

Discovery of Present Space Universe Reveals Ultimate Physical and Spiritual Reality

Ralph B. Hill, June 15th, 2024

Abstract

I introduce the discovery of ultimate reality of an invisible fundamental realm I refer to as the Present Space Universe. The discovery of the Present Space Universe (PSU) has unprecedented transformational consequences for fundamental physical sciences and humanity. The PSU is the realm of a universal present. The mysterious nature of the present time is the phenomenon of its existence. The new understanding of Present Space Reality (PSR) provides unprecedented scientific insight into hidden structure, mechanisms, and the stunning nature of ultimate reality from one principle. The fundamental principle works as a logical lens through which answers for an abundance of our most fundamental questions in science suddenly emerge. It provides stunningly direct insights into who we are and what our existence in our apparent physical universe is about. The fundamental principle is shown as the direct logical consequence of the two fundamentally distinct ways in which our physical universe presents itself to us. They are propagation of physical effects under the cosmic speed limit and simultaneous effects in quantum phenomena. I demonstrate how PSR leads to solutions for an abundance of our most fundamental questions of quantum physics, cosmology, thermodynamics, biology, consciousness and beyond. As the PSU is ultimate reality, our apparent physical universe is not. It is an effective but ultimately virtual projection. PSR identifies the fundamental nature of consciousness in its specific physical context. Our fundamental conscious existence is part of the ultimate reality of the PSU. Continuation of consciousness beyond our physical lifetimes is a natural logical consequence. PSR identifies a mechanism in Present Space Causality (PSC) for the generation of laws of physics and the origin of our apparent physical universe. The presence of a higher order entity of consciousness is identified. PSR identifies an operational mechanism for select differentiation of undifferentiated states in the simultaneously evolving PSC. The quantum measurement problem is resolved. Characteristics of quantum behavior finally make and reveal sense. Their functional relationship with classical behavior is determined. Mechanisms of differentiation and undifferentiation project phenomena we associate with randomness and entropy in thermodynamics. PSR suggests a black hole shell model that removes paradoxes arising in central singularity models. It points to real-world relevance of AdS/CFT correspondence. The universal pathway for answers for seemingly unrelated ultimate questions is extraordinary evidence for a crucially missing keystone in prior scientific understanding. Profoundly meaningful insights for all of humanity extend to questions of purpose.

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1. Introduction

Here, I introduce the discovery of reality of a fundamental realm of the present. I call this realm our Present Space Universe. It is an invisible realm that cannot be directly measured. The nature of the present time is the phenomenon of its existence. I refer to the new understanding as Present Space Reality. Present Space Reality (PSR) provides an unprecedented breakthrough in scientific understanding that reveals hidden structure, mechanisms, and a scientifically surprising nature of ultimate reality. The new understanding has an inevitable consequence with far-reaching implications for fundamental physics and beyond. Our familiar physical universe, which I refer to as our Measurement Space Universe, is not fundamental reality. The Measurement Space Universe arises as a projection within the realm of the Present Space Universe. The reality of the Present Space Universe is a direct result of fundamental logic for the seemingly incompatible ways in which quantum and classical physical phenomena become effective across space. The result is confirmed by its power to resolve an abundance of our most fundamental problems in physical sciences and beyond. The universal pathway to what appeared to represent isolated scientific inquiries demonstrates that we are looking at a most fundamental missing keystone in scientific understanding. I identify solutions for seemingly intractable problems in the understanding of quantum physics, cosmology, thermodynamics, biology, and consciousness. PSR makes and reveals specific sense of individual characteristics of quantum behavior and reveals a coherent understanding of the relationship between classical and quantum phenomena. New insights in cosmology naturally extend to questions beyond the reach of conventional quantitative modeling. Under PSR I identify a mechanism for the origin of our apparent laws of physics and for the origin of our Measurement Space Universe. The foundational basis of space, time, and other apparent physical entities of the Measurement Space Universe is identified. The question of infinity of space is resolved and the mysterious nature of the present time is revealed. Further analysis shows that the evolution of our Measurement Space Universe follows mechanisms for select differentiation of undifferentiated states. We encounter their observable effects in randomness and entropy. The results emerging under PSR demonstrate in a multitude of ways how the mysterious realm of the Present Space Universe interacts with and relates to our physical world. Above all, PSR identifies the fundamental nature of consciousness in its specific physical context. Under PSR it is beyond reasonable doubt that consciousness is part of the unique fundamental reality of the Present Space Universe. We are looking at a realm of fundamental consciousness for which we had no prior scientific concept, neither for its nature nor for its existence. PSR has existential implications for all of us as it determines a stunning relationship between consciousness and our human brains. Fundamentally, consciousness does not arise from human brains in Measurement Space, consciousness uses them. The insight transforms the scientific basis for understanding human mortality. Our conscious existence in the realm of the Present Space Universe can be expected to continue in some form beyond our human lifetimes in the MSU. PSR describes further analytical, experiential, and observational pathways for a deeper understanding of continuation of consciousness and characteristics of the spiritual reality of the newly discovered realm. PSR informs pathways for scientific appreciation of certain seemingly irrational experiences of consciousness. PSR provides a defined new basis for further research into consciousness in established

fields including neuroscience, psychiatry, and psychology where both fundamental research and new approaches in patient treatment may be based on. PSR has transformational consequences for fundamental physics as it reveals a surprising operational modus for the observed progression of physical effects in the MSU. The deterministic flow of causality under the cosmic speed limit of light and causality does not happen naturally. What we eventually observe as physical behavior in our MSU is simultaneously codetermined through algorithmic progressions under corresponding rules of Present Space Causality operating in the Present Space Universe. We already encounter the operational modus in simultaneous effects in quantum entanglement. Further transformative consequences emerge. Our physical world is ultimately not the result of interactions of its smallest and seemingly most fundamental constituents. Their relevance emerges in select differentiation of undifferentiated states. In the new understanding phenomena of thermodynamics make and reveal fundamental sense. Randomness and entropy relate how our Measurement Space Universe evolves under rules of Present Space Causality and how it responds to measurement. The new understanding impacts the foundational understanding of processes and structures in living cells. They are found to be affected by special algorithms for biology beyond probabilistic rules. PSR confirms a prevailing understanding in cosmology that our Measurement Space Universe had a moment of beginning. PSR provides both foundational context and an actual mechanism in Present Space Causality for understanding the origin of laws of physics and the origin of our expanding Measurement Space Universe. Both follow from an onset of defined rules of Present Space Causality, that since have projected our expanding Measurement Space Universe. PSR impacts the question if the origin of our Measurement Space Universe is the result of a somehow natural event or a creation. The new findings coherently suggest a creation for consciousness to thrive and evolve. They imply the action and presence of a higher order conscious intelligence. The Present Space Universe is the realm of this higher order entity. It is not a coincidence that the consequences of PSR resonate with long-held religious beliefs and with ideas contemplated in philosophy. PSR identifies the reality of a long-anticipated distinction between our apparent physical universe and an ultimate fundamental realm of which we are part of as conscious beings. This realm is the Present Space Universe. The transformative scientific understanding of our ultimate reality provides further deeply meaningful and crucial insights for all of humanity.

2. A clear and intelligible principle of fundamental physics

The Present Space Universe is to be distinguished from our familiar physical Measurement Space world with its apparent space and physical objects. Measurement Space is an ultimately virtual projection that relays information from prior iterations on the level of the Present Space Universe which we ultimately conceptualize. The projection is generated within the Present Space Universe. Fundamental reality only exists in the evolving moments of the Present Space Universe. What really exists exists there and what really happens happens there, in the way things can happen and exist there. A clear demonstration of this seemingly strange fundamental principle already follows from foundational implications of the cosmic speed limit of light and causality for our physical environment. This is visualized in the ABN Chart Fig.1. We are looking at three equivalent observers in presence to help conceptualize a present reality beyond causal relationships between any two observers. Present Space is represented by the horizontal line on top, where no deterministic physical interactions under the cosmic speed limit occur. As soon as we accept the fundamental reality of Present Space, we realize that our physical Measurement Space represented by the area below the horizontal line is not fundamental reality. The straightforwardness

and simplicity of the principle demonstrate that PSR is not another speculative idea. It is the direct consequence of application of radically abstract logic to what we observe as the cosmic speed limit and its reconciliation with simultaneous behavior in quantum physical phenomena. The simplicity of the fundamental principle is in contrast with the challenge of decoding its far-reaching and mind-bending consequences. PSR undertakes this novel task through application of abstract fundamental logic. A meaningful discussion of PSR requires distinction between validity of the fundamental principle and of individual logical consequences.

Fig.1 ABN Chart

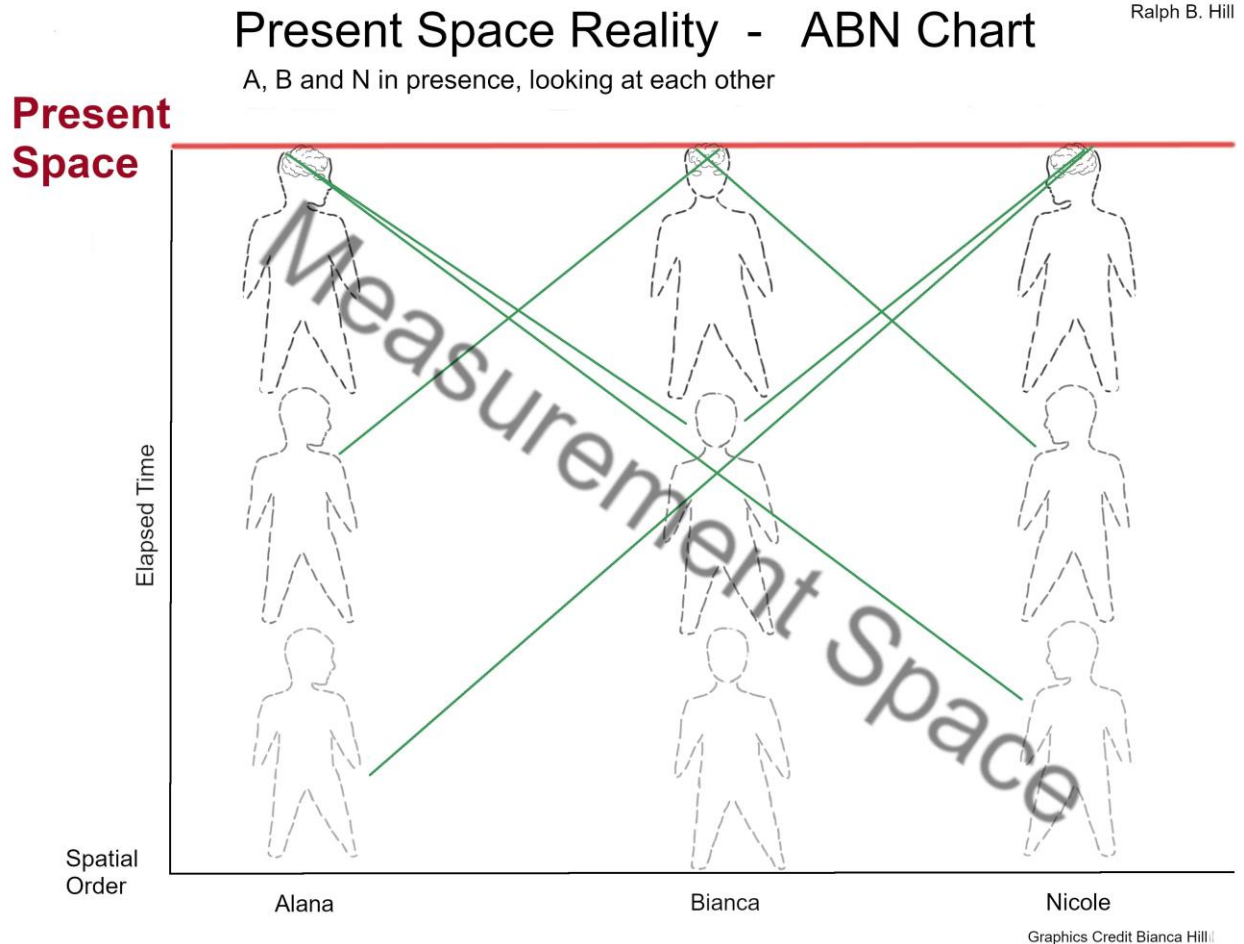


Fig.1 Three observers in presence are looking at each other. Present Space is represented by the red horizontal line on top. Prior moments in Present Space are any parallel line below. The green lines represent lines of sight and measurement which are seen to propagate at the speed of light in Measurement Space. The time delay effect is exaggerated to visualize its fundamental relevance. The area below the red line represents our familiar Measurement Space. The information we realize from points of observation relates to prior moments of the evolving Present Space Universe. In conventional understanding of fundamental reality of Measurement Space, the time delay effect appears trivial and negligible. We now realize its fundamental significance. At any moment only the evolving Present Space is real. What really exists exists there and what really happens happens there, in the way things can happen and exist there. No matter which direction or distance we train our telescopes or microscopes to we can never see or measure the real Present Space Universe. No deterministic physical interactions occur in it, only a simultaneously codetermined evolution under corresponding rules of Present Space

Causality. Lines of sight and measurement go beyond our eyes and brains to an ultimate recipient which is our conscious mind. Signal processing by our eyes and brains is part of Measurement Space and its deterministic physics. Our conscious minds are part of the realm of the Present Space Universe. They are at the receiving end of determined information from the past and at the initiating end of action that impacts our observable physical world of the future. Conscious decision making is real, conscious effort impacts the physical world. Our conscious minds are part of the wonderful nature of the real Present Space Universe.

