Phenomena of Mass-Energy Conversion in Natural Spacetime and their Relevance to the Energy and Materials Industry

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Abstract: By establishing spacetime mechanics and based on preliminary theories, this study reexamines the concepts and processes of human energy application, which have traditionally been built upon a relatively static spatial foundation. It highlights the lack of recognition and understanding regarding the concepts of time acceleration and the expansion of the universe due to high-speed motion, as well as the lack of awareness and comprehension of the phenomena and laws governing the mutual conversion of mass and energy in natural spacetime. Indiscriminately placing all industrial processes within the Earth's spatial environment, essential for human survival, has resulted in the accelerated expansion and destruction of Earth's spacetime, gradually diminishing its self-repair capacity, and severely violating the phenomena and laws of natural spacetime mechanics. It is imperative to enhance our cognitive ability to comprehend the universe and to innovate scientific theoretical frameworks. Constructing an energy and materials industry system that is zero-emission, zero-pollution, and highly efficient is also crucial. Accelerating the synchronized integration of industrial processes and promoting the early realization of zero-emission and zero-pollution industries are essential steps.
***Keywords*:** spatiotemporal properties of the universe, fundamental principles of spacetime mechanics, spacetime mechanics equations, realization process and significance of zero-emission, zero-pollution energy and materials industry

1. Introduction

The study and summary of spatiotemporal phenomena and laws in the energy and materials industry led to the emergence of spacetime mechanics. Through the integration and comparative research with the laws of spatiotemporal mass-energy processes in the natural universe, it gradually evolved into an independent branch of physics. Spacetime mechanics serves as the foundation of all mechanics and the mother of physical sciences. It reveals the essential properties of mass-energy motion in the spacetime of the universe, the spatiotemporal attributes of microscopic mass matter, and the motion attributes of macroscopic energy matter. They collectively possess properties such as spatiotemporal separation, merging, superposition, overlapping, compression, expansion, regeneration, and annihilation. The process of compressing spatiotemporal mass matter on a microscopic scale involves the attribute of dimensional energy transmission through sound waves. Spacetime mechanics formulates the equations of spatiotemporal mass-energy and comprehensively elucidates the interrelationship between the microscopic mass matter and macroscopic energy matter motion and effective spacetime. Time and space determine the effective range of activity for microscopic mass matter and macroscopic energy matter motion, influencing the processes and efficiency of energy matter motion. Spacetime mechanics provides robust theoretical support and effective method principles for the efficient upgrading of the energy and materials industry, promoting the synchronized integration of industrial processes and achieving the closed-loop, zero-emission, and zero-pollution realization of spatiotemporal processes in energy industries. By protecting the Earth's environment, it propels human civilization towards new heights.

2. Spatiotemporal Properties of the Universe

The essence of the universe arises from the motion of material mass-energy in spacetime, giving rise to the alternating conversion between the spatiotemporal dimensions of microscopic mass matter and macroscopic energy matter motion. This process forms an infinite spacetime characterized by properties such as separation, merging, superposition, overlapping, compression, expansion, regeneration, and annihilation, cyclically returning to the conversion of mass-energy. All material mass originates from the compression process of mass-energy in microscopic spacetime, and the motion of all material mass arises from the energy motion of macroscopic spacetime. The essence of time is the kinetic energy generated by macroscopic energy driving the motion of mass matter, while the essence of space is the potential energy generated by the motion of microscopic mass matter.

3. The Change in Understanding Brought by the Principles of Spacetime Mechanics to the Energy and Materials Industry

The history of human utilization of energy, symbolized by the use of fire, spans hundreds of thousands of years, which is extremely long in terms of human life but fleeting in the context of the universe. Over the past two centuries since the industrial revolution, humanity has gained tremendous wisdom and the ability to transform nature, leading to rapid development and improvements in living conditions. However, this progress has also brought irreversible and significant damage to the environment in which we exist. Therefore, in-depth analysis of the methods, processes, and applications of energy is of profound significance for improving industrial energy efficiency.

