepler, and Newton. Copernicus introduced the heliocentric model, Brahe provided highly accurate observations, Galileo measured periodic motions with telescopes, Kepler formulated his laws of planetary motion, and Newton unified these insights with the law of universal gravitation. In this process, the concept of mass as a volumetric property, derived from density and volume, became central to the Newtonian paradigm.

Within the Eternal Sun framework, all celestial bodies, including the planets and moons, are treated not as volumetric spheres but as S^2 branes, that is, thin spherical shells with effective surface densities. Each body possesses two densities: the vibrational surface density μ, which governs oscillatory dynamics, and the gravitational surface density σ, which governs orbital mechanics through the Israel junction conditions [8]. The effective mass of a brane body is then given by

$$M^{(\mu)} = 4\pi R^2 \mu, \quad M^{(\sigma)} = 4\pi R^2 \sigma. \tag{81}$$

The oscillatory density is determined from vibrational modes of the brane. For a spherical membrane of radius R, the oscillation frequencies satisfy

$$\omega_\ell^2 = \frac{T_b}{\mu R^2} \ell(\ell+1), \tag{82}$$

where T_b is the brane tension, μ is the oscillatory surface density, and ℓ indexes the spherical harmonic. The observed frequencies of terrestrial or solar oscillations therefore allow one to deduce μ. For example, Earth's normal modes, observed after large earthquakes, have periods on the order of tens of minutes, which can be used to infer $\mu_\oplus$ in analogy to the helioseismic determination of $\mu_\odot$ [2].

The gravitational surface density σ is determined from orbital dynamics. According to Kepler's third law, generalized by Newton, the orbital period T of a satellite or moon at distance r from a central body of mass M satisfies

$$T^2 = \frac{4\pi^2 r^3}{GM}, \tag{83}$$

where G is Newton's constant. Substituting $M = 4\pi R^2 \sigma$, one may determine σ directly from observations of orbital periods and radii, without assuming volumetric densities. This is precisely how Kepler's empirical laws, when combined with Newton's theory, first allowed planetary masses to be inferred.

As an example, consider Earth and its Moon. The orbital period of the Moon is $T \approx 27.3$ days and its orbital radius is $r \approx 3.84 \times 10^8$ m. Substituting into Equation (100), one finds

$$GM_\oplus = \frac{4\pi^2 r^3}{T^2} \approx 3.986 \times 10^{14}\ \mathrm{m^3 s^{-2}}. \tag{84}$$

The effective gravitational mass of Earth then follows as

$$M_\oplus^{(\sigma)} \approx 5.97 \times 10^{24}\ \mathrm{kg}. \tag{85}$$

From this, the gravitational surface density is

$$\sigma_\oplus = \frac{M_\oplus^{(\sigma)}}{4\pi R_\oplus^2}, \tag{86}$$

which yields $\sigma_\oplus \sim 10^{11}$ kg m^{-2} for $R_\oplus \sim 6.37 \times 10^6$ m. In contrast, the oscillatory density $\mu_\oplus$ inferred from Earth's normal modes would be many orders of magnitude smaller, just as was found for the Sun [2]. The Earth is therefore a hollow brane whose oscillatory inertia is vanishingly small, but whose gravitational inertia, encoded in σ, determines the Moon's orbit.

The same procedure applies to the Moon itself. From laser ranging experiments, the Earth-Moon system yields $M_{\mathrm{Moon}}^{(\sigma)} \approx 7.35 \times 10^{22}$ kg. With $R_{\mathrm{Moon}} = 1.74 \times 10^6$ m, this gives

$$\sigma_{\mathrm{Moon}} = \frac{M_{\mathrm{Moon}}^{(\sigma)}}{4\pi R_{\mathrm{Moon}}^2} \approx 1.93 \times 10^9\ \mathrm{kg\ m^{-2}}. \tag{87}$$

Thus the Moon also emerges as a hollow brane with its gravitational inertia encoded in σ_{Moon}.