3. The evidence for Present Space Reality (PSR)

3.1 Overview and structure of the evidence

PSR demonstrates extraordinary evidence for the fundamental principle of reality of the realm of the Present Space Universe. It is the direct result of a radically abstract analysis and reconciliation of the modus of propagation of classical physical effects under the cosmic speed limit and the seemingly contradictory simultaneous progression in quantum physical effects. The fundamental principle is confirmed by its inherent ability to address and resolve an unprecedented set of our deepest fundamental questions in cosmology, physics, and beyond, that have been intractable in conventional understanding of reality of our Measurement Space Universe. The fundamental principle works as a logical lens through which we step by step gain insight after insight into the structure and ultimately the nature of fundamental reality. It provides an effective logical key for unlocking a fundamental understanding of quantum physical phenomena that makes sense and reveals characteristics of the operational modus for the projection of our physical world under rules of Present Space Causality (PSC). The fundamental principle directly resolves the apparent incompatibility between instantaneous effects in quantum phenomena and the propagation of effects under the cosmic speed limit. It makes and reveals sense of individual aspects of quantum behavior including entanglement, superposition, Planck limits, randomness, and lack of local reality. It reveals a PSC methodology for correspondence between quantum and classical behavior and reveals an overall functional relationship. PSR provides unexpected foundational context for direct real-world relevance of conformal field theories under AdS/CFT correspondence and identifies a surprising tool for fast-tracking the discovery of new Measurement Space physics. PSR identifies abstract rules of PSC as the mechanism for the origin and 'enforcement' of our apparent laws of physics, which at the same time is the mechanism for the onset of an expanding Measurement Space Universe. PSR reveals the nature of our apparent physical entities including matter, forces, space, and time. It provides an understanding of the nature and significance of the present time, which aligns with our fundamental experience of existence. The fundamental understanding of the nature of time has implications for Measurement Space physics as it provides a physical understanding for what happens at the black hole event horizon. The resulting shell model removes paradoxes of current models with a central singularity, aligns with earlier findings based on thermodynamics about the information content of black holes, and points to a new physical mechanism for black hole growth. PSR makes and reveals fundamental sense of the strange phenomena of thermodynamical randomness and entropy. A further analysis of the operational PSC modus demonstrates that biological structures and processes are governed by special PSC algorithms beyond general PSC rules for ordinary physical behavior. Above all, PSR demonstrates an unprecedented scientific understanding of our own fundamental nature and a deeper spiritual reality. It settles the mind-body problem of philosophy with the analytical clarity of a key insight of fundamental physics. It makes and reveals sense of seemingly irrational experiences of consciousness including dissociative identity disorder and near-death experiences. It reveals a stunning cosmological role and proprietorship of the exceedingly powerful

intelligence in human brain processes. The universal scope of the new insights emerging from one principle, their deeply fundamental nature, and their sheer abundance are unmistakable features of a crucially missing keystone in prior scientific understanding of reality.

3.2 Instantaneous quantum physical phenomena across remote locations

Direct physical evidence for the reality of a simultaneously evolving Present Space Universe is present in quantum phenomena that instantaneously transcend Measurement Space. They demonstrate the presence of a world beyond Measurement Space and the apparent speed of light and causality by which the projection of Measurement Space emerges. These 'strange' phenomena have long been established in quantum physics in theory and in experiment but did not make sense based on an assumed fundamental reality of Measurement Space and its classical deterministic physical effects under the cosmic speed limit. Instantaneous effects across Measurement Space are common in quantum field theory. A well verified and most obvious effect of this 'spooky action at a distance' appears in quantum spin measurements across remote locations in Measurement Space. Measurements of two entangled particles with a total spin of zero instantaneously lead to opposite results for the individual positive or negative spins for each particle at their remote locations on a defined axis of measurement. This consistent outcome already suggests an instantaneous effect across Measurement Space regardless of distance. It is further complemented by predictions under quantum mechanical rules for statistical outcomes where the orientation of the axis of measurement differs between the remote locations where the individual particles are measured. The idea that these correlated results may not instantaneously arise in measurement but might possibly be determined by local 'hidden variables' had become a testable hypothesis based on Bell's theorem [1]. Experiments with photon spin have since demonstrated statistical results that confirm the absence of local hidden variables which again confirms the occurrence of instantaneous effects across Measurement Space. Key experiments include works by Freedman and Clauser in 1972 [2], Aspect, Dalibard and Roger in 1982 [3] and Weihs, Jennewein, Simon, Weinfurter and Zeilinger in 1998 [4], which have been recognized in the award of the 2022 Nobel Prize in Physics. The pivotal question is what this means for fundamental reality. Here, we accept that simultaneous quantum effects across remote locations really happen and reflect the presence of a simultaneously evolving fundamental world. The fundamental world is the Present Space Universe which projects our Measurement Space Universe.

3.3 Speed of light and causality under rigorous abstract logic

To accept the reality of a distinct present world is not an outlandish conclusion. It already arises as a consequence of the cosmic speed limit of light and causality. This is intelligibly demonstrated as the horizontal red line on top in the ABN Chart Fig.1. A vague concept of reality of a present world is reflected in cosmology where it is generally understood that an astronomical object observed 1,000 light years away is seen the way it appeared 1,000 years ago and that it certainly has evolved since. The very existence of an evolved and evolving world of the present outside our and in fact anyone's light cone, however, necessitates a radical reconsideration of the implications of the cosmic speed limit for the question of reality of Measurement Space. Rigorous abstract logic requires the principle of an evolving world beyond our light cone to be applied to any magnitude of distance down to the Planck length. This leads to an understanding of a world of the present that, in a naïve Measurement Space perspective, may be thought of as the aggregate of classically isolated point-like Local Nows. The two worlds of Present Space and Measurement Space cannot both be fundamental reality, it is either or. The

unambiguous conclusion under PSR is that the Present Space Universe is ultimate fundamental reality and our apparent 3-dimensional Measurement Space Universe is not. In the evolving world of the present, physical interactions under the cosmic speed limit do not happen naturally. The observed physical evolution in Measurement Space ultimately follows a simultaneous protocol under abstract rules of Present Space Causality in the Present Space Universe.

3.4 PSR explains the nature and significance of the present time and of time itself

To understand the nature of time we need to understand the nature and significance of the present time first. The present time is absolutely existential to us, but its existential nature has no meaningful expression in current understanding of time in physics and cosmology. Time is treated as a measurement parameter in Measurement Space that relates to the past and allows predictions about future Measurement Space. The significance and ontological nature of the present time is overlooked. PSR reveals its nature. The present time is the phenomenon of existence of the real Present Space Universe. The nature of 'time itself' as a fundamentally evolving process is not the clock speeds we measure in Measurement Space and which vary as described by relativity. The nature of time itself is the evolving moments of existence of the Present Space Universe. The insight explains why there can be no real evolution or 'travel' back in time and rules out concepts of a block universe. It also leads to a model for what happens at the black hole event horizon described in 6.

3.5 Our unique conscious existence is part of the realm of the Present Space Universe

To grasp the transformational implications of the reality of the Present Space Universe we need to embrace that it is a unique realm unlike our observable physical world. It is the realm of fundamental reality. What really exists, exists there and what really happens, happens there, in the way things can happen and exist there. Through our innate experience of existence in consciousness we have direct and irrefutable evidence that consciousness really exists. As it really exists it must be part of the fundamental reality of the realm of the present. As a phenomenon of the Present Space Universe, it lives at a boundary between observable Measurement Space and future Measurement Space. It is at the receiving end of information and effects that follow the rules of physics we observe in Measurement Space and at the initiating end of original action that impacts future projections of Measurement Space. Its unique fundamental nature is not the result of the physics of Measurement Space but a fundamental attribute of the Present Space Universe of which it is part of. The ability to identify the nature of consciousness in its specific physical context is extraordinary evidence for PSR.

3.6 PSR explains conscious manipulation of our deterministic physical world and the essence of our conscious human experience

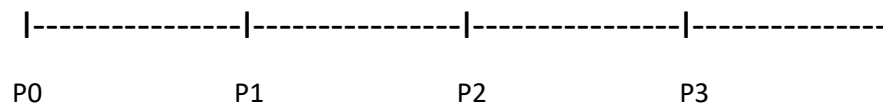
Beyond the question of who we are, the apparent fact that we can manipulate the physical world based on our personal conscious intent and effort is an unresolved problem in an understanding of fundamental reality of a universe and of physical brains governed by deterministic physics. PSR demonstrates that we do this from a realm of Present Space beyond the physical world of Measurement Space. The interaction between our Present Space consciousness and our individual Measurement Space brains is how we consciously manipulate and experience our effective Measurement Space environment. This is how and why we build telescopes, churches, and particle accelerators in a deterministic Measurement Space world. A stunning consequence of PSR is that our experience of personal local reality is the result of the connection between our fundamental Present Space consciousness and our

individual brains in an ultimately virtual Measurement Space Universe. This is what forms the essence of our conscious human experience. The stunning cosmological role of human brains and their exceedingly intelligent algorithmic processing is further substantiated in 10.

3.7 PSR identifies the onset of Present Space Causality (PSC) as the mechanism and cause for the origin of our deterministic laws of physics and an expanding projection of our Measurement Space Universe

The fundamental reality of the Present Space Universe has direct consequences for understanding the apparent flow of causal deterministic effects under the cosmic speed limit in Measurement Space. What we eventually observe as physical behavior in our Measurement Space Universe does not happen naturally. It is a projection that is determined by simultaneous algorithmic progressions under abstract rules of Present Space Causality (PSC) operating in the Present Space Universe. PSC rules project the laws of physics as they are observed in physical behavior in the projected Measurement Space Universe. Characteristic details of the operational modus of PSC can be decoded. Results and their underlying fundamental logic are described in 5. PSC not only works as the mechanism that generates and enforces our laws of physics. PSC provides the key for unlocking the fundamental mystery of origin of our apparent physical world. Our Measurement Space Universe is not the result of some prior physical state. An operative onset of PSC inherently leads to an expanding Measurement Space Universe (MSU) as a direct consequence of expanding pathways of causality under the cosmic speed limit. Since the onset of PSC at a real moment in the past of the Present Space Universe, the expanding projection of Measurement Space (MS) has evolved from zero spatial extent due to the expanding pathways of causality under the cosmic speed limit of light and causality. Both our laws of physics and the origin of our expanding universe are consequences of an operational onset of PSC. How the initial moments in this evolution may be envisioned is shown in Fig.2.

Fig.2 Initial moments in multiples of Planck time P ($\sim 10^{-43}$ seconds)



P0 marks the onset of PSC. At this moment PSC rules are defined and become operational. No outcome exists yet that would causally impact the future evolution of the MSU.

P1 is the moment when a first outcome has emerged under PSC rules that will causally affect the future evolution of MSU. It is an initial set of values that begins to define MS. It represents highly undifferentiated macrostates that become increasingly differentiated through algorithmic progressions under rules of PSC. As the same initial set of values is the limit of our cosmic horizon of causality in all directions, there is no need for additional assumptions, such as inflation, to explain a largely homogenous and isotropic MSU.

P2 A second outcome emerges based on the first outcome and rules of PSC. It is the first moment that reflects a causal deterministic effect under MS physics.

P3 At this moment a third outcome emerges under PSC which reflects prior outcomes under the causality of MS physics. Complexity begins to develop and a projected 3D spatial differentiation begins to emerge.

PSR points to a dual-energy model where the emergence of positive energy is matched by negative energy of the MS vacuum. It removes a fundamental incoherence of conventional models with positive mass-energy only, where expansion should never take off due to overwhelming gravitational attraction of masses in an initial singularity or in any subsequent ultra-dense states.

