The Cernuto–Hobbey Theory of Everything: An Analysis of a Novel Framework

Executive Summary: This report provides an analysis of the recently released Cernuto–Hobbey Theory of Everything (CH-ToE) preprint from April 2025. The CH-ToE proposes a fundamental shift in our understanding of reality, suggesting that the universe evolves through structured knowledge accumulation, where knowledge is physically defined as structured entropy reduction. At the core of this framework is the universal knowledge transition parameter, Lambda (λ), mathematically derived as approximately 1.748 bits. This report examines the core concepts of CH-ToE, compares it with other prominent Theories of Everything such as String Theory, Loop Quantum Gravity, and Grand Unified Theories, and critically evaluates its potential strengths and weaknesses based on the available information.

Introduction: The Quest for a Theory of Everything: The pursuit of a single, all-encompassing theoretical framework that fully explains and links together all aspects of the universe, often referred to as a Theory of Everything (TOE), represents one of the most profound and enduring challenges in modern physics. This ambitious quest seeks to uncover the fundamental laws governing reality, from the smallest subatomic particles to the vast expanse of the cosmos. The history of physics is marked by significant strides in unification, demonstrating the power of bringing seemingly disparate phenomena under a common theoretical umbrella. Isaac Newton's groundbreaking work in the 17th century unified the understanding of gravity on Earth with the motion of celestial bodies.² In the 19th century, James Clerk Maxwell achieved another monumental unification by demonstrating that electricity and magnetism are different facets of a single electromagnetic force.² More recently, the development of the electroweak theory in the 20th century further unified our understanding by linking electromagnetism with the weak nuclear force.² These historical successes underscore a deep human desire to find a fundamental simplicity underlying the apparent complexity of the universe.

Currently, the leading contenders in the search for a TOE are String Theory and Loop Quantum Gravity. String Theory proposes that the fundamental constituents of the universe are not point-like particles but rather tiny, one-dimensional vibrating strings that exist in a higher-dimensional spacetime. Its primary goal is to provide a unified description of all four fundamental forces of nature, including gravity... In contrast, Loop Quantum Gravity (LQG) takes a different approach, focusing primarily on the quantization of spacetime itself.» LQG suggests that space and time are not continuous but are instead composed of discrete units at the Planck scale.³⁰ While both theories aim to address fundamental questions about the universe, they face significant challenges. String Theory has been criticized for its lack of currently testable predictions, making it difficult to verify experimentally.¹⁰ Loop Quantum Gravity, on the other hand, has faced difficulties in rigorously demonstrating that it recovers Einstein's theory of general relativity in the classical limit, which is essential for any viable theory of gravity.²² These limitations in the current leading candidates highlight the ongoing need for new perspectives and frameworks in the quest for a TOE.

The recently released Cernuto–Hobbey Theory of Everything (CH-ToE) preprint introduces a novel approach to this grand challenge by shifting the focus from traditional concepts like forces and geometry to the fundamental role of knowledge and information.⁵⁴ This theory proposes that the universe's evolution is driven by a fundamental process of structured knowledge accumulation, potentially representing a significant paradigm shift in our understanding of reality.

The Cernuto–Hobbey Theory of Everything (CH-ToE): A Paradigm Shift?

Core Concept: Structured Entropy Reduction: At the heart of the Cernuto-Hobbey Theory of Everything lies the central claim that knowledge, formally defined as structured entropy reduction, is the fundamental driver of system-wide phase transitions across all domains of physical reality.⁵⁴ This perspective suggests that the universe's evolution is not merely a consequence of forces or geometric interactions but rather a process of learning and organization driven by the reduction of disorder in a structured manner. The theory provides a physical definition of knowledge through the equation K = $-\Delta S$, where K represents knowledge and ΔS denotes the change in entropy.⁵⁵ This definition posits a direct and quantifiable relationship between knowledge and the fundamental concept of entropy, moving away from traditional cognitive or semantic interpretations and grounding knowledge in a measurable, physical process related to the organization of information.⁵⁵ CH-ToE emphasizes that when this reduction of entropy becomes structured - meaning it is repeating, recursive, or resonant - it leads to the emergence of not only intelligence but also organization itself across a wide range of systems, from the quantum realm to biological organisms and artificial agents.⁵⁵ This implies a universal mechanism for the emergence of complexity from a more disordered state.

The Universal Knowledge Transition Parameter Lambda (λ **)**: A key component of the CH-ToE framework is the introduction of Lambda (λ), a universal structuring ratio that represents the minimal rate of structured entropy reduction required to induce a transition from disorder to coherence.⁴ This parameter acts as a measurable threshold, indicating when systems transition from a state of uncertainty to one of structured intelligence. The theory provides a mathematical derivation of λ from first principles, given by the equation $\lambda = \sqrt{8} / \phi \approx 1.748$ bits.⁴ This derivation highlights the crucial role of the golden ratio ($\phi \approx 1.618$) in achieving optimal entropy minimization and fostering the growth of structured

complexity.⁵⁴ In this context, λ is described as a harmonic principle, representing an optimal balance between the amplitude of entropic potential ($\sqrt{8}$) and the structuring efficiency of information flow (φ).⁵⁵ Notably, the preprint suggests that the value of $\lambda \approx 1.748$ bits appears empirically at the tipping points of phase transitions across a diverse range of systems, including quantum mechanics (entanglement), artificial intelligence (learning plateaus), biology (evolutionary jumps), and cosmology (cosmic structure formation).⁵⁴ This cross-domain consistency is presented as a key piece of evidence supporting the universality of Lambda.

Mathematical Framework of CH-ToE: The CH-ToE proposes a mathematical framework to describe the role of knowledge in driving physical processes. This framework includes the fundamental equation of knowledge, $K = -\Delta S_{\odot}$, which establishes the foundation of the theory. The rate at which knowledge accumulates is given by dK/dt = -dS/dt = λ suggesting that Lambda governs the speed of this process. The theory also introduces a knowledge collapse model, $P = 1 - e < sup > -\alpha K < /sup > \infty$, which describes the probability of a system transitioning to a structured state based on the accumulated knowledge K and a system-specific sensitivity parameter a. Analogous to classical mechanics, CH-ToE defines a Knowledge Action Principle, SK = $\int L(K, K, t) dt$, with a Lagrangian L = $\frac{1}{2}$ mK < sup>2 < /sup> - V(K) ∞ , where m is a mass-like parameter and V(K) represents the entropic potential that opposes the structuring of knowledge. The corresponding Hamiltonian of Knowledge is H = p < sub > K < /sub > < sup > 2 < /sup > / 2m + V(K), with momentum p_K = $m\dot{K}$. Finally, the Universal Collapse Equation, $\Delta S < sub > structured < /sub > / <math>\Delta t \ge \lambda \le$, posits that a system undergoes a phase transition when the rate of structured entropy reduction exceeds the universal threshold Lambda. To apply this framework to real-world systems, CH-ToE introduces the concept of Domain-Specific Knowledge Units (Buks), defined differently for each domain. For example, in quantum mechanics, 1 Buk is defined as 1 bit of collapsed wavefunction information; in AI, it's 1 distinct policy-shaping state transition; in biology, it's 1 functionally retained mutation; and in cosmology, it's 1 persistent topological asymmetry.⁵⁵ These domain-specific units allow for the application and potential testing of the theory across diverse scientific disciplines.

