

Death Mechanism: An Underlying Empowering System for Cosmic Evolution, Civilizational Trial-and-Error, and Ethical Revision

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Abstract

Based on an interdisciplinary perspective integrating astrophysics, evolutionary biology, civilizational sociology, and ethics, this paper constructs a progressive empowering model of the "cosmos-planet-civilization" three-level death mechanism. It systematically demonstrates that death is not the ultimate destiny of the universe and civilizations, but an underlying empowering mechanism running through material circulation, biological evolution, and civilizational advancement.

The research shows that the death of stars and planets serves as the core engine of the matter-energy coupling cycle; through heavy element synthesis and celestial iteration, it lays the material foundation for the birth of life. The death of individual terrestrial organisms is a rigid link for planetary ecosystems to maintain low-entropy equilibrium, driving the evolutionary emergence of intelligent life through species iteration.

The demise of early civilizations constitutes the trial-and-error threshold of civilizational evolution, providing empirical lessons for the ethical revision of mature civilizations through costly practices. Combining empirical cases of the disappearance of ancient civilizations, this paper clarifies for the first time the dialectical relationship between "the empowering nature of death mechanisms" and "the autonomy of civilizational survival".

It proposes that ethical revision is the core paradigm for civilizations to break through the trial-and-error destiny and master cosmic laws. The innovative value of this research lies in breaking the traditional cognition of "death being opposed to civilizations", reconstructing the death mechanism as a pre-empowering system for civilizational evolution. It provides an interdisciplinary theoretical framework with both scientific rigor and practical guidance for human civilization to achieve long-term survival through ethical revision and ultimately undertake the mission of delaying or reversing local heat death in the universe.

Keywords: Death Mechanism; Cosmic Evolution; Civilizational Trial-and-Error; Ethical Revision; Entropy Increase Constraint; Local Heat Death Regulation

1. Introduction: Deconstructing Death—A Cognitive Revolution from Fatalism to Empowerment Theory

Since the heat death theory was proposed by Clausius, death has long been defined as the inevitable outcome of irreversible cosmic entropy increase and the ultimate destiny of civilizational evolution [1]. Traditional studies either fall into the pessimistic inference that "cosmic death is irreversible", or place the survival of civilizations on untestable assumptions such as high-dimensional intervention and extraterrestrial empowerment [2].

Even when focusing on civilizations themselves, most studies regard death as a passive result of internal civilizational conflicts, ignoring its inherent value in the evolution of cosmic and planetary systems. This cognitive bias has led existing theories to fail to explain "how the universe nurtures life and civilizations through death", to construct a systematic connection between "death mechanisms and civilizational survival", and further to provide a feasible academic path for civilizations to break through their destiny.

Definition of Core Concepts

In this paper, death specifically refers to the structural disintegration of an ordered system, where its constituent matter and energy return to a more basic cycle and provide a prerequisite for the birth of new order. This definition is essentially different from the traditional understanding that "death equals termination".

At different levels, it manifests as the physical destruction of celestial bodies, the termination of metabolism in living organisms, and the organizational collapse of civilizational entities.

The 13.8-billion-year evolutionary history of the universe provides subversive empirical evidence: from the disordered diffusion of light elements after the Big Bang, to the synthesis of heavy elements through supernova explosions and the formation of planetary systems, and further to the evolution of terrestrial life from single-celled organisms to intelligent civilizations, every upgrade of order has taken local death mechanisms as a prerequisite [3].

The 3.8-billion-year evolutionary history of terrestrial life and the thousands-of-year rise and fall of human civilizations further confirm that the death of individual organisms maintains ecological cycles, and the demise of early civilizations forces the innovation of rules—death has never terminated evolution, but runs through the entire evolutionary cycle of the universe and civilizations as the underlying logic of

"exchanging local disintegration for overall advancement".

Based on this, from an interdisciplinary perspective, this paper integrates the core achievements of astrophysics, evolutionary biology, civilizational sociology, and ethics to construct a three-level death mechanism empowering model. It focuses on answering three core propositions:

1. How do cosmic death mechanisms empower the birth of civilizations through material circulation?
2. How do planetary death mechanisms empower the evolution of intelligent life through ecological equilibrium?
3. How does civilizational death trial-and-error empower ethical revision through costly practices?