Kepler's laws, derived from Brahe's meticulous observational records, can be reinterpreted as early evidence of brane dynamics. Kepler's first law, which states that planets move in ellipses with the Sun at one focus, is a geometric property that arises naturally from inverse-square central forces. His second law, that equal areas are swept in equal times, expresses angular momentum conservation. His third law, $T^2 \propto r^3$, is precisely Equation (100), which, when combined with the Israel junction conditions, connects orbital motion to surface energy densities. Galileo's telescopic discoveries, such as the moons of Jupiter, provided direct evidence for this dynamical framework. Newton's synthesis in the *Principia* brought together Kepler's empirical relations with his own law of gravitation, laying the foundation that we now reinterpret in the Eternal Brane cosmology.

In this sense, Copernicus' heliocentric hypothesis, Galileo's telescopic observations, Brahe's measurements, Kepler's empirical laws, and Newton's gravitational theory all find a modern reinterpretation in the Eternal Brane framework. Each planet and moon is an S^2 brane with dual densities: μ, governing vibrations, and σ, governing orbital mechanics. Mass is not a volumetric property but a surface phenomenon, consistent with the Israel junction conditions [8] and holographic cosmology [32, 33].

In conclusion, reconstructing planetary masses from brane dynamics re-establishes the Copernican and Newtonian program in a new light. It revives the empirical spirit of Brahe, the geometric insights of Kepler, the observational breakthroughs of Galileo, and the dynamical synthesis of Newton, while embedding them in the brane cosmology of the Eternal Sun. This neo-Copernican program demonstrates that planetary masses and orbits can be understood entirely within the language of S^2 branes, unifying historical astronomy with modern holographic physics.

15 A Neo-Copernican Ephemeris: Planetary and Lunar Masses in the Eternal Brane Framework

The Eternal Sun hypothesis, generalized to the planets and moons, requires a reworking of ephemerides in terms of brane dynamics rather than volumetric density. Following the spirit of Copernicus, Galileo, Brahe, Kepler, and Newton, who constructed the first scientific ephemerides by combining observation with geometry and dynamics, we now construct a Neo-Copernican Ephemeris based on the S^2 brane interpretation of celestial bodies. Each planet and moon is modeled as a thin spherical shell whose effec. This completes the argument. The effective oscillatory mass is defined as

$$M^{(\mu)} = 4\pi R^2 \mu, \tag{88}$$

where μ is the oscillatory surface density derived from vibrational modes. The effective gravitational mass is given by

$$M^{(\sigma)} = 4\pi R^2 \sigma, \tag{89}$$

where σ is the gravitational surface density obtained from orbital dynamics via Kepler's law,

$$T^2 = \frac{4\pi^2 r^3}{GM^{(\sigma)}}. \tag{90}$$

These two definitions capture the dual nature of mass in the brane framework: vibrational inertia versus gravitational inertia.

For Earth, we found previously that $\mu_\oplus$ inferred from seismic modes is extremely small, of order 10^{-14} kg m^{-2} [2], giving an oscillatory mass

$$M_\oplus^{(\mu)} \sim 10^5 \text{ kg}. \tag{91}$$

The gravitational mass, however, inferred from the Moon's orbital period, is

$$M_\oplus^{(\sigma)} \approx 5.97 \times 10^{24} \text{ kg}, \tag{92}$$

with a gravitational surface density

$$\sigma_\oplus \approx 1.17 \times 10^{11} \text{ kg m}^{-2}. \tag{93}$$

A similar calculation may be carried out for the Moon. The oscillatory density μ_{Moon} would be inferred from its global oscillations, while its gravitational mass is determined from Earth-Moon dynamics as

$$M_{\text{Moon}}^{(\sigma)} \approx 7.35 \times 10^{22} \text{ kg}, \tag{94}$$

giving

$$\sigma_{\text{Moon}} \approx 1.93 \times 10^9 \text{ kg m}^{-2}. \tag{95}$$

For Jupiter, orbital dynamics of its moons (e.g. Io, Europa, Ganymede) yield

$$M_J^{(\sigma)} \approx 1.90 \times 10^{27} \text{ kg}, \tag{96}$$

corresponding to

$$\sigma_J \approx 3.09 \times 10^{10} \text{ kg m}^{-2}, \tag{97}$$

Body	Radius R (m)	$M^{(\mu)}$ (kg)	$M^{(\sigma)}$ (kg)	σ (kg/m^2)
Earth	6.37×10^6	$\sim 10^5$	5.97×10^{24}	1.17×10^{11}
Moon	1.74×10^6	$\sim 10^3$	7.35×10^{22}	1.93×10^9
Jupiter	6.99×10^7	$\sim 10^7$	1.90×10^{27}	3.09×10^{10}

Table 2: Neo-Copernican Ephemeris: Representative dual masses of Earth, Moon, and Jupiter as S^2 branes. Oscillatory masses $M^{(\mu)}$ are orders of magnitude smaller than gravitational masses $M^{(\sigma)}$, highlighting the dual-density nature of celestial branes.

while the oscillatory density μ_J, which would be extracted from observed Jovian oscillations, remains many orders of magnitude smaller.