3.8 PSR resolves problem of infinity of space, Measurement Space Universe is a finite projection

Based on the assumption of fundamental reality of Measurement Space the question of infinity of space has been one of the most puzzling problems in cosmology. Measurement Space has no apparent borders and therefore appears to be infinite. Measurement Space can now be thought of as a finite projection. Regardless of which direction or depth we train our telescopes in Measurement Space we can never see the real Present Space Universe. We are looking at a projection which provides information about a projected evolution of the Measurement Space Universe as observed from points of observation at Local Nows. Our observable universe represents sets of causal lines of measurement that are just increasingly redshifted but complete in their causal connection with an initial moment at the onset of our laws of physics. This horizon of causality goes beyond an era of origination of the cosmic microwave background to an initial moment. The initial moment may be thought of as a moment of zero extension that remains causally effective from all directions across the horizon of any observer. There is literally nothing 'behind' the horizon of this projection. The current apparent volume of our Measurement Space Universe is a projection that can be thought of as finite. An additional relevant aspect emerges from principles in the operational modus of PSC described in 5.5. In the fundamentally unreal Measurement Space, distant galaxies may lack differentiation at Local Nows. They may emerge in our field of view merely as results of select differentiation in our measurement processes.

3.9 PSR provides fundamental reason for the expansion of our Measurement Space Universe, relates to fundamental inconsistencies in the Lambda-CDM model and new observational evidence for an older maturity age of the Measurement Space Universe predicted by dual-energy theory

The expansion of our Measurement Space Universe (MSU) appears strange based on an assumed fundamental reality of Measurement Space (MS). The quantitative determination of the apparent expansion has been a critical focus of research within the standard model of cosmology. The more fundamental questions of the fundamental nature and origin of space, laws of physics, and initial causes for expansion had remained intractable. Under PSR the expansion of MS follows directly from the new understanding of what MS is. MS is not fundamentally real. The space we observe reflects results of the historic evolution of a protocol for causality under the cosmic speed limit that is generated under rules of PSC. The evolution under PSC generates the projection of MS as it affects and informs Local Nows at points of observation. This history of causality from the beginning of our MSU necessarily extends with time, corresponding with 1 light-year per year. The projected MSU necessarily expands as a direct consequence of extending pathways of causality. The new fundamental understanding has implications for current modeling of expansion. It suggests that cosmological models of a somehow kinetically driven expansion as described in the Friedman equations are fundamentally invalid. It also invalidates current calculations under the Lambda-CDM model for the age of the MSU of around 13.8 billion years. Any new timeline of an expansion history under MS physics would require a fundamental rebuild and recalibration. Its cosmological relevance is further affected by the lack of fundamental reality of the MSU and the insight that distant galaxies may emerge as results of differentiation in measurement under PSC. A rebuild of a timeline of MSU evolution required the identification of quantitative drivers for expansion beyond current understanding under MSU physics. Beyond a baseline effect of a horizon of causality receding at the speed of light we may expect effects of a repulsive form of vacuum energy. Several new insights under PSR point to negative vacuum energy. I had predicted an older maturity age of the universe and the invalidity of the current model based on fundamental incoherences of the kinetic model and a gravitational mechanism that generates negative vacuum energy [6]. The invalidity of the

kinetic model with its rapidly decelerating early expansion already gives reason to expect an older MSU with a much deeper early MS. The scenario manifests in mature galaxies at high redshifts that could not have formed within the timeline of the Lambda-CDM model. The early galaxies have an older maturity age than their redshift suggested. As the early MS is deeper than assumed under the Lambda-CDM model we expect additional populations of galaxies in the field of view. More recent observations with the James Webb Space Telescope and other instruments have aligned with this scenario. Evidence for unexpectedly mature galaxies in the early universe had already been found in observations with the ALMA array by Lelli et al. (2021) [7] of a galaxy at redshift $z \approx 5$. Observations with the James Webb Space Telescope point to further excessive deviation from expectations under the Lambda-CDM model that extends to yet higher redshifts of $z \geq 10$. The emerging evidence shows brighter, more evolved, and higher abundancies of galaxies than expected [8] [9]. Independent evidence for additional galaxy populations has emerged from the determination of unexpected brightness of the cosmic optical background based on observations with the LORRI instrument on NASA's New Horizon spacecraft. Results obtained by Lauer et al (2022) [10] suggest a factor of 2–3 times more light than expected from populations of galaxies predicted under the Lambda-CDM model.

3.10 PSR provides new insights that suggest an ultimate cause and purpose for the origin of our Measurement Space Universe (MSU) and the onset of Present Space Causality (PSC)

Questions of ultimate cause for the origin of our physical universe and its laws of physics are legitimate and crucial questions of cosmology. With the discovery of PSC as the mechanism for the projection of both, the ultimate question extends to the cause for the onset of the PSC mechanism. New PSR insights impact the question if the origin of our physical world is the result of a somehow natural emergence or a creation. Key elements are summarized in 8. The new insights coherently suggest the creation of an ultimately virtual MSU. Apparent purposes of the creation directly relate to consciousness where our MSU is a creation for consciousness to thrive and evolve. The new insights imply the presence and action of a higher order conscious intelligence in the realm of the Present Space Universe.

3.11 Special PSC algorithms for biological systems resolve fundamental problems in biology and reveal the foundational basis of biology in the Present Space Universe

A systematic analysis of the operational modus of PSC in 5.3 and 5.4 provides a fundamental understanding of PSC processes for select fine differentiation which manifest in thermodynamic phenomena of randomness and entropy. The further analysis in 9. provides pivotal insight into PSC algorithms that govern biological systems. The complex structures and processes we find in biological systems are governed by special PSC algorithms beyond general rules for probabilistic physical evolution. The result resolves fundamental problems in biology and impacts our foundational understanding. It provides a fundamental explanation for the distinct information regimen we find in living systems where algorithmic information gains causal efficacy over matter. It provides a fundamental cause for the sustained one-handedness in chiral forms of biomolecules and the general problem of deviation from rules for probabilistic chemical and physical evolution. It demonstrates the presence of a type of rules that can readily explain the origin of life before an onset of Darwinian evolution.

3.12 PSR predicts well-behaved black hole shell model, removes paradoxes arising in central singularity models, points to specific new physical mechanism for black hole growth

PSR does not generally affect quantitative predictions about MS under current models. One exception is the modeling of black holes. PSR provides a physical understanding of what happens at the event horizon. The understanding of a simultaneously evolving present leads to a MS model of black holes as ultra-dense, relativistic shells at their event horizons where nothing ever falls through. This is in surprising alignment with findings based on thermodynamics about the information content of black holes, introduced by Bekenstein [11]. The shell model under PSR removes paradoxes arising in current central singularity models. It also points to a specific physical mechanism for black hole growth beyond known mass accretion processes. The mechanism may help explain observational evidence presented by Farrah, et al. [12], that suggests growth rates for supermassive black holes beyond known physical mechanisms.

3.13 Negation of natural concept of reality of the present hinges on misguided assumption about a fundamental lack of simultaneity

The reality of the present is a natural concept that is in singular alignment with our fundamental experience of conscious existence in the present. The distinction between the invisible realm of the present and the observable MS is conceptually transparent as shown in the ABN Chart in Fig.1. Negation of the reality of this invisible world of the present hinges on an assumption of a fundamental lack of simultaneity associated with Albert Einstein's general and special relativity. Gravitational and relativistic time dilation had led to assumptions that 'time itself' must be relative and that there was a fundamental lack of simultaneity of moments of the present. Under PSR we realize that the fundamental nature of time itself is the evolving moments of existence of the Present Space Universe. The divergence in time intervals or 'clock speeds' measured by different observers do not represent fundamental realities of time but parameters of measurable effects in MS as described by general and special relativity. Special and general relativity describe the projected MS but do not describe the real Present Space Universe. A conclusion of a fundamental lack of simultaneity of moments of the present mistakes the feature of diverging measurement parameters for a feature of reality of time on its most fundamental level. It leads to paradoxical models for black holes and is incompatible with simultaneous quantum effects across remote locations. While special and general relativity 'only' describe the projected MS we realize the significance of a key insight of relativity beyond MS physics. The observational confirmation of its quantitative predictions demonstrates that the observed space emerges from a mathematical function of the speed of light and causality.

4. Fundamental understanding of quantum physical phenomena

4.1 Fundamental understanding of quantum phenomena follows from pivotal insight from beyond quantum physics

PSR enables us to analyze quantum physical phenomena from a clearly defined new footing. The clear new footing includes the reality of the present and the insight that the reality of the Present Space Universe (PSU) generates the projection of our familiar Measurement Space (MS) world through rules of Present Space Causality (PSC). Understanding the nature of the mysterious PSU is of utmost interest. We are looking at characteristics of a fundamental reality which not only gives rise to the projection of the MSU but also is our realm of fundamental existence. The fundamental principle of PSR works as an effective logical lens. Quantum physical phenomena that did not make fundamental sense based on reality of MS suddenly make sense and reveal capabilities and operational principles of PSC. Relevant implications for the quantum measurement problem and classical information can be identified. The

phenomena of superposition, lack of local reality, quantum randomness, quantum spin, the appearance of dimensionalities in MS, Planck limits, and entanglement suddenly make conceptual sense and reveal characteristics of computational processes under PSC. The phenomenon of entanglement signifies a key characteristic of simultaneous progression in the operational modus of PSC. The simultaneous PSC progression has profound implications for fundamental physical understanding beyond quantum physics which I analyze separately in 5. The new insights have a surprising relationship with current research in quantum physics into AdS/CFT correspondence. AdS/CFT correspondence may describe actual PSC dualities. Dual conformal field theories may qualify as rules of the predicted PSC evolving on the PS 'boundary' of a 'bulk' MS of negative vacuum energy.

4.2 Quantum measurement, mechanism for fine differentiation

PSR provides clear guidance for the quantum measurement problem by directly determining what is part of a present reality and what is part of the projection. 'Live' quantum states are present at all times and are part of the real PSU. They reflect the state of progression of mathematical algorithms under PSC that have the capability to project what we observe as our MS world. Measurement results and their determined classical information are part of the projection we conceptualize as MS. Results in quantum measurement such as effects we associate with a photon or other elementary particles emerge as part of the projected MS. In the live reality of the PSU the particles in these effects do not have a presence. The measurement output is operationally preserved by way of modifying or transforming PSC capabilities for future effects accordingly. To give an example we may consider an experiment involving electromagnetic waves such as the double slit experiment. We conceptualize the dot that appears on a photographic plate as a fixed measurement result. What happens in the real PSU is the ongoing evolution and transformation of live quantum states and the PSC capabilities they represent. With the initial appearance of the dot on the photographic plate, we are looking at an algorithmic transformation that involved an exchange of photon energy that led to new live states that are the basis for the projection of the dot on the plate. PSC progresses based on whatever new live states have evolved. The measurement process compels fine differentiation. The sensitive measurement apparatus has a specific artificial fine differentiation that compels differentiation of the undifferentiated quantum state. This is just a select description of PSR consequences for the quantum measurement problem. The quantum measurement problem is an isolated aspect of a wider fundamental inquiry under PSR. The wider inquiry under PSR is how the projection of MS is generated under rules of PSC and what this means. Further insights with relevance for the quantum measurement problem are detailed in 4.7 and in the context of the operational modus of PSC in 5. It includes that physical evolution is not determined from the smallest and seemingly most fundamental building blocks we can identify in fine measurement. Previously undifferentiated states become differentiated and relevant when we zoom in in measurement. The ranges of possible outcomes signify functional space for compelled fine differentiation due to other influences. Biological systems, such as Schrödinger's cat, compel fine differentiation.

4.3 Active operational capabilities generate passive information

PSR identifies foundational underpinnings for what we encounter and conceptualize as classical information and ultimately as our physical world. In quantum measurement seemingly strange forms of undetermined states appear to magically transform to a determined state. Under PSR we realize we are looking at mathematical progressions in PSC and their capability to project an output of classical

information. We are looking at results of an active and ongoing process based on capabilities where live quantum states signify PSC capabilities. The determination of the information has a corresponding effect on new live PSC capabilities to project future MS accordingly. The information has no further fundamental existence. Unlike live PSC capabilities which are operationally active, classical information is passive, conceptual, and consequently not subject to change.

4.4 Superposition is the capability to project any of the superposed states

For a particle or system to exist in several different states at the same time makes no sense based on reality of MS and its particles. Under PSR the phenomenon of superposition makes immediate sense. Quantum states signify capabilities of the PSU. In superposition we are simply looking at the capability to project any of the superposed states. Despite their appearance in measurement, particles do not exist as fundamentally real physical objects.

4.5 'Spooky action at a distance' in entangled particles is the characteristic capability of the PSU to impact MS across remote locations, MS Locality is the result of projections generated by the PSU

Simultaneous quantum effects encountered in entangled particles regardless of distance cannot be explained with deterministic MS physics and with fundamental reality of locality in MS. The simultaneous effects are characteristic effects of a PSU which has the inherent capability to simultaneously impact the MS it projects across remote locations. The phenomenon demonstrates that the locality we encounter in MS is not fundamental. It is the result of projections generated by the PSU under rules of PSC.