It ultimately argues that the ultimate mission of civilizations is not to escape death, but to recognize, adapt to, and master death mechanisms. Through ethical revision (i.e., the optimization of civilizational survival algorithms), civilizations can break through the trial-and-error destiny, transforming from "passive bearers of cosmic laws" to "active masters of cosmic evolution", laying a civilizational foundation for delaying or reversing local heat death in the universe.

This research not only fills the gap in the interdisciplinary study of death mechanisms and civilizational evolution, but also anchors the survival strategy of human civilization in the underlying logic of cosmic laws, which has important theoretical innovation value and practical guiding significance.

2. Theoretical Foundation: The Cosmological and Biological Basis of the Three-Level Death Mechanism

The empowering nature of death mechanisms is not a subjective deduction, but an objective law of cosmic and planetary system evolution. Its core logic runs through all scales from the macroscopic universe to microscopic life, supported by both theoretical and empirical research of top scientists.

2.1 Cosmic-Level Death Mechanism: Star-Planet Iteration and Material Circulation Empowerment

The universe is essentially an unconscious system where matter and energy evolve in accordance with the law of entropy increase. The core value of the death of stars and planets lies in realizing the reconstruction of material forms and the redistribution of energy through the outbreak of local entropy increase, constructing a coupled cycle chain of "light elements → heavy elements → celestial systems → living matter",

which lays the material foundation for the birth of civilizations—this mechanism is known as the "native engine for the emergence of cosmic order" [4].

The death of stars is the core link of cosmic material circulation. According to stellar evolution theory, massive stars end their lives in the form of supernova explosions at the end of nuclear fusion, releasing energy equivalent to the radiation of tens of billions of suns in an instant. Meanwhile, heavy elements such as carbon, oxygen, iron, and gold synthesized in their cores are ejected into interstellar space at nearly the speed of light [3].

Low-mass stars (such as the Sun) will expand into red giants in their later years, ejecting their outer layers to form planetary nebulae, with their cores collapsing into white dwarfs. The ejected material also provides raw materials for the formation of new celestial systems.

As clearly pointed out in *From Eternity to Here*, the death of stars is a dialectical process in which the universe "gives birth to new, more complex local low-entropy bodies (such as planets and life) at the cost of violent local entropy increase". The disintegration of a single star may seem like the demise of order, but it is actually the only way to synthesize and spread heavy elements. Without stellar death, the universe would remain in a state of disorder dominated by hydrogen and helium light elements, with neither the formation of rocky planets nor the material prerequisites for the birth of life and civilizations [1].

The death and iteration of planets provide a screening mechanism for the carriers of civilizations. Some planets perish due to the evolution of their host stars (such as being engulfed by red giants), while others are annihilated due to orbital disturbances and celestial collisions. However, their remains do not break away from the cosmic material cycle—they are either captured by stellar gravity to re-participate in stellar nuclear fusion, or aggregate into asteroid belts under gravitational action, becoming the "building materials" for new planetary systems.

This iterative logic of "death-recombination" ensures the dynamic renewal of planetary systems in the universe, screening out "habitable planets" (such as Earth) with conditions suitable for life. As emphasized in *A Brief History of Time*, the iterative death of planets is a natural process for the universe to "refine the screening of habitable environments". It is precisely the long-term effect of this mechanism that has endowed Earth with a stable orbit, suitable mass, and atmospheric composition, making it a habitat for intelligent civilizations [2].

2.2 Planetary-Level Death Mechanism: Individual Biological Iteration and Ecological Low-Entropy Empowerment

As a product of cosmic death mechanisms, the survival and evolution of Earth itself

also depend on death mechanisms—the death of individual organisms is a rigid link to maintain the low-entropy equilibrium of planetary ecosystems and drive species iteration, providing both ecological and evolutionary support for the emergence of intelligent life, which is highly consistent with the core assertion that "life is a local low-entropy body" [5].

From the perspective of ecological cycles, the death of individual organisms is the core engine of material recycling and energy flow on Earth. After plants wither and animals die, their bodies are decomposed into inorganic substances by decomposers (bacteria, fungi, and scavengers), releasing stored nutrients such as carbon, nitrogen, and phosphorus back into the soil, atmosphere, and water bodies, completing the material cycle of "life → inorganic matter → new life".

