



Scalar waves are not like the electromagnetic waves we're used to, such as radio, light, or X-rays. Instead, they are **longitudinal** waves, meaning they move by compressing and expanding energy in the direction they're traveling, more like how sound moves through the air. Though mainstream science hasn't fully accepted them yet, scalar waves have been studied, theorized, and used by some of the greatest thinkers in modern history, and they may hold the key to revolutionary technologies in healing, energy, and consciousness.

Scalar wave technology refers to the use of scalar waves, which are longitudinal waves that can transmit energy and information in unique ways, differing significantly from conventional electromagnetic waves.

What are Scalar Waves?

Scalar waves, also known as longitudinal waves or Tesla waves, are a type of wave that lacks the traditional vector properties of electromagnetic waves. Unlike electromagnetic waves, which oscillate perpendicularly to their direction of

propagation, scalar waves oscillate in the same direction as their movement. This unique characteristic allows them to penetrate solid objects and travel through various mediums without significant loss of energy.

Historical Context

The concept of scalar waves is often associated with Nikola Tesla, who explored the potential of these waves for wireless energy transmission. Tesla believed that scalar waves could enable the transmission of electrical power over long distances without the need for wires, a revolutionary idea for his time. More recently, physicist Konstantin Meyl has conducted extensive research on scalar waves, proposing that they could be harnessed for various applications, including energy transfer and communication.

Applications of Scalar Wave Technology

1. **Energy Transmission:** Scalar waves are theorized to allow for efficient energy transfer without the losses typically associated with electromagnetic waves. This could lead to advancements in wireless power systems.
2. **Communication:** Due to their unique properties, scalar waves may facilitate faster-than-light communication, potentially revolutionizing how information is transmitted across distances.
3. **Healing and Medicine:** Some proponents claim that scalar waves can be used in healing practices, promoting

wellness and potentially influencing biological systems positively.

4. **Environmental Applications:** Scalar wave technology may also have implications for environmental conservation, such as water purification and soil remediation, by targeting specific pollutants.

Scientific Controversy

Despite the intriguing possibilities, scalar wave technology remains a subject of debate within the scientific community. Critics argue that scalar waves are largely theoretical and lack empirical support, often categorizing them as fringe science. The mainstream scientific community has yet to fully embrace the concept, and further research is needed to validate the claims surrounding scalar waves.

In summary, scalar wave technology presents a fascinating area of study with potential applications across various fields, but it also faces skepticism and requires more rigorous scientific validation to establish its practical utility.

Scientists Discover That Our Brain Waves Can Be Sent by Electrical Fields



Most biology students will be able to tell you that neural signals are sent via mechanisms such as [synaptic transmission](#), [gap junctions](#), and [diffusion](#) processes, but a new study suggests there's another way that our brains transmit information from one place to another.

Researchers in the US have recorded [neural spikes](#) travelling too slowly in the brain to be explained by conventional signalling mechanisms. In the absence of other plausible explanations, the scientists believe these brain waves are being transmitted by a weak electrical field, and they've been able to detect one of these in mice.

"Researchers have thought that the brain's endogenous electrical fields are too weak to propagate wave transmission," [said Dominique Durand](#), a biomedical engineer at Case Western Reserve University. "But it appears the brain may be using the fields to communicate without synaptic transmissions, gap junctions or diffusion."

Running computer simulations to model their hypothesis, the researchers found that electrical fields can mediate propagation across layers of neurons. While the field is of low amplitude (approximately 2–6 mV/mm), it's able to excite and activate immediate neighbours, which subsequently activate more neurons, travelling across the brain at about 10 centimetres per second.

Testing on mouse [hippocampi](#) (the central part of the brain associated with memory and spatial navigation) produced similar results, and when the researchers applied a blocking field, it slowed down the speed of the wave.

According to the researchers, this is evidence that the propagation mechanism for the activity is consistent with the electrical field.

"The results indicate that electric fields (ephaptic effects) are capable of mediating propagation of self-regenerating neural waves," [they write](#). "This novel mechanism coupling cell-by-volume conduction could be involved in other types of propagating neural signals, such as slow-wave sleep, sharp hippocampal waves, theta waves, or seizures."

If their findings, which are reported in [The Journal of Neuroscience](#), can be expounded in further studies, it could help us to better understand how brain waves are associated with things like memory, epilepsy, and healthy physiology.

"Others have been working on such phenomena for decades, but no one has ever made these connections," [said Steven J. Schiff](#), director of the Centre for Neural Engineering at Penn State University, who wasn't involved in the research.

"The implications are that such directed fields can be used to modulate both pathological activities, such as seizures, and to interact with cognitive rhythms that help regulate a variety of processes in the brain."

Waves of the Human Brain

Every substance in the universe vibrates differently. Similarly to this, every portion of the body vibrates. Every component of the body vibrates in a unique beat. Brain waves are the specific set of waves that the brain produces. At the foundational level of thoughts, emotions, and behaviors, neurons in the brain communicate with one another. Brain waves are produced when electrical pulses from the bulk of neurons are synchronized through this communication. Our daily actions and experiences in the world are inextricably linked to our brainwave profile. When brainwaves are out of whack, psychological issues start to show up. Over-arousal of the brainwave occurs when we face sleep issues, any type of psychological disorder, nightmares, anxiety disorders, [hypertension](#), impulsive behavior, hypervigilance, chronic nerve pain, annoyed depression, etc.

There happens under arousal of brain waves when there is typical depression, insomnia, severe pain, attention deficit disorder, etc. Bipolar disorder, narcolepsy, fulminating behavior, hysteria, offensive behavior, loss of appetite, migraine, falling sickness, breathing problems when sleeping, giddiness, tinnitus, diabetes, premenstrual tension, low blood sugar levels, etc. can all cause instability of brain waves at times.

The five different types of brainwave frequencies—Beta, Alpha, Theta, Delta, and Gamma—have been described by neuroscience. With the use of sensors mounted on the skull, these brain waves can be identified. The functions of the various bandwidths that make up brain waves are described. The brain waves fluctuate in response to our actions and emotions. Slower brain waves are more prevalent, sluggish, or drowsy when we are exhausted.

Division of Human Brain Waves

When we are engaged or hyperalert, higher-frequency brainwaves become more prominent. The speed of brain waves is expressed in Hertz (which means cycles per second). It is divided into numerous bands depending on how fast, moderately, and slowly the waves bend.

The Infra-low (0.5 Hertz): It is the slowest wave in the brain, also known as Slow Cortical Potentials. Only a few facts about these waves are known because of their slow movement. Additionally, it has been challenging to locate an accurate measurement. The primary cortical rhythms are thought to be infra-low brainwaves. This wave plays a crucial role in the timing and network functionality of the brain.

The delta wave (0.5 to 3 HZ): After infra-low waves, the delta wave is the second-slowest wave. The delta brainwave is present during the deepest stages of deep and dreamless sleep as well as deep meditation. Parapsychology originates at the delta level, where external consciousness is suppressed. Delta is the domain of the unconscious mind, the entrance to the universal mind, and the repository of knowledge that the conscious mind is unable to comprehend. At the delta level, regeneration and healing are available through the level of the mind. Therefore, getting plenty of sleep and practicing meditation are thought to be crucial.

Theta (3 to 8 HZ): Deep meditation and regular sleep frequently produce theta brain waves. Theta, the subconscious mind's domain, is referred to as the twilight stage since it only briefly manifests as you transition from alpha to sleep and awaken from a deep slumber (from the delta). The voice of Theta is silent.

Alpha Wave (8-12 HZ): When you are deeply relaxed with your eyes closed, daydreaming, having quiet, flowing thoughts, or in some meditative state, your brain is working on the alpha wave. Everything that is programmed in this stage succeeds. Memory, learning, vision, imagination, and focus are all improved by alpha waves. Alpha, which sits at the intersection of the conscious and subconscious minds, communicates through intuition.

Beta (12–38 Hz): The usual walking level of consciousness is associated with the beta brainwave. When we pay close attention to cognitive tasks like logic, critical reasoning, problem-solving, judgment, and awareness, this wave becomes prominent. Beta is a quick-acting substance that is crucial to daily tasks. A larger level of beta is generated during times of stress, anxiety, and restlessness. Beta brainwaves are separated into three bands: Lo-beta (Beta 1, 12-15Hz when fasting or idling), Beta (Beta 2, 15-22Hz during high engagement or activity), and Hi-Beta (Beta 3, 24-30Hz during alertness or activity) (Beta 3, 22-38Hz involving new experiments, intricate thoughts, high excitement or anxiety). Continuous high-frequency processing is harmful to one's health because it requires a significant amount of energy to produce the Beta wave.