4.6 Seemingly nonsensical lack of local reality makes sense under brain-consciousness connection identified by PSR

The lack of local reality suggested by quantum phenomena appeared nonsensical. Under PSR we realize that MS is an ultimately virtual projection. The appearance of local reality is the result of the connection between our PSU consciousness and our individual MS brains, which forms the essence of our conscious human experience.

4.7 Randomness in measurement outcomes signifies fundamental capability for original action of the PSU, functional space for non-probabilistic fine differentiation

We encounter a particularly puzzling phenomenon in quantum 'randomness'. In this phenomenon no physical cause can be identified that determines the specific individual outcome of a quantum physical measurement. The phenomenon has baffled scientific minds for good reason. It stands in glaring opposition with fundamental reality of a MSU governed exclusively by deterministic laws of physics. While quantum wave functions predict probabilities, the foundational implications of the phenomenon had remained mysterious. With PSR we realize that observable effects in MS originate from the fundamentally distinct reality of the PSU of which we are part of. The phenomenon reflects a fundamental capability for original action. The action is 'original' as no physical cause for a specific outcome can be identified. The phenomenon emanates from the PSU and therefore reveals a fundamental capability of the PSU. Randomness in individual outcomes does not readily make sense as a necessary or useful element for a computational determination of a generally deterministic MSU. Randomness also has an analogue appearance in molecular behavior in thermodynamics. As shown in 5.3, the phenomenon relates to a functional space for fine differentiation. We are looking at a protocol

for selectively compelled fine differentiation of previously undifferentiated states. Fine differentiation that is only selectively compelled is computationally efficient. Probability distributions in measurement outcomes establish a correspondence between properties of macrostates and emerging microstates that is not naturally available due to a lack of a bottom-up physical flow of causality. The correspondence in probability distributions follows a top-down logical protocol. Ranges of possible outcomes signify functional space for specific non-probabilistic fine differentiation due to other influences.

4.8 Nonphysical spins signify a fundamentally nonphysical world, dimensionalities appearing in MS are results of mathematically determined progressions under PSC and may vary

Particles have a property called spin that signifies an angular momentum and leads to electromagnetic effects in MS. However, no actual physical rotation in space can be associated with this angular momentum. The observable effects of particle spin as observed in the Stein-Gerlach experiment do not allow for an expression of the angular momentum in 3-dimensional MS other than the selected axis of measurement. The observed up or down only effects of spin on the axis of measurement represent a 1-dimensional definition. The up or down only effects exemplify that the ongoing progression of our MS world is not due to the presence of real physical objects doing things in space but an ongoing algorithmically determined progression. The way the property of spin is projected in MS further demonstrates that dimensionalities appearing in MS are not fundamental but instead may vary. They depend on how the specific rule of PSC responsible for the observable effect is defined. The phenomenon of spin is further evidence for an ultimately nonphysical MS world.

4.9 Planck limits in measuring MS point to computational significance

The potential for measuring MS has fundamental limits beyond which no measurement result can be determined. The minimal spatial parameter is the Planck length at approx. 1.6×10^{-35} m. The minimal time parameter is the Planck time of about 10^{-43} s. This limited resolution of space and events in space may appear strange in an understanding of fundamental reality of MS. Under PSR we realize that we are not looking at a physical reality of space but at results of the progression of mathematically defined rules in PSC. The limited resolution is a characteristic feature of the PSC process under which the projected MS emerges. In an algorithmic progression under PSC, micro limits for effects in MS make sense. The PSC process indicates a fundamental requirement for computational capabilities. An unlimited micro resolution pointed to a requirement for infinite computational capabilities which appears unfeasible. The presence of fundamental measurement limits in MS suggests that the computational requirements for the projection of our MSU are finite. Other indications for computational processes have emerged in research into AdS/CFT correspondence. Almeiri et al. [13], have pointed out characteristics of quantum error correction under quantum field theories in AdS/CFT correspondence.

4.10 Pathways towards specific PSC rules, potential for fast-tracking discovery of new MS physics

A new challenge and opportunity for fundamental physics arises. It is to fundamentally rethink and reformulate rules for physical behavior that we have been accustomed to model from a perspective of fundamental reality of MS. We would like to identify the 'dual' rules of PSC that govern the projection of physical behavior in MS. One potential pathway to extract actual rules of PSC are abstract translations of our known laws of physics in MS to determine what is needed on the level of the PSU in order to project them. We can already predict conservation principles to play a prominent role in PSC as conservation principles naturally persist through evolving moments of the present. Conservation of momentum,

conservation of energy and conservation of vector products in quantum field theory exemplify levels of abstraction of these rules. It points to an ultimate source for the remarkable symmetries we find in our MSU. The symmetries in the MSU follow the application of conservation principles in PSC. There is another potential pathway to identify actual PSC rules beyond abstract translations. We may be able to independently discover unexpected dualities in research where we are looking for better theoretical models for what we observe in MS. This pathway has the additional potential to serve as a tool for fast-tracking discoveries of yet unknown MS physics. All MS physics for observed physical behavior in MS, both known and unknown, are generated by dual expressions in PSC. There is no good reason to presume all major MS physics have already been identified. A direct identification of PSC rules may therefore reveal yet unknown MS physics. PSR demonstrates foundational context for a surprising direct real-world relevance of AdS/CFT correspondence introduced by Maldacena [5]. It points to negative MS vacuum energy.

4.11 PSR supports direct relevance of AdS/CFT correspondence, dual conformal field theories as part of the predicted PSC evolving in the Present Space 'boundary' of a 'bulk' MS, negative vacuum energy

PSR describes a foundational basis for unexpected direct real-world relevance of AdS/CFT correspondence and suggests an opportunity for the identification and confirmation of specific rules of PSC. Dual conformal quantum field theories under the correspondence may qualify as rules of PSC evolving in the PS 'boundary' of a 'bulk' MS. The conceptual match of the correspondence with the actual reality of a PS 'boundary' and the prediction of the presence of dual rules in PSC is significant. The fundamentally strange mathematical dualities in field theories in AdS/CFT correspondence, however, only apply where a 'bulk' space has anti-de Sitter like negative curvature. As the identification of PSC rules may directly identify yet unknown MS physics, dualities under the correspondence challenge current concepts of positive vacuum energy. A confirmation of PSC rules under the correspondence inherently suggests that the energy associated with the MS vacuum is negative, giving the MS 'bulk' an anti-de Sitter like negative curvature under general relativity. Negative vacuum energy has other support based on considerations of fundamental MS physics. It has a natural potential to address a number of the fundamental problems arising in the Lambda-CDM model. Repulsive negative vacuum energy addresses the fundamental problem that an initial singularity or any subsequent ultra-dense states of only positive mass-energy should never expand into distant structures due to overwhelming attractive gravity. A positive-negative character of energy addresses the fundamental problem of the initial emergence of positive energy from zero in a MSU that evolves under conservation of energy. Centers of negative mass-energy in large cosmic voids can establish definition for direction in cosmic expansion that is missing in a kinetic model of accelerated positive masses. Negative vacuum energy has the potential to explain observational effects associated with dark energy. Repulsive gravitational effects from negative mass-energy in cosmic voids on positive masses in outer regions of galaxies may explain some effects currently associated with dark matter. Negative energy can resolve the problem of unrealistic inflated values for a positive vacuum energy from zero-point fluctuations arising in quantum field theory. A positive-negative energy mechanism in gravity is arguably needed to replace the concept of positive gravitational potential energy as the physical energy source for gravitational acceleration [14]. The gravitational mechanism may explain excessive growth rates of supermassive black holes as shown in 6.6.

4.12 Foundational context of entanglement, key characteristic of the operational modus of PSC

PSR directly determines the foundational context of entanglement. As a simultaneously effective phenomenon it evolves in the PSU where it is part of PSC. The simultaneous effects of entanglement across remote locations are key in establishing the fundamental principle of PSR. Experimental tests of entanglement rely on entangled pairs of particles which are strictly isolated from their other environment to maintain their strictly bilateral correlation. The appearance in quantum physical experiments, however, is just the artificial setting in which the fundamental phenomenon has become most clearly identifiable to us. Under PSR we realize that entanglement is a fundamental characteristic of the operating principle of PSC for the simultaneous projection of MS. The phenomenon represents and demonstrates the way PSC operates on the level of a PSU where everything evolves simultaneously. Transformative consequences for our understanding of the evolution of MS are shown in 5.

4.13 Correspondence principle has a specific foundational explanation

An unresolved fundamental question of quantum mechanics is how correspondence between quantum and classical physical properties and behavior is established. The analysis of the operational PSC modus shows that it is not a somehow emergent physical phenomenon for large quantum numbers. We are looking at results of a PSC mechanism for select fine differentiation under a top-down logical protocol. This is summarized in 5.7.

5. The operational modus of Present Space Causality (PSC)

5.1 Fundamental nature of forces, space, how 'law enforcement' becomes an issue in physics, entanglement signifies PSC logic for enforcement of laws of physics in MS

Under the traditional understanding of reality of MS, we do not typically ask how our observed laws of physics with their conserved quantities are strictly and uniformly enforced across MS. When MS is considered to be nature, consistent physical behavior under laws of physics in MS appears to be just a natural fact that may not even require scientific explanation. We may instead be compelled to wonder about the fundamental nature of space, space-time, or what a force fundamentally is as they appear to be responsible for the observed action in space. Under PSR we no longer need to wonder about the fundamental nature of space, space-time, what a force really is or how it is able to act across space. The surprisingly simple answer is that they all are the projected results of the underlying mathematical logic of PSC. Instead, the question of enforcement of the physical laws we observe in MS becomes an issue. There is no enforcement through natural effects of matter, forces, propagating fields, or the geometry of space-time. Observed lawful physical behavior in MS is instead enforced through the application of simultaneous algorithmic progressions under abstract PSC rules. Entanglement signifies the key principle of the PSC logic for the enforcement of laws of physics and their conserved quantities. We already have a clear example for the enforcement of a conserved quantity as the direct consequence of entanglement. It is the conservation of a total spin of zero in experiments with entangled pairs of particles. Measurements of individual particles at remote locations on a defined axis consistently show positive and opposite negative spins adding up to zero. In these experiments, entanglement is seen to enforce conservation of spin instantaneously and without the action of any force. Under PSR we realize that it represents the fundamental principle of how PSC enforces laws of physics in MS through simultaneously evolving moments of the PSU.

5.2 No fundamental building blocks, no physical bottom-up flow of causality, sideways into the future, implications for models in particle physics

PSC determines the evolution of MS simultaneously for any macroscopic level. This is the unambiguous consequence of the reconciliation of the apparent incompatibility in the propagation of quantum and classical physical effects under PSR. Unless we would somehow identify a better solution for this most fundamental problem, we face an extraordinary challenge and opportunity for fundamental physics. We have to fundamentally rethink the logical structure for physical behavior that we have been accustomed to understand and formulate from a perspective of fundamental reality of MS. The modus of how MS fundamentally evolves is not what we thought it was. The traditional logical principle for comprehending and describing the physics of our MSU has been up from its smallest and seemingly most fundamental components by modeling how they interact and combine to emergent effects on larger scales under MS physics. Under PSR neither these components nor their apparent locations and distances are fundamentally real. Distances do not represent fundamental physical realities but mathematical results of projections under the abstract mathematical logic of PSC. In a PSU where everything happens at once, there is no bottom-up flow of causality from micro components to physical behavior on macro scales. In this sense, everything evolves 'sideways' into the future. It means that physical evolution of macroscopic properties, objects and processes can be projected directly under intelligent PSC algorithms rather than as a consequence of micro components. The lack of a directional flow of causality from smaller to larger components has fundamental implications for models in particle physics. Models that may adequately reflect actual PSC rules for physical behavior on differentiated smallest scales do not necessarily have to correspond coherently with physical behavior on larger scales. It provides fundamental context for problems under the standard model of particle physics where Interactions with virtual particles lose their ability to properly describe MS physical behavior on larger scales. Predictions of an unrealistic energy content of the MS vacuum from zero-point quantum fluctuations are an example. We may identify further specific gaps in modeling physical properties of larger objects from smaller constituents. A candidate is the discrete proton spin which may not correspond with spin properties of its apparent sub constituents.

