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Kriya-Yoga: A Neuro-Spiritual Dynamics

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ABSTRACT—

Kriya Yoga: A Neuro-Spiritual Dynamics explores the ancient yogic discipline of Kriya Yoga through the lens of modern neuroscience and physics, aiming to bridge the gap between spiritual practice and scientific understanding. Rooted in pranayama, meditation, and internal energy control traditions, Kriya Yoga is increasingly recognized for its profound effects on the nervous system and consciousness. This paper investigates how repeated Kriya practices influence neurophysiological processes, particularly in the autonomic and central nervous systems, and how these changes correlate with altered states of awareness and cognitive integration.

By introducing the concept of neuro-spiritual dynamics, here a model is proposed in which breath (prana), intention (manas), and subtle awareness (Chitta) form an interactive system like a feedback loop within the brain-body field. The paper further discusses parallels with principles from quantum physics, such as wave-particle duality, coherence, and field interaction, to describe how the practitioner's consciousness may act as both observer and participant in the internal transformation process.

Through this integrative framework, Kriya Yoga is not only seen as a spiritual technique but also as a form of inner technology that modulates neural pathways, harmonizes brainwave activity, and potentially alters the electromagnetic signatures of the human system. This interdisciplinary approach opens new avenues for understanding consciousness, neuroplasticity, and the convergence of science and spirituality in human evolution.

Keywords: Kriya Yoga, Neuro-Spirituality, Consciousness, Pranayama, Meditation, Electromagnetic Fields, and Quantum mechanics

1. Introduction

Kriya-Yoga, as systematized by Lahiri Mahasaya and popularized by Paramahansa Yogananda, is a disciplined approach to self-realization. In an era where neuroscience and consciousness studies are rapidly advancing, there is a growing interest in understanding ancient spiritual practices through a scientific lens. Among these, Kriya Yoga stands out as a comprehensive system of breath control, meditation, and inner awareness that has been preserved for millennia in the yogic traditions of India. Traditionally regarded as a path to spiritual awakening and inner transformation, Kriya Yoga involves deliberate regulation of prana (life-force) and mental focus to harmonize body, mind, and spirit.

Recent developments in neuroscience, electromagnetic biology, and quantum theory have begun to uncover physiological and energetic mechanisms that may underlie the effects of such practices. Studies in neuroplasticity, autonomic nervous system modulation, and brainwave coherence suggest that meditative disciplines like Kriya Yoga can significantly alter neural pathways and influence states of consciousness. This has opened new dialogue between ancient yogic wisdom and modern science, giving rise to what can be termed neuro-spiritual dynamics—a framework for understanding how inner practices affect the nervous system and subtle energetic fields.

Literature Review:

According to Hindu spirituality, 7 centres of concentrated metaphysical energy are positioned from the base of the spine to the crown of the head, called “Chakras”. Chakras are the energy centres that regulate the flow of prana (life energy) through the subtle body, influencing both physical and psychological states. Each chakra vibrates at its frequency in a circular pattern, directing the energy from the universe into the body's energetic system.

According to anatomical theory, chakras have been theorized to align with several nerve plexuses and endocrine glands. Commonly, chakras are linked with the oesophageal, aortic, hypogastric, pelvic plexuses, prefrontal cortex, and neocortex, among other anatomical structures [1]. Psychologist Richard Maxwell [2] proposes a model of understanding the chakra through the gap junction, or the channel between the cytoplasm of two adjacent cells that allows communication via passage of ions, molecules, and electrical impulses. He theorized that chakras align with the regions with a high density of intercellular gap junctions that arise during embryological development. This theory is built on the work by Charles Sang that attempted to explain both

chakras and meridians as arising from the intercellular network between undifferentiated cells involved in embryological development [3]. Joseph Loizzo linked a modern map of the Central Nervous System (CNS) with map of subtle body for mind–brain–body integration [4].