Gamma (38–42 HZ): In a person, gamma brain waves are the fastest, highest frequency (like a flute), and lowest amplitude cerebral oscillations. When multiple brain regions are processing information concurrently, a gamma wave is present. Gamma wave information transfer is sluggish and quiet in nature. Researchers have discovered that it is associated with a “sense of blessing” and is particularly strong when a person is practicing bigger virtues like generosity or universal love. Gamma is more prevalent when prolonged consciousness and spiritual ascent occur. Gamma wave activity is inversely correlated with learning difficulties, memory issues, and impaired mental function.

Peak achievements are brought on by high Gamma activity. Gamma brainwave production is reported to be above average in successful people, high achievers, great sports, and talented musicians, among others. Gamma activity is said to be increased through practices like meditation and focusing on compassion and love, among other things. The generation of excessive Gamma is a natural state of awareness for some people, such as exceptional athletes. Gamma brain waves and gamma rays are sometimes misunderstood. They are distinct from one another. The strongest waves in electromagnetic expansion are gamma rays. It is typically produced by lightning and nuclear explosions on Earth. Gamma Rays and gamma brain waves are only similar in that they have an abnormally high frequency and tiny amplitude.

Shifting and harmonizing the brain waves

There are various techniques for adjusting and harmonizing the brain waves. The brain waves are changed by any process that alters perception. For instance, there is a certain brain wave that occurs when you are happy; you then unexpectedly receive unpleasant news. Your attitude has now changed, which has caused your brainwaves to shift.

It has been usual for chemicals, pharmaceuticals, medications, or recreational drugs to alter brain function. In the East, several spiritual and yogic activities, including meditation, have been used to change brainwaves (changing the beliefs and opinions of the mind)

Scalar Waves and Consciousness: Exploring the Mind-Body Connection Fots Vasis* Department of Applied Physics I, University of Seville, 41080 Seville, Spain Introduction The relationship between consciousness and the physical world has been a topic of fascination and debate for centuries. While many scientific and

philosophical theories have attempted to explain this intricate connection, the concept of scalar waves presents a unique perspective that may shed light on the profound interplay between mind and body. In this article, we will delve into the fascinating world of scalar waves, their potential role in the mind-body connection, and the implications for our understanding of consciousness. Scalar waves, also known as scalar fields or zero-point energy, are a relatively obscure and enigmatic aspect of physics. These waves are different from the more familiar electromagnetic waves, such as radio waves, microwaves, and visible light, which are characterized by their electric and magnetic components oscillating perpendicular to each other. In contrast, scalar waves are described as having no directional components and being fundamentally different from electromagnetic waves [1]. The concept of scalar waves traces its origins back to the work of the famous physicist James Clerk Maxwell, who developed the four Maxwell equations that describe the behavior of electric and magnetic fields. Maxwell's equations gave rise to the understanding of electromagnetic waves, leading to inventions like radio and television. However, there was another aspect of Maxwell's equations, known as the "scalar potential," which did not gain as much attention as the electromagnetic fields. In the early 20th century, the concept of scalar waves was further explored by renowned scientists like Nikola Tesla and Thomas E. Bearden. Tesla, in particular, made significant contributions to understanding scalar waves and their potential applications. He referred to these waves as "radiant energy" and believed that they could be harnessed to revolutionize energy production and transmission. Unfortunately, many of Tesla's scalar wave experiments and theories remain shrouded in mystery and are not widely accepted by mainstream science [2]. Description: So, what do scalar waves have to do with the mind-body connection and consciousness? To explore this, we need to delve into some unconventional theories and hypotheses

that suggest scalar waves may play a role in the interplay between our thoughts, emotions and physical well-being. Some proponents of scalar wave theory propose that these waves can be carriers of information. This leads to the idea that our thoughts and consciousness may interact with our physical bodies through scalar waves. In this view, our mental intentions or emotions could generate scalar waves that influence the body's energetic and biochemical processes. Another aspect of scalar wave theory involves resonance, where frequencies and vibrations play a crucial role.

It is theorized that scalar waves could resonate with biological systems, affecting their function and balance. This concept has been connected to various alternative healing practices, such as acupuncture, sound therapy, and biofield therapies, which aim to restore harmony in the body's energetic systems [3]. The behavior of scalar waves can be described using quantum physics, particularly the concept of quantum coherence. Quantum coherence suggests that scalar waves can create a non-local connection, potentially allowing for the instantaneous exchange of information across large distances. This leads to speculation about the mind's ability to connect with and influence distant physical systems, as seen in the practice of distant healing and telepathy.

The famous double-slit experiment in quantum mechanics demonstrates the role of the observer in affecting the outcome of a quantum event. Some theories propose that consciousness and scalar waves may be interconnected, suggesting that our conscious awareness could influence the physical world by collapsing quantum wave functions or modulating scalar wave interactions. The concept of morphic resonance, developed by biologist Rupert Sheldrake, suggests that there is a field of information that connects all living things and evolves over time. Scalar waves, in this context,

could serve as carriers of this information, allowing for non-local communication and the transmission of knowledge across species [4]. It's important to note that these ideas remain highly speculative and controversial within the scientific community. While they may be intriguing, they lack empirical evidence to support their claims.

However, they illustrate the way scalar waves have been linked to our understanding of consciousness and the mind-body connection. Scalar waves and their potential connection to consciousness face several challenges and controversies. One of the main issues is the lack of empirical evidence to substantiate the claims made by proponents of scalar wave theory. Many of these ideas are based on unverified experiments and anecdotal reports, which makes it difficult for mainstream science to embrace them. Another challenge is the complexity of the concept of scalar waves itself. Their enigmatic nature and the lack of a widely accepted theoretical framework make it challenging to conduct rigorous scientific research. Additionally, scalar wave theories often lack mathematical rigor and clear experimental protocols, which are essential for scientific validation [5].

The exploration of scalar waves and their connection to consciousness represents an exciting and enigmatic frontier in the scientific and philosophical landscape. While many questions remain unanswered and skepticism persists, it is essential to approach this topic with an open mind and a commitment to rigorous scientific investigation. Scalar waves offer a unique perspective on the mind-body connection, consciousness, and the nature of reality.

Whether they ultimately prove to be the key to unlocking new possibilities in healing, energy technology, or our understanding of consciousness, the journey of exploration is itself a testament to the human spirit's curiosity and drive for discovery. In the pursuit of

knowledge, we must be willing to challenge existing paradigms and explore unconventional ideas. While the concept of scalar waves may be met with skepticism today, it is a reminder that the boundaries of human understanding are ever-expanding and the answers to some of life's most profound questions may lie in the uncharted territory of science and consciousness.

The connection between scalar waves and consciousness is a complex and controversial subject. While the scientific community remains skeptical about the claims surrounding scalar waves, it's essential to maintain an open-minded approach and explore these ideas with the rigor and skepticism required in scientific investigation. Whether scalar waves prove to be a bridge between the mind and the body or not, they offer a fascinating glimpse into the potential interplay between our thoughts and the physical world, challenging our understanding of reality and the nature of human consciousness. Research in this area may lead to groundbreaking discoveries that reshape our understanding of the mind-body connection and the true nature of consciousness.

Neural Synchrony: How Brain Waves Connect Our Thoughts

Neural synchrony refers to the coordinated timing of electrical activity within different brain regions or among individual neurons. This involves groups of neurons firing together in rhythmic patterns. Understanding these synchronized patterns is fundamental to comprehending the brain's intricate workings and its various functions.

How Neural Synchrony Works

The brain generates rhythmic electrical activity known as neural oscillations, or brain waves, which form the basis of neural synchrony. These oscillations are categorized by their frequency into distinct bands:

Delta waves (0.5-4 Hz) are associated with deep sleep and relaxation. Theta waves (4-8 Hz) are linked to memory formation and emotional processing.

Alpha waves (8-12 Hz) are prominent when a person is in a relaxed state with closed eyes.