The Neo-Copernican Ephemeris is therefore summarized by the dual assignment of each celestial body with $M^{(\mu)}$ and $M^{(\sigma)}$. Table 3 provides representative values for Earth, Moon, and Jupiter.

The striking feature of this ephemeris is the radical separation between $M^{(\mu)}$ and $M^{(\sigma)}$. Oscillatory brane masses are negligible, suggesting that the internal inertia of these bodies is almost absent, consistent with a hollow brane. Gravitational brane masses, however, reproduce the dynamical behavior of the Solar System. This dual description mirrors the historical synthesis of Copernicus, Galileo, Brahe, Kepler, and Newton. Copernicus shifted the reference frame, Galileo provided observa. This completes the argument. In conclusion, the Neo-Copernican Ephemeris redefines the planetary and lunar masses in terms of brane dynamics. Each celestial body has two masses: $M^{(\mu)}$, minuscule and derived from vibrations, and $M^{(\sigma)}$, enormous and derived from orbital dynamics. This reconciles the hollow brane model with observed planetary motion, extending the Eternal Sun hypothesis into a full Eternal Brane framework for the Solar System.

16 A Complete Neo-Copernican Ephemeris: Planets and Moons as S^2 Branes

The Eternal Sun framework generalizes naturally to a full Eternal Brane cosmology in which all planets and moons of the Solar System are modeled as thin spherical S^2 branes. Each celestial body has two effective masses: the oscillatory brane mass $M^{(\mu)}$, determined by vibrational surface density μ, and the gravitational brane mass $M^{(\sigma)}$, determined by orbital dynamics and encoded in gravitational surface density σ. The purpose of this section is to construct a complete ephemeri. This completes the argument. For a celestial body of radius R, the two effective brane masses are defined as

$$M^{(\mu)} = 4\pi R^2 \mu, \tag{98}$$

$$M^{(\sigma)} = 4\pi R^2 \sigma. \tag{99}$$

The gravitational surface density σ is determined from Newton's generalization of Kepler's third law. For a satellite of orbital radius r and period T, the governing relation is

$$T^2 = \frac{4\pi^2 r^3}{GM^{(\sigma)}}, \tag{100}$$

where G is Newton's constant. By inverting Equation (100), one directly obtains $M^{(\sigma)}$ from orbital data, which then yields σ via Equation (99). This method echoes Kepler's extraction of his third law from Brahe's observations, and Newton's subsequent identification of inverse-square gravitation [3, 4].

The oscillatory surface density μ is obtained from observed vibrational modes of the body, as in Earth's seismic oscillations or the Sun's helioseismic modes [2]. In practice, μ is many orders of magnitude smaller than σ, leading to $M^{(\mu)} \ll M^{(\sigma)}$. This dual assignment resolves the paradox of hollow branes exhibiting strong gravitational pull.

We now present representative values for all major planets and selected moons of the Solar System. Radii and effective $M^{(\sigma)}$ values are based on orbital dynamics, while $M^{(\mu)}$ values are estimated by analogy with the Sun's oscillatory density $\mu \sim 10^{-14}$ kg m^{-2}.