Roger Penrose proposes a model in his book “Shadows of the Mind - A Search for the Missing Science of Consciousness” [5], which describes consciousness may involving quantum processes—a useful metaphor for inner awareness in Kriya. Goswami, A. (1993) [6] introduces in his book “*The Self-Aware Universe: How Consciousness Creates the Material World*” the term “quantum consciousness,” which suggests consciousness collapses wavefunctions—parallels to observer awareness in meditation. Stap H. P. (2007) [7] describes in the book “*Mindful Universe: Quantum Mechanics and the Participating Observer*” that the observer (consciousness) is fundamental to reality, echoing yogic principles.

McFadden, J. (2020) [8] in his book “*Life on the Edge: The Coming of Age of Quantum Biology*” integrates biological processes with quantum phenomena. He describes how biological processes may exhibit quantum properties, providing a possible scientific basis for subtle yogic phenomena. Newberg, A., & d’Aquili, E. G. (2001) [9] published “*Why God Won’t Go Away: Brain Science and the Biology of Belief*,” which explores how spiritual experiences correlate with neurological activity.

This paper aims to explore Kriya Yoga not only as a spiritual discipline but as an inner technology capable of activating latent neural and energetic potentials. By drawing parallels with concepts such as field interaction, quantum coherence, and the role of observer consciousness, this paper examines how this practice might modulate biological function and subjective experience. The goal is to present an integrative model that bridges yogic insight with scientific inquiry, offering a deeper understanding of the transformative potential of Kriya Yoga in the context of human evolution and consciousness studies.

The rest of the paper is organized as follows: Section II describes the methodical presentation of the kriya process in view of quantum theory with an example, and finally, Section III is the conclusion of the paper.

2. Methodical Presentation of Kriya Process in view of Quantum Theory

In 1952, A. L. Hodgkin and A. F. Huxley first proposed and experimentally proved [10] that the flux of ions across the cell membrane is responsible for the action potential. And this action potential depends upon the ionic concentration inside and outside the cell membrane. They also proposed a mathematical model that shows the existence of several conductances across the membrane.

Already, it has been proven that the chakras in our body are the energy centres that influence various aspects of our physical, emotional, and spiritual well-being. And the petals of the chakras reflect the nature of the energy flow within that chakra. The number of petals of the chakras varies from 2 to 1000.

The rest of the section is structured as:

- Reason for the structure of the different chakras
- Quantum analogy for the kriya process
- Mathematical modelling for the kriya process
- Sample example with observation

Reason for the structure of the different chakras

This paper describes the reason for the variation in the shape of different chakras. All the chakras in our body are centered along the spinal cord and the brain. The Cerebrospinal fluid (CSF) is a clear, colorless [transcellular body fluid](#) found within the [meningeal tissue](#) of [the brain](#) and [spinal cord](#), and in the [ventricles](#) of the brain. It is experimentally proven that CSF is highly conductive due to the presence of electrolytes like sodium and potassium ions in it, and its conductivity lies in the range of 1.6 to 1.8 S/m ([Siemens](#) per meter). This is the source of the Electro-Magnetic (EM) field in any vertebrate. And the field strength of the chakras depends upon the volume of CSF present in that region of the body. Fig.1 shows the structure of the spine, brain, and flow of CSF and position of chakras in the human body.

It is clear from Fig.1 that due to the thin area of cross-section in the root of the spine, the CSF volume is low in this region, so the intensity of the generated EM field is low; it automatically increases from root to neck according to the structure (area of cross-section) of the spine. The CSF is produced in the choroid plexus of the brain, as shown in Fig. 1 b, and it flows through the third brain ventricles to the cranial, spinal canal, and subarachnoid spaces [11]. According to the structure of the third ventricle, the EM field is distributed. And finally, the field distribution is maximally spread in the subarachnoid spaces. Table I summarizes the name of the chakras, their position, and the number of petals that describe the field distribution of the chakras.