Spatiotemporal mechanics reveals the existence modes of microscopic mass matter in spacetime, the operational laws of macroscopic energy matter motion in spacetime, the interconversion relationship between microscopic mass matter spacetime and macroscopic energy matter motion spacetime, and the essence of the annihilation of spacetime in the return to mass and energy formation. Time and space are fundamental units of measurement for the motion of mass-energy. Mass and energy are inseparable modes of existence, and the history of human energy usage has transitioned from spatially concentrated efficiency to the centralized and large-scale industrialization marked by industrial chimneys and power exhausts. The recognition of time efficiency has emerged, and uncovering the mystery of temporal kinetic energy efficiency is the central theme of this article.

4. The Hidden Principles of Spacetime Mechanics Equations in Energy Application Processes

$$E_1 = C_0^2 S^2 TP/12\pi r$$

$$E_1 = C_0^2 S^2 TPr^2/16V$$

E_0: Spatiotemporal mass-energy of matter in a static state at absolute zero; Unit: j/m^3

E_1: Spatiotemporal mass-energy of matter in a moving state; Unit: j/m^3

C_0: Internal acoustic wave velocity at material density; Unit: m/s

C: Speed of light; Unit: m/s

P: Current material density in spacetime; Unit: kg/m^3

S: Spatiotemporal relative acoustic wave velocity mass-energy time at the current material density; Unit: s (seconds)

T: Temperature: Internal energy environment temperature of the current material in spacetime; Unit: °C (degrees Celsius)

R: Effective radius in spacetime at material density; Unit: m (meters)

V: Volume of the current material density in spacetime; Unit: m^3 (cubic meters)

π: Pi (mathematical constant)

The equations of spacetime mechanics are derived from the conversion of mass and energy, unveiling the interrelationships between the fundamental elements of matter in the process of mass-energy conversion. They provide a theoretical basis for improving the efficiency of local and overall spacetime processes in energy applications and offer a scientific interpretation for enhancing the quality and excellence of material products.

The equations of spacetime mass-energy represent a dynamic mechanics equation, comprehensively reflecting the essence and laws of mass-energy motion. In contrast to traditional mechanics, which solely relies on determining and calculating thermal energy based on a state of relative rest in spacetime, it neglects the calculation of the conversion of kinetic energy and angular momentum into thermal energy in thermodynamic processes. This leads to significant deviations in the design and application of thermal equipment such as suspension preheating and suspension decomposition furnaces. In the equation, the velocity C_0 represents the kinetic energy state of mass matter, time s represents the angular momentum state of mass matter, temperature T represents the energy intensity in spacetime, density P represents the mass of matter existing in a particular or overall spacetime, and radius R represents the effective length of spacetime from the start of energy application to the emission into the atmosphere. The spacetime mass-energy equation is a versatile and dynamic mechanics equation that conforms to the laws of natural motion, surpassing Newton's laws of motion centered around the sun, upgrading Einstein's theories of general and special relativity for a static universe, and providing an effective interpretation of mechanics for a high-speed expanding universe. It serves as an essential theoretical basis for improving the efficiency and upgrading the application of energy devices by humanity.

5. Transformation Modes and Processes of Mass-Energy in Natural Spacetime

5.1 Circulation of Mass-Energy in Natural Spacetime

The fundamental attribute of efficient energy utilization lies in the circulation of matter and energy in the process. However, the conditions for circulation exist based on the factors of time and space within the application process. These factors arise from two aspects: Firstly, the macroscopic energy driving the motion of matter, including the devices used, the extent of mass-energy exchange, and the complete process of circulation within an effective spacetime. Secondly, the microscopic process of energy absorption through the compression of matter, which pertains to the efficiency of devices in terms of disrupting the existing microscopic spacetime of mass matter and creating new microscopic spacetime. The ultimate manifestation of this process lies in the radius of the microscopic mass matter. The purpose of the four elements (velocity, time, temperature, density) in the spacetime mass-energy equation is to disrupt the existing spacetime radius and structure of microscopic mass matter, create new microscopic mass matter spacetime, and generate products that can be effectively utilized over the long term. By clarifying the objectives and the related influencing factors during the realization process, as well as their interrelationships, we gain a clear understanding that provides theoretical guidance for the efficient use of energy. Simultaneously, we gain a comprehensive understanding of the internal and external circulation through effective application processes, as well as insights into how to effectively utilize the four major mass-energy conversion elements: velocity, time, temperature, and density. Under suspended conditions, the internal preheating cycle is the preferred natural spacetime mass-energy conversion method, utilizing velocity, effective density, and temperature reduction to compress spacetime. It is also the fastest and most efficient method of altering the microscopic spacetime radius of mass matter and represents the best approach in accordance with natural laws for altering and disrupting the existing microscopic spacetime of mass matter. Effective external macroscopic spacetime energy-matter circulation promotes the formation of microscopic mass matter spacetime through the compression and conversion of macroscopic energy spacetime. It is also a necessary condition and optimal outcome for establishing closed-loop energy application processes in macroscopic spacetime devices. This approach challenges and improves the previous shallow understanding and deviations in the theoretical and practical aspects of energy application processes, which were characterized by industry-driven singular and inefficient behaviors. It inevitably leads to the development of a best practice approach that aligns with the natural laws of efficient circulation, thereby driving the comprehensive improvement of energy application efficiency.