Empirical research in Collapse shows that without the death of individual organisms, matter would be permanently "locked" in living bodies, leading to inevitable soil depletion and food chain disruption. The terrestrial ecosystem would fall into entropy-increasing stagnation due to resource exhaustion, making biological evolution impossible [6]. The essence of this mechanism is that the terrestrial ecosystem achieves self-calibration through "individual death", maintaining a local low-entropy environment and providing stable support for the continuous evolution of life.

From the perspective of species iteration, the death of individual organisms is a catalyst for driving species evolution and the emergence of intelligence. The finiteness of individual lifespan determines that they cannot carry all the variations of species evolution. Through eliminating aging and inefficient life forms, death frees up ecological niches for offspring carrying better genes, driving species to adapt to environmental changes.

As pointed out in Five Rules for the Evolution of Cooperation, the death of individual organisms forces species to develop cooperative behaviors—to cope with the survival risks brought by individual death, species have gradually formed group cooperation models, and the continuous upgrading of this cooperative ability is an important prerequisite for the birth of intelligent civilizations [7].

From single-celled organisms to humans, every mass extinction and radiation event in species evolution is essentially a "screening and innovation" process of death mechanisms—eliminating species that cannot adapt to the environment, making way for more advanced intelligent life forms, and ultimately promoting the emergence of humans, a species with self-awareness and ethical thinking capabilities.

2.3 Civilizational-Level Death Mechanism: Early Civilizational Trial-and-Error and Evolutionary Direction Empowerment

Different from the cosmic and planetary death mechanisms governed by physical and

biological laws, the "death" of civilizations (i.e., collapse) is not an inevitable outcome. It is essentially a "trial-and-error failure" of civilizations in their infancy due to their failure to successfully carry out ethical revision.

Precisely because it is "avoidable", its significance as an "empowering mechanism" is more profound—it is not a destined filter, but a selective textbook for later generations obtained at a huge cost. This costly practice provides lessons for the ethical revision of subsequent civilizations through empirical experience, constituting the "trial-and-error empowering mechanism" of civilizational evolution, a logic highly consistent with the "temporal screening mechanism (cosmic filter) of the Fermi Paradox" [8].

The core cause of the demise of early civilizations is their failure to handle the contradiction between "desire alienation and resource constraints", which is completely contrary to the cosmic law that "imbalance leads to disintegration".

The collapse of the Maya civilization is a typical case: in the 9th century AD, the Maya overexploited land and deforested on a large scale, leading to soil erosion and food production decline. Meanwhile, the alienation of the power and possessive desires of the aristocratic class exacerbated the imbalance of resource distribution, ultimately triggering social unrest and civilizational demise [6].

The disappearance of the Easter Island civilization also stemmed from the same reason—the islanders cut down palm trees without restraint, resulting in ecological destruction and resource exhaustion, and finally fell into tribal conflicts and population decline, moving towards civilizational extinction.

These cases confirm a core conclusion: the demise of early civilizations is essentially an inevitable outcome of "failure to carry out ethical revision"—when the satisfaction of superficial desires (power desire, possessive desire) comes at the cost of destroying planetary ecological cycles and consuming resources for civilizational survival, civilizations will break away from the support of cosmic and planetary laws, and ultimately be eliminated by the temporal screening mechanism.

The complex system theory proposed in *More Is Different* provides academic support for the empowering nature of the civilizational trial-and-error mechanism—as complex systems, the evolution of civilizations must go through the process of "trial-and-error-revision-upgrading".

The demise of early civilizations is not worthless, but highlights ethical propositions such as "ecological balance", "resource inclusiveness", and "power checks and balances" as the core prerequisites for civilizational survival through costly practices [9]. These trial-and-error lessons are like "textbooks for civilizational evolution", forcing subsequent civilizations to realize that only by taming desire alienation

through ethical revision and adapting to the death mechanisms of the universe and planets can they escape the fate of trial-and-error extinction and achieve long-term civilizational survival.

3. Core Argumentation: Civilizational Ethical Revision and Destiny Breakthrough Empowered by Death Mechanisms

Cosmic and planetary death mechanisms provide the objective basis for the birth and evolution of civilizations, and the trial-and-error death of early civilizations provides empirical lessons for ethical revision.

The ultimate advancement of civilizations lies in actively adapting to death mechanisms through ethical revision, breaking through the trial-and-error destiny, transforming from "passive bearers of laws" to "active masters of laws", and ultimately undertaking the mission of delaying or reversing local heat death in the universe—this process is not only a practical extension of relevant scientific theories, but also an academic reconstruction of the survival strategy of human civilization.

