



©

## International Journal on Eternal Wisdom and Contemporary Science

Volume 2 • Issue 1 • June 2025 • pp 1-23

### A Four-layered Vedantic Framework for Solving the Reverse Hard Problem - Deriving Materiality from Consciousness

Goutam Ghosh

*Independent Researcher-Consciousness Studies, Bengaluru, India*

#### Abstract:

The ‘hard problem’ of consciousness, i.e., how consciousness emerges from the brain, has not been solved till date. To bridge the gap between materiality and consciousness, philosophers and scientists are delving into deeper layers of reality. This paper addresses the issue from a perspective rooted in *Vedanta* philosophy, which has extensively analysed the deeper layers of reality. *Mandukya Upanishad*, one of the most important texts of *Vedanta* philosophy, describes four states of consciousness, each associated with a distinct layer of reality. *Vedanta* philosophy has thoroughly explored these four layers of reality and their roles in the whole spectrum of creation process, beginning with the Universal Consciousness as the fundamental layer and culminating in the physical world as the fourth and the outermost layer. In this paper, I have presented the ideas related to this four-layered system of reality in a structured and consolidated framework that offers a solution to the reverse ‘hard problem’, i.e., it explains the emergence of materiality from consciousness. The paper also includes a brief comparative analysis of this framework with some popular consciousness theories like those proposed by David Chalmers, Roger Penrose, Stuart Hameroff, Donald Hoffman and Giulio Tononi. Thereafter, I have highlighted the consonance of this layered framework with some significant physical phenomena and laws of nature.

**Keywords:** Hard problem of consciousness, Consciousness theory, Universal Consciousness, *Vedanta*, *Mandukya Upanishad*, Science and spirituality

#### 1. INTRODUCTION

The main focus of present-day consciousness studies is to explain how the brain processes give rise to our subjective experiences. This problem has been termed as the ‘hard problem’ of consciousness by David Chalmers. In their attempt to solve the ‘hard problem’ of consciousness, some consciousness studies researchers have suggested the existence of more

than one layer of reality. David Chalmers takes conscious experience itself as one of the fundamental features of the world, in addition to mass, charge, etc. Roger Penrose had proposed a third layer to reality – the Platonic world of mathematical forms. He visualized the reality in terms of three worlds - the physical world, the mental world and the Platonic world of mathematical forms. Stuart Hameroff teamed up with Roger Penrose and proposed a theory of consciousness based on quantum gravity effects in the microtubules inside the neurons. This theory adds a new layer to reality; the proto-consciousness. Donald D. Hoffman, on the other hand, takes consciousness to be fundamental. His idea revolves around conscious agents, the dynamics of interacting conscious agents, and how the perception of objects and space-time emerges from such dynamics. Giulio Tononi analysed the essential properties of experience and then developed his Integrated Information Theory. I will discuss these theories in more details in one of the later sections of this paper.

If we look at *Vedanta* philosophy, we find a broader and all-inclusive layered system that has been extensively analysed. *Mandukya Upanishad*, one of the most important texts of *Vedanta* philosophy, describes four states of consciousness and each state is associated with a distinct layer of reality. *Vedanta* philosophy has thoroughly explored all these four layers of reality along with their roles in the whole spectrum of creation process, beginning with the *Brahman* (Universal Consciousness) as the first and the fundamental layer and culminating in the physical world as the fourth and the outermost layer; thus, effectively solving the reverse ‘hard problem’ – the emergence of matter from consciousness. While ‘hard problem’ of consciousness deals with the basic question - how consciousness arises from matter, the term ‘reverse hard problem’ will be used here to deal with the question - how matter arises/emerges from consciousness.