Examples are as follows. (1) In the solar system, the eight planets orbit the Sun under its gravitational pull, absorbing high-energy released by the Sun through its own mass loss in a restricted spacetime. As a result, the planets undergo gradual changes in their spacetime dynamics by absorbing solar energy. (2) Within the solar system, there are asteroid belts, Kuiper belts, and Oort clouds. Comets, under the influence of the gravitational forces of the Sun and planets, carry kinetic energy and return to the inner solar system, colliding with the Sun and planets. This conversion of microscopic mass-energy into macroscopic spacetime light energy simultaneously consumes a portion of mass while upgrading the structure of microscopic mass spacetime. This is a natural law of effective external mass-energy circulation. (3) Comparing this process with our industrial devices, the similarity is striking, particularly with the operational mechanism of suspension preheaters in industry. The main difference lies in the absence of a synchronized external circulation process.

5.2 Modes and Significance of Spin and Rotational Motion in Mass-Energy Interchange in Spacetime

Spin and rotational motion are fundamental natural attributes and laws of micro and macroscopic mass bodies in the spacetime mechanics of the universe. However, the rotational motion of these small mass bodies around massive objects is not solely limited to a single massive object. It involves a superposition of motions induced by different levels of massive objects. The process of mass-energy interchange in the natural spacetime of the universe occurs in the presence of highly dense microscale mass matter undergoing rapid rotational motion at the speed of light and in the local macroscopic spacetime with high mass-energy density in a relatively stationary state.

5.3 Quantum Relationship in the Interchange of Microscale Mass Matter Spacetime and Macroscopic Mass-Energy Motion Spacetime

The interchange of mass and energy between microscale mass matter spacetime and macroscopic mass-energy motion spacetime involves the exchange of quantum particles. The basic exchange units are the molecules formed by the superposition of microscale mass matter spacetime among atoms in the elements that constitute the universe. To effectively absorb the energy photons in the macroscopic spacetime, certain macroscopic spacetime conditions are required, including high-speed rotational motion of mass matter, a specific duration of stay in a particular macroscopic spacetime, temperature, microscale

mass matter density, and, most importantly, a microscale mass matter spacetime radius approaching the size of atoms and molecules. Only under these conditions, the energy photons present in the macroscopic spacetime can be rapidly absorbed by microscale mass matter, forming high potential energy microscale mass matter spacetime that can be effectively utilized by humans in the long term. All of these processes originate from the natural mass-energy conversion in the universe. For example, supernova explosions result in high-density, high-atomic-element environments; accretion disks around black holes tear apart low-density microscale mass matter spacetime, enlarging the black holes; cosmic regenerative pillars, under strong gravitational forces, tear apart microscale mass matter spacetime through high-speed rotational motion, creating macroscopic spacetime environments similar to the solar system, where civilizations can exist.