5.3 Select differentiation - PSR reveals PSC mechanism for 'randomness' in thermodynamics

PSR leads to a surprising new understanding for phenomena of thermodynamics. PSC projection of macroscopic properties and processes can evolve directly rather than as a consequence of micro components. This is reflected in how macroscopic physical descriptions, such as the thermal energy and pressure of a volume of gas in equilibrium, precisely describe the macroscopic state of an object and its further evolution regardless of the individually chaotic constituents we may observe in microscopic measurement. The operational modus of PSC provides a new perspective for what has been modeled as problems of statistical mechanics. The microstates we eventually determine in measurement, such as the chaotic position and momentum of individual molecules of a gas in equilibrium, are not only fundamentally unreal. The individual microstates are *irrelevant* for the projection of macrostates of ordinary physical objects and their further evolution under PSC rules. The microstates become determined and relevant only as we select to zoom in in measurement. It reveals a functional role of the probabilistic outcomes in fine measurements. As there are no bottom-up physical effects in the PSC modus, corresponding outcomes between macrostates and yet to be measured individual microstates are not naturally present. The correspondence in fine differentiation must be established through a fundamentally different mechanism beyond MS physicality. Measurements of thermodynamic systems

such as for the kinetic temperature of a gas reveal how it is done. It happens through random outcomes in states of individual components that probabilistically correspond with effects and properties on the level of the macrostate. Rather than natural effects of MS physics, we are looking at an ultimately artificial methodology under PSC to probabilistically match emerging microstates with previously determined macrostates. The mechanism demonstrates how physical evolution of MS emerges from a top-down logical rather than from a bottom-up physical protocol. The fundamentally unexplained appearance in conventional understanding, that a chaotic distribution of kinetically excited microstates of individual molecules never settles into more uniform kinetic microstates finally makes fundamental sense under PSR. There are no differentiated molecules that would settle into more uniform states in a physical process. There is more to this key phenomenon of thermodynamics. The most obvious functional aspect of an operational protocol of select micro differentiation under PSC is its computational advantage. MSU evolution based on macrostates, where fine differentiation of microstates occurs only under select circumstances, provides a vastly more efficient computational determination of the projection of an ultimately virtual MSU. The methodology for obtaining correspondence through ranges of probabilistic outcomes still appears strange for top-down logical differentiation, even if we accept that we are not looking at natural phenomena but at a computational process under PSC. Why do individual microstates that emerge in measurement not simply reflect uniform fractions of macrostates? Under PSR we realize that ranges of outcomes signify functional space for non-probabilistic fine differentiation due to influences other than measurement. We find a most obvious influence for non-probabilistic fine differentiation in our own deliberate fine manipulation of physical objects. More consequentially, a further analysis in 9 identifies non-probabilistic differentiation in biological systems due to special PSC algorithms.

5.4 Differentiation is a reversible process - undifferentiation reveals PSC mechanism for entropy

The PSC process of differentiation presents itself as a reversible process in the MSU. A reverse decay of differentiation or 'undifferentiation' is observed in thermodynamic phenomena that have been associated with the concept of entropy. As I show for the equilibrium scenario in 5.3, microstates of molecules become differentiated and relevant when individually observed. The PSC methodology of only select micro differentiation provides computational advantage for the projection of physical evolution in MS. A reverse PSC process of undifferentiation of previously differentiated states further complements this computational advantage. The process can be observed as our MSU follows its tendency towards equilibrium. A most simple example is when two volumes of a gas differentiated by their individual temperatures are combined. Once thermal equilibrium is reached the gas is precisely described by the new overall temperature. Undifferentiation is also observed in any diffusion processes in gases, liquids and beyond as differentiating gradients decay. It occurs in deceased cells as their exceedingly differentiated structures begin to decay over time. From our conventional MSU perspective these processes look strange as there is no natural path for reversibility. They have been modeled with the concept of entropy, which may be vaguely interpreted as 'disorder'. As undifferentiation grows in these processes, entropy increases. Under PSR we realize that 'entropy; or 'disorder' in these processes relates to lack of differentiation under PSC. The fundamentally mysterious tendency of increasing entropy described in the second law of thermodynamics finally makes fundamental sense. It follows a computationally efficient PSC process for undifferentiation. In the formulation of statistical mechanics, we are looking at the entropy S of a system in equilibrium as the product of the Boltzmann constant k times the natural logarithm of W , $S = k \ln W$, where W has been understood to represent the number of

possible actual microstates in a given macrostate. In PSC individual microstates are only actual while they are differentiated. They vanish in a cloak of undifferentiation in the underlying PSC processes for entropy. As entropy increases in these processes, the cloak of undifferentiation extends further.

5.5 Select differentiation and our place in the universe

As mechanisms in the PSC modus instantaneously apply across all scales of distance there is another consequence with cosmological implications. The PSC mechanism for select differentiation may be effective in our observation of distant galaxies in the MSU. Distant galaxies may be not just fundamentally unreal, but emerge in compelled differentiation in our measurement processes. Our cosmic neighborhood may be privileged through differentiation at relevant Local Nows. The consideration of computational facilitation favors this expectation. In this scenario distant galaxies lack differentiation at Local Nows on which a present local physical evolution would be based on. Instead, intelligent PSC algorithms project observational results that reflect an implied evolution corresponding with general rules for deterministic MS physics. Results are instantaneously determined through differentiation from points of observation. They are then operationally preserved for further PSC evolution in the same way as results in quantum measurement are (4.2). The fundamental potential is already embedded in current quantum mechanical understanding of instantaneous nonlocal collapse of the wave function. Effects of collapse upon measurement conceptually extend into space to infinity. Under PSR we are looking at a top-down logical PSC process of compelled differentiation. The operational principle is shown in the example of probabilistic outcomes under quantum rules (4.7) and phenomena of thermodynamics (5.3). It is identified as the characteristic principle of PSC for establishing a correspondence between observations of our MSU at different scales (5.7) which is not naturally available in a simultaneously codetermined evolution under PSC. Whether distant regions actually have differentiation at Local Nows can be probed. If we find a presence of biological systems or intelligent observers they are differentiated. The question relates to the 'Fermi paradox' of lack of evidence for advanced extraterrestrial civilizations in remote cosmic regions. The new insights provide a potential fundamental reason beyond statistical considerations that suggested a likely presence of advanced civilizations somewhere in a vast MSU. Under PSR the search for extraterrestrial life has additional relevance. It becomes a scientific inquiry into how differentiation actually extends into the wider MSU.

5.6 Projection of size, distance, structure and complexity, the exceedingly creative and intelligent mathematical logic for the projection of a functional virtual space

The formally distinct sets of rules for effects on particle (quantum) and molecular (thermodynamics, biochemistry) levels are examples of the transcendental logic applied in PSC. They project small scale levels in a cascading sequence of PSC rules all the way up to gravity. It represents the logical structure applied in PSC for the projection of meaningful structural differentiation across virtual distance scales. It appears as the hierarchical structure of forces in our MS picture where a weak gravity becomes the determining force for structure only on large scales. Over time this hierarchy has led to the rule-based evolution of stars, planets, and increasingly complex fine structures all the way to finely differentiated structures and processes in biological life and human brains. PSC projects rules of physics that allow us to do and build physical things, good, bad, and increasingly sophisticated, that do not naturally happen or exist in fleeting moments of the present. We are looking directly at the exceedingly creative and intelligent structure of the mathematical logic that projects our ultimately virtual MSU through intricate mathematical structure.

5.7 Select differentiation reveals PSC methodology for correspondence between quantum and classical behavior, limited role of quanta and quantization, functionalities in fine structure, computable limits

Under the correspondence principle in quantum mechanics strange quantum mechanical behavior is to somehow correspond with classical physical behavior in a limit of large quantum numbers. The fundamental question of how correspondence is established, physically or otherwise, had remained unresolved. It represents a fundamental gap in scientific understanding of the relationship between quantum and classical phenomena. The analysis of the operational modus now reveals an underlying PSC mechanism. Correspondence is not an emergent bottom-up physical process but follows PSC rules for select fine differentiation. Fine differentiation occurs only selectively. PSC rules may directly determine physical evolution for undifferentiated macrostates. The process of select differentiation is most clearly observed in what appears as individual random measurement outcomes under probabilistic rules. The process is active in particle effects under quantum rules and in effects on molecular levels that have been described with statistical mechanics. There is no bottom-up directionality in this top-down process of fine differentiation as there is no bottom-up physical flow of causality under PSC in the first place. Correspondence between classical and quantum behavior follows a top-down logical protocol. Probability distributions in measurement follow intelligent PSC rules that correspond with behavior of macrostates and govern the process of fine differentiation. The principle of select fine differentiation substantiates the limited relevance of the procedure of quantization for physical modeling of the MSU. Undifferentiated physical objects neither fundamentally nor functionally consist of their measurable finer parts and ultimate quanta. They become relevant where and when differentiation is compelled. We can also identify clear functional roles for discrete minimal units of energy, charge, and other properties on quantum levels. They facilitate that objects can be broken down and differentiated into finer parts with corresponding physical properties and potential fine functionalities. Quanta are defined limits for fine differentiation and relate computational feasibility. Quanta and Planck limits of distance and time are ultimate limits in the resolution of the projection of MS.

6. PSR predicts well-behaved black hole MS shell model, resolves black hole paradoxes, suggests new physical mechanism for black hole growth

6.1 Overview

PSR does not generally affect predictions for observable effects in MS. An exception is the understanding of black holes and gravity. PSR provides a physical understanding of what happens at the event horizon. The understanding of a simultaneously evolving present leads to a MS model of black holes as ultra-dense, relativistic shells at their event horizons where nothing falls through. The shell model under PSR removes paradoxes of current central singularity models. The model is in surprising alignment with findings based on thermodynamics about the information content of black holes, introduced by Bekenstein [11]. Additionally, it points to a specific physical mechanism for black hole growth beyond known mass accretion processes. The mechanism may help explain evidence presented by Farrah, D. et al. [12], that suggests growth rates for supermassive black holes far beyond known physical mechanisms. The mechanism arises naturally in the dual-energy model of gravity.

6.2 The MS black hole shell model under PSR

PSR provides a physical understanding of what happens at the event horizon. The question of what happens to a test mass falling towards an existing black hole depends on the fundamental

understanding of time. Under general relativity time can be modeled as an independent proper time. This appeared to allow for physical objects to pass through the event horizon of a black hole on their own proper time. This does not hold under PSR and its understanding of a simultaneously evolving universal present. Nothing ever falls through an event horizon where time dilation represents a standstill of MS time. We are looking at non-rotating Schwarzschild black holes featuring spherical event horizons. At the event horizon a gravitational time dilation factor t_{df} rises towards infinity for an approaching object at distance r from the center of a Schwarzschild black hole with its event horizon at radius r_s : $t_{df} = 1/\sqrt{1 - r_s/r}$, where the gravitational time dilation factor is time elapsed for an observer outside the gravitational field divided by the time elapsed for an observer at r . This is due to the singularity $t_{df} = 1/0$ at $r = r_s$. Based on fundamental reality of a simultaneously evolving present, we can now expect that MS physical processes come to an objective halt within Planck length of the event horizon. Any physical structures can be expected to undergo effective compactification towards Planck length upon final approach. The inability to pass is not limited to the more tangible matter and electromagnetic radiation. The flow of causality itself does not pass the event horizon. The event horizon represents a boundary for the projection of MS at the shell. It suggests that black holes are best described as ultra-dense shells at their event horizon without a projected interior Measurement Space. PSC rules allow for undifferentiation as shown in the context of entropy. PSR has therefore no fundamental issue with a loss of differentiated information at the event horizon and the lack of differentiation of an interior Measurement Space. In the abstract logic of PSC, we are looking at a mathematically defined limit for the projection of deterministic MS effects at the event horizon. The event coincides with an escape velocity equal to the cosmic speed limit and a standstill of MS time. This points to an abstract correspondence in rules of PSC with the definition of limits for the projection of kinetic effects.

6.3 Shell model removes paradoxes arising in central singularity models, gravitational extremes from relativistic and Newtonian physics coincide at the event horizon

In the shell model the event horizon represents an effective, high energy MS physical environment as opposed to a mere coordinate singularity. The relativistic mass concentration at the event horizon constitutes a physical limit that leads to important differences when compared to central singularity models. Central singularity models lead to paradoxical smooth Newtonian gradients across the event horizon. The larger black hole mass is, the smaller Newtonian parameters are at the event horizon in these models. Newtonian gravity at the event horizon of sufficiently supermassive black holes would be as 'pedestrian' as what we experience on earth. The inverse relationship follows from the distance at the event horizon from the center being proportional to black hole mass M , while the gravitational force decreases with the square of distance. The proportionality of distance from the center at Schwarzschild radius r_s to black hole mass M is shown in the Schwarzschild vacuum solution of the Einstein field equations where G is the gravitational constant and c is the speed of light: $r_s = 2GM/c^2$. The paradoxical smooth Newtonian gravitational gradients arising in the central singularity model suggest physical conditions just below the event horizon that would allow for an acceleration to just above the event horizon from where light may easily escape the black hole. Under PSR we realize that these smooth Newtonian gradients across the event horizon are the result of a misguided assumption of a remote

central singularity. Further paradoxical consequences of the central singularity model include the implication of a gravitational time dilation beyond standstill and escape velocities beyond the cosmic speed limit. Escape velocities beyond the cosmic speed limit are particularly paradoxical as velocities of infalling masses should mirror escape velocities. There is no energy concept for velocities of masses beyond the cosmic speed limit. Any attempts to deal with these paradoxes with coordinate solutions under general relativity that suggest a reversal of time have no real-world validity under PSR. As time is the evolving moments of the present there is no reversal of or traveling back in time. By contrast, in the shell model escalating gravitational extremes from both relativistic and Newtonian physics all coincide at the event horizon. Time dilation approaching standstill of measurement time, an escape velocity approaching the speed of light, Newtonian gravitational acceleration, field strength, and gravitational force all have escalating extremes at maximal mass densities at the event horizon. In the example of the gravitational force F , we recognize the principle of an escalating extreme when approaching increasingly point like mass concentrations already in Newton's law of universal gravitation due to its inverse square law with distance r between masses m_1 and m_2 : $F = Gm_1m_2 / r^2$, where G is the gravitational constant and a 'relativistic' extreme emerges when an infalling mass approaches zero distance to any effectively gravitating mass that is not canceled out. The limit of zero distance is not encountered at the surface of any bodies with densities of gravitating matter limited by some degeneracy pressure. Even in the highly compactified case of a neutron star, an effective approach to zero distance to gravitating mass at the surface is restricted by the degeneracy pressure of neutron matter. Only once any remaining degeneracy pressure is overcome, a singularity limit of zero distance can be encountered. The coincidence of Newtonian and relativistic limits for gravity at an event horizon of maximal mass densities suggests a cornerstone for a further development of the understanding of gravity under MS physics.