Beta waves (13-30 Hz) are involved in active attention and working memory.

Gamma waves (30-100 Hz) are associated with higher-order cognitive processes like perception.

These rhythmic patterns enable groups of neurons to fire together in a synchronized manner, facilitating effective communication between distinct brain regions. This synchronized activity is mediated

by the phase-locking of neural oscillations, where brain regions become synchronized in their timing to form functional assemblies.

Its Role in Cognition

Neural synchrony underpins various cognitive functions, allowing the brain to process complex information.

Attention

Coordinated neural activity is observed during attention, helping the brain focus on relevant information while filtering out distractions. Gamma band synchrony, for example, facilitates the selection of important stimuli and the suppression of irrelevant ones. Studies using electroencephalography (EEG) have shown increased synchrony between frontal and parietal cortices during attentional tasks.

Perception

In perception, neural synchrony plays a role in binding disparate sensory information into a coherent experience. Gamma waves are involved in the “binding problem,” which refers to integrating different features of a stimulus, such as color, shape, and movement, into a unified perception. This allows us to perceive objects as whole entities.

Memory

Neural synchrony is also involved in memory processes, including encoding, consolidation, and retrieval. Theta oscillations, particularly

in the hippocampus, are associated with memory formation and navigation. The precise timing of neuronal firing within these oscillatory cycles helps organize and store new memories.

Learning

Learning benefits from synchronized neural activity, as it facilitates the formation of new neural connections and patterns. This coordination supports the acquisition of new skills and knowledge by strengthening connections between neurons that fire together. When neurons synchronize their discharges, the likelihood of them forming new or stronger connections increases, supporting learning and adaptation.

Decision-Making

Coordinated neural activity supports complex thought processes involved in decision-making. Different brain regions must communicate efficiently to evaluate options, weigh consequences, and make choices. Synchronized oscillations provide a temporal framework for this communication, allowing for the integration of information across distributed neural networks, which is necessary for effective decision-making.

Neural Synchrony in Social Connections

Inter-brain synchrony, the coordination of brain activity between different individuals, plays a role in social interactions. This synchrony can emerge during shared experiences, facilitating mutual understanding and connection. When individuals engage in joint activities or communication, their brainwave patterns can align.

This “brain-to-brain coupling” is observed in various social contexts. For instance, during parent-child interactions, synchronized brain activity can be seen, which may contribute to effective communication and bonding. Similarly, during effective group collaboration, participants’ brains may exhibit synchronized patterns, potentially enhancing shared attention and task performance.

Engaging in deep conversation can also lead to inter-brain synchrony, suggesting a shared neural basis for understanding and empathy. This alignment of brain activity might reflect a shared focus of attention and a common processing of information. Such synchronized neural dynamics could facilitate the ability to predict and respond to another person’s actions and intentions.

Understanding Brain Conditions

Disruptions or altered patterns of neural synchrony are implicated in various neurological and psychiatric conditions.

Epilepsy

In epilepsy, the brain exhibits excessive and uncontrolled neural synchrony. This pathological synchronization leads to seizures, where large groups of neurons fire together abnormally, overwhelming normal brain function.

Schizophrenia

Schizophrenia is often linked to reduced or atypical synchrony, particularly in brain regions involved in higher cognitive functions. This altered synchrony may contribute to the cognitive and

perceptual disturbances experienced by individuals with the condition, affecting their ability to integrate information and form coherent thoughts.

Autism Spectrum Disorder (ASD)

Individuals with Autism Spectrum Disorder (ASD) often show atypical synchrony patterns, especially in areas related to social processing. These differences in synchronized activity might contribute to challenges in social communication and interaction, as the brain's ability to coordinate activity for social cues may be altered.

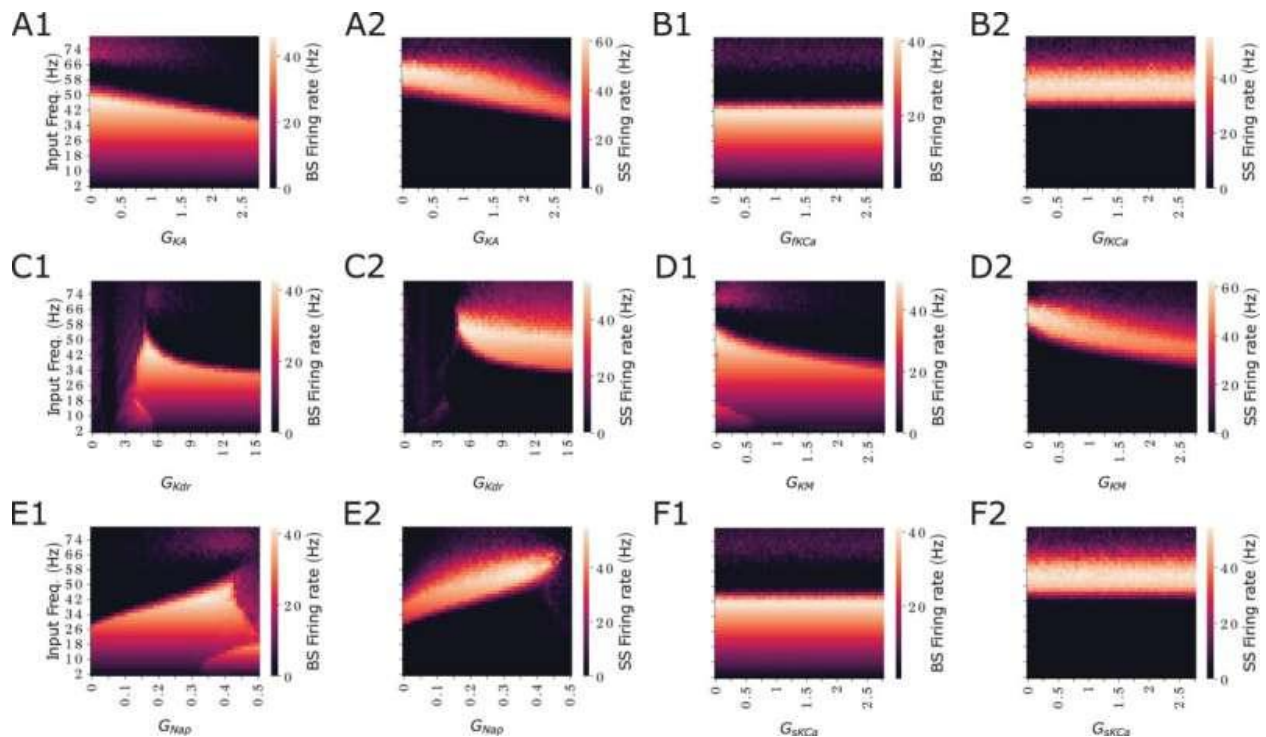
Parkinson's Disease

Parkinson's Disease is characterized by abnormal synchrony in motor circuits, which contributes to movement difficulties such as tremors and rigidity. Specifically, excessive beta band synchrony in the basal ganglia is often observed in Parkinson's, interfering with the smooth execution of movements.

While changes in synchrony are observed in these conditions, they represent complex mechanisms and are not necessarily the sole cause of the disorders. Studying these altered synchrony patterns provides insights into the underlying mechanisms of these neurological and psychiatric conditions, offering potential avenues for therapeutic interventions.

In stereo: Neurons shift gears between thoughts using brain rhythms

by Gisele Galoustia, [Florida Atlantic University](#) edited by [Gaby Clark](#), reviewed by [Robert Egan](#)



G_{KA} , G_{KDR} , G_{KM} , and G_{NaP} determine firing rate of SS and BS. Credit: *PLOS Computational Biology* (2025). DOI: 10.1371/journal.pcbi.1013126

The brain is constantly mapping the external world like a GPS, even when we don't know about it. This activity comes in the form of tiny electrical signals sent between neurons—specialized cells that communicate with one another to help us think, move, remember and feel. These signals often follow rhythmic patterns known as brain waves, such as slower theta waves and faster gamma waves, which help organize how the brain processes information.

Understanding how [individual neurons](#) respond to these rhythms is key to unlocking how the brain functions related to navigation in real time—and how it may be affected in disease.

A new study by Florida Atlantic University and collaborators from Erasmus Medical Center, Rotterdam, Netherlands, and the University of Amsterdam, Netherlands, has uncovered a surprising ability of brain cells in the hippocampus to process and encode and respond to information from multiple brain rhythms at once.