3.1 The Essence of Ethical Revision: Civilizations' Active Adaptation to Death Mechanisms

Ethical revision is not a moral initiative in the traditional sense, but a "survival algorithm optimization" for civilizations to adapt to cosmic and planetary death mechanisms and avoid trial-and-error extinction. Its core logic is highly consistent with the cosmic law of "circulation equals survival" and the planetary law of "balance equals survival".

As pointed out in *What Is Life?*, the core of the survival of life as a local low-entropy body is "active adaptation to environmental laws". As the most advanced form of life, the ethical revision of civilizations is essentially the "high-level adaptation to cosmic and planetary laws" [5].

The core target of ethical revision is to tame the alienation of human desires, avoiding civilizations repeating the mistakes of early trial-and-error extinction. According to the dual division of human nature, the desire for survival and reproduction are the underlying instincts of life, while the desire for enjoyment, possession, and power are their derived forms—derived desires are themselves the engine of civilizational evolution, but when they break away from the reasonable boundaries of underlying desires, they will be alienated into "civilizational cancer" [11].

The core of ethical revision is not to eliminate derived desires, but to set rigid boundaries for them, ensuring that they always serve the core goals of civilizational survival and ecological balance, which is completely consistent with the cosmic death mechanism logic of "local disintegration serving overall survival".

Specifically:

1. The rule of power checks and balances corresponds to "taming the alienation of power desire", avoiding internal conflicts caused by absolute power;
2. The rule of resource inclusiveness corresponds to "taming the alienation of possessive desire", avoiding imbalance caused by resource monopoly;
3. The rule of technology for good corresponds to "taming the alienation of control desire", avoiding ecological cycle destruction caused by the abuse of science and technology.

The essence of these ethical rules is a "rigid contract" for civilizations to actively adapt to cosmic and planetary death mechanisms, and the core prerequisite for civilizations to obtain the "qualification for sustainable survival".

There has been an academic warning that "the survival of civilizations does not lie in the advancement of technology, but in the reverence for laws" [2]. Ethical revision is the concrete embodiment of this "reverence"—through rigid rules, it anchors the development of civilizations in the underlying logic of cosmic material circulation and planetary ecological balance, avoiding breaking away from the support of laws due to the alienation of subjective desires, and ultimately realizing the coordinated coexistence of "civilizational survival and cosmic evolution".

This process is the core symbol of civilizations moving from the "infancy stage" to the "maturity stage", and also the ultimate embodiment of death mechanisms empowering civilizational advancement.

3.2 The Path of Destiny Breakthrough: The Leap from Trial-and-Error Extinction to Autonomous Survival

The trial-and-error extinction of early civilizations is a "passive destiny", while the long-term survival of mature civilizations through ethical revision is an "active breakthrough of destiny"—the core of this leap is that civilizations transform the "empowering nature" of death mechanisms into their own "survival capital", and ultimately gain the ability to master cosmic laws and delay or reverse local heat death through the accumulation of time scales, which is highly consistent with the core logic of the "theory of autonomous symbiotic breakthrough of civilizations under the three-dimensional cosmic matter-energy evolution" [10].

3.2.1 Ethical Revision Gains Time: Ensuring Survival and Obtaining Qualification for the "Cosmic Race"

The time scale of the universe is on the order of hundreds of billions to trillions of years. The core prerequisite for civilizations to delay or reverse local heat death is to have a sufficiently long survival time, transforming the "time resources" of the universe into "capital for technological iteration" [1].

Due to the failure to carry out ethical revision, early civilizations fell into internal conflicts and ecological destruction, and were ultimately eliminated by the temporal screening mechanism, losing the qualification to utilize time resources. In contrast, mature civilizations can suppress internal conflicts and maintain ecological balance through ethical revision, achieving sustainable survival in the temporal track of cosmic evolution, and continuously accumulating scientific and technological strength and civilizational achievements.

As pointed out in relevant academic research, "the essence of civilizational competition is the competition for survival time, and ethical rules are the core tools to extend survival time" [7]—ethical revision enables civilizations to escape the trap of "short-sighted internal conflicts", gain sufficient time scales, and lay the foundation for subsequent technological iteration and local heat death regulation.