5.4 New Insights on Energy Application Processes Provided by Spacetime Mechanics and Mass-Energy Equations

Spacetime mechanics enables us to have a clear understanding that energy application processes are macroscopic spacetime processes involving the movement of energy, mass, and matter. Effective compression of macroscopic spacetime mass matter leads to the formation of high potential energy microscale mass matter spacetime. Controlling the process of macroscopic spacetime mass-energy motion is the fundamental approach to enhancing efficiency. The spacetime mass-energy equation allows us to understand that different physical forms of microscale mass matter spacetime in an effective macroscopic spacetime environment yield different outcomes. It provides directions and effective methods for improving efficiency in the compression process and recognizes that energy intensity, microscale mass matter velocity, density, time, temperature, and degree of separation overlap significantly, constituting the essence of efficient mass-energy conversion. The materialization, energization, spacetimeization, and encapsulation of energy resources are the foundational principles for addressing the effective preservation of the Earth's mechanical environment within the context of human industrial civilization and survival. Without this solid foundation, the grand, beautiful, and magnificent structure of industrial civilization will ultimately collapse. Humanity will inevitably pay the price for its improper energy industrial practices.

6. Flaws in the Forms of Mass-Energy Conversion in the Current Energy Materials Industry and Methods for Improvement

There are differences and shortcomings to some extent in the main energy-consuming devices of the current industrial sector regarding the phenomena of natural spacetime mass-energy conversion. These flaws lead to low energy utilization efficiency and the infinite expansion of applied spacetime mechanics, while also being the fundamental cause of accelerated changes in the Earth's spacetime mechanics. The existing problems can be analyzed from several aspects: 1. Devices, 2. Energy release and combustion aids, 3. Thermal theory calculations, and 4. Process technology.

First, let's analyze the following main energy-consuming devices: suspended preheaters, vertical kilns, rotary kilns, fluidized bed boilers, and suspension calciners.

6.1 Devices

6.1.1 Suspended Preheater

Advantages: It possesses kinetic energy and angular momentum that comply with the natural motion of spacetime mass-energy conversion phenomena. It exhibits high-speed movement of mass matter, and temperature stability is easily maintained. It can effectively break and separate microscale mass matter at a high radius, achieving a high degree of mass-energy overlap. It is suitable for auxiliary devices in large-scale production.

Disadvantages: The overall mass-energy density in the spacetime is insufficient, and the process of breaking and separating microscale mass matter at a short time and radius is not fully differentiated, leading to rapid mass-energy loss. It lacks an outer circulation process synchronized with high-density matter.

Improvement methods: Enhance the process of rotational flow without changing the overall flow velocity, increase the residence time of mass matter, improve the degree of breaking and separation of microscale mass matter at a high radius, improve heat exchange methods to increase mass-energy density at critical locations and enhance kinetic energy movement speed, introduce necessary outer circulation processes synchronized with high-density matter, promote the efficient recovery of thermal energy by leveraging the increased angular momentum in the rotational flow process, and stimulate the natural efficient absorption of material thermal energy by kinetic energy and angular momentum. Upgrade the processing capability of the device in an effective spacetime and promote large-scale production.

Evaluation: Moderate efficiency in terms of spatial potential energy, high efficiency in terms of temporal kinetic energy.

6.1.2 Vertical Kiln

Advantages: It complies with the mass-energy conversion laws of relatively static spacetime and has a high density of mass matter. It has low energy density, a long duration of mass-energy conversion, slow mass-energy loss, high degree of mass-energy overlap, and temperature stability is easily maintained.

Disadvantages: The movement speed of mass matter and the rate of energy release are slow. The destruction rate of microscale mass matter at the effective radius in spacetime is slow, resulting in weak penetration of multiple microscale spacetime overlaps of matter. The energy form needs to be pre-processed, and it lacks a process of kinetic energy movement and slow mass-energy conversion.

Improvement methods: Increase suspended preheating and reduce calcination load to accelerate the calcination speed of the vertical kiln body and enhance the capacity of the device.

Evaluation: High efficiency in terms of spatial potential energy, no efficiency in terms of temporal kinetic energy.

6.1.3 Rotary Kiln

Advantages: Easy control of the overall conversion speed of mass matter, and density of mass-energy can be balanced by adjusting the speed.

Disadvantages: Lack of alignment with natural laws of mass-energy conversion, low effective density of mass-energy, lack of effective high-speed kinetic energy in mass matter, slow movement and energy absorption rates, poor degree of mass-energy overlap, long distances and durations for microscale spacetime conversion processes, weak destructive and overlapping penetration capabilities of multiple microscale spacetime in matter, high energy consumption.