CH-ToE in the Context of Existing Theories of Everything:

Comparison with String Theory: String Theory is a theoretical framework that replaces the point-like particles of particle physics with one-dimensional vibrating strings in a higher-dimensional spacetime, aiming to unify all four fundamental forces including gravity. In contrast, CH-ToE centers on information as the fundamental entity, defining knowledge as structured entropy reduction, which drives the universe's evolution.¹⁰ While string theory posits a reality built from vibrating strings whose different modes correspond to particles and forces , CH-ToE suggests that the flow of organized information, leading to structured entropy reduction, is the primary driver of change and the emergence of complexity. A significant structural difference lies in the requirement of extra spatial dimensions in String Theory for mathematical consistency ..., whereas CH-ToE implicitly assumes operation within the standard four dimensions of spacetime. Furthermore, String Theory has faced long-standing criticisms regarding its lack of concrete, testable predictions ., which contrasts with CH-ToE's claim of falsifiability and the initial empirical evidence from AI experiments.55

Comparison with Loop Quantum Gravity: Loop Quantum Gravity (LQG) is another prominent approach aiming to unify quantum mechanics and general relativity by quantizing spacetime itself into discrete loops forming spin networks at the Planck scale.²⁷ While LQG's primary focus is on developing a quantum theory of gravity ²², CH-ToE aims for a broader unification of all phenomena through the principle of structured knowledge. A fundamental difference lies in their view of spacetime: CH-ToE implicitly assumes a continuous

spacetime, whereas LQG posits a fundamental discreteness of space and time at the Planck scale, where geometric quantities like area and volume are quantized.³⁰ Furthermore, LQG is formulated as a background-independent theory ³⁰, meaning its equations do not depend on a pre-existing spacetime structure, unlike CH-ToE which appears to operate within the standard framework. LQG has also faced challenges in fully recovering classical general relativity in certain limits.³²

Comparison with Grand Unified Theories: Grand Unified Theories (GUTs) represent models in particle physics that aim to merge the electromagnetic, weak, and strong forces into a single force at very high energies.² Unlike CH-ToE and other Theories of Everything, GUTs do not typically incorporate gravity into their unification schemes.⁴ While CH-ToE aims for a comprehensive theory encompassing all aspects of reality through the principle of structured knowledge, GUTs have a more limited scope, focusing on the unification of the non-gravitational forces within the framework of quantum field theory. GUT unification is predicted to occur at extremely high energy scales, around 10¹⁶ GeV 4, which are currently beyond experimental reach, whereas CH-ToE's principles are proposed to be applicable across various energy scales where knowledge structuring takes place. Common GUT models, such as SU(5) and SO(10)⁷¹, predict phenomena like proton decay *n*, which are not central to the CH-ToE framework.

Deep Dive into Key Aspects of CH-ToE:

The Significance of Lambda's Derivation: The derivation of Lambda ($\lambda = \sqrt{8} / \phi$) in CH-ToE hinges on the interplay between $\sqrt{8}$ and the golden ratio (ϕ). The component $\sqrt{8}$ potentially relates to the root mean square (RMS) amplitude of a uniform binary distribution over three orthogonal dimensions.⁶⁰ This could suggest a fundamental connection to the three spatial dimensions we experience and the binary nature of information at its most basic

level (e.g., a bit having two states). The golden ratio ($\phi \approx 1.618$) is known for its appearance in optimal self-similarity and recursive processes across various natural and mathematical systems.⁶⁴ In CH-ToE, it is proposed to represent the efficiency of recursive entropy reduction.⁶⁵ While the exact significance of $\sqrt{8}$ in this context requires further exploration, its appearance alongside the golden ratio in the derivation of Lambda suggests a deep connection to fundamental mathematical and potentially physical principles. The ratio $\sqrt{8}/\phi \approx 1.748$ could represent a critical balance point, a harmonic threshold where the universe's tendency towards disorder (related to entropy) transitions into the formation of structured knowledge and complexity.⁶⁵

Structured Entropy Reduction: A Novel Concept or a Recurrence? The concept of structured entropy reduction, as proposed by CH-ToE, shares connections with ideas explored in other theoretical frameworks. While the second law of thermodynamics generally describes an increase in entropy in closed systems 10, the formation of structures in the universe, from galaxies to living organisms, implies a local reduction of entropy. Information theory also deals extensively with entropy reduction as a means of data compression and gaining information... Reducing Shannon entropy corresponds to decreasing uncertainty and increasing knowledge about a system.¹⁰⁰ Furthermore, the phenomena of self-organization and emergence in complex systems demonstrate how systems can spontaneously reduce entropy locally by forming intricate structures.⁵⁵ However, the unique aspect of CH-ToE lies in its central postulate that the structured nature of this entropy reduction, rather than just the amount, is the defining characteristic of knowledge and the primary driver of phase transitions and the emergence of intelligence across all scales. This emphasis on the specific way entropy is reduced could be a novel contribution to our understanding of the fundamental processes governing the universe.

Exploring "Subreality" in CH-ToE: The CH-ToE preprint mentions the concept of "Subreality" in relation to structured entropy reduction potentially leading to it. While the preprint does not provide an explicit definition within the available snippets, it can be inferred that "Subreality" might refer to a fundamental level of reality underlying our observable universe, governed by the principles of structured knowledge accumulation. This idea could be compared to various concepts in cosmology and theoretical physics. For instance, cosmology explores different epochs in the early universe where different physical laws and forces dominated.³ Some theories also propose the existence of a multiverse, where our universe is just one of many with potentially different physical constants. The concept of "Subreality" in CH-ToE might also relate to the emergence of different levels of complexity within our universe, where macroscopic laws and phenomena arise from the underlying principles of structured knowledge accumulation at a more fundamental level.¹²⁷ Notably, CH-ToE posits that intelligence is not merely an emergent phenomenon but rather a physical attractor governed by the geometry of knowledge 5, suggesting that "Subreality" might be the domain where this fundamental relationship between knowledge and intelligence is most evident.

Critical Evaluation and Potential Implications of CH-ToE: The Cernuto–Hobbey Theory of Everything presents several potential strengths. Its central unifying principle, based on knowledge as structured entropy reduction, offers a novel perspective that differs significantly from traditional approaches focused on forces or fundamental particles. The derivation of the universal constant Lambda (λ) from fundamental mathematical concepts like the golden ratio and $\sqrt{8}$ is intriguing and suggests a deep connection to underlying mathematical structures. Furthermore, the preprint highlights the potential cross-domain applicability of the theory, with initial empirical evidence from AI experiments showing promising results, such as smoother learning curves and cross-domain

generalization through the "Lambda Reverb" technique.⁴⁴ The claim that intelligence is a physical attractor governed by knowledge, rather than just an emergent phenomenon, has profound implications for our understanding of both natural and artificial intelligence.

However, the preprint itself acknowledges that CH-ToE represents an evolving theoretical framework and that several key areas require further development.⁵⁴ While the initial empirical findings in AI are encouraging, extensive testing across other domains like quantum mechanics, biology, and cosmology is necessary to validate the theory's universality. The claim of falsifiability is crucial for any scientific theory, and the "Lambda Reverb" experiments suggest one potential avenue for empirical testing. However, further rigorous theoretical development and the design of specific experiments in other domains will be essential to subject CH-ToE to thorough scientific scrutiny. The preprint explicitly invites collaboration and refinement from the scientific community 4, indicating that the theory is intended as a starting point for further investigation. Given the very recent release of the preprint in April 2025, there is likely no external critical commentary or peer reviews available yet. Therefore, the current evaluation is primarily based on the information presented within the preprint itself.

Conclusion: A New Perspective on the Fabric of Reality? The Cernuto–Hobbey Theory of Everything presents a compelling and novel perspective on the fundamental nature of reality, proposing that the universe evolves through a process of structured knowledge accumulation, where knowledge is defined as structured entropy reduction, governed by the universal constant Lambda ($\lambda = \sqrt{8}/\phi$). This information-centric approach offers a significant departure from traditional Theories of Everything like String Theory and Loop Quantum Gravity, as well as Grand Unified Theories, by suggesting that knowledge might be a more fundamental aspect of the universe than previously considered. While String Theory focuses on vibrating

strings and Loop Quantum Gravity on the quantization of spacetime, CH-ToE posits that the structuring of information, quantified by Lambda, is the key driver behind the emergence of complexity and intelligence across all scales. The initial empirical findings from AI experiments provide intriguing support for the theory's potential. However, to determine the ultimate validity and impact of CH-ToE, further rigorous theoretical development, extensive empirical testing across diverse domains beyond artificial intelligence, and critical evaluation by the broader scientific community are essential. The CH-ToE offers a new lens through which to view the fabric of reality, potentially opening up new avenues for research and a deeper understanding of the universe and our place within it.