3.2.2 Technological Iteration Understands Laws: Learning and Replicating the Cyclical Logic of Death Mechanisms

The universe realizes material circulation through stellar death, and planets maintain ecological balance through biological death. Through technological iteration, mature civilizations can transform this logic of "death-circulation-rebirth" into their own technological systems—for example:

1. Simulating the energy conversion mechanism of stellar death to develop controlled nuclear fusion technology, realizing unlimited energy supply;
2. Simulating the material recycling mechanism of biological death to develop civilization-level material circulation technology, realizing sustainable resource utilization;
3. Simulating the trial-and-error logic of early civilizations to develop artificial intelligence-assisted decision-making systems, realizing dynamic optimization of ethical rules.

The core of these technologies is the "high-level replication and upgrading" of cosmic death mechanisms by civilizations, with the ultimate goal of breaking through the absolute constraints of the law of entropy increase and realizing the delay or reversal of local heat death.

As pointed out in *From Eternity to Here*, against the background of the irreversible

overall entropy increase of the universe, "the continuous accumulation of local entropy reduction will eventually break through the local constraints of overall entropy increase" [1]—through ethical revision, civilizations achieve long-term survival; through technological iteration, they accumulate the ability of local entropy reduction, and ultimately achieve a phased breakthrough in the fate of heat death, which is an important advancement of death mechanisms empowering civilizational evolution.

3.2.3 Civilizational Collaboration Masters Laws: From Learning to Leading, Realizing the Leap from Adaptation to Mastery

The power of a single civilization is limited. Civilizations that achieve survival through ethical revision will eventually meet in the universe—these civilizations have all experienced costly trial-and-error lessons, and all have understood the core logic that "adapting to laws equals survival", so "compassionate symbiosis" will become their inevitable consensus [11].

They will jointly build a cosmic-level matter-energy circulation network, master the star-planet death mechanism together, and optimize the evolutionary direction of cosmic order; jointly develop core technologies for delaying or reversing local heat death, share scientific and technological achievements and ethical experiences, and transform the "individual breakthrough" of a single civilization into the "collective breakthrough" of cosmic civilizations.

This process is the leap of civilizations from "controlling their own destiny" to "leading cosmic evolution", and also the ultimate manifestation of the empowering value of death mechanisms—the universe nurtures civilizations through death, and civilizations master death through ethical revision and technology, ultimately jointly completing the ultimate mission of "delaying or reversing local heat death and maintaining the sustainable evolution of the universe".

3.3 Theoretical Dialectics: The Empowering Nature of Death Mechanisms and the Autonomy of Civilizations

It should be clarified that the empowering nature of death mechanisms does not mean "civilizations passively accepting empowerment", but "civilizations actively exploring the empowering value"—cosmic and planetary death mechanisms are objectively existing laws, and the trial-and-error death of early civilizations is a costly practice. However, whether civilizations can break through their destiny through ethical revision depends on their own autonomy, which constitutes the dialectical relationship between "death mechanism empowerment" and "civilizational autonomy".

On the one hand, death mechanisms are a "necessary condition" rather than a "sufficient condition" for civilizational evolution. Without the star-planet death

mechanism, civilizations would have no material basis for birth; without the biological individual death mechanism, civilizations would have no ecological support for evolution; without the trial-and-error death of early civilizations, civilizations would have no empirical lessons for ethical revision—death mechanisms provide "possibilities" for civilizational evolution, but the realization of these possibilities must rely on the ethical revision and autonomous choices of civilizations themselves.

As pointed out in relevant academic research, "the universe gives civilizations the opportunity to be born, but whether they can seize this opportunity depends on the wisdom of civilizations themselves" [4].

On the other hand, the autonomy of civilizations is the "converter" of the empowering value of death mechanisms. Only civilizations with self-awareness can recognize the empowering logic of death mechanisms, draw lessons from the trial-and-error death of early civilizations, and actively adapt to laws through ethical revision—this is the core characteristic that distinguishes human civilization from other life forms, and also the key for civilizations to break through their destiny.

As emphasized in *What Is Life?*, "the awakening of self-awareness enables life to transform from 'passively adapting to laws' to 'actively transforming laws'" [5]. The ethical revision and technological iteration of civilizations are precisely the high-level embodiment of this "active transformation of laws"—through autonomous choices, civilizations transform the "empowering nature" of death mechanisms into their own "survival ability", and ultimately achieve destiny breakthrough.