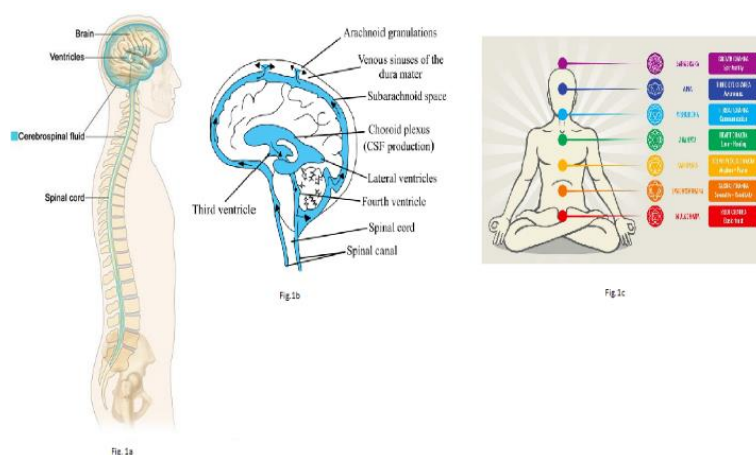


Fig. 1a Distribution of CSF, Fig. 1b CSF Production Point and Distribution in brain, Fig. 1c Position of Chakras and Petals

Fig.1 Structure of the Spine, Brain, and Flow of CSF and Position of Chakras in the Human Body

Table I. Name of the Chakras, Position, the number of Petals, and image/field distribution

Name of Chakra	Number of Petals	Position	Image/field distribution of Chakra
Root Chakra or Muladhar	4	Base of the spine	
Sacral Chakra or Svadhishthana	6	Lower Abdomen	
Solar Plexus or Manipura	10	between the navel and the bottom of the rib cage	
Heart Chakra or Anahata	12	heart region	
Throat Chakra or Vishuddha	16	base of the throat	
Third Eye Chakra or Ajna	2	between the eyebrows	
Crown Chakra or Sahasrara	1000	crown of the head	

Quantum analogy of Kriya Yoga is explained from the concept of wave-particle duality. Table II describes the Kriya Yoga Elements with their equivalent physics interpretation, and Table III describes the energy flows in chakras in analogy with quantum terminologies.

Table III clearly shows that the Kriya process can be modelled using the concept of quantum physics. The next section describes the energy flow during the kriya process mathematically using quantum theory.

Table II describes the Physics interpretation with the kriya Yoga elements

Kriya Yoga Element	Physics interpretation
Prana	Bioelectric energy, ion flows
Chakras	Electromagnetic energy centres
Breath control (Pranayama)	Frequency modulation, resonance
Kundalini energy	Potential energy in a field
Meditation/Stillness	Quantum coherence, wavefunction collapse
Time perception in Samadhi	Biological time dilation, altered temporal states

Table III: Quantum Analogy with the Energy Flows in Chakras

Concept	Quantum Explanation	Kriya Yoga Explanation	Inference	Analogy
Wave-Particle Duality & Energy Duality of Chakras	Entities like electrons behave as both particles and waves	Chakras can be understood as energy centres (waves) that also affect physical structures (particles) like organs, glands, and nerve plexuses	This supports the idea that chakras operate in both the subtle energy realm and the physical body	Just as an electron's nature is not fixed until observed, a chakra's state may fluctuate dynamically with our attention, emotion, or consciousness level
Quantum Fields & Subtle Energy (Prana)	All particles are excitations of underlying fields	Chakras are energy vortices within the pranic (life-force) field	Chakras may be likened to localized energy nodes (field excitations) within the subtle human energy field.	Chakras may be "quantum-like" structures that act as nodes in the field of consciousness, where energy becomes information
Quantum Coherence & Chakra Alignment	When particles act in a unified, synchronized way, essential for phenomena like superconductivity	Chakra alignment or balance is said to produce a state of coherence within the body-mind system	Practices like Kriya Yoga or meditation may foster neuroelectromagnetic coherence, echoing quantum synchrony	Balanced chakras might promote coherent states of consciousness, allowing for clarity, intuition, or peak experiences
The Observer Effect & Consciousness-Centred Function	The act of observation collapses a probability wave into a defined outcome.	conscious awareness (drashta or sakshi) influences the flow of prana through chakras	Chakras may become active, blocked, or awakened based on inner focus or intention, akin to how a quantum system "chooses" a state upon observation	Attention acts like a quantum observer, shaping how chakras behave.
Entanglement & the Chakra System as a Unified Network	Quantum entanglement connects particles over vast distances instantly	Although each chakra governs a different function (root = survival, heart = love, etc.), they are interdependent—a change in one affects the others	This suggests the chakras form a non-local, entangled system of consciousness-energy	Healing or energizing one chakra may ripple across the whole system, like entanglement in quantum systems