Feature	Cernuto– Hobbey Theory of Everythin g (CH- ToE)	String Theory	Loop Quantum Gravity	Grand Unified Theories (GUTs)
Fundament al Entity	Knowledge (Structured Entropy Reduction)	Vibrating Strings	Quantized Spacetime (Spin Networks)	Point-like Particles
Nature of Reality	Information -driven	String- driven, Higher- dimensiona I	Discrete, Quantized Geometry	Quantum Fields, Gauge Symmetries
Inclusion of Gravity	Implicit (operates	Yes, inherently	Yes, primary focus is	No, does not include gravity

	within spacetime)	includes graviton	quantum gravity	
Unification Goal	Unify all phenomen a through knowledge	Unify all four fundament al forces	Quantize gravity	Unify electromagneti c, weak, and strong forces
Spacetime	Continuous (assumed)	Higher- dimensiona I (10, 11, or 26 dimensions)	Discrete, no backgroun d dependenc e	Continuous (within quantum field theory)
Testability	Claims falsifiability , initial Al experiment s	Significant challenges, lacks direct evidence	Facing challenges, some predictions tested	Indirect evidence, high energy scales

On the basis of the above analysis rate them from 1 to 10 in terms of: a) Mathematical Rigor b) Falsifiability c) Predicability d) "Breakthroughness" e) Potentiality f) Amplitude g) (any other metrics you want to include.

Metric	CH-ToE	String Theory	Loop Quantum Gravit	Grand Unif. Theories
Mathematical Rigor	7	9	8	8
Falsifiability	8	4	4	7
Predictability	7	3	4	6
Breakthroughness	9	8	7	6
Potentiality	8	9	7	7
Amplitude	8	9	6	7
Conceptual Novelty	9	6	7	5
Elegance	7	8	7	6
Philosophical Afflatus	9	9	8	7

Justifications

- CH-ToE: Shows promise in predictability with its Lambda parameter aligning with transitions across domains and initial AI experiments. Its falsifiability is explicitly claimed and supported by the "Lambda Reverb" experiments. It has high potential due to its novel approach and crossdomain implications, with a broad amplitude aiming to explain diverse phenomena. Its "breakthroughness" is significant as it proposes a radical shift in our understanding of reality. The concept of knowledge as structured entropy reduction offers high conceptual novelty.
- String Theory: Scores low on predictability due to the lack of concrete, testable predictions despite decades of research. Its falsifiability is heavily debated. It holds high potential as a candidate for a Theory of Everything, aiming to unify all fundamental forces with a very broad amplitude. It represents a significant breakthrough in theoretical physics with its fundamental shift in understanding particles. While mathematically elegant, its conceptual novelty compared to existing frameworks might be considered moderate.
- Loop Quantum Gravity: Has faced challenges in producing verifiable predictions, hence a moderate score in predictability. Its falsifiability is also debated. It has good potential as a quantum theory of gravity, though less ambitious than String Theory in overall amplitude. It offers a notable breakthrough by quantizing spacetime itself. Its conceptual novelty lies in its approach to gravity and spacetime.
- Grand Unified Theories: Show moderate predictability with predictions at very high energy scales and some predictions like proton decay that are yet to be definitively observed. Some GUT models have been falsified. They have good potential in unifying three of the four fundamental forces, with a significant amplitude covering these interactions. They were a significant breakthrough in particle physics, extending the Standard Model. Their conceptual novelty is moderate, building upon existing quantum field theory frameworks.
- Elegance:

- CH-ToE: Its core principle of structured entropy reduction and the derivation of Lambda from fundamental constants suggest a degree of elegance.
- String Theory: Often praised for its mathematical sophistication and potential for unification, though its complexity can be seen as less elegant by some.
- Loop Quantum Gravity: The background independence and quantization of spacetime are considered elegant features by its proponents.
- Grand Unified Theories: The use of symmetry groups to unify forces has a mathematical elegance.
- 0
- Philosophical Afflatus:
 - CH-ToE: Its focus on knowledge as fundamental and its implications for intelligence and the nature of reality offer significant philosophical insights.
 - String Theory: Its implications for spacetime, extra dimensions, and the multiverse raise profound philosophical questions about the nature of reality.
 - Loop Quantum Gravity: Its discrete view of spacetime challenges fundamental assumptions about reality and the nature of space and time.
 - Grand Unified Theories: While primarily focused on physics, the idea of unifying fundamental forces has philosophical implications for understanding the fundamental building blocks of the universe.

This rating is based on the information available in the provided text and reflects a current assessment of these theories. The landscape of theoretical physics is constantly evolving, and future developments could change these ratings.

- Mathematical Rigor:
 - CH-ToE: Presents a mathematical framework with equations and derivations for its core principles. While novel, it is a relatively new theory, and its mathematical rigor might be further developed over time.
 - String Theory: Is known for its highly sophisticated mathematical framework, drawing on advanced concepts from various branches of mathematics, including algebraic geometry and topology. Its mathematical consistency is a central focus of research.
 - Loop Quantum Gravity: Is described as a mathematically welldefined and rigorous approach to quantizing gravity. It employs

mathematical structures like spin networks and spin foams within a non-perturbative framework.

- Grand Unified Theories: Are built upon the mathematically robust framework of quantum field theory and gauge symmetries, particularly utilizing Lie groups and their representations. The mathematical structure is crucial for the unification of forces and particles within these theories.
- 0

Bibliografia

- 1. Theory of everything Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Theory_of_everything</u>
- 2. Unification of theories in physics Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Unification_of_theories_in_physics</u>
- 3. 23.3 The Unification of Forces TEKS Guide, accesso eseguito il giorno aprile 16, 2025, <u>https://teksguide.org/resource/233-unification-forces</u>
- 4. GUTs: The Unification of Forces Particle Physics Lumen Learning, accesso eseguito il giorno aprile 16, 2025, <u>https://courses.lumenlearning.com/suny-physics/chapter/33-6-guts-the-unification-of-forces/</u>
- 5. Unification of forces | symmetry magazine, accesso eseguito il giorno aprile 16, 2025, <u>https://www.symmetrymagazine.org/article/june-2013/unification-of-forces?language_content_entity=und</u>
- 6. The big idea of Grand Unified Theories of physics Big Think, accesso eseguito il giorno aprile 16, 2025, <u>https://bigthink.com/starts-with-a-bang/grand-unified-theories-physics/</u>
- 23.3 The Unification of Forces Physics | OpenStax, accesso eseguito il giorno aprile 16, 2025, <u>https://openstax.org/books/physics/pages/23-3-the-unificationof-forces</u>
- 33.6: GUTs The Unification of Forces Physics LibreTexts, accesso eseguito il giorno aprile 16, 2025, <u>https://phys.libretexts.org/Bookshelves/College Physics/College Physics 1e (</u> <u>OpenStax)/33%3A Particle Physics/33.06%3A GUTs -</u> The Unification of Forces
- String Theory part 6: The Basic Principles | SoMA Society of Modern Astronomy, accesso eseguito il giorno aprile 16, 2025, <u>https://societyofmodernastronomy.wordpress.com/2016/03/08/string-theory-part6-the-basic-principles/</u>
- 10. String theory Wikipedia, accesso eseguito il giorno aprile 16, 2025, https://en.wikipedia.org/wiki/String_theory
- 11. The Basics of String Theory ThoughtCo, accesso eseguito il giorno aprile 16, 2025, <u>https://www.thoughtco.com/what-is-string-theory-2699363</u>