Improvement methods: Increase suspended preheating, reduce the thermal load entering the rotary kiln, accelerate the calcination speed of the rotary kiln, improve the heating environment during calcination, enhance the processing capacity of the device itself and as a whole, and achieve large-scale production.

Evaluation: Low efficiency in terms of spatial potential energy, low efficiency in terms of temporal kinetic energy.

6.1.4 Fluidized Bed Boiler and Calcination Equipment

Advantages: Complies with the natural laws of mass-energy conversion, high movement speed and density of mass matter, capable of rapid and effective decomposition of microscale mass matter at the effective radius in spacetime, high degree of mass-energy overlap.

Disadvantages: Difficulty in controlling the mutual conversion process of mass matter and energy, poor stability, lack of effective control over the effects of kinetic energy grading and residence time, currently unable to achieve large-scale production in industries other than traditional power generation.

Improvement methods: Increase suspended preheating, fully utilize the destructive effect of preheating on the microscale spacetime of mass matter, use high-purity oxygen for assistance in calcination to enhance energy density and stabilize the calcination process.

Evaluation: Relatively high efficiency in terms of spatial potential energy, average efficiency in terms of temporal kinetic energy.

6.1.5 Suspension Calcination

Advantages: Fully complies with the natural laws of mass-energy conversion in spacetime, high density of mass-energy, high efficiency in a small spacetime.

Disadvantages: Difficult to control, poor process stability, currently not implemented in large-scale industrial applications.

Improvement methods: Increase suspended preheating and decomposition processes, strengthen the speed, duration, and density of suspended preheating and calcination processes, weaken the temperature process, fully utilize the destructive effect on the microscale radius of the original matter in spacetime, and accelerate the formation process of new material in spacetime.

Evaluation: High efficiency in terms of spatial potential energy, high efficiency in terms of temporal kinetic energy, high process complexity.

Phenomena of mass and energy conversion in the natural spacetime of the universe: (1) Interior of celestial bodies: A necessary condition for the formation of high-density elemental microscale mass matter. (2) Regenerative pillars: The main conditions for the formation of cosmic galaxies. (3) Accretion disks: Formation conditions for the conversion of cosmic mass and energy.

6.2 Energy Release and Combustion Assistance Medium

Industrial civilization relies heavily on energy applications, and in traditional energy applications, air has always been

the convenient and widely used medium, which has greatly facilitated industrial production. However, this practice has placed the Earth's environment within the spacetime of energy application, leading to an increase in temperature in the Earth's surface spacetime and accelerating the process of environmental degradation. Therefore, direct use of air as a combustion assistance medium in industrial activities is not feasible. Industrial combustion assistance should instead utilize high-purity industrial oxygen. The same principle applies to the use of clean hydrogen energy, where combustion assistance gas is not usually required. Electric smelting and calcination, as a natural form of energy conversion in a relatively stationary state, generally do not require combustion assistance and the consideration of combustion assistance gas.

Until now, the mainstay of industrial civilization has been using air as the combustion assistance medium in traditional energy applications, which has facilitated the rapid development of energy and material industries. However, this practice lacks the absorption process of different-density mass matter for energy, resulting in a large amount of mixed waste gas that cannot be separated and recycled. An effective solution is to use oxygen as a combustion assistance medium, recycle a portion of the waste gas, and separate and recover high-concentration carbon dioxide. This approach reduces or eliminates the emission of mixed waste gas and energy, and improves the efficiency of utilizing valuable resources and energy effectively.

6.3 Thermal Theory Calculation

Traditionally, thermal theory calculations have been based on static and quantitative measurement methods, lacking a dynamic understanding of the conversion of kinetic energy, angular momentum, and structural spacetime energy. The conversion of mass and energy is not a simple static heat energy process. Although the existence of the dynamic conversion process of mass energy and the activation force of spacetime energy is recognized, there has been a lack of theoretical interpretation and effective scientific calculation methods. The consideration of kinetic energy, angular momentum, and spacetime energy has been overlooked, resulting in an inaccurate understanding and calculation of thermal processes. This discrepancy between process design calculations and actual operations is further amplified with the increase in process speed and scale. Spacetime mechanics and spacetime mass-energy equations are effective and complete supplements to thermal theory calculations, enabling more accurate thermal calculations, more efficient equipment design and application, and more significant energy saving and emission reduction.The universe has never been static, and all matter undergoes changes through superimposed high-speed movements. Using static and quantitative methods to determine the process of high-speed movement and mass-energy within a device is inherently flawed and incomplete.