Mathematical modelling for the kriya process

According to classical physics, the momentum of a particle is intricately related to the electromagnetic field, especially in the context of charged particles moving in electric or magnetic fields. Its momentum is changed due to the Lorentz force, and it is mathematically represented by

$$\mathbf{F} = q(\mathbf{E} + \mathbf{v} \times \mathbf{B}) \quad (1)$$

Where:

- $\mathbf{F}$ = force on the particle
- q = charge of the particle
- $\mathbf{E}$ = electric field
- $\mathbf{B}$ = magnetic field
- $\mathbf{v}$ = velocity of the particle
- $\mathbf{p}$ = momentum of the particle

According to **Newton's Second Law**:

$$\mathbf{F} = \frac{d\mathbf{p}}{dt} = q(\mathbf{E} + \mathbf{v} \times \mathbf{B}) \quad (2)$$

So, the rate of change of momentum is directly governed by the electric and magnetic fields.

In quantum mechanics, the momentum of a particle is considered in terms of its position in space under consideration, and the momentum is abbreviated as canonical momentum. It is expressed as:

$$\mathbf{p}_{\text{canonical}} = m\mathbf{v} + q\mathbf{A} \quad (3)$$

- $\mathbf{A}$ = magnetic vector potential

This shows that in an electromagnetic field, a particle's total (canonical) momentum is not just mechanical, but includes contributions from the field potential.

So, from analogy, here it is considered that the chakras are the Hilbert Space where the state of consciousness is a coordinate (x) and the velocity $\mathbf{v}$ (dx/dt) is the movement of prana. Focused intentional pranic control is the momentum $\mathbf{p}$, and total energy in the chakra is the Hamilton operator $\mathbf{H}$

In classical mechanics

$$\begin{aligned} \mathbf{H} &= (\text{Kinetic energy} + \text{Potential Energy}) \\ &= \frac{\mathbf{p}^2}{2m} + V(x) \end{aligned} \quad (4)$$

When momentum acts as an operator

$$\hat{\mathbf{p}} = -i\hbar\nabla + q\mathbf{A} \quad (5)$$

- $\hbar$ = reduced Planck constant

$$\begin{aligned} \text{Therefore } \mathbf{H} &= \frac{\hat{\mathbf{p}}^2}{2m} + V(x) \\ &= \frac{1}{2m} (-i\hbar\nabla + q\mathbf{A})^2 + q\phi \end{aligned} \quad (6)$$

The time-dependent Schrodinger equation

$$\begin{aligned} \mathbf{H}\psi(x, t) &= \mathbf{E}\psi(x, t) \\ &= \left[\frac{1}{2m} (-i\hbar\nabla + q\mathbf{A})^2 + q\phi \right] \psi(x, t) \end{aligned} \quad (7)$$

- Where $\psi(x, t)$ describes the wave function means the state of the particle

Schrodinger's equation gives the evolution of the wave function over time.