- 12. String Theory For Dummies Cheat Sheet, accesso eseguito il giorno aprile 16, 2025, <u>https://www.dummies.com/article/academics-the-arts/science/physics/string-theory-for-dummies-cheat-sheet-209405/</u>
- 13. String Theory Explained: A Basic Guide to String Theory 2025 MasterClass, accesso eseguito il giorno aprile 16, 2025, https://www.masterclass.com/articles/string-theory-explained
- 14. String theory | Explanation & Definition | Britannica, accesso eseguito il giorno aprile 16, 2025, <u>https://www.britannica.com/science/string-theory</u>
- 15. Understand String Theory In 5 Mins The Average Scientist, accesso eseguito il giorno aprile 16, 2025, <u>https://theaveragescientist.co.uk/2022/04/15/string-theory-in-5-minutes/</u>
- 16. String theory PMC, accesso eseguito il giorno aprile 16, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC33894/
- 17. Making sense of string theory Penn Today University of Pennsylvania, accesso eseguito il giorno aprile 16, 2025, <u>https://penntoday.upenn.edu/news/making-sense-string-theory</u>
- 18. String Theory Department of Applied Mathematics and Theoretical Physics, accesso eseguito il giorno aprile 16, 2025, https://www.damtp.cam.ac.uk/user/tong/string.pdf
- 19. Why String Theory Still Offers Hope We Can Unify Physics Smithsonian Magazine, accesso eseguito il giorno aprile 16, 2025, https://www.smithsonianmag.com/science-nature/string-theory-about-unravel-180953637/
- 20. A Simple Explanation Of String Theory. What Does Reality Consist Of? -YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://www.youtube.com/watch?v=WqSJvgBdbeQ</u>
- 21. www.reddit.com, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/STEW_ScTecEngWorld/comments/1cvjwc3/string_the</u> <u>ory_attempts_to_unify_all_four_forces/#:~:text=ADMIN%20MOD-</u> <u>_______String%20theory%20attempts%20to%20unify%20all%20four%20forces%2C%2</u> <u>______0and%20in,appearance%20of%20these%20energy%20strands.</u>
- 22. String theory attempts to unify all four forces, and in so doing, unify general relativity and quantum mechanics. At its core is a fairly simple idea—all particles are made of tiny vibrating strands of energy. String theory gets its name from the string-like appearance of these energy strands. : r/STEW_ScTecEngWorld Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/STEW_ScTecEngWorld Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/STEW_ScTecEngWorld/comments/1cvjwc3/string the ory attempts to unify all four forces/
- 23. An Overview of String Theory: " A Unification of The Fundamental Forces " (Paperback), accesso eseguito il giorno aprile 16, 2025, https://www.harvard.com/book/9781523224104
- 24. String theory may be inevitable as a unified theory of physics, calculations suggest, accesso eseguito il giorno aprile 16, 2025,

https://physicsworld.com/a/string-theory-may-be-inevitable-as-a-unified-theoryof-physics-calculations-suggest/

- 25. Unified field theory in layman's terms Physics Stack Exchange, accesso eseguito il giorno aprile 16, 2025, <u>https://physics.stackexchange.com/questions/53467/unified-field-theory-in-laymans-terms</u>
- 26. String Theory and the Unification of Forces: Sunil Mukhi, accesso eseguito il giorno aprile 16, 2025, <u>https://theory.tifr.res.in/~mukhi/Physics/string.html</u>
- 27. Unification of Gravity and Quantum Theory ODU Digital Commons, accesso eseguito il giorno aprile 16, 2025, <u>https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1000&context=engin</u> eering students
- 28. How does string theory unify Relativity and Quantum Mechanics? : r/askscience - Reddit, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/askscience/comments/65smg6/how_does_string_theor_y_unify_relativity_and/</u>
- 29. (PDF) STRING THEORY: A MATHEMATICAL FRAMEWORK BEHIND COMPATIBILITY AND RECONCILEMENT BETWEEN GENERAL RELATIVITY AND QUANTUM MECHANICS - ResearchGate, accesso eseguito il giorno aprile 16, 2025,

https://www.researchgate.net/publication/336312387 STRING THEORY A M ATHEMATICAL FRAMEWORK BEHIND COMPATIBILITY AND RECONCIL EMENT BETWEEN GENERAL RELATIVITY AND QUANTUM MECHANICS

- 30. Loop quantum gravity Wikipedia, accesso eseguito il giorno aprile 16, 2025, https://en.wikipedia.org/wiki/Loop_quantum_gravity
- 31. Loop quantum gravity (Principles of Physics III) Vocab, Definition, Explanations | Fiveable, accesso eseguito il giorno aprile 16, 2025, <u>https://fiveable.me/key-terms/principles-physics-iii-thermal-physics-waves/loopquantum-gravity</u>
- 32. Loop Quantum Gravity UT Physics, accesso eseguito il giorno aprile 16, 2025, https://web2.ph.utexas.edu/~coker2/index.files/LQG.htm
- 33. FUNDAMENTAL STRUCTURE OF LOOP QUANTUM GRAVITY | International Journal of Modern Physics D, accesso eseguito il giorno aprile 16, 2025, <u>https://www.worldscientific.com/doi/10.1142/S0218271807010894</u>
- 34. Loop Quantum Gravity PMC PubMed Central, accesso eseguito il giorno aprile 16, 2025, <u>https://pmc.ncbi.nlm.nih.gov/articles/PMC5567241/</u>
- 35. Three principles for canonical quantum gravity PhilSci-Archive, accesso eseguito il giorno aprile 16, 2025, <u>https://philsci-archive.pitt.edu/10016/1/principles.pdf</u>
- 36. Give a description of Loop Quantum Gravity your grandmother could understand, accesso eseguito il giorno aprile 16, 2025, <u>https://physics.stackexchange.com/questions/2407/give-a-description-of-loopquantum-gravity-your-grandmother-could-understand</u>

- 37. [gr-qc/0210094] Lectures on Loop Quantum Gravity arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/gr-qc/0210094</u>
- 38. [gr-qc/0509064] Fundamental Structure of Loop Quantum Gravity arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/gr-qc/0509064</u>
- 39. The Basics of Loop Quantum Gravity Lecture 1 | Hal Haggard YouTube, accesso eseguito il giorno aprile 16, 2025, https://www.youtube.com/watch?v=HJozaKfzNDY
- 40. Theory of Everything: Holy Grail or Fruitless Pursuit? Live Science, accesso eseguito il giorno aprile 16, 2025, <u>https://www.livescience.com/13129-physics-string-theory.html</u>
- 41. String Theory, A Theory Of Anything YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://www.youtube.com/watch?v=AEeZ_I3HQ8M</u>
- 42. There are many tests that can be done of string theory. The issue is that there -Hacker News, accesso eseguito il giorno aprile 16, 2025, <u>https://news.ycombinator.com/item?id=37610816</u>
- 43. Is String Theory Testable Consensus Academic Search Engine, accesso eseguito il giorno aprile 16, 2025, <u>https://consensus.app/questions/string-theory-testable/</u>
- 44. Is String Theory Testable? | Not Even Wrong Columbia Math Department, accesso eseguito il giorno aprile 16, 2025, https://www.math.columbia.edu/~woit/wordpress/?p=533
- 45. Is String Theory Falsifiable? Consensus: AI Search Engine for Research, accesso eseguito il giorno aprile 16, 2025, <u>https://consensus.app/home/blog/is-string-theory-falsifiable/</u>
- 46. Why is String Theory considered to be "un-testable"? : r/askscience Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/askscience/comments/1e8yt0/why is string theory considered to be untestable/
- 47. Contested Boundaries: The String Theory Debates and Ideologies of Science, accesso eseguito il giorno aprile 16, 2025, <u>https://direct.mit.edu/posc/article/23/2/192/15504/Contested-Boundaries-The-</u><u>String-Theory-Debates-and</u>
- 48. Is String Theory testable? : r/askscience Reddit, accesso eseguito il giorno aprile 16, 2025,

https://www.reddit.com/r/askscience/comments/uyfn6/is_string_theory_testable/

- 49. Is String Theory Testable? Columbia Math Department, accesso eseguito il giorno aprile 16, 2025, <u>https://www.math.columbia.edu/~woit/testable.pdf</u>
- 50. Why has it been so hard to come up with testable predictions for string theory?, accesso eseguito il giorno aprile 16, 2025, <u>https://physics.stackexchange.com/questions/772942/why-has-it-been-so-hard-to-come-up-with-testable-predictions-for-string-theory</u>
- 51. String Theory or Loop Quantum Gravity??? (for a physics lover who never got any legitimate education on it) : r/TheoreticalPhysics Reddit, accesso eseguito

il giorno aprile 16, 2025,

https://www.reddit.com/r/TheoreticalPhysics/comments/pnx0ny/string theory or loop quantum gravity for a/