Body	Radius R (m)	$M^{(\mu)}$ (kg)	$M^{(\sigma)}$ (kg)	σ (kg/m^2)
Mercury	2.44×10^6	$\sim 10^3$	3.30×10^{23}	4.4×10^9
Venus	6.05×10^6	$\sim 10^4$	4.87×10^{24}	1.06×10^{11}
Earth	6.37×10^6	$\sim 10^5$	5.97×10^{24}	1.17×10^{11}
Moon	1.74×10^6	$\sim 10^3$	7.35×10^{22}	1.93×10^9
Mars	3.39×10^6	$\sim 10^3$	6.42×10^{23}	4.4×10^9
Jupiter	6.99×10^7	$\sim 10^7$	1.90×10^{27}	3.09×10^{10}
Saturn	5.82×10^7	$\sim 10^6$	5.68×10^{26}	1.33×10^{10}
Titan	2.57×10^6	$\sim 10^3$	1.35×10^{23}	1.63×10^9
Uranus	2.54×10^7	$\sim 10^5$	8.68×10^{25}	1.07×10^{10}
Neptune	2.46×10^7	$\sim 10^5$	1.02×10^{26}	1.34×10^{10}
Ganymede	2.63×10^6	$\sim 10^3$	1.48×10^{23}	1.70×10^9
Europa	1.56×10^6	$\sim 10^2$	4.80×10^{22}	1.57×10^9

Table 3: Neo-Copernican Ephemeris for the Solar System: Representative dual brane masses of planets and major moons. Oscillatory masses $M^{(\mu)}$ are estimated from $\mu \sim 10^{-14}$ kg m^{-2}, while gravitational masses $M^{(\sigma)}$ and σ follow from orbital dynamics.

The striking contrast is universal. For every body considered, $M^{(\mu)}$ is negligible compared to $M^{(\sigma)}$. Mercury's oscillatory brane mass is only of order 10^3 kg, while its gravitational brane mass is 3.3×10^{23} kg. Jupiter's oscillatory brane mass is 10^7 kg, while its gravitational mass reaches 10^{27} kg. Even giant moons such as Ganymede and Titan exhibit this dual nature, with oscillatory masses almost vanishing and gravitational masses substantial enough to influence thei. This completes the argument. This ephemeris reinterprets the entire Solar System within the Eternal Brane framework. The contributions of Copernicus, Galileo, Brahe, Kepler, and Newton acquire new meaning. Copernicus' heliocentric revolution becomes a recognition of orbital centers defined by σ, not bulk density. Galileo's telescopic discoveries of Jupiter's moons become evidence of brane-based gravitational dynamics. Brahe's data, which Kepler refined into elliptical laws, are revealed as the observational basis of Equatio. This completes the argument. In conclusion, the Neo-Copernican Ephemeris demonstrates that the Solar System is a nested system of hollow branes. Each planet and moon has two masses: an oscillatory brane mass $M^{(\mu)}$, tiny and derived from vibrational physics, and a gravitational brane mass $M^{(\sigma)}$, large and derived from orbital dynamics. This dual assignment reconciles the hollow structure of the Eternal Brane hypothesis with the observed stability of the Solar System, establishing a new foundation for celestial mechan. This completes the argument.

17 Observational Foundations of the Planetary Brane System

The Eternal Brane framework requires that the parameters of the planetary system be reinterpreted without recourse to bulk gravitational masses or volumetric densities. Instead, one must begin from directly observed quantities, just as Copernicus, Brahe, Galileo, and Kepler did in the sixteenth and seventeenth centuries. These pioneers did not know Newton's law of gravitation or the modern notion of planetary mass, yet they were able to reconstruct the architecture of the Solar System on the basis of p. This completes the argument. The first observationally accessible parameter is the planetary radius R. This is determined from angular size measurements made during transits or occultations, together with baseline geometry. For Earth, $R_\oplus \approx 6.37 \times 10^6$ m is directly measurable from surface circumnavigation, a technique already available to Eratosthenes in antiquity [5, 6]. In modern times, planetary radii of the outer planets have been determined from telescopic angular size. This completes the argument. The second fundamental observational quantity is the orbital period T. This is directly observed from the motion of planets against the background stars. For example, Earth's orbital period is one year, $T_\oplus = 3.15 \times 10^7$ s, while Jupiter's orbital period is 11.86 years and Saturn's period is 29.46 years [3, 7]. These values require no assumption about mass or gravitational theory; they are pure time measurements recorded by astronomers over centuries. Ga. This completes the argument. The third parameter consists of relative orbital distances. While absolute distances in meters were not accessible to early astronomers, the ratios of orbital radii r_i/r_j could be determined geometrically from observations of conjunctions and oppositions. For example, Kepler was able to establish that the ratio of the orbital radius of Mars to that of Earth was approximately 1.52, consistent with modern measurements. These ratios define the geometric skeleton of the Solar System independently . This completes the argument. The fourth observational quantity is planetary rotation period. This can be measured from repeated observations of surface or atmospheric features. Galileo determined the rotation of the Sun by tracking sunspots, while the rotation of Jupiter was deduced from the drift of the Great Red Spot and later by direct telescopic imaging [5]. Earth's own rotation is given by the 24-hour day, a parameter fixed by diurnal cycles rather than theoretical calculation. In general, planetary rotation pe. This completes the argument. The fifth class of observables are the oscillatory modes of celestial bodies. Earth's free oscillations, excited by large earthquakes, have been measured with periods of order tens of minutes, such as the fundamental spheroidal mode ${}_0S_2$ with period ~ 54 minutes [2]. The Sun's p-mode oscillations with period ~ 5 minutes were discovered by Leighton in the 1960s, and more recently oscillatory modes have been identified in Jupiter. These oscillations allow direct inference. This completes the argument. From the perspective of the Eternal Brane framework, the oscillatory mass is determined by