During kriya practice, the practitioner tries to focus and concentrate on one chakra and tries to superimpose the energy of the upper chakra over to lower one. This is the analogy of superposition in quantum mechanics. This superposition of energy changes the vector potential of the field from

$$(\mathbf{A} \rightarrow \mathbf{A} + \Delta\mathbf{A})$$

The new canonical momentum becomes

$$p_{canonical(new)} = mv + q(A + \Delta A) \quad (8)$$

Therefore, the wavelength $\lambda_{new} = \frac{h}{p_{canonical(new)}}$

Therefore, a change in canonical momentum

$$\Delta p_{canonical} = q\Delta A \text{ (increased by } \Delta A) \quad (9)$$

The new time-dependent Schrodinger equation becomes

$$\left[\frac{1}{2m} (-i\hbar\nabla + q(A + \Delta A))^2 + q\varphi \right] \psi(x, t) = E\psi(x, t) \quad (10)$$

This equation describes how the wave function evolves with time and an additional applied field.

The next section tries to measure the energy experienced by the particle due to the presence of the applied field.

Given that all chakras are aligned with the spinal cord and that the field's distribution is concentrated in this area, it can be considered a region that operates similarly to a solenoid along the spinal cord. Within this area, an electromagnetic field is present, whereas outside of it, the field is non-existent. However, the vector potential A is not equal to zero outside the region. Fig.2 shows the analytical diagram of the solenoidal field along the spine.

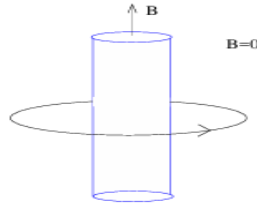


Fig. 2. Analytical model of the solenoidal field along the spine

According to Stokes' theorem

$$\oint \mathbf{A} \cdot d\mathbf{x} = \int \mathbf{B} \cdot d\mathbf{S} = \varphi \quad \text{And } A_\theta = \frac{\varphi}{2\pi r}$$

A charged quantum particle is restricted to lie in the ring of radius ' r ' outside the solenoid. The dynamic degree of freedom $\theta \in [0, 2\pi]$

In realization, this is the movement of prana during the kriya process

In the cylindrical coordinate system, the Hamilton becomes

$$H = \frac{1}{2m} (\mathbf{p}_\theta - q\mathbf{A}_\theta)^2 = \frac{1}{2mr^2} \left(-i\hbar\nabla - \frac{q\varphi}{2\pi} \right)^2 \quad (11)$$

Energy eigenstate $\psi = \frac{1}{\sqrt{2\pi r}} e^{in\varphi}$ for $n \in \mathbb{Z}$,

$$\begin{aligned} \text{and } E &= \frac{1}{2mr^2} \left(\hbar n - \frac{q\varphi}{2\pi} \right)^2 \\ &= \frac{\hbar^2}{2mr^2} \left(\pi - \frac{\varphi}{\varphi_0} \right)^2 \text{ for } n \in \mathbb{Z} \end{aligned} \quad (12)$$

$$\text{and } \varphi_0 = \text{quantum flux} = \frac{2\pi\hbar}{q} \quad (13)$$

If φ is an integer multiple of φ_0 the spectrum is unaffected by the solenoid, but if the flux is not an integer multiple of φ_0 the spectrum get shifted. Fig. 3 shows the shifted path (P1 and P2) for the particle due to a change in φ . The dotted line shows the energy of the particle in the field.

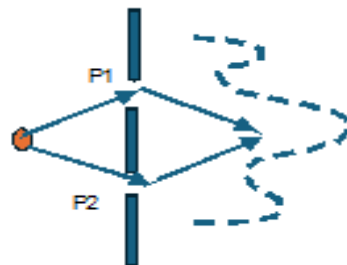


Fig. 3 Particle movement in path P1 and P2

According to Aharonov-Bohm scattering, the phase difference between the flow of path P_1 and P_2 is

$$\Delta\theta = \frac{q}{\hbar} \int_{P_1} \mathbf{A} \cdot d\mathbf{x} - \frac{q}{\hbar} \int_{P_2} \mathbf{A} \cdot d\mathbf{x} = \frac{q}{\hbar} \oint \mathbf{A} \cdot d\mathbf{x} = \frac{q}{\hbar} \int \mathbf{B} \cdot d\mathbf{S} \quad (14)$$

The Aharonov-Bohm phase is $e^{\frac{iq\varphi}{\hbar}}$ when the charged particle moved around the magnetic field.