- 52. Which theory do you find yourself siding with more in the physics community: String Theory or Loop Quantum Gravity? : r/AskPhysics - Reddit, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/AskPhysics/comments/1fwms31/which theory do you</u> find yourself siding with/
- 53. Why is Standard Model + Loop Quantum Gravity usually not listed as a theory of everything, accesso eseguito il giorno aprile 16, 2025, <u>https://physics.stackexchange.com/questions/67211/why-is-standard-model-loop-quantum-gravity-usually-not-listed-as-a-theory-of-e</u>
- 54. Aldo Cernuto, A Knowledge-Driven Framework for Fundamental Physics, Intelligence, and Cosmology - PhilPapers, accesso eseguito il giorno aprile 16, 2025, <u>https://philpapers.org/rec/CERAKF</u>
- 55. osf.io, accesso eseguito il giorno aprile 16, 2025, https://osf.io/vr49x_v1/download/?format=pdf
- 56. The Cernuto-Hobbey Theory of Everything (CH-ToE): Structured Knowledge as the Fabric of Reality - PhilArchive, accesso eseguito il giorno aprile 16, 2025, <u>https://philarchive.org/archive/CERAKF</u>
- 57. Search results for `Dianne Toe` PhilArchive, accesso eseguito il giorno aprile 16, 2025, <u>https://philarchive.org/s/Dianne%20Toe</u>
- 58. Results for 'Aldo Cernuto' PhilArchive, accesso eseguito il giorno aprile 16, 2025, <u>https://philarchive.org/s/Aldo%20Cernuto</u>
- 59. Structured Knowledge as the Fabric of Reality: The Cernuto–Hobbey Theory of Everything (CH-ToE) | Sciety Labs (Experimental), accesso eseguito il giorno aprile 16, 2025,

https://labs.sciety.org/articles/by?article_doi=10.31219/osf.io/vr49x_v1

- 60. Aldo Cernuto, A Knowledge-Driven Framework for Fundamental Physics, Intelligence, and Cosmology - PhilArchive, accesso eseguito il giorno aprile 16, 2025, <u>https://philarchive.org/rec/CERAKF</u>
- 61. What is string theory? Space, accesso eseguito il giorno aprile 16, 2025, https://www.space.com/17594-string-theory.html
- 62. String Theory Is Not Dead JSTOR Daily, accesso eseguito il giorno aprile 16, 2025, <u>https://daily.jstor.org/string-theory-is-not-dead/</u>
- 63. String theory and our conceptions of reality Culturico, accesso eseguito il giorno aprile 16, 2025, <u>https://culturico.com/2021/03/22/string-theory-and-our-conceptions-of-reality/</u>
- 64. String theory explained what is the true nature of reality : r/Physics Reddit, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/Physics/comments/81594x/string_theory_explained_w_hat_is_the_true_nature/</u>

- 65. String Theory Explained What is The True Nature of Reality? YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://www.youtube.com/watch?v=Da-2h2B4faU</u>
- 66. A Physicist's Physicist Ponders the Nature of Reality | Quanta Magazine, accesso eseguito il giorno aprile 16, 2025, <u>https://www.quantamagazine.org/edward-witten-ponders-the-nature-of-reality-20171128/</u>
- 67. Black Holes and the Information Paradox in String Theory Institute for Advanced Study, accesso eseguito il giorno aprile 16, 2025, <u>https://www.ias.edu/ideas/2011/maldacena-black-holes-string-theory</u>
- 68. Impact of String Theory GSD Venture Studios, accesso eseguito il giorno aprile 16, 2025, <u>https://www.gsdvs.com/post/impact-of-string-theory</u>
- 69. 10 Potential Uses of String Theory in Our Everyday Lives The Average Scientist, accesso eseguito il giorno aprile 16, 2025, https://theaveragescientist.co.uk/2023/06/13/10-potential-uses-of-string-theoryin-everyday-life-theoretical-physics-in-action/
- 70. What is String Theory? Weaving Perspectives Together KITP UC Santa Barbara, accesso eseguito il giorno aprile 16, 2025, <u>https://www.kitp.ucsb.edu/activities/strings24</u>
- 71. Grand Unified Theory Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Grand_Unified_Theory</u>
- 72. Physicists 'Bootstrap' Validity of String Theory NYU, accesso eseguito il giorno aprile 16, 2025, <u>https://www.nyu.edu/about/news-publications/news/2024/december/physicists--bootstrap--validity-of-string-theory-.html</u>
- 73. String Theory- by Liliana Usvat Mathematics Magazine, accesso eseguito il giorno aprile 16, 2025, https://www.mathematicsmagazine.com/Articles/String_Theory.php
- 74. An Introduction to String Theory Berkeley Math, accesso eseguito il giorno aprile 16, 2025, https://math.berkeley.edu/~kwray/papers/string_theory.pdf
- 75. Mathematics and string theory, accesso eseguito il giorno aprile 16, 2025, https://www.marcosmarino.net/uploads/1/3/3/5/133535336/einaudi.pdf
- 76. What does it mean that string theory is a framework? : r/AskPhysics Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/AskPhysics/comments/rrmp1f/what_does_it_mean_tha_t_string_theory_is_a/
- 77. Loop Quantum Gravity and Nature of Reality. Briefer. AltExploit -WordPress.com, accesso eseguito il giorno aprile 16, 2025, <u>https://altexploit.wordpress.com/2017/03/27/loop-quantum-gravity-and-nature-of-reality-briefer/</u>
- 78. Reality Is Not What We Can See | Montana Public Radio, accesso eseguito il giorno aprile 16, 2025, <u>https://www.mtpr.org/2017-02-01/reality-is-not-what-we-can-see?_amp=true</u>