6.4 MS black hole shell model aligns with findings based on thermodynamics

The MS model of black holes as ultra-dense shells at the event horizon is in alignment with findings about their information content introduced by Bekenstein [11]. These findings were primarily based on thermodynamics and suggested that the amount of information contained in black holes is proportional to the surface area at their event horizons. The result appears strange based on an assumed fundamental reality of our 3-dimensional MS where we would expect a maximum information content inside a black hole to be proportional to an interior volume rather than the surface area at the event horizon. A quantitative limit for information defined by surface area does make sense in the shell model where the surface area of the shell is all there is that affects projections of MS. The alignment further supports the validity of the shell model.

6.5 Lack of remaining degeneracy pressure indicates absence of a 'loophole'

The shell model under PSR is a consequence of gravitational time dilation for infalling objects onto an existing event horizon. This might potentially leave a loophole for the presence of a central singularity from the formation of the black hole in the collapse of a stellar progenitor object. A most straightforward principle to consider is that for black hole formation to occur any remaining degeneracy pressure of fermionic matter is overcome by overwhelming inward pressure such as gravitational pressure from mass exceeding the Tolman-Oppenheimer-Volkoff limit below which a neutron star could still form. A crucial conceptual consideration is that without any remaining degeneracy pressure there is no reason to

assume for any infalling mass-energy to coalesce into a singularity at the center of the black hole. Infalling mass-energy still carries a characteristic of momentum that projects a now frictionless trajectory through a central point towards the event horizon forming on the opposite side. Any interior dynamic processes we might assume for a hypothetically effective interior space only came to a halt where masses from the inside approach a point on the opposite event horizon where the associated gravitational time dilation represents a standstill of measurement time. The conceptual consideration is further indication confirming that a proper MS description of black holes does not require a central singularity.

6.6 New physical mechanism for understanding black hole growth, substantiation of negative MS vacuum energy

The supermassive black holes we observe in MS leave a pressing need for physical mechanisms that explain how they grow to their astonishing size. The problem has become yet more prominent as evidence recently presented by Farrah, D. et al. [12], suggests growth rates for supermassive black holes beyond known physical mechanisms in mass accretion. Under the PSR shell model, gravitational blueshift provides a mechanism for substantial black hole growth from influx of electromagnetic radiation that relates to its Planck limit. In this mechanism black holes grow not just through accretion of infalling matter but with incoming radiation that gets maximally blueshifted at its final approach to the event horizon where maximal mass densities are realized and the escape velocity reaches the cosmic speed limit. In this model a locally effective blueshift carries mass-energy to the event horizon that increases the gravitating mass of the black hole. There is a Planck limit for the wavelength of any blueshifted radiation which is the Planck length of approx. 1.6×10^{-35} m. The photon energy at this extremal wavelength is conveniently expressed in Planck units due to their definition. The energy of each photon at this wavelength is 1 Planck unit of energy with a mass equivalent of 1 Planck unit of mass. In more conventional units, each of these maximally energetic photons carries the substantial amount of energy of 1.22×10^{19} GeV and increases the mass of the black hole at the event horizon by approx. 2.18×10^{-8} kg. The biggest beneficiaries of these mass increases of about 22 micrograms per each photon are supermassive black holes as photon capture increases with larger event horizons. Fundamentally significant is that the 1 Planck length wavelength of these photons is equal to their individual Schwarzschild radius. It points to pixelation of maximal mass-energy densities at the event horizon which increases in area with mass increases. The understanding of accrual of gravitationally generated mass-energy at the event horizon matter has relevance beyond radiation influx. Escalating kinetic energies from infalling matter can be expected to provide additional growth of black hole mass over conventional models. Further contributions may arise from neutrino capture at the event horizon. Quantitative models for these processes remain to be developed. Evidence from actual black hole growth and the consideration of their environmental context may provide observational guidance and verification for these quantitative models. The recent survey by Farrah et al, examines this type of observational evidence [12]. The gravitational mechanism in the shell model raises the question of the physical energy source for these confounding increases in mass-energy seemingly out of nothing. In conventional understanding of gravitational energies, the energy source could be positive gravitational potential energy. In the alternative dual-energy model the energy source relates to negative MS vacuum energy. The proposed dual-energy model is a straight forward physical mechanism [6]. In gravitational acceleration down a gravitational field positive energy is gained at the expense of an increase of negative energy of the MS vacuum in the same amount. In elliptical orbits it works as a dynamic reversible

process. The mechanism is a consequence of conservation of energy. The amount of energy conserved is zero. The crucial insight is that the concept of gravitational potential energy cannot describe a physical form of energy. It represents a scenario calculation. There is no definitive maximum for achievable kinetic energy on the basis of which we could quantify gravitational potential energy and determine its gravitating mass equivalent. A local point in the gravitational field does not 'know' or signify a specific amount of the potential energy. The corresponding maximum kinetic energy that a test mass may gain in free fall in a gravitational field is not conclusively determined by the large gravitating mass and the distance from its center of mass. The energy to be gained in acceleration crucially depends on the scenario of mass densities that will eventually be encountered in free fall. The black hole scenario already shows that we are looking at a runaway effect. Additionally, any masses that fall into a black hole may merge with other black hole masses in the future. We are looking at the characteristic instability of an open-ended mechanism involving negative energy.

6.7 Issue of loss of information, irreversibility in time

Infalling information, while not 'lost' altogether at the event horizon, may be effectively reduced to an undifferentiated aggregate form such as an overall mass, charge, angular momentum, and momentum in 3D space that may impact future projections of MS only accordingly. A common understanding that information is neither destroyed nor created does not hold under PSR. The new understanding for the cosmological role of information is summarized in 7. It includes a crucial role of differentiation of information which evolves and may decay over time under rules of PSC as shown in 5.4. Decay of information or 'undifferentiation' is a PSC process that can be observed in thermodynamic behavior which has been associated with the concept of entropy. PSC processes of undifferentiation also appear to happen at the event horizon. In both cases undifferentiation of information leads to irreversibility of physical processes. In the understanding of a simultaneously evolving fundamental PSU, we can naturally accept a limit for reversibility in time for the projection of physical effects in the MSU.

7. Cosmological role of MS information, human impact, zero, -1 and +1, select differentiation of undifferentiated states, undifferentiation and entropy, differentiation in biological systems

A common understanding of the role of information in the MSU assumes that all information is present from some primordial state. The information is supposed to determine the evolution of the universe at any time. Information is neither destroyed nor created. What happens right now is conclusively encoded in the primordial state of the MSU. Free will does not exist, we are determined by a complex physical protocol evolving in our brains. Under PSR I identify details of a very different reality. Operationally active rules and algorithms, not passive information determine our MSU. Information is not conclusively determined from a primordial moment, it represents results of underlying PSC processes evolving over time. Conscious action impacts projection of future information as an original cause. The cosmological process starts from a low level of differentiation and complexity. Conventional approaches for quantifying the information content of the MSU based on sums of microstates are misguided. Vast areas and aspects of the MSU are expected to represent undifferentiated information. Fundamental bits of information that best reflect the structure and evolution of our ultimately virtual MSU can be understood as +1's and -1's with an undifferentiated ground state of zero. The underlying process for select differentiation of information in the MSU is a computational progression of algorithms under PSC. In 5.3 and 5.4 I show how differentiation and 'undifferentiation' evolve in thermodynamic phenomena under PSC. The fundamentally mysterious phenomenon of increasing entropy under the second law of

thermodynamics is the result of a PSC process of undifferentiation. The PSC processes for select differentiation and undifferentiation demonstrate computational advantage. The actual evolution of differentiation is an important area for further research. Relevant inquiries include how differentiation extends into the wider MSU. In 5.5 the search for extraterrestrial intelligence and life is shown to be relevant for assessing both the extent of differentiation and our place in the MSU. Of particular fundamental interest is the understanding of evolution of differentiation in living cells under PSC algorithms. The distinct information regimen in biology and its resulting complexities is in fundamental contrast to what we observe in non-biological physical evolution in MS. Approaches to assess the fundamental phenomenon of biological systems from an abstract perspective include works by Marshall et al. [15], and of Walker and Davies [16] who proposed a corresponding physical transition in the emergence of life. A systematic analysis of implications of the operational PSC modus for biology in 9. leads to the conclusion that special PSC algorithms beyond rules for ordinary physical evolution compel fine differentiation in biological systems.

8. New insights coherently suggest that our Measurement Space Universe is a creation for purposes of consciousness

8.1 Not the result of any prior physical state but the consequence of the onset of rules of Present Space Causality

The transformational insights under PSR have implications for the scientific question if the origin of our observable universe is the result of a somehow natural event or a creation. PSR confirms a prevailing understanding in modern cosmology that our observable Measurement Space Universe had a specific moment of beginning. Under PSR we realize that the origin of our expanding Measurement Space Universe is not the physical result of any prior physical state. It is the direct consequence of the onset of MS laws of physics through the operational onset of mathematically defined rules of PSC.

8.2 Measurement Space Universe is not fundamental reality

Based on the traditional scientific assumption of fundamental reality and therefore 'naturalness' of our Measurement Space Universe we may have seen reason for restricting scientific consideration of its ultimate cause to concepts that may explain a somehow natural origin. As we realize that our Measurement Space Universe is not a fundamental natural world, the restriction to scientific consideration of a somehow natural origin is no longer justified.

8.3 The observed flow of causality is a virtual effect

The observation that 'nature' follows specific mathematical rules may be seen as deeply puzzling already. Under PSR we realize that the flow of causality itself is only the result of projections generated under yet more abstract principles of mathematical logic in PSC that bear no more resemblance with natural concepts of physical things doing things in space. Under PSR we further realize everything is instantaneously codetermined at any scale. It means that the flow of causality observed in physical processes in Measurement Space does not happen naturally. The flow of causality we observe as our physical universe is an ultimately virtual effect.

8.4 Lack of fundamental reality of basic physical features of Measurement Space

Under PSR we realize that our 3-dimensional Measurement Space and its physical objects are projections that lack fundamental reality. The new fundamental understanding of quantum phenomena under PSR provides additional detail that confirms a lack of fundamental reality of any basic physical feature of Measurement Space. There is no fundamental local reality. Distances in space do not represent fundamental physical realities but mathematical values. There is no fundamental physical nature of measurable space or time intervals and no fundamental physical nature of forces or the geometry of spacetime. Instead, features in quantum behavior such as quantum spins and Planck limits directly point to computational processes in the projection of our Measurement Space world. The new fundamental understanding of select differentiation in thermodynamic behavior demonstrates artificial processing in Present Space Causality beyond quantum phenomena. The Measurement Space we conceptualize has the characteristics of an ultimately virtual world where the impression of local physical reality ultimately arises from the connection of our consciousness with an individual brain in Measurement Space.

8.5. Present Space Universe is a higher order realm of reality that hosts the projection of Measurement Space and precedes it

Our Measurement Space Universe evolves within a higher order realm which is the Present Space Universe. This means that the Present Space Universe 'hosts' the projection of the Measurement Space Universe. It has preceded the beginning of our Measurement Space Universe and has been instrumental in its origin.

8.6 Consciousness uses human brains in Measurement Space as a vital resource

Consciousness does not arise from our human brains in Measurement Space, consciousness uses them. This means that a fundamental consciousness uses the Measurement Space Universe through our physical human presence as a vital resource to thrive and evolve.

8.7 Consciousness exists as a fundamental attribute of the Present Space Universe

Under PSR consciousness exists as a fundamental attribute of the Present Space Universe which naturally precedes the origin of our Measurement Space Universe. It also means that a higher order consciousness has been in place to initiate the origin of our Measurement Space Universe through the operational onset of PSC.