6.4 Technological Processes

The division of the energy industry has led to various technological processes. How many of these industrialized technological processes align with the conversion of mass and energy in the natural spacetime of the universe, and their impact on the Earth's natural spacetime mechanics, has been rarely considered. Therefore, it is not sufficient to evaluate technological processes solely based on their industrial applications. Technological processes should strive to align with the laws of mass-energy conversion in natural spacetime. By improving and perfecting technological processes, efficiency in industrial equipment can be enhanced.

Comprehensive improvement in energy application efficiency requires innovation in scientific and technological fields, the establishment of a theoretical understanding of spacetime mechanics that aligns with the laws and phenomena of natural mechanics and energy conversion. When applied in the energy industry, this approach can yield positive results. New scientific discoveries and technologies can only be accepted if they are essential for human survival and development, addressing the primary challenge faced by industrial civilization: improving energy efficiency. Outdated theoretical concepts and methods need to be upgraded, while new cognitive concepts gradually form and improve. Only through these efforts can energy conservation and emission reduction be achieved.

6.5 Formation and Distribution of Thermal Fields

In the current energy industry, there is a focus on the formation and distribution of thermal fields, including combustion devices and heat exchange devices. Strictly speaking, these processes involve the macroscopic compression of energy and spacetime in a spacetime mechanics framework, leading to the formation of microscopic matter, mass, and energy. However, current theories do not fully analyze the process and phenomena of thermal fields from a mechanical perspective. Spacetime mechanics equations provide a comprehensive and clear analysis of the different mechanical processes and phenomena within thermal fields, considering kinetic energy, angular momentum, and spacetime energy. Whether thermal fields conform to the laws of natural spacetime mass-energy conversion is crucial for achieving high efficiency.

6.6 The Essence of Energy Conservation and Reduction of Carbon Dioxide and Other Greenhouse Gases

The essence of energy conservation and emission reduction lies in effectively controlling the macroscopic spacetime application processes of energy, enabling the complete and efficient conversion of macroscopic energy movement into the absorption and formation of microscopic matter, mass, and spacetime potential energy. It is not simply about reducing carbon dioxide and other greenhouse gases. The use of air as an oxidizer is convenient, but a significant amount of nitrogen absorbs and consumes energy during the heating process, elevating the microscopic spacetime mass-energy (potential energy) and releasing energy when emitted into the atmosphere, contributing to the increase in Earth's spacetime mechanics temperature. Oxygen-rich combustion and carbon dioxide capture, utilization, and storage (CCUS) alone cannot fully address the fundamental issues of low energy efficiency and the accelerated degradation of Earth's spacetime mechanics environment. The only solution is to adopt the use of oxygen with a purity of over 95% as an oxidizer in enclosed energy applications. Different densities and forms of microscopic spacetime mass-energy entities should be employed as the main absorbers at different stages of macroscopic energy processes. Various processes and methods should be employed to synchronously and fully absorb energy without emissions at different stages of the macroscopic energy combustion process.

6.7 Waste Heat Recovery

Waste heat refers to the residual energy in microscopic matter formed by the conversion and compression of macroscopic spacetime energy through devices. The recovery of waste heat needs to consider the formation of new material forms and different forms and methods for different substances and spacetime processes. A reasonable approach is to gradually reduce the density and temperature levels of the recovered material. However, the spacetime process and form of the recovery are equally important.

Examples are as follows. (1) In astrophysics, when a black hole absorbs a neutron star or various stars and planets with different masses and densities, the relationship between mass and energy is not linear. Typically, gas giant planets and stars with low densities consume very little energy and form small accretion disks that emit weak light. (2) In industry, there are some devices that do not achieve high production capacity, and some never even reach their basic design capacity. This is because they use raw materials with high spacetime energy, resulting in very low overall energy consumption within the industry. However, individual devices may consistently maintain a benchmark level above industry standards. (3) In the cooling process of cement clinker, the grate cooler often exhibits the phenomenon of "red river" on the fine material side, indicating poor cooling efficiency. Such phenomena and processes exist that violate basic laws of physics.