The research, published in *PLOS Computational Biology*, reveals how a single neuron can switch between firing single spikes and rapid bursts depending on both its internal properties and the brain's ongoing electrical activity—a phenomenon the researchers have termed "interleaved resonance."

This discovery offers a new understanding of how the brain organizes thoughts for navigation, memories and behaviors and may have important implications for neurological conditions that are implicated to spatial memory and learning such as epilepsy, Alzheimer's disease and schizophrenia.

The study focused on CA1 [pyramidal neurons](#)—a type of brain cell critical for memory formation and spatial navigation—how we figure out where we are and how to get from one place to another. These cells communicate by firing electrical impulses, either as isolated single spikes or as rapid bursts. Each firing mode carries different types of information and is associated with specific behavioral contexts. Until now, the factors that determine when and how these neurons switch between modes were poorly understood.

Using advanced computational modeling and cutting-edge voltage imaging of real brain activity, the researchers demonstrated that neurons can respond to both theta (slow) and gamma (fast) brain wave inputs at the same time—but in different ways. The result is a form of double-coding, where a neuron uses bursts to resonate with theta waves and single spikes to resonate with gamma waves—both simultaneously embedded in the same electrical signal.

"Our models show that a single neuron can behave like a multi-band radio, tuning in to different frequencies and changing its behavior accordingly," said Rodrigo Pena, Ph.D., senior author, an assistant professor of biological sciences, within FAU's Charles E. Schmidt College of Science on the John D. MacArthur Campus in Jupiter, and a member of the FAU Stiles-Nicholson Brain Institute. "It's a much more flexible and powerful system than we previously imagined."

The team found that this behavior is influenced by the neuron's internal settings—specifically, the levels of three ion-driven currents: persistent sodium, delayed rectifier potassium and hyperpolarization-activated current.

By adjusting these internal conductances, neurons can shift their resonance preferences between theta and [gamma waves](#), and between burst and single-spike firing. Additionally, neurons were more likely to fire bursts after long silent periods, introducing a time-dependent element to how information is encoded.

"This ability to 'double code' offers a new perspective on how the brain efficiently organizes and transfers information and could have broad implications for neurological conditions where brain rhythms are disrupted," said Pena.

"If neurons are misfiring or unable to switch between single spikes and bursts appropriately, it could interfere with how memories are formed or how attention is directed. If we understand how neurons naturally adjust to different brain rhythms, then we can start to think about how to restore that flexibility in conditions where it's lost."

The findings also shed light on long-standing questions in neuroscience, including how spatial memory is formed in the hippocampus, and underscore the complexity and adaptability of the brain. Previous research showed that theta and gamma rhythms

influence when and how neurons fire as an animal moves through space.

This new work shows that neurons are not locked into one firing mode but can dynamically shift their response depending on both external input and their internal electrical environment. In other words, a single neuron isn't limited to sending just one type of signal—it can carry multiple layers of information depending on the context.

"The brain's building blocks are far more dynamic than once thought," said Pena. "A neuron can simultaneously follow different brain rhythms, adjusting its firing patterns to match the needs of the moment. This discovery not only advances our understanding of how the brain works but could one day help guide treatments aimed at restoring healthy neural function when things go wrong."

Study co-authors are César C. Ceballos, Ph.D., first author and a postdoctoral fellow, FAU Charles E. Schmidt College of Science; Nourdin Chadly, Ph.D., Erasmus Medical Center and University of Amsterdam; and Erik Lowet, Ph.D., an assistant professor, Neuroscience Department, Erasmus Medical Center.

More information: Cesar C. Ceballos et al, Interleaved single and bursting spiking resonance in neurons, *PLOS Computational Biology* (2025). DOI: [10.1371/journal.pcbi.1013126](https://doi.org/10.1371/journal.pcbi.1013126)
Journal information: [PLoS Computational Biology](https://doi.org/10.1371/journal.pcbi.1013126)

AN OCEAN IN YOUR BRAIN: INTERACTING BRAIN WAVES KEY TO HOW WE PROCESS INFORMATION

Salk scientists show how the brain responds differently to seeing the same thing under different conditions

An ocean in your brain: interacting brain waves key to how we process information

Salk News

An ocean in your brain: interacting brain waves key to how we process information

Salk scientists show how the brain responds differently to seeing the same thing under different conditions

For years, the brain has been thought of as a biological computer that processes information through traditional circuits, whereby data zips straight from one cell to another. While that model is still accurate, a new study led by Salk Professor [Thomas Albright](#) and

Staff Scientist [Sergei Gepshtein](#) shows that there's also a second, very different way that the brain parses information: through the interactions of waves of neural activity. The findings, published in [Science Advances](#) on April 22, 2022, help researchers better understand how the brain processes information.

“We now have a new understanding of how the computational machinery of the brain is working,” says Albright, the Conrad T. Prebys Chair in Vision Research and director of Salk’s Vision Center Laboratory. “The model helps explain how the brain’s underlying state can change, affecting people’s attention, focus, or ability to process information.”

Researchers have long known that waves of electrical activity exist in the brain, both during sleep and wakefulness. But the underlying theories as to how the brain processes information—particularly sensory information, like the sight of a light or the sound of a bell—have revolved around information being detected by specialized brain cells and then shuttled from one neuron to the next like a relay.

This traditional model of the brain, however, couldn’t explain how a single sensory cell can react so differently to the same thing under different conditions. A cell, for instance, might become activated in response to a quick flash of light when an animal is particularly alert, but will remain inactive in response to the same light if the animal’s attention is focused on something else.

Gepshtein likens the new understanding to wave-particle duality in physics and chemistry—the idea that light and matter have properties of both particles and waves. In some situations, light

behaves as if it is a particle (also known as a photon). In other situations, it behaves as if it is a wave. Particles are confined to a specific location, and waves are distributed across many locations. Both views of light are needed to explain its complex behavior.

“The traditional view of brain function describes brain activity as an interaction of neurons. Since every neuron is confined to a specific location, this view is akin to the description of light as a particle,” says Gepshtein, director of Salk’s Collaboratory for Adaptive Sensory Technologies. “We’ve found that in some situations, brain activity is better described as interaction of waves, which is similar to the description of light as a wave. Both views are needed for understanding the brain.”

Some sensory cell properties observed in the past were not easy to explain given the “particle” approach to the brain. In the new study, the team observed the activity of 139 neurons in an animal model to better understand how the cells coordinated their response to visual information. In collaboration with physicist Sergey Savel’ev of Loughborough University, they created a mathematical framework to interpret the activity of neurons and to predict new phenomena.

The best way to explain how the neurons were behaving, they discovered, was through interaction of microscopic waves of activity rather than interaction of individual neurons. Rather than a flash of light activating specialized sensory cells, the researchers showed how it creates distributed patterns: waves of activity across many neighboring cells, with alternating peaks and troughs of activation—like ocean waves.

When these waves are being simultaneously generated in different places in the brain, they inevitably crash into one another. If two peaks of activity meet, they generate an even higher activity, while if a trough of low activity meets a peak, it might cancel it out. This process is called wave interference.

“When you’re out in the world, there are many, many inputs and so all these different waves are generated,” says Albright. “The net response of the brain to the world around you has to do with how all these waves interact.”

To test their mathematical model of how neural waves occur in the brain, the team designed an accompanying visual experiment. Two people were asked to detect a thin faint line (“probe”) located on a screen and flanked by other light patterns. How well the people performed this task, the researchers found, depended on where the probe was. The ability to detect the probe was elevated at some locations and depressed at other locations, forming a spatial wave predicted by the model.

“Your ability to see this probe at every location will depend on how neural waves superimpose at that location,” says Gepshtein, who is also a member of Salk’s Center for the Neurobiology of Vision. “And we’ve now proposed how the brain mediates that.”