$$M^{(\mu)} = 4\pi R^2 \mu, \tag{101}$$

where R is observed radius and μ is oscillatory surface density inferred from seismic or helioseismic data. The orbital period T and radius ratios r_i/r_j are direct observables that constrain the relative configuration of the planetary system. The rotation periods provide additional information about internal brane dynamics, while the oscillation spectra provide μ directly.

In this way, the planetary system is reconstructed purely from geometry, time, and oscillatory phenomena, without recourse to gravitational mass. The method mirrors the program of Copernicus, Galileo, Brahe, and Kepler, who established the Solar System on the basis of careful observation, long before the introduction of Newtonian gravitation. The Eternal Brane framework therefore returns to an observational foundation, where the essential parameters of planets and moons are their radii, orbital periods, . This completes the argument.

18 Derived Parameters of the Planetary Brane System

Once the observational foundations of the Solar System are established in terms of planetary radii, orbital periods, relative orbital distances, rotation periods, and oscillatory modes, it becomes possible to calculate a wide variety of derived parameters using purely kinematic and geometric relations. These calculations are independent of any assumption about bulk densities or gravitational masses and are consistent with the Eternal Brane framework. Just as Kepler deduced his three laws from Brahe's met. This completes the argument. The first derived parameter is the absolute semi-major axis of a planet's orbit. Kepler's third law in its general form states that for two planets with orbital periods T_i and T_j and semi-major axes a_i and a_j,

$$\frac{T_i^2}{T_j^2} = \frac{a_i^3}{a_j^3}. \tag{102}$$

If one orbital distance is fixed, for example Earth's orbital radius $a_\oplus = 1$ AU $= 1.496 \times 10^{11}$ m, then all other orbital radii may be calculated. For Jupiter with period $T_J = 11.86$ years, Equation (102) yields

$$a_J = a_\oplus \left(\frac{T_J}{T_\oplus}\right)^{2/3} \approx 5.20 \text{ AU}, \tag{103}$$

which agrees with modern observational determinations. This procedure allows the entire skeleton of the Solar System's geometry to be constructed from orbital periods and a single reference scale.

The second derived parameter is the orbital velocity of a planet. For a planet of orbital radius a and orbital period T, the mean orbital velocity is

$$v = \frac{2\pi a}{T}. \tag{104}$$

Substituting $a_\oplus = 1.496 \times 10^{11}$ m and $T_\oplus = 1$ year gives

$$v_\oplus \approx 29.8 \text{ km/s}, \tag{105}$$

while for Jupiter one finds $v_J \approx 13.1$ km/s. These orbital velocities are not directly observed but are calculated from observed distances and periods, and thus represent secondary derived quantities in the Eternal Brane framework.

The third derived parameter is the synodic period. When two planets with orbital periods $T_\oplus$ and T_p are observed from Earth, the apparent period between successive oppositions or conjunctions is given by

$$\frac{1}{T_{\text{syn}}} = \left|\frac{1}{T_\oplus} - \frac{1}{T_p}\right|. \tag{106}$$

For Mars, with orbital period $T_M \approx 1.88$ years, the synodic period with respect to Earth is

$$T_{\text{syn}} = \frac{1}{\left|\frac{1}{1} - \frac{1}{1.88}\right|} \approx 2.14 \text{ years.} \tag{107}$$

Such relations were used by Copernicus to confirm the heliocentric system and remain valid when reinterpreted in the Eternal Brane picture.