The correct interpretation of the above problem can only be achieved through the principles of spacetime mechanics and the spacetime mass-energy equation. By analyzing the relationships between the various physical elements provided by spacetime mechanics and the spacetime mass-energy equation, we can obtain accurate answers regarding the applied spacetime processes. This also proves that spacetime is not only composed of the perceivable dimensions of time and space but also a form of energy. It encompasses the potential energy of mass-energy within the microscopic spacetime of mass matter and the motion of matter under the macroscopic spacetime energy. Spacetime is a dynamic process in which absolute mass is concentrated to create a strong gravitational force that drives the spin and rotational motion of relatively small mass matter under different spacetime conditions in the micro and macro levels. These motions overlap and superimpose on each other, simultaneously existing in both separation and convergence. Spacetime is a mechanical process in which mass and energy synchronize and transform. Mass and energy coexist within spacetime. Any physical or chemical process inevitably involves changes in spacetime and cannot evade the existence of mass and energy. Time and space are not merely mechanical processes but also determine the forms and processes of mechanics. By adhering to the laws of symmetric compression, expansion, mass-energy conservation, and spacetime, there is constant interchange between compressed, expanded, and overlapping mass, energy, kinetic energy, angular momentum, dark matter, and dark energy within spacetime. Energy, kinetic energy, and angular momentum are conserved in the micro and macro levels within a single spacetime. Space determines the density and abundance of mass, while time determines the intensity and abundance of energy. Under the conditions of compression and expansion within the spacetime environment, there is frequent transformation and overlapping of mass, energy, kinetic energy, angular momentum, dark matter, and dark energy between micro and macro spacetime mass and energy forms. Therefore, the existence of symmetric macro and micro spacetime conditions for release and absorption does not exist. As a result, the conservation of energy, kinetic energy, and angular momentum is not present within a single macro spacetime, leading to the law of asymmetrical spacetime and the non-conservation of energy. This is the result of the interaction between the overlapping and overlapping of diverse forms of spacetime in the microscopic mass and the singular form of spacetime energy at the macro level. Spacetime is a form of existence for mass and energy, and it is a physical science that reflects

the states and laws of mass and energy. It is the origin and foundation of all physical mechanics, determining the forms and trajectories of mechanical mass and energy under different spacetime and the recurring laws of life. Spacetime is the mother of all physical sciences, built upon the foundation of Newton's heliocentric cosmology establishing classical mechanics and Einstein's stationary universe theory formulating the special and general theories of relativity. It represents a reexamination of physical science under the context of an infinitely expanding and compressing universe, and it stands as a significant discovery and breakthrough in human physics.

Transforming the current energy and materials industry apparatus's design concepts and application methods of energy processes into forms that align with the natural laws of spacetime, fully utilizing the inherent spacetime processes within the apparatus, and eliminating boundaries between industries to synchronize the upgrade of potential energy in different processes and materials with varying densities. This will enable the complete absorption of energy processes and create a diverse and synchronized integrated device system. By strictly adhering to the laws of symmetric compression, expansion, and symmetrical mass-energy conservation, energy processes can be transformed into usable forms of mass and potential energy without the generation of exhaust gases and waste. This eliminates the overflow of mass and energy, and energy efficiency can be fundamentally improved, leading to the realization of true energy conservation and emission reduction. The protection of the Earth's spacetime mechanical environment becomes a reality.