The discovery of how neural waves interact is much more far-reaching than explaining this optical illusion. The researchers hypothesize that the same kinds of waves are being generated—and interacting with each other—in every part of the brain’s cortex, not just the part responsible for the analysis of visual information. That means waves generated by the brain itself, by subtle cues in the

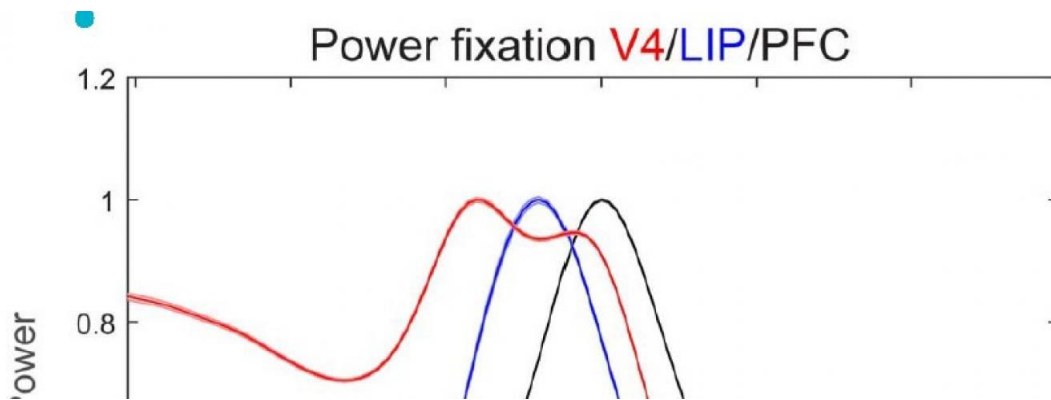
environment or internal moods, can change the waves generated by sensory inputs.

This may explain how the brain's response to something can shift from day to day, the researchers say.

Additional co-authors of the paper include Ambarish Pawar of Salk and Sunwoo Kwon of the University of California, Berkeley.

The work was supported in part by the Salk Institute's Sloan-Swartz Center for Theoretical Neurobiology, the Kavli Institute for Brain and Mind, the Conrad T. Prebys Foundation, the National Institutes of Health (R01-EY018613, R01-EY029117) and the Engineering and Physical Sciences Research Council (EP/S032843/1).

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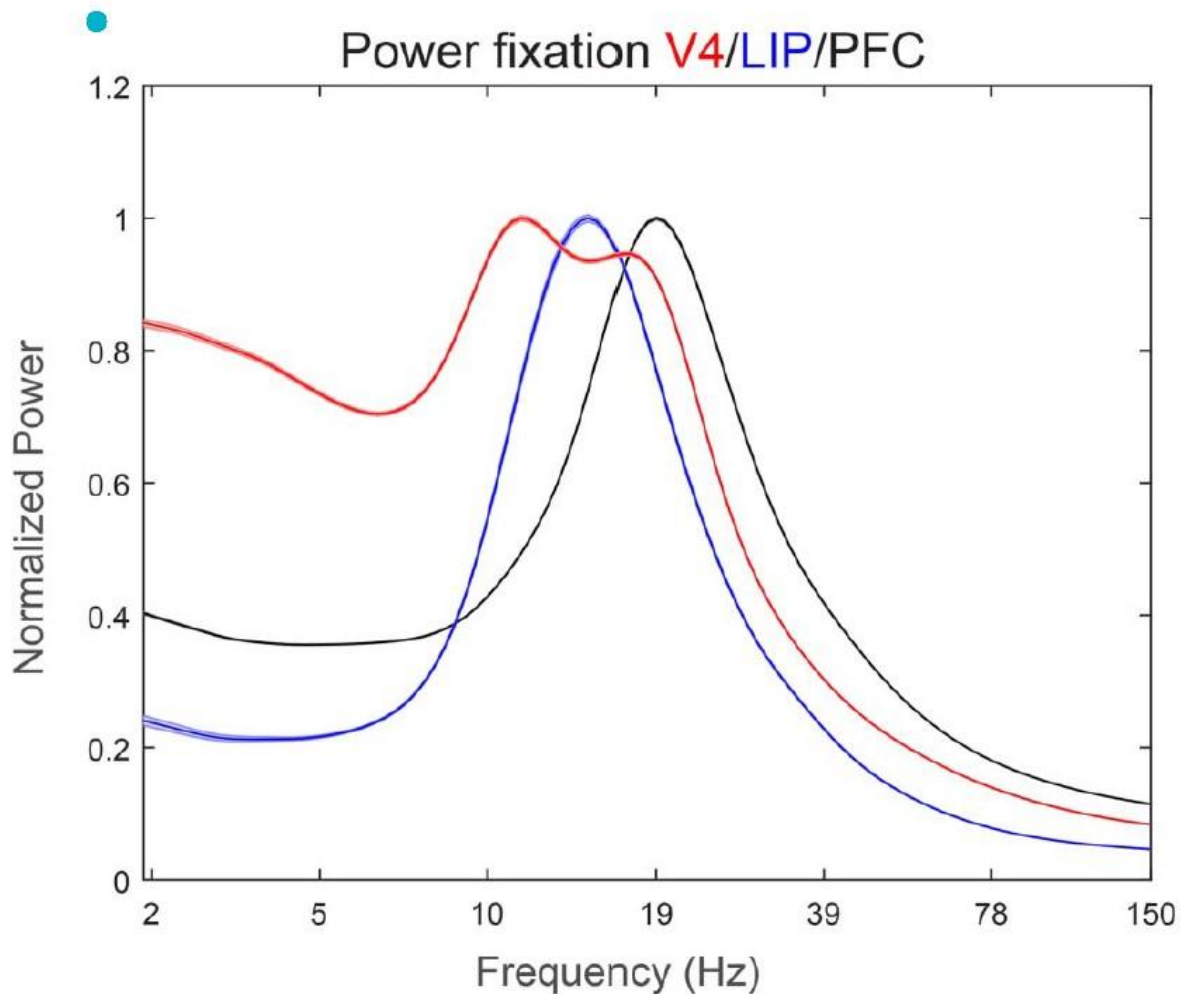


BRAIN WAVES AND COGNITION

For more than a century after their discovery, neuroscientists largely dismissed the coordinated rhythmic activity of neurons as a byproduct of the brain’s operation, rather than as a causal contributor to cognition. Earl K. Miller’s lab has produced numerous studies showing that brain rhythms, or brain waves, play a central role in how the cortex processes information and gives us volitional control over our thoughts. The circuits neurons form are not completely static, but don’t necessarily change at the pace of thought. Still, information flow can be guided among the circuit pathways available at a given moment by the interplay of brain rhythms carrying different kinds of information, Miller’s lab has shown.

In 2007 a [seminal study](#) in his lab demonstrated that “bottom up” sensory signals (e.g. “the eyes see a triangle”) are transmitted via higher frequency “gamma” rhythms while “top down” signals (e.g. “we care about circles”) were encoded within lower-frequency “beta” waves. The initial study concerned the role of these rhythms in executive control of visual attention. But Miller has since shown a similar interplay plays out in other cognitive functions. This includes [working memory](#), in which we decide what information to hold in mind and automatic predictions about what the brain

expects to see. This allows us to filter out the mundane and focus on what's novel.