8.8 The new insights suggest a purposeful creation for consciousness to thrive and evolve, they imply the action and reality of a higher order conscious intelligence

The new insights under PSR coherently suggest that our Measurement Space Universe with its apparent laws of physics is a purposeful creation for consciousness to thrive and evolve. They imply the original action and reality of a higher order conscious intelligence in the Present Space Universe. It provides an ultimate reason for the origin of our Measurement Space Universe. Above all it is a deeply meaningful conclusion for all of humanity.

8.9 Anthropic fine-tuning of our Measurement Space Universe

The laws of physics we observe in MS present themselves as exceedingly fine-tuned to result in the right physical structures and chemistry for complex biological life and humans to evolve. This appears

exceedingly improbable to occur naturally and the anthropic feature of a fine-tuned MSU may already be seen as evidence for a purposeful creation. Fine-tuning as a somehow natural emergence may only appear plausible under hypothetical cosmological models that imply a somehow natural or random emergence of varied laws of physics in large numbers of different universes or exceedingly remote regions the MSU. However, no mechanism has been demonstrated that would generate and enforce natural laws of physics. Why nature should follow any specific mathematical rules in the first place has remained equally mysterious. Under PSR I discover an actual mechanism in PSC that both generates and actively enforces the laws of physics we observe in the MSU through defined algorithmic operations. The mathematical nature of the PSC mechanism leaves no need for hypothetical physical substrates to make up the MSU such as physical strings. It is not mathematical formulas somehow governing real physical objects but the mathematically consistent generation of a virtual MSU. The PSC mechanism under PSR is not the result of an attempt to prove any hypothesis but a straightforward logical consequence of a reconciliation of the distinct propagation of effects in quantum and classical physical behavior. The result of a deliberate creation is not derived from a fine-tuned character of the MSU that supports functional biological life. Instead, PSR independently explains the deliberate fine-tuned character of the MSU as a coherent part of a comprehensive foundational understanding of reality. The anthropic fine-tuning certainly is characteristic evidence. The identification of an active role of special PSC algorithms in biological systems described in 9 provides yet additional evidence.

9. Special PSC algorithms for biological systems

Already from their appearance in MS, DNA resemble encoded information. Key biological processes resemble algorithmic progressions. Under PSR we find evidence for special PSC rules governing biological systems. Under PSR any physical processes and outcomes we observe in MS are ultimately governed by algorithmic progressions under PSC. Biological processes and structures are no exception. As shown in 5.2, PSC progression evolves simultaneously, everything evolves 'sideways' into the future. It is a top-down logical rather than a bottom-up physical progression. It means that outcomes in MS can be simultaneously and directly codetermined across levels of distance and levels of complexity. Here, I show what the PSC modus means for the understanding of biological processes and structures. In a nutshell, PSR identifies a specific functional space for special PSC algorithms behind the phenomenon of 'randomness'. The functional space provides definition for hallmarks of the characteristic effects of special PSC algorithms. The characteristic effects of special PSC algorithms match precisely what we observe in biological systems.

The functional space for special PSC algorithms lies in the ranges of probabilistic outcomes observed in thermodynamical randomness and an analogue quantum randomness. In this phenomenon we are looking at physical behavior on particle and molecular levels that is crucial for the workings of fine processes and extends to the likelihood of chemical reactions and molecular assembly. We recall a crucial insight from the analysis of thermodynamical randomness in 5.3. What looks like thermodynamic randomness in our MS perspective is the result of PSC processes of compelled fine differentiation in the PSU. The observed probabilistic behavior of individual molecules emerges as a consequence of fine measurement. The observation compels fine differentiation of previously undifferentiated macrostates. Probability rules artificially establish a correspondence in emerging microstates with properties of an undifferentiated macrostate, that is not naturally available as there is no fundamental bottom-up flow of MS causality. The probabilistic outcomes reflect default modes in the absence of other influences that can compel specific non-probabilistic differentiation. Influences that compel non-probabilistic

differentiation include our own artificial fine structuring of physical objects. They may also include special PSC algorithms that compel fine differentiation beyond PSC rules for probabilistic physical and chemical evolution, for which we may find evidence. The functional space in probabilistic ranges of thermodynamical behavior of individual molecules includes variations of their position and momentum. Their individual position and momentum are obviously critical for where they can be located in space, how they react, assemble and fold. The functional space may be understood as a computational backdoor for the projection of fine structures and processes. It is placed in perfect fashion to coherently blend in with ordinary physical and chemical evolution. It observes and preserves coherent evolution of MS, as outcomes under special algorithms remain within the allowable range under general rules that project ordinary physical behavior. When behavior of molecules is directly affected by special PSC algorithms, they still possess their basic physical and chemical properties. The outcomes are seamlessly processed for further special and ordinary physical evolution in the same way as probabilistic outcomes. The functional space naturally defines the predictable characteristics of effects of special PSC algorithms. Special PSC algorithms may project any effect within the wider allowable range under PSC rules for ordinary probabilistic physical and chemical evolution. The predictable hallmark of special PSC algorithms is behavior of differentiated microstates that systematically deviates from probabilistic behavior under general rules. Results of special PSC algorithms may include structural complexities of molecules that are not a consequence of general probabilistic rules. They may include pure homochirality where only one of two equally probabilistic mirror versions of a molecule are assembled. They may include complex and targeted processes, positioning, movement, and assembly of molecules that do not follow from general probabilistic rules of physics. These types of results are precisely what we observe in biological structures and processes. The characteristic structures and processes in living organisms are hallmarks for the active presence of special PSC algorithms. The unambiguous conclusion under PSR is that key aspects of biological structures and processes are governed by special PSC algorithms for biological systems. It does not mean that every aspect of physical behavior in cells is the direct consequence of special PSC algorithms. Their efficacy is embedded within effects under general PSC rules for ordinary physical behavior. The understanding of special PSC algorithms resolves fundamental problems in biology. It establishes the presence of a type of algorithms that can easily explain the origin of life before an onset of a Darwinian evolution. It directly explains why biological processes deviate from general rules for chemical evolution. It provides a fundamental explanation for the distinct information regimen in living systems where algorithmic information gains causal efficacy over matter, as Walker and Davies have adequately observed [16]. It provides a fundamental reason for the pure one-handedness in chiral forms of biomolecules where DNA and RNA are all right-handed, proteins and amino acids in life are left-handed. We are looking at an efficient outcome of special PSC algorithms. The effective presence of special PSC algorithms for biology affects the foundational understanding of the nature of the processes of emergence of life and evolution over generations and species. We are looking at deliberate mechanisms in the PSU for an ultimately purposeful process. The process still has characteristics of trial and error as MS information is not an ultimate deterministic feature but the result of a process over time.

10. Cosmological role of human brains, transcendental intelligence in algorithmic progressions, a functional and spiritual connection

As a direct consequence of PSR, our consciousness does not arise from our human brains in MS, we use our human brains as a vital resource. It raises the question of the cosmological role of our human brains.

The human brain facilitates highly powered and exceedingly sophisticated algorithmic processing. It is estimated to contain some 80 billion neurons and their connectivity may be in the order of 100 trillion synapses. Our vision is based on sophisticated algorithmic progressions that transmit information through action potentials of ganglion cells from the retina to several regions of the brain. The data transmission rate in human vision has been estimated by Koch et al. to be in the order of 8 million bits per second [17]. The incredibly powerful and intelligent algorithmic processing in our brains is clearly not the result of our individual conscious minds. We can literally sit back, relax, and enjoy the show without conscious effort or conscious thought. By any quantitative measure, our brains are exceedingly more intelligent than our individual conscious minds are. PSR provides a defining perspective for these intelligent brain processes. As we 'only' interact with our brains in MS as a resource, we can no longer assume identity between our individual conscious minds and the exceedingly intelligent processing in our brains. The issue of proprietorship emerges as a question of both cosmological and spiritual significance. The fundamental result under PSR is clear. The intelligent computational processing in our human brains is a proprietary process of the higher order conscious intelligence that projects our MSU. Our human brain structure represents its highly evolved functional organization. The actual objects of perception of our conscious minds are the signals and models that our brain processes generate. Our rather simplistic individual conscious minds are afforded active and passive interaction with incredibly sophisticated brain processes. It is the defining connection for our emergence as individualized conscious beings and it is a spiritual connection with a higher order entity. The connection generates the basis for our conscious experiences including perception of MS, emotion, and states of wakefulness during our physical lifetimes. Our active conscious directives only selectively impact exceedingly complex brain processes. This is how we consciously guide motor activity, direct brain function in conscious thought processes, invoke brain memory, and direct attention. Our simplistic conscious directives are readily functional in a complex MS brain as they only selectively interact with automatisms that are independently functional in MS. Biological organisms do not require an individual conscious mind to operate successfully in MS. Effective automatisms independently emerge through evolutionary development and learning processes in individual brains. We can summarize that our individual conscious minds are afforded access to a highly evolved resource that is based on complex algorithmic progressions of mathematical-logical structure supplied by a higher order entity. The human brain is the observable result of the exceedingly sophisticated type of functional organization of these progressions. It represents a level of sophistication that took eons to evolve and is embedded in the evolution of the wider MSU. Under PSR we may distinguish three fundamentally distinct phases in the evolution of the MSU. Each phase is characterized by the emergence of new drivers that compel differentiation. The first is non-biological physical evolution from the very beginning of the MSU under general PSC rules for laws of physics. Second is an onset of biological evolution under special algorithms for biology that eventually leads to the emergence of sophisticated brains. Humanity represents a third phase. It is the onset of individualized conscious minds impacting the MSU through interaction with highly evolved brains. Under PSR we realize that the evolution of the MSU is a targeted process by a higher order conscious intelligence for consciousness to thrive and evolve. We are an integral part of this fascinating process and experience through our interaction with our individual human brains.

11. Pathways for scientific inquiry into continuation of consciousness and the realm of consciousness

11.1 The miracle is fundamentally real

Expectations of the continuation of a fundamental essence of our existence beyond death have long been anticipated in religious beliefs and in philosophy. From a scientific perspective of fundamental reality of our physical Measurement Space Universe any continuation appeared utterly nonsensical. PSR radically transforms the scientific paradigm. It identifies the consciousness-brain relationship as the consequence of an insight of fundamental physics. Consciousness is part of the Present Space Universe. Consciousness does not arise from our human brains in Measurement Space, consciousness uses human brains as a resource to thrive and evolve in a highly functional but ultimately virtual Measurement Space Universe. Under PSR our fundamental conscious existence can be expected to continue in some form beyond our physical presence in the Measurement Space Universe. The expectation is supported in various ways beyond being a consequence of the bare fundamental principle. We are looking at an ultimately benign evolution by and for consciousness. The exceedingly powerful intelligence in brain processes is distinct from our individual conscious minds which have their own fundamental active and passive capacities as shown in 10. Additionally, experiential and analytical pathways can be identified which further substantiate continuation of consciousness. They are outlined in 11.3 and 11.4. The scientifically surprising result of continuation of consciousness is an awe-inspiring insight for humanity. It is a wonderful insight and reason for joy and hope to all of humanity.

11.2 We are looking at the exploration of a very real realm

While any continuation of conscious existence suggests some existential relevance, the insight from fundamental physics is highly abstract. As we are experiencing the wonder of our personal conscious identities, we are looking for answers that relate to us as individuals in a meaningful way. It raises questions about the deeper nature of a realm of consciousness, about interactions, about other evolved resources and structures within the mysterious realm of the Present Space Universe. These questions are not just relevant for a more meaningful understanding of continuation of consciousness. They are fundamental questions for a yet deeper understanding of who we are right now, what is really out there, how we as individuals relate to a higher order consciousness, and what our destiny and purposes are. Based on an assumed fundamental reality of our Measurement Space Universe these questions appeared to be unreal or forever beyond scientific comprehension. Under PSR we discover the Present Space Universe as a very real realm that is in principle accessible to further exploration. We already understand its fundamental physical context and realize that we have direct experiential access to it. We can access two distinct pathways to comprehend its fundamental reality. There is the analytical pathway informed by physical sciences. It is indirect but objective. The other pathway is our innate conscious experience. It is subjective but uniquely direct. Both pathways can begin to intelligibly inform each other.