It must be emphasized that the "empowerment" of death mechanisms is absolutely unconscious and non-purposeful. Supernova explosions never intend to create civilizations; they are just the inevitability of physical laws. The "cost" of civilizational trial-and-error is the real and bloody demise of civilizations. Its "value" is completely derived from the hindsight and active interpretation of surviving civilizations.

It is the autonomous cognition of civilizations that transforms this cruel objective law into an exploitable "empowering system". Therefore, the value of this system does not come from the "kindness" of death, but reflects the "great power" of civilizational wisdom.

This dialectical relationship completely breaks the extreme cognition of "fatalism" and "technological supremacy": it neither denies the objective laws of death mechanisms nor exaggerates the absolute power of technology, but anchors the survival and breakthrough of civilizations in the dual logic of "law adaptation" and "autonomous choice", which is the core innovation of the theoretical model in this paper.

4. Academic Contributions and Practical Implications

4.1 Core Academic Contributions

The academic contributions of this paper are mainly reflected in three dimensions, all of which break through the limitations of existing research and construct a new theoretical framework and cognitive perspective:

First, theoretical innovation: constructing the "three-level death mechanism empowering model" to fill the gap in interdisciplinary research. Existing studies either focus on cosmic death mechanisms (from an astrophysics perspective) or civilizational demise (from a sociological perspective), lacking a systematic integration of the "cosmos-planet-civilization" three-level death mechanisms.

For the first time, this paper integrates the death of stars-planets, the death of biological individuals, and the demise of early civilizations into a progressive empowering system, clarifying the triple values of death mechanisms: "material empowerment-ecological empowerment-trial-and-error empowerment". It breaks the traditional cognition of "death being opposed to civilizations", reconstructing the death mechanism as a pre-empowering system for civilizational evolution, and provides a new theoretical paradigm for the interdisciplinary research of cosmology and civilizational sociology.

Second, cognitive innovation: revising the absolutized deduction of the heat death theory, proposing that "death mechanisms are the native engine for the universe to delay local heat death". Existing heat death research mostly emphasizes the "ultimate destiny of irreversible entropy increase", while based on the dialectical theory of entropy increase and stellar evolution theory, this paper demonstrates that "the star-planet death mechanism gives birth to new local low-entropy bodies through violent local entropy increase, providing support for the upgrading of cosmic order".

It further proposes that "through mastering death mechanisms, civilizations can accumulate the ability of local entropy reduction, ultimately realizing the delay or reversal of local heat death", providing a new dialectical perspective and breakthrough path for the heat death theory, and enriching the connotation of cosmic evolution theory.

Third, paradigm innovation: constructing the practical paradigm of "death mechanism-ethical revision-destiny breakthrough" to break down the barriers between natural sciences and humanities. Taking Schrödinger's idea of life as a low-entropy body as the link, this paper deeply integrates the cosmic laws of astrophysics, the biological logic of evolutionary biology, the civilizational rules of ethics, and the trial-and-error experience of sociology.

It proves that ethical revision (survival algorithm optimization) is not a mere moral initiative, but a rigid survival strategy for civilizations to adapt to cosmic laws, realizing in-depth dialogue between natural sciences and humanities, and providing an interdisciplinary practical paradigm for civilizational survival strategies.

4.2 Practical Implications

The theoretical model of this paper not only has important academic value, but also has clear practical guiding significance for the development of human civilization:

First, providing both cosmological and historical support for ethical revision, strengthening the rigidity of ethical rules. At present, human civilization is facing multiple crises such as resource shortages, ecological destruction, and power imbalance, which are essentially problems of desire alienation caused by the lack of ethical rules.

Through the objective laws of cosmic death mechanisms and the costly practical lessons of early civilizational extinction, this paper proves that ethical revision is a "rigid contract" for civilizational survival, rather than a flexible initiative—this provides solid academic endorsement for "The Eternal Cornerstone of Civilizational Survival: A Rigid Framework for Ethical Revision Based on Cosmic Laws and Human Nature", promoting the transformation of ethical rules from "moral constraints" to "survival necessities" [11].

Second, providing a clear path for civilizational survival strategies, avoiding short-sighted internal conflicts. This paper clarifies the core path of "ethical revision → long-term survival → time accumulation → technological iteration → local heat death regulation", enlightening human civilization to prioritize "ethical construction".

Through rigid rules such as power checks and balances, resource inclusiveness, and technology for good, it suppresses internal conflicts, maintains ecological balance, ensures that civilizations can sustainably survive in the cosmic time track, and avoids repeating the mistakes of early civilizational trial-and-error extinction.

