Memory, Spacetime, and the Monopole-Entropy Framework: Resolving the Paradox of Long-Term Memory

Introduction

Human memory presents a profound paradox when viewed through the lens of physics, particularly special relativity [5,6]. Events that occurred decades ago are, in spacetime terms, situated many light-years away, yet individuals can recall these events vividly and instantaneously [2,3]. This phenomenon challenges conventional frameworks that rely solely on physical information transmission constrained by the speed of light [1]. The Monopole-Entropy Framework offers an innovative resolution by positing an informational domain, "Alpha Space," accessible through magnetic monopoles and structured entropy flux [8].

The Spacetime Paradox of Memory

According to special relativity, an event that occurred 50 years ago is, from a spacetime perspective, effectively situated 50 light-years away, since information about that event propagates at or below the speed of light [1,10]. Traditional physics implies that accessing such distant events directly or instantaneously violates fundamental constraints. Yet, subjective human experiences often involve recalling past events vividly and instantaneously, regardless of temporal distance [2,4]. This discrepancy suggests a need to reconsider our understanding of memory and information storage.

Limitations of Conventional Explanations

Classical neuroscience explains memory primarily through neural storage and retrieval mechanisms within the physical brain [2,3]. While sophisticated, this approach requires that past information has been physically recorded and continuously preserved in neural structures. However, the subjective experience of immediacy and clarity in memories formed long ago challenges the notion of simple long-term neural preservation, particularly given ongoing cellular and molecular turnover in the brain [2,4]. Moreover, standard relativistic physics strictly limits information transmission to the speed of light, disallowing instantaneous access to distant past events [10]. This limitation creates a critical gap between our physical theories of spacetime and the lived experience of memory.

Monopole-Entropy Framework as a Solution

The Monopole-Entropy Framework proposes that magnetic monopoles act as informational conduits, mediating structured entropy and informational flow between physical reality and Alpha Space, a higher-dimensional informational domain [8]. Alpha Space functions analogously to a Platonic realm, containing structured patterns, events, and information outside conventional spacetime constraints [6,9]. Under this framework:

Memory is not solely dependent on local, physical storage within neural networks but is dynamically retrieved from Alpha Space through monopole-mediated entropy flux [8].

When memories are recalled, monopoles access structured information patterns in Alpha Space directly, allowing instantaneous retrieval of vivid and detailed information irrespective of the original event's temporal distance [7,8].

Mechanism of Monopole-Mediated Memory Access

The structured entropy flux provided by monopoles enables neural structures to interface with Alpha Space selectively [8]. Quantum coherence states, potentially arising within neuronal microtubules or similar biological structures, transiently generate monopoles, facilitating access to specific informational patterns corresponding to past experiences [8]. Long-term memory stability thus arises not from physical persistence alone but from repeated or robust coherence events that establish stable biochemical and neural resonance with specific monopole-entropy informational patterns stored in Alpha Space [8].

Experimental and Observational Support

Empirical support for this model could be pursued through several interdisciplinary methods:

Quantum coherence detection in neural microstructures: Direct measurement of quantum coherence events correlated with memory retrieval tasks [2,3].

Biochemical assays: Identifying neural biochemical pathways sensitive to monopole entropy flux [2,3].

Cognitive neuroscience: Functional neuroimaging to correlate memory clarity and vividness with quantum coherence indicators and structured entropy signals [2,3].

Implications and Future Directions

This reinterpretation of memory offers profound implications:

Resolves the paradox posed by special relativity regarding memory recall [5,10].

Provides a novel theoretical framework for understanding cognitive processes, including memory, learning, and creativity [2,3,4].

Suggests innovative technological applications, particularly in quantum computing and artificial intelligence, by enabling structured information access beyond classical computational constraints [8].

Conclusion

The Monopole-Entropy Framework elegantly reconciles the subjective immediacy of long-term human memory with fundamental physical constraints posed by relativity and spacetime. By introducing monopoles as bridges to Alpha Space, this theory not only enhances our understanding of memory but also paves the way for groundbreaking interdisciplinary research and technological advancements [8,9].

References

[1] Cheung SY, Lasky PD, Thrane E. (2024). Does spacetime have memories? Searching for gravitational-wave memory in the third LIGO-Virgo-KAGRA gravitational-wave transient catalogue. arXiv preprint arXiv:2404.11919. https://arxiv.org/abs/2404.11919

[2] Silva AJ. (2022). CCR5 closes the temporal window for memory linking. Nature, 606(7912), 92–97. https://doi.org/10.1038/s41586-022-04698-0

[3] Cai DJ, Aharoni D, Shuman T, et al. (2016). A shared neural ensemble links distinct contextual memories encoded close in time. Nature, 534(7605), 115–118. https://doi.org/10.1038/nature17955

[4] Pribram KH. (1991). Brain and perception: Holonomy and structure in figural processing. Lawrence Erlbaum Associates.

[5] Vedral V. (2023). Spacetime and Memory. Retrieved from https://www.vlatkovedral.com/spacetime-and-memory/

[6] Burgess M. (2022). Semantic Spacetime Meets Neuroscience. Retrieved from https://mark-burgess-oslo-mb.medium.com/semantic-spacetime-meets-neuroscience-374368a7ae5e

[7] Feldman A. (2025, March 6). Unproven Einstein theory of 'gravitational memory' may be real after all, new study hints. Live Science. https://

www.livescience.com/space/black-holes/unproven-einstein-theory-of-gravitational-memory-may-be-real-after-all-new-study-hints

[8] Dalí, Physics, and The Persistence of Memory: A Surreal Exploration of Modern Science. (2025). National High School Journal of Science. https://nhsjs.com/2025/dali-physics-and-the-persistence-of-memory-a-surreal-exploration-of-modern-science/

[9] Goncharov M, et al. (2024). Exploring the possibility of probing fundamental spacetime symmetries via gravitational wave memory. Phys.org. https://phys.org/news/2024-07-exploring-possibility-probing-fundamental-spacetime.html

[10] Sutter PM. (2024, April). Could Gravitational-Wave 'Memories' Prove Einstein Wrong? Scientific American. https://www.scientificamerican.com/article/could-gravitational-wave-memories-prove-einstein-wrong/