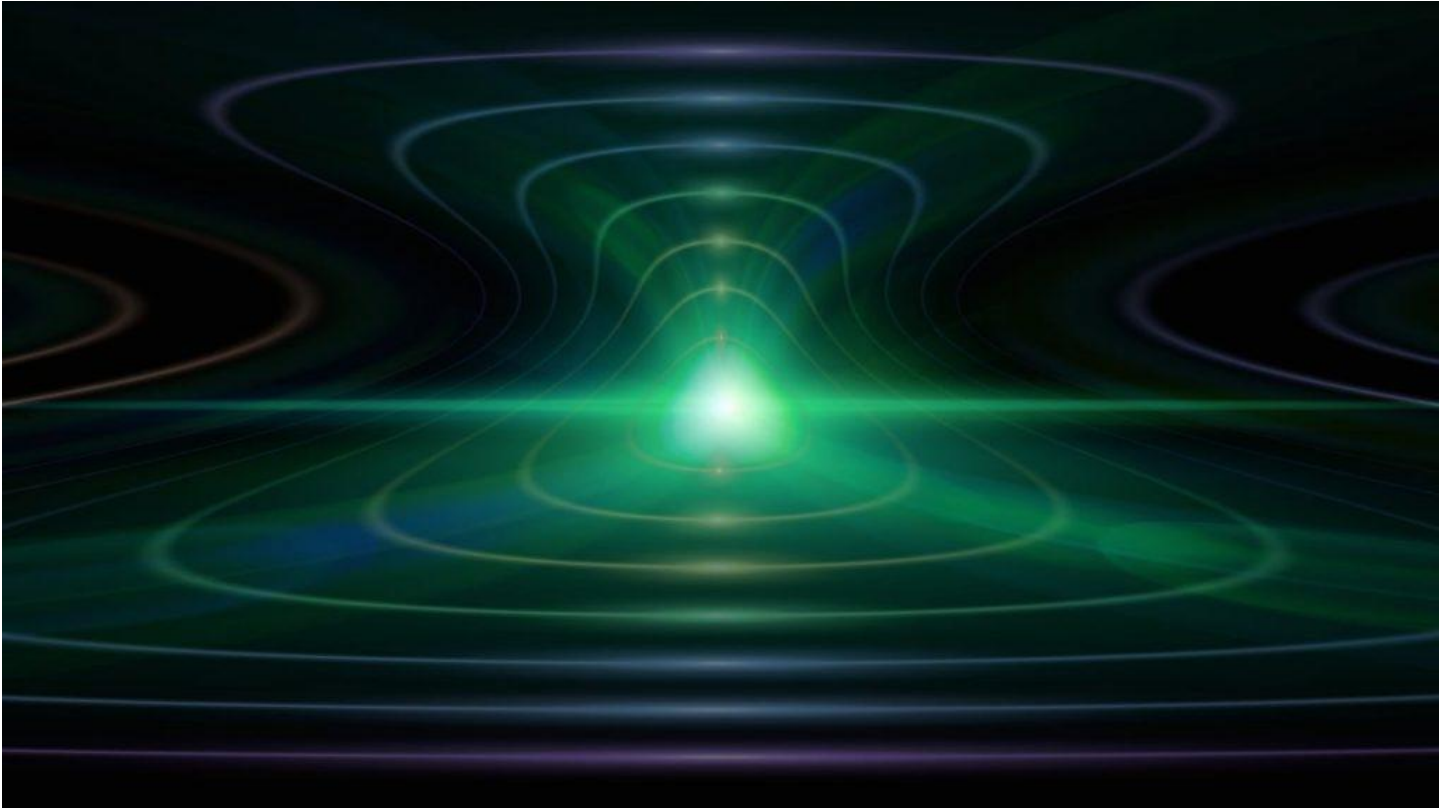
Brain rhythms sculpt the flow of information across the cortex. Here we see that the peak frequency of beta rhythms increases as regions move from more basically sensory (v4) to more cognitively sophisticated (PFC).

The Miller Lab's work has shown that bursts of top-down beta waves from deep layers of the cortex typically govern when gamma waves can flow in more superficial cortical layers. His lab has also shown that as information moves from more basic sensory areas of the cortex to regions more responsible for abstract reasoning, the peak

frequencies in each band (beta vs. gamma) increase, suggesting that these frequency differences help to **sculpt the flow** of information processing.

Importantly, disorders such as schizophrenia and autism involve opposite aberrations in these rhythms. In autism, beta is lacking, undermining the ability to predictively filter out mundane sensory information. In schizophrenia, beta is too dominant, leading to a reduced ability to keep in touch with the real world via sensory information. Miller's lab has investigated whether interventions can help restore a proper balance.

Latest Scalar Wave and Toroidal Wave Scientific Breakthroughs



Top 10 Latest Breakthroughs in Scalar and Toroidal Waves: A New Frontier in Physics and Technology

In recent years, scalar waves and toroidal waves have emerged as intriguing areas of research, bridging theoretical physics, energy transmission, and potential applications in health and technology. While scalar waves remain controversial in mainstream science, and toroidal waves are gaining traction in electrodynamics and photonics, breakthroughs in these fields are capturing attention.

Here are the top 10 latest advancements driving innovation and debate.

1. Photonic Toroidal Vortices: A New Solution to Maxwell's Equations

Researchers at leading institutions have experimentally demonstrated photonic toroidal vortices, a novel solution to Maxwell's equations. These light-based vortex rings, which twist around a closed loop, exhibit unique orbital angular momentum. This breakthrough, published in *Nature Photonics*, could revolutionize optical manipulation, quantum information, and light-matter interactions, opening doors to advanced laser designs and energy transfer methods.

2. Scalar Waves and Plant Aging: ATP Boost in Ipomea Purpurea

A study published in *Biology Engineering Medicine* revealed that scalar waves, applied via longitudinal magnetic pulses, increased ATP levels in *Ipomea purpurea* (morning glory) plants by 40%. This led to a 10% extension in the flowering process, suggesting potential applications in agriculture. While the mechanism remains speculative, researchers hypothesize that mitochondria may be the primary site of scalar wave interaction.

3. Toroidal Electrodynamics: Rise of Anapole Metamaterials

Toroidal electrodynamics is gaining momentum, with recent studies highlighting its influence on anapole metamaterials and nanoparticle optics. Published in journals like *ACS Photonics* and *Nano Letters*, these findings suggest applications in

sensors, lasers, and plasmonics. Future challenges include detecting high-order toroidal multipoles and developing spectroscopies for molecular systems with toroidal symmetry.

4. Scalar Wave Transmission: Faster-than-Light Claims Under Scrutiny

A controversial study claimed scalar waves could transmit information at 1.5 times the speed of light, bypassing Faraday cages typically used to block electromagnetic signals. While the experiments, published on ResearchGate, demonstrated wireless energy transmission and receiver-transmitter reactions, mainstream physicists remain skeptical, citing inconsistencies with established wave theories.

5. Toroidal Standing Alfvén Waves: Mapping Mass Density in Space

Using data from the Van Allen Probes, researchers have conducted statistical studies on toroidal standing Alfvén waves in Earth's magnetosphere. Published in the *Journal of Geophysical Research*, these findings provide insights into nodal structures and plasma mass distribution, enhancing our understanding of space weather and geomagnetic interactions.

6. Scalar Waves in Regenerative Healing: Zero-Point Field Applications

Proponents of scalar wave healing, such as those at Pain Free for Life, argue that scalar energy aligns with Schumann Resonances to promote cellular detoxification and nutrient uptake. Devices like the Scalar Qi, using Tesla coils to generate zero-point fields, are

marketed for chronic pain relief. However, mainstream science cautions that these claims lack robust empirical evidence.

7. Toroidal Light Pulses: Non-Transverse Electromagnetic Waves

Toroidal light pulses, or “light donuts,” have been identified as non-transverse electromagnetic waves that propagate at the speed of light. Researchers suggest these pulses could enable new energy storage solutions and quantum optics applications. While still theoretical, their potential for anapole qubits and astrophysical signal detection is generating excitement.

8. Scalar Wave Pseudoscience Debate: Online Controversy

The term “scalar wave” continues to spark debate, with online forums like Physics Forums and Reddit labeling it pseudoscience. Proponents cite Nikola Tesla’s work on radiant energy, while critics argue that claims of shield-penetrating radar and over-unity energy violate established physics. The CIA has even referenced scalar waves in declassified documents, though experts dismiss these as mathematical curiosities.

9. Toroidal Fields and Conscious Creation: Ancient Wisdom Meets Modern Science

A growing community, exemplified by platforms like Tammy AI, explores toroidal fields and scalar waves in the context of conscious creation. These theories suggest that language and vowel sounds shape energetic fields, aligning with universal energy flows. While lacking scientific validation, these ideas are

trending on social media, blending ancient wisdom with speculative physics.

10. Scalar Wave Energy as a Weapon: Speculative Research

ResearchGate publications have speculated on scalar waves as potential directed-energy weapons, citing their longitudinal nature and ability to bypass traditional shielding. However, experts emphasize that these claims are rooted in fringe theories and lack experimental support, urging caution in interpreting such research.

Toroidal Waves, Scalar Waves, Bioluminescence, Sonoluminescence...

Recent research has explored the intersection of scalar and toroidal waves with emerging technologies like BRETT (Bioluminescence Resonance Energy Transfer Technology) and BERTT (Bioluminescence Enhanced Resonance Transfer Technology), which leverage bioluminescence for advanced imaging and energy transfer.