7. The process and significance of achieving zero emissions and zero pollution in the energy materials industry

Achieving zero emissions and zero pollution in the energy materials industry requires effective control of the macroscopic spatiotemporal processes of energy utilization and the establishment of a completely enclosed spatiotemporal application environment. It also sets higher standards for the transformation and compression of microscopic mass-energy in the spatiotemporal domain. Typically, the mass of elemental substances is measured based on the mass radius of atoms and molecules. If the mass of microscopic spatiotemporal matter cannot be compressed to the mass radius of atoms and molecules, the performance of mass products will inevitably decrease. Especially in the case of solid microscopic spatiotemporal mass, there exist significant differences in structural spatiotemporal mass-energy, which makes it difficult for us to fully understand the process of mass-energy conversion. The establishment of spatiotemporal mechanics and the development of spatiotemporal mass-energy equations provide us with a gradually clearer understanding of the laws governing the universe and mass-energy essence. They provide an effective theoretical basis for improving energy utilization efficiency. Achieving zero emissions and zero pollution in the energy materials industry is the ultimate goal of spatiotemporal mass-energy application. It is also a crucial indicator of industrial civilization advancement. By maximizing the utilization of Earth's limited resources and energy, optimizing the integrated efficiency of resource and energy applications, and safeguarding the stability and long-term viability of Earth's spatiotemporal environmental mechanics, we can ensure the long-term continuation and development of human civilization.

8. Conclusion

New scientific discoveries and technologies are often initially difficult to be accepted by the general population. The standard for judging new scientific discoveries and technologies is typically based on experimental verification. First, it involves comparing the laws of natural mass-energy conversion and then conducting industrial experiments to refine the understanding. Spatiotemporal mechanics and spatiotemporal mass-energy equations are summaries derived from the laws of natural phenomena in the universe. The spatiotemporal mass-energy equation is an evolved derivation of the mass-energy equation, aligning with concentrated processes in the conversion of natural mass-energy, such as accretion disks of black holes, regeneration pillars, collision explosions, stellar radiation, galaxy movements, and other natural phenomena. Each of these phenomena follows the principles of spatiotemporal mechanics and spatiotemporal mass-energy equations. They have been partially confirmed through numerous industrial experiments, including the principles of multi-channel burners with high solid-gas ratios, and other physical principles that comply with the spatiotemporal mechanics and spatiotemporal mass-energy equations. With the passage of time, it is believed that the theoretical application scope will be further expanded, becoming an important scientific theoretical system in the progress of human civilization. It will serve as a crucial tool and theoretical basis for the upgrading of methods and processes in the progress of human civilization.The emergence of life requires specific microscopic spatiotemporal environments of mass-energy matter and macroscopic spatiotemporal environments of mass-energy motion. The appearance of intelligent life, such as humans, imposes more stringent requirements on the spatiotemporal environment. Therefore, the spatiotemporal environment of human energy utilization must be based on the preservation of the self-survival environment. It involves the complete conversion and enclosed application of

microscopic matter mass and efficient processes of macroscopic energy motion matter absorption. This mass-energy spatiotemporal application process is the only efficient method that can protect the spatiotemporal environmental mechanics of the Earth from continuous and accelerated destruction caused by industrialization. It is the only reliable and effective method to ensure the long-term and sustainable progress and development of civilization.

By reexamining the history and process of human energy application using a first-principles approach, and through innovative reconstruction of the theoretical methods and processes of energy application, based on spatiotemporal mechanics and guided by the spatiotemporal mass-energy equations, it is possible to effectively control the spatiotemporal trajectory of mass and energy, creating new methods and technologies for zero-pollution and zero-emission energy material applications in industries. This approach will inevitably become the ultimate goal for fundamentally improving the efficiency of human energy application and the only method to address the accelerated destruction of the Earth's spatiotemporal environmental mechanics caused by current energy application processes. The spatiotemporal mass-energy application in the energy material industry will drive human industrial civilization to new heights. Maintaining the stability of the Earth's spatiotemporal environmental mechanics and protecting the safety of human existence is crucial. It is hoped that the description provided in this manuscript will inspire and deeply resonate with managers, producers, researchers in the energy material industry, and advocates for environmental protection. It aims to steer our industrial civilization towards a path that aligns with the laws of nature, ensuring the effective protection of the Earth's spatiotemporal environmental mechanics and the sustainable development of human industrial civilization. With everyone's support and collaboration, under the guidance of this new theory, an integrated spatiotemporal closed-loop mode of energy material industry, characterized by the conversion of mass and energy, can be established. Only then can energy efficiency be significantly improved, and the Earth's spatiotemporal environmental mechanics be effectively protected, leading human industrial civilization to new heights and entering a new era.

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