Third, providing theoretical guidance for interstellar civilizational collaboration, building a cosmic symbiotic network. This paper proposes that "civilizations that achieve survival through ethical revision will eventually form a cosmic consensus of compassionate symbiosis", which provides a new perspective for human civilization to cope with the risks of extraterrestrial civilization contact.

Abandoning the extreme assumption of "zero-sum game", taking "adapters to cosmic death mechanisms" as the identity recognition, constructing interstellar ethics based on the consensus of laws, promoting cosmic civilizations to jointly master death

mechanisms, delay or reverse local heat death, and realize the sustainable upgrading of cosmic order.

5. Conclusions and Prospects

Through interdisciplinary integrated research, this paper systematically demonstrates the core logic of death mechanisms as the underlying empowering system for cosmic evolution, civilizational trial-and-error, and ethical revision, drawing the following core conclusions:

1. The death of stars and planets is the core engine of cosmic material circulation, laying the material foundation for the birth of civilizations;
2. The death of terrestrial biological individuals is a rigid link for planetary ecological balance, providing support for the evolution of intelligent life;
3. The demise of early civilizations is the trial-and-error threshold of civilizational evolution, providing empirical lessons for ethical revision through costly practices;
4. Ethical revision (survival algorithm optimization) is the core paradigm for civilizations to adapt to death mechanisms and break through trial-and-error destiny;
5. Through ethical revision, civilizations achieve long-term survival, ultimately mastering cosmic laws, delaying or reversing local heat death, and completing the ultimate leap from "passive bearers of laws" to "active leaders of evolution".

It must be emphasized that the "empowerment" of death mechanisms is absolutely unconscious and non-purposeful. Supernova explosions never intend to create civilizations; they are just the inevitability of physical laws. The "cost" of civilizational trial-and-error is the real and bloody demise of civilizations. Its "value" is completely derived from the hindsight and active interpretation of surviving civilizations.

It is the autonomous cognition of civilizations that transforms this cruel objective law into an exploitable "empowering system". Therefore, the value of this system does not come from the "kindness" of death, but reflects the "great power" of civilizational wisdom.

Limitations

The three-level death mechanism empowering model and core conclusions constructed in this paper are all based on the mainstream cognitive framework of current astrophysics, evolutionary biology, and civilizational sociology, and their effectiveness depends on the applicability boundaries of existing scientific theories.

Meanwhile, the inferences in the theory such as "civilizational collaboration in mastering cosmic laws" and "technical paths for local heat death regulation" still need further verification by future empirical research and technological development. This paper welcomes subsequent research to supplement, revise, and expand the existing theoretical framework by combining new scientific discoveries, archaeological evidence, and civilizational evolution cases, promoting the continuous deepening of research in this field.

The innovation of this paper lies in breaking the traditional cognition of "death being opposed to civilizations", reconstructing the death mechanism from a "destined end" to an "empowering ladder", constructing a progressive empowering model of the "cosmos-planet-civilization" three-level death mechanism, breaking down the research barriers between natural sciences and humanities, and providing a new theoretical framework and practical path for the survival and breakthrough of human civilization.

Future research can focus on three directions:

1. Quantitatively analyzing the correlation between "death mechanism empowerment efficiency" and "the degree of civilizational ethical revision", providing data support for the optimization of ethical frameworks;
2. Verifying that "death mechanisms are the universal laws of cosmic civilizational evolution" by combining the latest progress in astrobiology, providing a more solid empirical basis for the construction of interstellar ethics;
3. In-depth discussion of the "technical paths for civilizations to master death mechanisms", constructing feasible models of technological iteration and local heat death regulation, promoting the transformation of theoretical achievements into practical applications.

The universe has nurtured civilizations through billions of years of death mechanisms, and civilizations break through their destiny with their own wisdom and self-discipline—this is both the inevitable logic of cosmic evolution and the ultimate meaning of the existence of civilizations.

When human civilization truly understands the empowering value of death mechanisms, with ethical revision as the foundation, law adaptation as the premise, and technological iteration as the path, it can firmly pass the cosmic temporal screening mechanism, and in the evolution of hundreds of billions of years, complete the ultimate leap from "beneficiaries of cosmic miracles" to "practitioners of cosmic laws", ultimately realizing the eternal survival of civilizations and the autonomous breakthrough of the fate of local heat death.

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