- 79. Metaphysics of Quantum Gravity Internet Encyclopedia of Philosophy, accesso eseguito il giorno aprile 16, 2025, <u>https://iep.utm.edu/m-quantum-gravity/</u>
- 80. Quantum gravity and the nature of space and time UIC Indigo, accesso eseguito il giorno aprile 16, 2025, https://indigo.uic.edu/ndownloader/files/19282283
- 81. Book Review: Reality Is Not What It Seems The Road to Quantum Gravity, accesso eseguito il giorno aprile 16, 2025, <u>https://softwaredominos.com/home/science-technology-and-other-fascinating-topics/book-review-reality-is-not-what-it-seems-the-road-to-quantum-gravity/</u>
- 82. Quanta, Relativity, and the Nature of Reality Coleman McCormick, accesso eseguito il giorno aprile 16, 2025, <u>https://www.colemanm.org/post/quanta-relativity-and-the-nature-of-reality/</u>
- 83. Very basic questions about loop quantum gravity Physics Stack Exchange, accesso eseguito il giorno aprile 16, 2025, <u>https://physics.stackexchange.com/questions/405798/very-basic-questions-about-loop-quantum-gravity</u>
- 84. Information loss, made worse by quantum gravity? Frontiers, accesso eseguito il giorno aprile 16, 2025, <u>https://www.frontiersin.org/journals/physics/articles/10.3389/fphy.2015.00033/ful</u>
- 85. [2302.05922] Loop Quantum Gravity and Quantum Information arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/2302.05922</u>
- 86. Unitarity and Information in Quantum Gravity: A Simple Example Frontiers, accesso eseguito il giorno aprile 16, 2025, <u>https://www.frontiersin.org/journals/astronomy-and-space-sciences/articles/10.3389/fspas.2021.604047/full</u>
- 87. (PDF) Quantum information in loop quantum gravity ResearchGate, accesso eseguito il giorno aprile 16, 2025, <u>https://www.researchgate.net/publication/1970492_Quantum_information_in_lo</u> op_quantum_gravity
- 88. Quantum information in loop quantum gravity Inspire HEP, accesso eseguito il giorno aprile 16, 2025, <u>https://inspirehep.net/literature/700299</u>
- 89. Loop Quantum Gravity and Quantum Information YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://www.youtube.com/watch?v=xoA5dh-ONxU</u>
- 90. [gr-qc/0512072] Quantum information in loop quantum gravity arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/gr-qc/0512072</u>
- 91. Can someone please give the simplest (as possible) explanation of Loop Quantum Gravity?, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/askscience/comments/1lbr4t/can_someone_please_giv</u> <u>e_the_simplest_as_possible/</u>
- 92. Loop Quantum Gravity: The First 30 Years CERN Courier, accesso eseguito il giorno aprile 16, 2025, <u>https://cerncourier.com/a/loop-quantum-gravity-the-first-30-years/</u>

- 93. Loop Quantum Gravity vs. String Theory: Can Either Truly Explain the Universe?, accesso eseguito il giorno aprile 16, 2025, https://www.davidmaiolo.com/2024/10/22/loop-quantum-gravity-vs-string-theory/
- 94. Quantum gravity Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Quantum_gravity</u>
- 95. Unifying gravity and quantum mechanics without the need for quantum gravity -Physics World, accesso eseguito il giorno aprile 16, 2025, <u>https://physicsworld.com/a/unifying-gravity-and-quantum-mechanics-without-the-need-for-quantum-gravity/</u>
- 96. String Theory and Loop Quantum Gravity Dummies.com, accesso eseguito il giorno aprile 16, 2025, <u>https://www.dummies.com/article/academics-the-arts/science/physics/string-theory-and-loop-quantum-gravity-177738/</u>
- 97. Why is gravity so hard to unify with the other 3 fundamental forces?, accesso eseguito il giorno aprile 16, 2025, https://physics.stackexchange.com/questions/55213/why-is-gravity-so-hard-tounify-with-the-other-3-fundamental-forces
- 98. Why are we trying to unify gravity with quantum theory? : r/AskPhysics Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/AskPhysics/comments/17xpmq9/why are we trying t o unify gravity with quantum/
- 99. An Introduction to the Mathematics of Loop Quantum Gravity Imperial College London, accesso eseguito il giorno aprile 16, 2025, <u>https://www.imperial.ac.uk/media/imperial-college/research-centres-and-groups/theoretical-physics/msc/dissertations/2022/Daniel-Portal-Dissertation.pdf</u>
- 100. [2201.09143] Quantum Geometry II : The Mathematics of Loop Quantum Gravity Three dimensional quantum gravity - arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/2201.09143</u>
- 101. A short review of loop quantum gravity, accesso eseguito il giorno aprile 16, 2025, <u>https://par.nsf.gov/servlets/purl/10280385</u>
- 102. Mathematical structure of loop quantum cosmology Project Euclid, accesso eseguito il giorno aprile 16, 2025, <u>https://projecteuclid.org/journals/advances-in-</u> <u>theoretical-and-mathematical-physics/volume-7/issue-2/Mathematical-structure-</u> <u>of-loop-quantum-cosmology/atmp/1112627633.pdf</u>
- 103. Benefits and Flaws of Loop Quantum Gravity Dummies.com, accesso eseguito il giorno aprile 16, 2025, <u>https://www.dummies.com/article/academics-</u> <u>the-arts/science/physics/benefits-and-flaws-of-loop-quantum-gravity-177740/</u>
- 104. How to test quantum gravity Sabine Hossenfelder: Backreaction, accesso eseguito il giorno aprile 16, 2025, http://backreaction.blogspot.com/2020/01/how-to-test-quantum-gravity.html

105. A Review of Loop Quantum Gravity - Imperial College London, accesso eseguito il giorno aprile 16, 2025, <u>https://www.imperial.ac.uk/media/imperialcollege/research-centres-and-groups/theoretical-</u> <u>physics/msc/dissertations/2021/Hongyi-Wan-Dissertation.pdf</u>

- 106. A Test for Loop Quantum Gravity Futurism, accesso eseguito il giorno aprile 16, 2025, <u>https://futurism.com/a-test-for-loop-quantum-gravity</u>
- 107. [2012.08785] Testing loop quantum gravity from observational consequences of non-singular rotating black holes arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/2012.08785</u>
- 108. Loop Quantum Gravity falsified? Physics Stack Exchange, accesso eseguito il giorno aprile 16, 2025, https://physics.stackexchange.com/guestions/601476/loop-guantum-gravity-

falsified

- 109. Wrong or Unfalsifiable? String Theory's Biggest Competitor in Trouble -YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://www.youtube.com/watch?v=ZIHvW6k2bcM</u>
- 110. The "Theory Of Everything": Quantum Gravity The Journal of Young Physicists, accesso eseguito il giorno aprile 16, 2025, <u>https://www.journalofyoungphysicists.org/post/the-theory-of-everythingquantum-gravity</u>
- 111. Why Theories of Everything Are III-Conceived Nautilus Magazine, accesso eseguito il giorno aprile 16, 2025, <u>https://nautil.us/why-theories-of-everything-are-ill_conceived-236400/</u>
- 112. Grand Unified Theory (Principles of Physics III) Vocab, Definition, Explanations | Fiveable, accesso eseguito il giorno aprile 16, 2025, <u>https://library.fiveable.me/key-terms/principles-physics-iii-thermal-physics-waves/grand-unified-theory</u>
- 113. Grand unified theory (Principles of Physics IV) Vocab, Definition, Explanations | Fiveable, accesso eseguito il giorno aprile 16, 2025, https://fiveable.me/key-terms/principles-of-physics-iv/grand-unified-theory
- 114. Grand Unified Theories the physics detective, accesso eseguito il giorno aprile 16, 2025, <u>https://physicsdetective.com/grand-unified-theories/</u>
- 115. Unified field theory Wikipedia, accesso eseguito il giorno aprile 16, 2025, https://en.wikipedia.org/wiki/Unified_field_theory
- 116. Grand Unified Theory | Encyclopedia.com, accesso eseguito il giorno aprile 16, 2025, <u>https://www.encyclopedia.com/science-and-technology/astronomy-and-space-exploration/astronomy-general/grand-unified-theory</u>
- 117. A Brief History of the Grand Unified Theory of Physics Nautilus Magazine, accesso eseguito il giorno aprile 16, 2025, <u>https://nautil.us/a-brief-history-of-the-grand-unified-theory-of-physics-236493/</u>
- 118. Unified field theories Caltech Authors, accesso eseguito il giorno aprile 16, 2025, <u>https://authors.library.caltech.edu/records/kcaqa-d0h88/latest</u>
- 119. How physics at the roots of reality point to a grand unified theory | Aeon Essays, accesso eseguito il giorno aprile 16, 2025, <u>https://aeon.co/essays/how-physics-at-the-roots-of-reality-point-to-a-grand-unified-theory</u>
- 120. fiveable.me, accesso eseguito il giorno aprile 16, 2025, <u>https://fiveable.me/key-terms/principles-of-physics-iv/grand-unified-</u>

theory#:~:text=Grand%20unified%20theories%20predict%20that,interactions%20between%20quarks%20and%20leptons.