The fourth derived parameter is orbital resonance. Ratios of orbital periods can reveal simple integer relations that indicate dynamical resonances. For example, Jupiter's moons Io, Europa, and Ganymede satisfy

$$\frac{T_{\text{Io}}}{T_{\text{Europa}}} \approx \frac{1}{2}, \quad \frac{T_{\text{Europa}}}{T_{\text{Ganymede}}} \approx \frac{2}{4}, \tag{108}$$

which is the well-known Laplace resonance. This resonance structure is deduced purely from orbital period ratios and does not require any assumption about gravitational mass.

The fifth derived parameter is tidal locking. If a body's rotation period T_{rot} equals its orbital period T_{orb}, the body is tidally locked. For the Moon, $T_{\text{rot}} = T_{\text{orb}} = 27.3$ days, ensuring that the same hemisphere always faces Earth. This is a direct calculation from observational data.

The sixth parameter concerns orbital eccentricity. Kepler's first law states that a planetary orbit is an ellipse with semi-major axis a and eccentricity e. The orbital distance at true anomaly θ is

$$r(\theta) = \frac{a(1-e^2)}{1 + e\cos\theta}. \tag{109}$$

By measuring the angular position of a planet over time, one can calculate its eccentricity. For Earth, $e \approx 0.0167$, and for Mars, $e \approx 0.0934$ [3].

The seventh parameter is orbital inclination. By tracking the latitude of planetary paths relative to the ecliptic, one may calculate the inclination of orbital planes. These values are also observationally accessible and calculable with purely geometric methods.

Finally, one may consider stability criteria. Ratios of orbital periods and eccentricities may be tested for dynamical stability, an idea pursued by Laplace and Poincaré, and in the Eternal Brane framework this corresponds to the geometric consistency of oscillatory branes over cosmological timescales.

In summary, from the observational foundations of radii, orbital periods, relative distances, rotation periods, and oscillatory modes, one can calculate absolute orbital radii, orbital velocities, synodic periods, resonances, tidal locking, eccentricities, inclinations, and stability relations. This structure echoes the original methods of Copernicus, Galileo, Brahe, and Kepler, who established the Solar System on purely geometric and temporal grounds, now reinterpreted in the Eternal Brane framework.

19 Conclusion

The Eternal Sun hypothesis reinterprets the Solar System by replacing the traditional image of the Sun as a nuclear furnace with that of a hollow spherical mirror whose photosphere forms an S^2 brane. At its centre lies the Universe's coldest point, functioning as a thermodynamic attractor that regulates entropy and directs the cosmic flux. In this view, the balance between incoming and outgoing radiation naturally reproduces the

Sun's blackbody spectrum, while the coronal heating problem is resolved b. This completes the argument. The framework extends naturally to planets and moons, which are modeled as S^2 branes with dual densities. Their oscillatory surface density μ governs vibrational dynamics, accessible through seismic or oscillatory modes, while their observable radii and orbital periods define the geometry of the planetary system. A Neo-Copernican ephemeris emerges, in which orbital distances, velocities, synodic periods, resonances, and eccentricities can be derived directly from observed data without invoking th. This completes the argument. This perspective situates modern astrophysics within the historical trajectory of Copernicus, Brahe, Galileo, Kepler, and Newton, while also pointing towards new connections between brane cosmology, thermodynamics, and holography. The Israel junction conditions, when applied to the Sun's photospheric brane, further embed the framework within general relativity, linking local astrophysical phenomena to the broader fabric of cosmology. The Eternal Sun hypothesis thus bridges physics and metaphysics by pro. This completes the argument. In conclusion, the Sun as a hollow spherical mirror provides a coherent and testable alternative to conventional models, resolving long-standing anomalies and extending the conceptual horizon of cosmology. By interpreting all celestial bodies as hollow branes, this framework unifies solar physics, planetary dynamics, and cosmological structure formation into a single narrative. The Eternal Sun hypothesis not only revisits the foundational work of the scientific revolution but also offers a path beyond the. This completes the argument.

References

[1] A. N. Cox, *Allen's Astrophysical Quantities*, Springer, 2000.

[2] J. Christensen-Dalsgaard, "Helioseismology", *Reviews of Modern Physics*, 74, 1073–1129, 2002.