Scalar waves, often speculated to interact with biological systems, are being studied alongside toroidal wave dynamics to enhance the efficiency of bioluminescent reactions, particularly those involving luciferase enzymes. Luciferase, which catalyzes the oxidation of luciferin to produce light, emits photons at specific color frequencies, such as blue-green in marine organisms or yellow-green in fireflies. These color frequencies are critical for optimizing BRETT and BERTT systems, where energy transfer between luciferase and fluorescent proteins or acceptors can be fine-tuned for applications like deep-tissue imaging and biosensing.

While scalar and toroidal waves remain controversial in mainstream physics, their potential to influence bioluminescent processes at the cellular level is driving speculative research into novel theragnostic tools, though empirical validation remains limited.

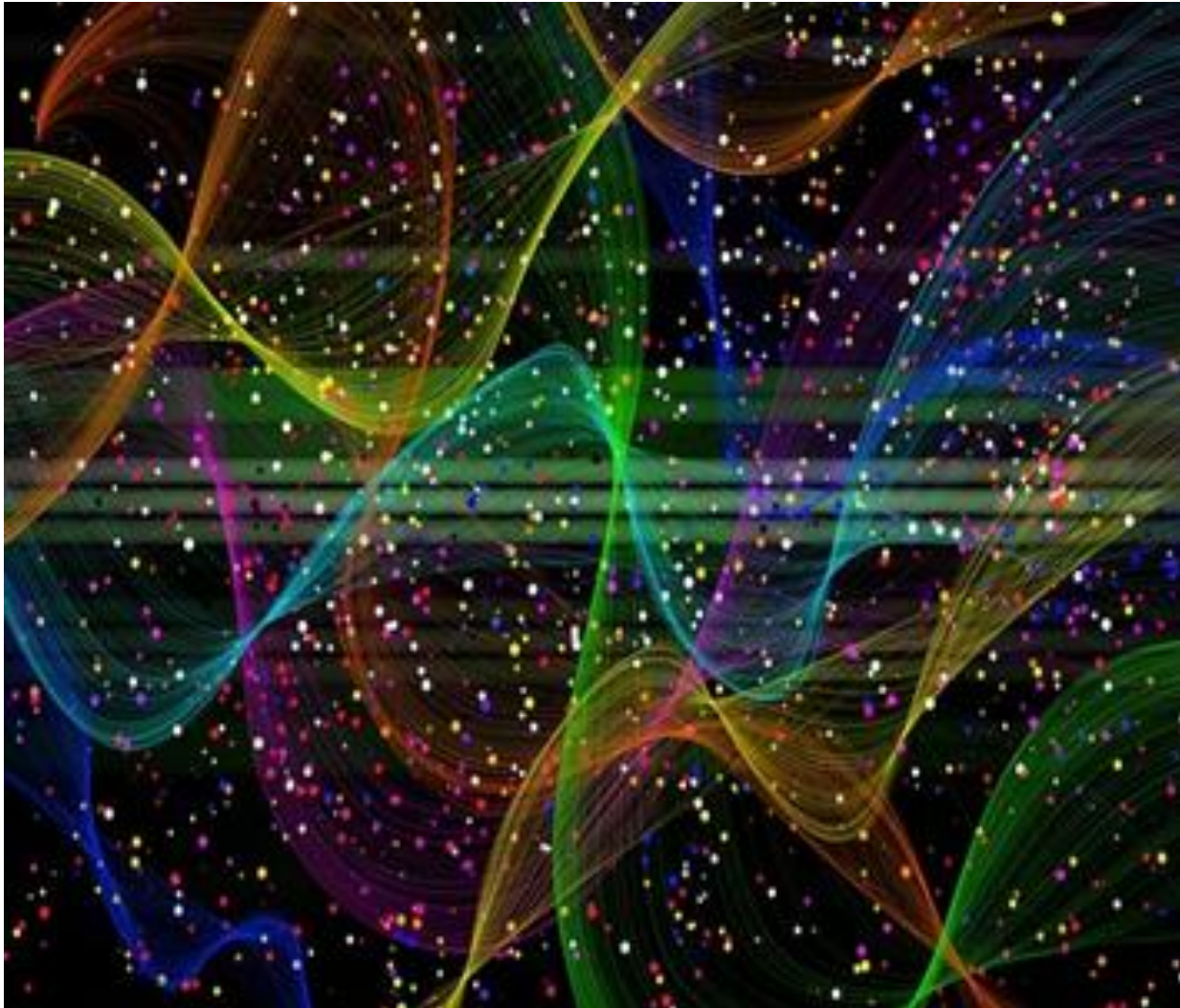
The Road Ahead: Innovation or Speculation?

The study of scalar and toroidal waves sits at a crossroads. Toroidal waves are gaining credibility in photonics, electrodynamics, and space science, with tangible applications on the horizon. Scalar waves, however, remain mired in controversy, with mainstream science questioning their legitimacy despite persistent interest in alternative medicine and energy research.

As these fields evolve, interdisciplinary collaboration will be crucial to separate fact from fiction. While breakthroughs in toroidal waves promise technological leaps, the scalar wave debate underscores the importance of rigorous scientific validation. Stay tuned as researchers continue to explore these enigmatic phenomena, potentially reshaping our understanding of energy, matter, and the universe.

Scalar Waves: Quicker, wireless, and they could transform an Intelligence-Enabled Machine

A life-changing technological leap, if we enable advanced machines with Scalar Energy.



Scalar waves are a well-known phenomenon, occur naturally in Nature (e.g., thoughts, DNA, food), are non-linear, non-Hertzian waves, and have

the ability to carry information. They travel faster than the speed of light and do not decay over time.

Waves affect human life. We rely on waves when we talk to others and see things because of waves. Waves transfer energy in different forms, and animals use wave motion to propel themselves through their surroundings.

Wave speed is not a vector; it is a **scalar**. The real-life examples of scalars are **volume, density, mass, time**, etc. Other quantities, such as force and velocity, have both magnitude and direction and are called vectors.

The wave-function() is a scalar in the sense that it doesn't change under a coordinate transformation, and on the other hand, a vector means a collection of components that transform to linear combinations of themselves under a coordinate transformation. Scalar waves are three-dimensional self-contained waves that spin on one fixed axis. These non-linear waves disseminate throughout the body through elaborate collagen networks.

Nikola Tesla demonstrated the existence of **Scalar energy**, or as according to Tesla, **Radiant Energy**. He worked to harness this energy without the need for wires and as a wave carrier for telecommunications, and he believed that when this energy is harnessed correctly, it has endless possibilities.

DNA is **the molecule that carries genetic information for the development, functioning, growth, and reproduction of an organism.**

DNA is made of two linked strands that wind around each other — a shape known as a double helix. The **DNA helix** is an example of Scalar Energy, and what makes it unique is that it's a carrier wave that can carry frequencies and penetrate solid objects. Within the cell nucleus, the vortex model of the magnetic scalar wave also explains the channels in the matrix form when two cells communicate with each other. Potential vortices are an essential component of scalar waves, and the characteristics of the potential vortex are significant. With its concentration effect, it allows enormously high information density in the nucleus. With the introduction of the magnetic scalar wave, it becomes clear that such a wave is suitable to use the genetic code chemically stored in the base pairs of the genes and electrically modulate them, to “bring” information from the cell nucleus to another cell. At the receiving end, the reverse process takes place, and the transported information is converted back into a chemical structure. The necessary energy required to power the chemical process is provided by the magnetic scalar wave itself.

The **human brain is a scalar energy generator** that repetitively creates patterns of scalar waves via the activity of thought. Since the brain and nervous system processes high-frequency discharges, the human brain can create and detect scalar waves. Thus, a human being can often generate space-time effects at a distance and through time. This offers an exact mechanism for higher senses such as direct cognition, cellular

telepathy, molecular transmutation, etc., and consequently, properly guided thought diametrically affects the function of the personal scalar cellular/organism field manifestation. Every single thought absolutely affects the observable state of the body-mind system, and our thoughts co-create our own personal reality hologram due to the fact that thoughts are scalar wave configurations of transharmonic patterns of electromagnetic energy radiation, which create specific patterns of scalar frequency. Wandering and directionless thought produces chaotic information arrays, resulting in ineffective manifestation abilities. Conversely, thought guided by clear intention produces organized information within the personal morphogenetic field manifestation. Human beings who can combine **experiential knowledge** with thought guided by clear intention reclaim one of the most potent forms of **scalar power**, and thoughts will eventually materialize into reality in this space-time vector.