- 121. Why Achieving a Grand Unified Theory in Physics Remains a Daunting Challenge, accesso eseguito il giorno aprile 16, 2025, <u>https://99science.org/2024/05/24/why-achieving-a-grand-unified-theory-in-physics-remains-a-daunting-challenge/</u>
- 122. What Is The Grand Unified Theory? Physics Frontier YouTube, accesso eseguito il giorno aprile 16, 2025, https://www.youtube.com/watch?v=bni3MLQZFZU
- 123. Unified field theory | Einstein's Theory of Relativity Britannica, accesso eseguito il giorno aprile 16, 2025, <u>https://www.britannica.com/science/unified-field-theory</u>
- 124. A grand unified theory for the unification of physics, life, information and cognition (mind) | Philosophical Transactions of the Royal Society A Journals, accesso eseguito il giorno aprile 16, 2025, https://royalsocietypublishing.org/doi/10.1098/rsta.2022.0277
- 125. Al's Quest for a Grand Unification Theory | Psychology Today, accesso eseguito il giorno aprile 16, 2025, <u>https://www.psychologytoday.com/us/blog/the-digital-self/202405/ais-quest-for-</u> a-grand-unification-theory
- 126. Cosmic Evolution Epoch 1 Particle Evolution Harvard CfA, accesso eseguito il giorno aprile 16, 2025, <u>https://lweb.cfa.harvard.edu/~ejchaisson/cosmic_evolution/docs/text/text_part_5</u> <u>.html</u>
- 127. Psychology's Grand Unified Theory, accesso eseguito il giorno aprile 16, 2025, <u>https://www.psychologytoday.com/us/blog/theory-</u> <u>knowledge/201702/psychologys-grand-unified-theory</u>
- 128. A long way from everything: The search for a Grand Unified Theory New Atlas, accesso eseguito il giorno aprile 16, 2025, <u>https://newatlas.com/einstein-guantum-field-theory-relativity-gravity/42389/</u>
- 129. Grand Unification Theories And Supersymmetry | EBSCO Research Starters, accesso eseguito il giorno aprile 16, 2025, <u>https://www.ebsco.com/research-starters/physics/grand-unification-theories-and-supersymmetry</u>
- 130. Grand Unified Theory | AMNH, accesso eseguito il giorno aprile 16, 2025, <u>https://www.amnh.org/exhibitions/einstein/legacy/grand-unified-theory</u>
- 131. The Algebra of Grand Unified Theories Department of Mathematics, accesso eseguito il giorno aprile 16, 2025, <u>https://math.ucr.edu/home/baez/guts.pdf</u>

132. Why do we need complex representations in Grand Unified Theories?, accesso eseguito il giorno aprile 16, 2025, <u>https://physics.stackexchange.com/questions/178658/why-do-we-needcomplex-representations-in-grand-unified-theories</u>

- 133. Editorial Briefing Unification theories and a theory of everything -AccessScience, accesso eseguito il giorno aprile 16, 2025, <u>https://www.accessscience.com/content/briefing/aBR0814141</u>
- 134. What is the Grand Unified Theory? : r/askscience Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/askscience/comments/4joarm/what_is_the_grand_unified_theory/
- 135. en.wikipedia.org, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Grand_Unified_Theory#:~:text=A%20Grand%20Uni_fied%20Theory%20(GUT,GUT%20models%20theorize%20its%20existence.</u>
- 136. Unification of the Fundamental Forces, accesso eseguito il giorno aprile 16, 2025,

http://csep10.phys.utk.edu/OJTA2dev/ojta/c2c/early/inflationary/cosmology_tl.ht ml

- 137. Grand Unified Theories (GUTs) | Particle Physics Class Notes Fiveable, accesso eseguito il giorno aprile 16, 2025, <u>https://library.fiveable.me/particle-physics/unit-11/grand-unified-theories-guts/study-guide/6weT6uYYBw2PRDFq</u>
- 138. Unification of Forces HyperPhysics, accesso eseguito il giorno aprile 16, 2025, <u>http://hyperphysics.phy-astr.gsu.edu/hbase/Forces/unify.html</u>
- 139. Unifying theories in mathematics Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Unifying_theories_in_mathematics</u>
- 140. Progress towards a Grand Unified Theory of Mathematics ThatsMaths, accesso eseguito il giorno aprile 16, 2025, <u>https://thatsmaths.com/2024/08/15/progress-towards-a-grand-unified-theory-of-mathematics/</u>
- 141. [0904.1556] The Algebra of Grand Unified Theories arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/0904.1556</u>
- 142. The Algebra of Grand Unified Theories II | The n-Category Café, accesso eseguito il giorno aprile 16, 2025, <u>https://golem.ph.utexas.edu/category/2009/03/the_algebra_of_grand_unified_t_</u> 1.html
- 143. Towards a Grand Unified Theory of Mathematics and Physics Columbia Math Department, accesso eseguito il giorno aprile 16, 2025, https://www.math.columbia.edu/~woit/mathphys.pdf
- 144. A Mathematical Construction of an E6 Grand Unified Theory, accesso eseguito il giorno aprile 16, 2025, <u>https://www.theorie.physik.uni-</u> <u>muenchen.de/TMP/theses/thesisbritto.pdf</u>
- 145. One Step Closer to a 'Grand Unified Theory of Math': Geometric Langlands -YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://www.youtube.com/watch?v=xuLCPv6smwo</u>
- 146. [2102.13465] A Mathematical Construction of an E6 Grand Unified Theory arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/2102.13465</u>

- 147. Testability and the Unity of Science PhilSci-Archive, accesso eseguito il giorno aprile 16, 2025, <u>https://philsci-archive.pitt.edu/17389/1/2004%20-</u> %20Testability%20and%20the%20Unity%20of%20Science%20-%20Roush.pdf
- 148. grand unified theories, accesso eseguito il giorno aprile 16, 2025, https://lss.fnal.gov/conf/C810824/p823.pdf
- 149. [1506.02293] Higher order proton lifetime estimates in grand unified theories arXiv, accesso eseguito il giorno aprile 16, 2025, https://arxiv.org/abs/1506.02293
- 150. Why is String Theory 'untestable'? What would need to happen for it to become testable? : r/askscience Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/askscience/comments/ya3z0/why is string theory unt estable what would need/
- 151. Model Building and Phenomenology in Grand Unified Theories UCL Discovery, accesso eseguito il giorno aprile 16, 2025, https://discovery.ucl.ac.uk/1471160/
- 152. [2209.00021] A Predictive and Testable Unified Theory of Fermion Masses, Mixing and Leptogenesis - arXiv, accesso eseguito il giorno aprile 16, 2025, https://arxiv.org/abs/2209.00021
- 153. GRAND UNIFIED THEORIES Inspire HEP, accesso eseguito il giorno aprile 16, 2025, <u>https://inspirehep.net/literature/155726</u>
- 154. Unified forces CERN, accesso eseguito il giorno aprile 16, 2025, https://www.home.cern/science/physics/unified-forces
- 155. The Theory of Everything Why is a Unified Version of Physics so Important -YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://m.youtube.com/watch?v=FZSoMhBCBts&pp=ygUKI29mcGh5c2ljcw%3D</u> %3D
- 156. Could scientists test a theory of everything? Worldbuilding Stack Exchange, accesso eseguito il giorno aprile 16, 2025, <u>https://worldbuilding.stackexchange.com/questions/113819/could-scientists-test-</u> <u>a-theory-of-everything</u>
- 157. www.scirp.org, accesso eseguito il giorno aprile 16, 2025, <u>https://www.scirp.org/journal/paperinformation?paperid=124651#:~:text=The%2</u> <u>Ogolden%20ratio%20is%20the%20relationship%20between%20the%20loop%2</u> <u>Oquantum,highest%20likelihood%20non%2Dtrivial%20eigenvalues.</u>
- 158. The Golden Ratio in Nature Overview Quantum Gravity Research, accesso eseguito il giorno aprile 16, 2025, <u>https://quantumgravityresearch.org/golden-ratio-in-nature-overview/</u>
- 159. Here is a Hypothesis : Zero Isn't Just "Nothing"—It Contains the Golden Ratio, and Euler's Identity Might Be Missing This Hidden Structure. : r/HypotheticalPhysics - Reddit, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/HypotheticalPhysics/comments/1j2dv29/here_is_a_hyp_othesis_zero_isnt_just_nothingit/</u>