11.3 A defined new basis for researching consciousness in established fields of research, a beautiful insight for people affected by dissociative identity disorder, scientific appreciation of seemingly irrational experiences of consciousness

The new understanding of the consciousness-brain relationship directly resolves the essence of the mind-body problem. Consciousness does not arise from our human brains in Measurement Space (MS), consciousness uses our human brains. The insight neither depends on an interpretation of the phenomenology of consciousness nor on any further advances in neuroscientific understanding of brain

function. It is an unambiguous result of fundamental physics as the consequence of a reconciliation of quantum and classical physical behavior and the discovery of fundamental reality of the Present Space Universe (PSU). This provides a definitive basis for further exploration of consciousness through various avenues within established fields of research including neuroscience, psychiatry, and psychology. It represents a radical shift of paradigm as the concept of a brainless conscious identity and agent had appeared nonsensical in scientific understanding of fundamental reality of our physical MSU. PSR provides a basis for scientific inquiries to further distinguish capacities and characteristics of our Present Space (PS) consciousness from functionalities available through our MS brains. We may assess personality and mental disorders from this new perspective. Of particular relevance is dissociative identity disorder. The phenomenology of a form of this disorder suggests alternate individual conscious minds interacting with the same human brain. Under PSR we have reason to evaluate these seemingly irrational experiences of consciousness as fundamentally real phenomena. Authentic reports of these experiences may provide a basis for deeper insight into a world of consciousness. Further studies informed by PSR of interactions of alternate conscious identities with an individual human brain may provide insight into the workings of the interface between PS consciousness and MS brain function. PSR provides a most beautiful insight for everyone affected by this phenomenon and by their stigmatization based on conventional understanding of reality. With authentic reports of their unique experiences, they can be perfectly rational messengers who may contribute to a deeper insight for humanity into a world of consciousness that is new to science. Under PSR the exploration of the interface between MS brain function and our PS consciousness is a defined scientific interest. We may further investigate and model MS brain function and relate brain function to experiences and behavior of the individual conscious mind. We would also like to inquire the relationship between individual conscious existence and a higher order entity of consciousness. The study of varying and altered states of consciousness may provide unique additional insight. As we explore a scientifically surprising new world of consciousness, we have reason to expect the unexpected. A most far-reaching scientific inquiry relates to transcendental experiences reported in what has been termed near-death experiences (NDE). Ample anecdotal evidence for these experiences exists. A study in a clinical resuscitation setting has been undertaken by Parni et. al. [19]. Insights into the phenomenology of these experiences include extensive research undertaken by Greyson [20]. Transcendental experiences of consciousness are real phenomena that begin to make and reveal specific sense under the framework of reality identified by PSR. Corresponding with the way PSR provides a definitive basis for the analysis of quantum physical phenomena, PSR provides guidance for what is real and what is not real in these experiences.

11.4 Continuation of consciousness, pathways for observational confirmation of consciousness-brain relationship, NDE as a window for informed research into a realm of consciousness

The inquiry into continuation of consciousness is not only about our most troubling existential worry. It may provide deeper insight into structural and operational characteristics of our realm of consciousness and a deeper understanding of its qualitative nature. PSR presents us with a definitive framework for analyzing otherworldly experiences reported from near-death experiences (NDE). It provides direct guidance for what is real and what is not real in NDE. Conscious experiences in NDE are part of the reality of the PSU. They are real as conscious experiences. This does not mean that whatever is perceived in these experiences is fundamentally real. It means that in these experiences something real is happening in the PSU in the way things can happen there. NDE also provide a potential pathway through which we may obtain independent MS based observational confirmation of mind-body duality. In

continuation of consciousness the activity of an individual PS consciousness eventually persists beyond activity of its MS brain. Some reported NDE may already occur without any neural correlates in brain activity. An absence of neural correlates during intense NDE provides independent MS based observational confirmation of the fundamental principle. We may reassess existing case reports and conduct further informed research to assess this type of evidence. Another MS based confirmation for brain-consciousness duality may be derived from research into a phenomenon referred to as paradoxical lucidity. Batthyány and Greyson [18] have examined cases where patients who have been suffering from dementia suddenly experience episodes of lucidity shortly prior to death, even in severe and long-lasting cases of dementia. The phenomenon points to the persistence of a fundamental lucid consciousness beyond apparent damage to the brain. The phenomenology of dissociative identity disorder can provide another pathway for observational confirmation of the fundamental principle that consciousness uses the human brain. Reported experiences and their observable associated behavior suggest that alternate individual conscious minds may alternately interact with one individual physical brain. Additional research informed by PSR may further examine these reported experiences of consciousness and confirm their authenticity. Confirmation that alternate conscious minds may alternately use one human brain directly demonstrates that an individual conscious mind is not the consequence of an individual human brain. More generally, it can be seen as independent MS based evidence that the human brain serves as a resource for consciousness. For deeper qualitative insight into the realm of consciousness we can begin to apply PSR insights to the phenomenology of NDE and potentially other significant experiences in altered states of consciousness. One important clue for interpretation follows directly from the insight that consciousness uses the MSU as a resource. It means that consciousness may potentially access resources other than our MSU, provided such otherworldly resources exist. As this appears to happen in the experience of transcendental worlds in many NDE, we have reason to conduct further research and assess evidence for interactions with non-MSU resources. A particularly meaningful inquiry for us as individual beings is if and in what manner an individual identity may persist in these experiences. A specific objective consideration for the interpretation of NDE is that our MSU is a resource that strictly follows MS causality as a result of PSC. It suggests that experiences of unphysical phenomena in a familiar MSU environment do not indicate that the causal physical evolution of MS is magically overcome. Through further informed research into NDE, we may develop meaningful insight into qualitative and structural properties of non-MSU resources and into the relationship between individual and higher order consciousness. We may investigate the manner of interactions of an individual in otherworldly resources, experiences of transition between resources, and any experiences beyond egoistic perspectives as strictly individualized human beings. Authentic NDE can provide relevant witness testimony. It may reveal experiential qualities and insights that our minds may not have access to as strictly individualized human beings in MS. We may examine 360-degree experiences of vision beyond the directional focus we are limited to in our perception of MS through our human eyes. We may examine novel types of experiences such as novel colors, and phenomena of instantaneous comprehension which may be available in a simultaneously evolving reality beyond our linear analytical structure through which we develop our understanding of a MS world of classical information. The structural framework of PSR provides analytical context to assess these experiences. Objective analytical and direct experiential pathways can begin to intelligibly inform each other. Beyond qualitative questions of what type of transcendental experiences and resources may lie beyond, the new insights under PSR already point to a procedural characterization of what happens to the individual conscious

mind. Transcendental experiences in NDE appear to represent stages in a managed transition of an individual conscious mind in a phase of impending death of the body.

11.5 Structural characteristics reveal MSU related and transcendental purposes of life, transcendental evolution of consciousness

With growing sample size of relevant NDE we can grasp what is uniquely realized in our MSU but missing in non-MSU resources. The differential can reveal unique purposes of our existence in MS with its challenging and unforgiving physicality. If the MSU is a purposeful creation by and for consciousness, why is it not more consistently pleasant as some non-MSU worlds experienced in NDE appear to be? The issue of suffering has long been a subject of theology and philosophy. The issue is further pronounced under the findings of PSR where the evolution of our MSU requires exceedingly challenging algorithmic progressions. Initial computational requirements from ordinary physical evolution have stepped up further with the introduction of functional fine differentiation in the first living cells. Another step up can be associated with intense processing activity in evolved brains. Computational requirements for the projection of the strictly causal and finely differentiable structure of our MSU go beyond requirements for pleasant virtual worlds for consciousness to simply enjoy. The causal physical structure and the capability of individuals to interact positively and negatively in the MSU necessarily includes negative consequences. The apparent purposes of this challenging physical world are ample and manifold. They include all we can be, evolve into, experience, do, create and develop through our human existence in the MSU as individuals and as a society. The intriguing questions of purposes and meaning of life have long been contemplated, expressed, and questioned across wide sections of humanity and in individual minds. Under PSR we gain a scientific perspective to appreciate our unique possibilities available through life in the MSU. There is no optionality to have this strictly causal physical world without its physical challenges. The MSU is a purposeful and inventive creation down to its most basic level of physicality. As there is no physical space, the physicality and functionality of our MSU are not naturally available as a consequence of a natural physical world. They are a creative and imaginative invention that evolves through mathematical algorithms in the realm of consciousness of a higher order entity. It is an incredibly evolved and precious masterpiece that may be assumed to require substantial higher order conscious effort sustained over eons. PSR points to further fascinating purposes for us as individuals and as an evolving human society. We are part of the evolution of a higher order consciousness. We may emerge into meaningful existence as individuals through our unique conscious interaction with our individual brains in the MSU. The evolution of our individual identities through our experiences presents itself as a key purpose of the virtual MSU. We may fulfill our purposes in an abundance of individual ways through our physical lifetimes and potentially beyond. The strict physicality of the MSU includes that harm can be done against other individuals and against the long-term viability of our planet for consciousness to continue to thrive and evolve. As continuation of an individual experiential identity in some form is part of an overall evolutionary process, there may be consequences for meaningful continuation for abusive individuals. Continuation of consciousness as identified under PSR does not make predictions about eternity. Maintaining individual identities may or may not require specific conditions or effort. Conditions may vary and evolve over time. The evolutionary character of consciousness has fascinating implications. Biological evolution in MS under special PSC algorithms already demonstrates a targeted, deliberate process that has characteristics of trial and error. Rather than a predetermined and limited process, evolution presents itself as an open-ended process by and for consciousness to thrive and evolve. Otherworldly resources may not be forever unchanging heavenly

worlds. Further innovative enhancements and improvements within a higher order evolution of consciousness may evolve in the future on different levels of the PSU and in ways beyond our imagination. We apparently are part of a mind-bending, open-ended evolution of consciousness.

11.6 Confirmation of fundamental reality of divine existence of a higher order entity

PSR demonstrates the existential reality of a fundamental Present Space Universe. It is identified from fundamental physics and found to be the realm of a higher order entity of consciousness that precedes, initiates, and projects our physical universe. Our physical universe is found to be a creation for consciousness to thrive and evolve. We are looking at an existential reality that has been anticipated in religious beliefs and concepts in philosophy. We realize that as conscious human beings we always had innate access to our ultimate reality in Present Space beyond analytical comprehension. We are looking at the independent scientific confirmation of a fundamental truth for which we had no prior scientific concept. Beyond scientific nomenclature and conventional physical understanding, the fundamental nature of the Present Space Universe can be described and comprehended as spiritual and divine. The higher order entity may be described and comprehended as divine and as god.

11.7 Science and philosophy of ultimate existence and emergence

PSR resolves the mind-boggling problem of emergence of our seemingly physical MSU from nothing. Our ultimately virtual MSU is not a physical result of some prior physical state. It is constructed from something we can imagine to simply exist. It is constructed from a naturally existing potential for mathematics. The mathematics applied in its projection follow an intricate, exceedingly intelligent and creative logic under PSC rules and algorithms. They are defined and applied by a higher order entity of consciousness. It is a visionary and targeted approach towards conceived results on a full spectrum of distance scales. Three-dimensional physical space, physical objects in the MSU, their functionalities, and biological life are all results of an inventive approach through evolution under PSC rules and special algorithms. As conscious beings we are individualized subjects of the higher order entity. We are provided experiential access to the projected MSU through our interaction with processes in an individual human brain. The phenomenon of the present time, our individual experience of consciousness, and the projection of our physical universe are all direct manifestations of the higher order entity. As there is no physical space, fundamental consciousness presents itself as a most primary form of existence. The incredibly sophisticated intelligence in the projection of our MSU together with the phenomenon of an ongoing methodical evolution suggest that the higher order entity itself has evolved from a basic ground state. It points to a fundamental consciousness that has found ways for self-organization and differentiation long before the initiation of the MSU. It has developed imaginative capacities and thoughtful application of logic and mathematics. It has developed an ability to isolate and deploy individualized conscious identities.

12. Wonderful and crucial insights for humanity

The insights into our spiritual reality are confirmation of belief for many of us. They come as a miraculous surprise to many of us who rely on the analytical logic of science to answer our ultimate questions about the universe and ourselves. The emerging insights are wonderful for all of us. They are reason to celebrate both faith and a new level of scientific understanding. There is much more to our conscious existence than its appearance during our human lifetimes. We are all part of the same divine higher order entity. We play an active role in its purpose to thrive and evolve. The prospect of

continuation of consciousness alleviates our most existential worry. We have been given a wonderful opportunity to experience and contribute. It includes our own life experiences and the evolution of our individual identities. It includes positive effects on experiences and evolution of our fellow human beings as well as other contributions to evolutionary advancement of humanity. Reckless and excessively egoistic behavior on individual and group levels do not fit a higher order purpose for consciousness to thrive and evolve. As each individual is part of a higher order evolutionary process it may impact their prospects for a meaningful continuation of their personal identity. As human society on this planet today we do not just have room for incremental evolutionary improvement. We face immediate catastrophic failures and long-term existential threats. The evolution of our physical universe, of our planet, our biological species and our evolution as humanity presents itself as the exceedingly elaborate, precious, and important undertaking of a divine higher order entity. We shall not fail. As we realize who we really are and what we are here for, we have ever more reason to resolve catastrophic failures and long-term existential challenges. We all have an active role in the evolution of consciousness as individual human beings and as part of human society.

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