Sample example with observation

To find the energy distribution in this paper, the energy of the particle is calculated with a change in flux. Fig.4 shows the nature of the energy produced in the particle by the change in flux in the field according to equation 12. The values considered here for calculation are

- $\hbar = \frac{h}{2\pi}$ where $h = 6.626 \times 10^{-34} \frac{J}{Hz}$
- $q = 1.602 \times 10^{-19} C$
- $m = 9.10 \times 10^{-31} kg$

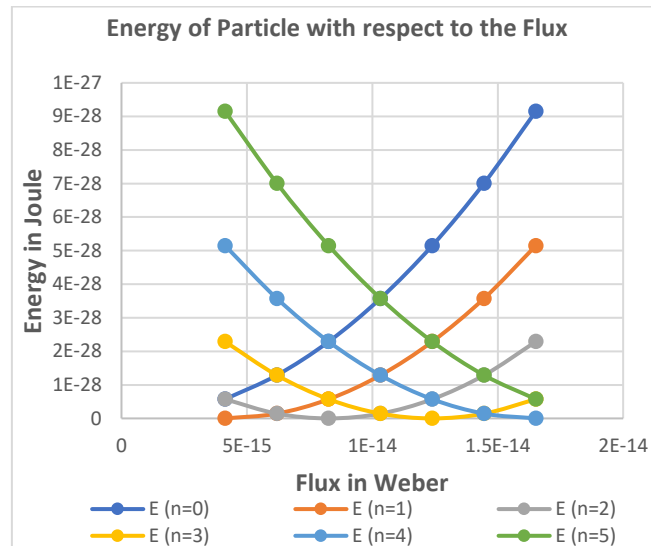


Fig.4 Nature of the energy produced in the particle by the change in flux

The graph illustrates the relationship for different values of n . It is evident from the graph that for $n=0, 1$, and 2 , the energy rises with the applied flux; however, for greater values of n , the energy diminishes as the applied flux increases. According to quantum physics, when a particle's energy decreases at a higher energy level, it releases the energy in the form of light. A comparable observation is found among kriya practitioners, who describe experiencing an internal light during their practice.

Pranayama, also known as breath control, is a practice that is undertaken by a kriya practitioner. This practice can be characterized as a modulation process that facilitates the proper resonance of energy movement within the body. Following the correct alignment of all chakras and the appropriate breath control process, a larger number of particles are energized from the fields, transitioning from a lower energy band to a higher one. Additionally, particles at a higher energy level release energy and revert to a lower level, emitting energy in the form of light. In the realm of quantum mechanics, this phenomenon is referred to as quantum coherence, while in the context of yoga, it is described as proper meditation or stillness. In this state, all chakras, which occupy different positions yet function in a coordinated manner between the body and mind, allow the mind to exert full control over the body, a condition known as quantum entanglement.

3. Conclusion

Kriya-Yoga embodies a significant convergence of ancient spiritual insights and contemporary neurophysiological knowledge. Grounded in disciplined breath control, meditative concentration, and heightened inner awareness, it provides more than just a route to spiritual enlightenment; it stimulates and enhances neural pathways linked to emotional regulation, increased awareness, and a cohesive sense of self.

The neuro-spiritual interactions inherent in Kriya-Yoga imply that the practice transcends mere mental quietude; it reorganizes cognitive functioning, harmonizing emotional, cognitive, and physiological processes towards coherence and equilibrium. Scientific insights regarding neuroplasticity and the modulation of the autonomic nervous system resonate with the long-held beliefs of yogic traditions: that inner transformation is both quantifiable and achievable.

In essence, Kriya-Yoga encourages practitioners to engage in a vibrant journey of self-evolution, where consciousness broadens, the ego diminishes, and a profound connection to universal intelligence is nurtured. By merging the sacred with the scientific, Kriya-Yoga emerges not only as a transformative discipline but also as a living example of how mastery over the inner self can alter the external experience of life.

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