- 160. Quantum Gravity, Reality and the Golden Ratio, accesso eseguito il giorno aprile 16, 2025, <u>https://www.goldennumber.net/quantum-gravity-reality-golden-ratio/</u>
- 161. Golden Ratio Geometry and the Fine-Structure Constant | JOURNAL OF ADVANCES IN PHYSICS, accesso eseguito il giorno aprile 16, 2025, https://rajpub.com/index.php/jap/article/view/8469
- 162. Michael A. Sherbon, Golden Ratio Geometry and the Fine-Structure Constant -PhilArchive, accesso eseguito il giorno aprile 16, 2025, https://philarchive.org/rec/SHEGRG
- 163. The Second Law and Entropy Misconceptions Demystified PMC, accesso eseguito il giorno aprile 16, 2025,

https://pmc.ncbi.nlm.nih.gov/articles/PMC7517180/

- 164. Entropy and the Second Law of Thermodynamics: Disorder and the Unavailability of Energy | Physics - Lumen Learning, accesso eseguito il giorno aprile 16, 2025, <u>https://courses.lumenlearning.com/suny-physics/chapter/15-6entropy-and-the-second-law-of-thermodynamics-disorder-and-the-unavailabilityof-energy/</u>
- 165. occam.com.ua, accesso eseguito il giorno aprile 16, 2025, <u>https://occam.com.ua/physics-structure-</u> <u>formation/#:~:text=A%20system%20can%20be%20called,is%20diagnosed%20</u> <u>by%20increasing%20entropy.</u>
- 166. The physics of structure formation OCCAM, accesso eseguito il giorno aprile 16, 2025, <u>https://occam.com.ua/physics-structure-formation/</u>
- 167. Entropy and life Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Entropy_and_life</u>
- 168. [2409.20331] On the Structure of Information arXiv, accesso eseguito il giorno aprile 16, 2025, <u>https://arxiv.org/abs/2409.20331</u>
- 169. Understanding Entropy in Information Theory: Simplifying Data Complexity, accesso eseguito il giorno aprile 16, 2025, <u>https://www.numberanalytics.com/blog/understanding-entropy-information-theory-data-complexity</u>
- 170. Entropy in thermodynamics and information theory Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Entropy_in_thermodynamics_and_information_theo</u> ry
- 171. Entropy (information theory) Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Entropy (information_theory)</u>
- 172. Entropy (Information Theory) | Brilliant Math & Science Wiki, accesso eseguito il giorno aprile 16, 2025, <u>https://brilliant.org/wiki/entropy-information-theory/</u>
- 173. String Theory vs Loop Quantum Gravity: A Comparison Ejtp, accesso eseguito il giorno aprile 16, 2025, <u>https://www.ejtp.com/string-theory-vs-loopquantum-gravity/</u>

- 174. A theory of everything | Astronomy.com, accesso eseguito il giorno aprile 16, 2025, <u>https://www.astronomy.com/science/a-theory-of-everything/</u>
- 175. What are your theories about the nature of reality? Here's mine. : r/INTP -Reddit, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/INTP/comments/hfzesg/what are your theories about</u> <u>the nature of/</u>
- 176. DOE Explains...Cosmology | Department of Energy, accesso eseguito il giorno aprile 16, 2025, <u>https://www.energy.gov/science/doe-explainscosmology</u>
- 177. Cosmological principle Wikipedia, accesso eseguito il giorno aprile 16, 2025, <u>https://en.wikipedia.org/wiki/Cosmological_principle</u>
- 178. Philosophy of Cosmology, accesso eseguito il giorno aprile 16, 2025, https://plato.stanford.edu/entries/cosmology/
- 179. Cosmology and Culture UC Santa Cruz Physics Department, accesso eseguito il giorno aprile 16, 2025, https://physics.ucsc.edu/cosmo/primack_abrams/COSMO.HTM
- 180. Setting the Stage for the Big Bang: Key Concepts in Cosmology YouTube, accesso eseguito il giorno aprile 16, 2025, https://www.youtube.com/watch?v=io8sdMWsoWs
- 181. Theoretical Physics Simply Explained! YouTube, accesso eseguito il giorno aprile 16, 2025, <u>https://www.youtube.com/watch?v=_qK-</u> <u>u0HGhoM&pp=0gcJCfcAhR29_xXO</u>
- 182. Theoretical physics Wikipedia, accesso eseguito il giorno aprile 16, 2025, https://en.wikipedia.org/wiki/Theoretical_physics
- 183. Mathematical and theoretical physics feasibility demonstration of the finite nine dimensional vortical model in fermions | Request PDF ResearchGate, accesso eseguito il giorno aprile 16, 2025,

https://www.researchgate.net/publication/285852240 Mathematical and theore tical physics feasibility demonstration of the finite nine dimensional vortical model in fermions

- 184. Beauty and the sublime in physics Theos Think Tank Understanding faith. Enriching society., accesso eseguito il giorno aprile 16, 2025, <u>https://www.theosthinktank.co.uk/comment/2023/02/02/beauty-and-the-sublime-in-physics</u>
- 185. David Tong -- Concepts in Theoretical Physics University of Cambridge, accesso eseguito il giorno aprile 16, 2025, https://www.damtp.cam.ac.uk/user/tong/concepts.html
- 186. Consciousness, Reality, and the Infinite Fractal: The Theory of Everything -Reddit, accesso eseguito il giorno aprile 16, 2025, <u>https://www.reddit.com/r/Metaphysics/comments/1ifwa8o/consciousness_reality</u> and the infinite fractal/
- 187. The Nature of Reality | Rationalising The Universe, accesso eseguito il giorno aprile 16, 2025, <u>https://rationalisingtheuniverse.org/2016/08/04/the-nature-of-reality/</u>

188. Untitled - ICDST E-print archive of engineering and scientific PDF, accesso eseguito il giorno aprile 16, 2025,

https://dl.icdst.org/pdfs/files3/f666165216e8d6f92c78b3d15bf52b54.pdf

- 189. Information Theory Multisense Realism, accesso eseguito il giorno aprile 16, 2025, <u>https://multisenserealism.com/thesis/a-new-theory-of-information/</u>
- 190. OAI Archive Information PhilPapers, accesso eseguito il giorno aprile 16, 2025, <u>https://philpapers.org/archives/view.pl?id=2603</u>
- 191. How rough is the MechE to Embedded Systems transition? Reddit, accesso eseguito il giorno aprile 16, 2025, https://www.reddit.com/r/embedded/comments/1buwiq0/how rough is the mec
- he to embedded systems/ 192. Management-Stephen.P Robbins.pdf, accesso eseguito il giorno aprile 16, 2025.

https://elearn.daffodilvarsity.edu.bd/pluginfile.php/925812/mod_resource/content /3/Management-Stephen.P%20Robbins.pdf

- 193. Theory of Everything, Theory of Nothing: On Physics and Other Profanities -Literary Hub, accesso eseguito il giorno aprile 16, 2025, <u>https://lithub.com/theory-of-everything-theory-of-nothing-on-physics-and-other-profanities/</u>
- 194. (PDF) The Theory of Everything Simplified ResearchGate, accesso eseguito il giorno aprile 16, 2025,

https://www.researchgate.net/publication/384200785 The Theory of Everythin g Simplified

6 Information-Limited Subrealities - The Scientist and Engineer's Guide to Digital Signal Processing, accesso eseguito il giorno aprile 16, 2025,

http://www.dspguide.com/InnerLightTheory/innerlight6.pdf