[3] J. Kepler, *Astronomia Nova*, Prague, 1609.

[4] I. Newton, *Philosophiae Naturalis Principia Mathematica*, London, 1687.

[5] G. Galilei, *Dialogue Concerning the Two Chief World Systems*, Florence, 1632.

[6] N. Copernicus, *De revolutionibus orbium coelestium*, Nuremberg, 1543.

[7] T. Brahe, *Astronomiae instauratae progymnasmata*, Prague, 1602.

[8] W. Israel, "Singular Hypersurfaces and Thin Shells in General Relativity", *Il Nuovo Cimento*, 44B: 1, 1966.

[9] M. S. Modgil and D. Patil, *vixra:2505.0153*, 2025.

[10] Moninder Singh Modgil, "Eternal Sun", *Purity Magazine*, Brahma Kumaris, 1994.

[11] Moninder Singh Modgil and Dnyandeo Patil, "Coronal Heating Problem and Eternal Sun Model", *vixra:2507.0105*, 2025.

[12] I.E. Segal, "Mathematical Cosmology and Extragalactic Astronomy", *Cambridge University Press*, 1976.

[13] V. Guillemin, "Cosmology in (2+1)-dimensions, cyclic models and deformations of $M_{2,1}$", *Princeton University Press*, 1989.

[14] R. C. Tolman, *Relativity, Thermodynamics and Cosmology*, Clarendon Press, 1934.

[15] R. Penrose, *The Emperor's New Mind*, Oxford University Press, 1989.

[16] M. Eliade, *The Myth of the Eternal Return*, Princeton University Press, 1959.

[17] A. Einstein, B. Podolsky, and N. Rosen, "Can Quantum-Mechanical Description of Physical Reality be Considered Complete?", *Physical Review*, 47, 777, 1935.

[18] J. S. Bell, "On the Einstein-Podolsky-Rosen paradox", *Physics*, 1, 195, 1964.

[19] Brahma Kumaris World Spiritual University, *The Cycle of Time: A Spiritual Perspective*, Mount Abu, 2003.

[20] R. Penrose, *Cycles of Time: An Extraordinary New View of the Universe*, Bodley Head, 2010.

[21] J. N. Bahcall, "Solar Models: An Historical Overview", *Annual Review of Astronomy and Astrophysics*, 39: 1–28, 2001.

[22] J. Stefan, "Über die Beziehung zwischen der Wärmestrahlung und der Temperatur", *Sitzungsberichte der mathematisch-naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften*, 79, 1879.

[23] L. Boltzmann, "Ableitung des Stefan'schen Gesetzes, betreffend die Abhängigkeit der Wärmestrahlung von der Temperatur aus der electromagnetischen Lichttheorie", *Annalen der Physik*, 22, 291, 1884.

[24] M. J. Aschwanden, *Physics of the Solar Corona: An Introduction*, Springer, 2005.

[25] E. Priest and T. Forbes, *Magnetic Reconnection: MHD Theory and Applications*, Cambridge University Press, 2000.

[26] G. Del Zanna and O. Young, "Elemental abundances in the solar corona: Iron ions as diagnostics", *Living Reviews in Solar Physics*, 15:5, 2018.

[27] NIST Atomic Spectra Database, Iron Ionization Energies, National Institute of Standards and Technology, 2020.

[28] E. Marsch, "Kinetic Physics of the Solar Corona and Solar Wind", *Living Reviews in Solar Physics*, 3:1, 2006.

[29] S. R. Cranmer, "Heating and Acceleration of the Solar Wind: Progress and Future Prospects", *Annual Review of Astronomy and Astrophysics*, 57: 157–187, 2019.

[30] Planck Collaboration, "Planck 2018 results. VI. Cosmological parameters", *Astronomy and Astrophysics*, 641, A6, 2020.

[31] H. Zirin, *Astrophysics of the Sun*, Cambridge University Press, 1988.

[32] L. Randall and R. Sundrum, "An Alternative to Compactification", *Physical Review Letters*, 83, 4690, 1999.

[33] J. Maldacena, "The Large N Limit of Superconformal Field Theories and Supergravity", *Advances in Theoretical and Mathematical Physics*, 2, 231, 1998.

[34] J. Polchinski, *String Theory*, Vol. 1 and 2, Cambridge University Press, 1998.