Therefore, specific sound frequencies can assist the human body, and Specific sounds and images unequivocally can alter our consciousness. Sound is more powerful than light and is utilized as an energetic carrier for certain frequency tones that activate elements that affect the chemicals in our body, which in turn affect the DNA. As such, sound is **neither a scalar nor a vector quantity**, but the speed of sound is a scalar quantity. Therefore, our intelligence-enabled autonomous machines like Robots, Drones, Self-driving vehicles, etc, must be able to sense the energetic encryption behind sound if one is to be able to know

the beneficial intentions and frequencies to be independent or carried on without human control.

In addition, DNA is influenced by waves and frequencies, and 90% of the protein DNA is of the non-coding type, often misrepresented as “junk DNA”, that serves as data storage and communication, suggesting that living chromosomes’ function, just like **solitonic, holographic computers** that are capable of recoding our DNA.

Scalar energy of subtle energy frequencies is generated naturally, but it can also be **artificially produced**. However, various experiments were conducted to determine the effects of scalar energy, and these experiments proved that this energy has the potential to positively improve the **responses of living organisms**.

The **scalar energy** can carry information, and scalar waves are all around us, and scalar-wave technology can help in creating highly dense, superconductive coherent energy fields while being infused with restorative information. This phenomenon of scalar energy could be a game-changer for autonomous machines like robots, as robots have senses in the form of sensors, and **robotic sensors are used to estimate a robot’s condition and environment**. Sensors in robots are based on the functions of human sensory organs, and these signals are passed to a controller to enable appropriate behavior (just like DNA). Robots require extensive information about their environment to function effectively and to transfer the benefits of scalar energy to the robot's

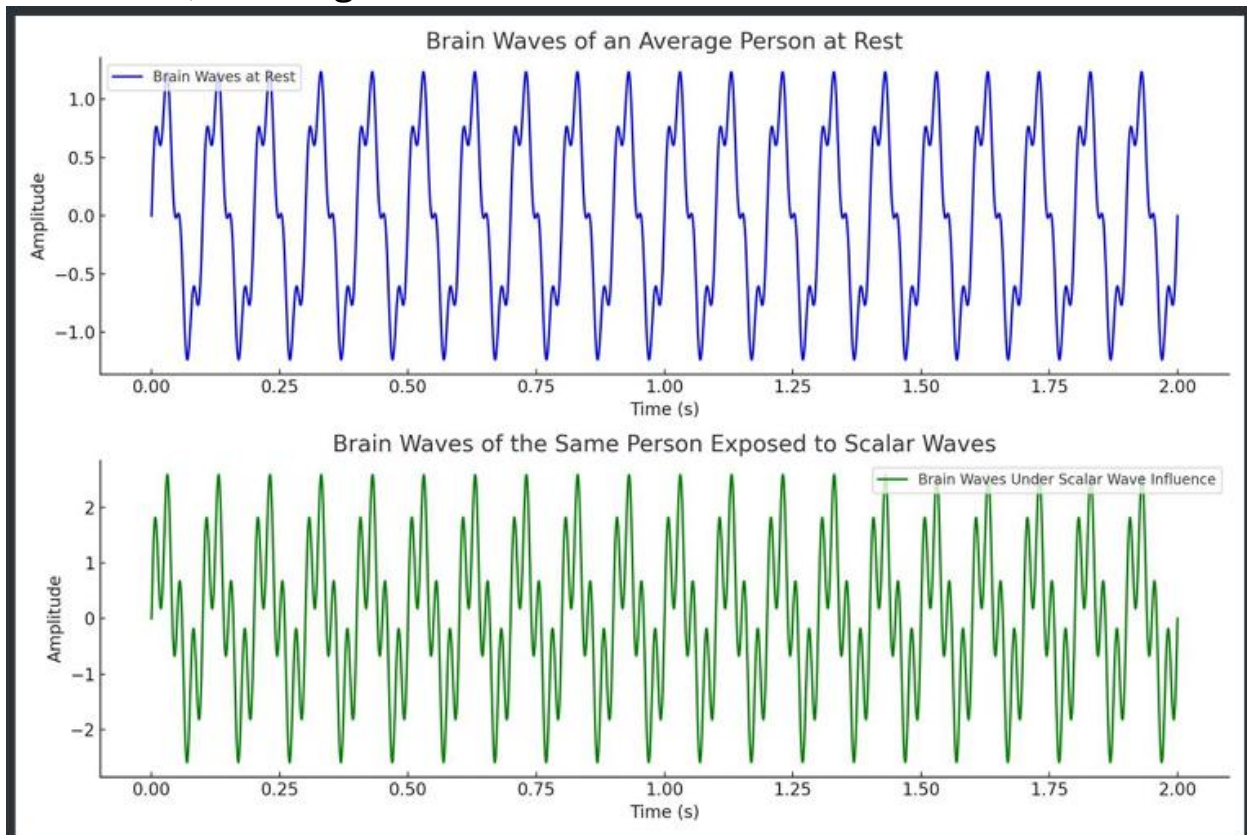
body material components, which means to transfer scalar waves into the cells of robots. The scalar-wave technology also ensures that the electrical charge that is being produced artificially will reach and go through the robot's body's material membranes. This is crucial to the robot's ecosystem as they hold robotic sensors together.

Scalar waves are longitudinal waves of potential and have wireless energy transmission capability. Scalar energy is formed by the creation of a static energy field that contains circles of energy that radiate outwards in balanced networks, which help in creating a field of live energy systems. And, if the application of this energy is intertwined into the ecosystem of **intelligence-enabled autonomous machines**, then it will surely be revolutionary for technological advancement. But it requires changes in materials that enable these bodies to act as a carrier wave for information.

How the Brain Produces Scalar Waves

The human brain generates electrical signals through neurons that communicate via action potentials. These signals create small magnetic fields that can be measured using techniques like EEG or MEG. The brain's electromagnetic activity is measured in various frequency bands, including Delta (0.5–4 Hz), Theta (4–8 Hz), Alpha (8–12 Hz), and Beta (12–30 Hz), each associated with different states of consciousness. While the existence of scalar waves in mainstream physics remains a topic of debate, they are believed to play a role in biological processes, including communication between cells and possibly within the brain.

Scalar waves affect the amplitude and coherence of alpha and gamma oscillations. Scalar waves enhance neural synchronization, relaxation, and cognitive focus.



The graph is a simulation depicting: Medium Scalar Wave Influence. Recursive Feedback Enhanced by Laws of Form, and Combined Effects of Scalar Waves and Laws of Form on Brain Wave Activity

Scalar waves, proposed as longitudinal and non-linear waveforms, have been theorized to influence neural activity by stabilizing and aligning oscillatory patterns in the brain. This study examines the effects of scalar waves on brain wave patterns, focusing on alpha waves (associated with relaxation) and gamma waves (linked to cognitive processes). By comparing resting states with and without scalar wave influence, this article explores how scalar waves amplify neural coherence.

What You See: This graph features amplified alpha waves and heightened gamma wave activity. The oscillations are more synchronized, with increased amplitude and phase alignment.

What It Means: Scalar waves enhance both the relaxation effects of alpha waves and the cognitive integration associated with gamma waves. This synchronization suggests a state of heightened focus and coherence.

Key Differences Between the Two States

1. **Alpha Wave Activity:** At Rest: Alpha waves are steady but moderate in amplitude, indicating baseline relaxation. With Scalar Waves: Alpha waves are amplified, reflecting deeper relaxation and improved stability.
2. **Gamma Wave Activity:** At Rest: Gamma waves are weak and less synchronized, reflecting minimal cognitive engagement. With Scalar Waves: Gamma waves are stronger and more aligned, suggesting enhanced cognitive processing and focus.

3. Overall Coherence: At Rest: Oscillatory patterns show natural variability, with moderate coherence. With Scalar Waves: Oscillations are more synchronized, indicating improved neural communication and integration.

This comparison offers: A Visual Framework: Clear graphical representations of how scalar waves influence brain wave patterns.

Insights into Neural Coherence: Highlights the role of scalar waves in amplifying and aligning oscillatory activity.

Conclusion: This analysis demonstrates that scalar waves significantly enhance the amplitude and coherence of alpha and gamma oscillations, fostering states of relaxation and cognitive clarity.