In this paper, which is based on *Mandukya Upanishad*<sup>1</sup>, Self-knowledge of Sri Shankaracharya<sup>2</sup>, *Vedānta-sāra* of Sadānanda Yogindra<sup>3</sup> and several other related texts (along with some inputs from *Sankhya* philosophy), I have attempted to present the concepts related to this four-layered system of reality in a structured and consolidated way that provides a solution to the reverse ‘hard problem’, i.e., it explains the emergence of materiality from consciousness. Additionally, I have included a brief comparative analysis of select layers and structures of this Vedantic framework in relation to the consciousness theories mentioned above. I have also highlighted the consonance of the layers and structures of the Vedantic framework with some significant physical phenomena and laws of nature and provided suggestions for further research work.

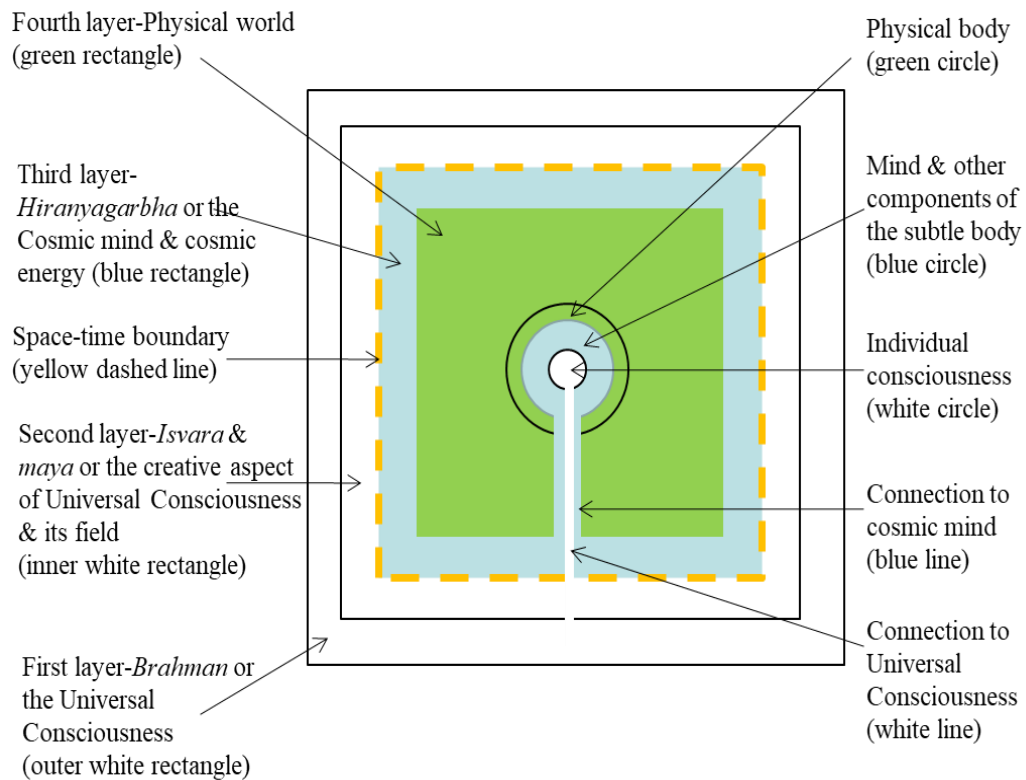
At this point, it is necessary to mention that many *Vedantic* terms (written here in italics) are non-translatable. Their English translations may not convey the inherent ideas fully. For instance, there is a crucial difference in the way the term consciousness is used in *Vedanta* philosophy and in contemporary western theories of consciousness. The term consciousness, as we find in current western theories, is generally associated with the experiences of the mind. But in *Vedanta* philosophy, *chit* - translated as consciousness, has a wider connotation. “In Indian thought consciousness is independent of mind; consciousness exists by itself as a self-

luminous entity.....It is pure ‘contentless’ awareness. It is absolute self-awareness which transcends the senses.”<sup>4</sup>

## 2. DESCRIPTION OF THE FOUR-LAYERED FRAMEWORK

### 2.1 The Basic Structure

Figure-1 is an illustration of the four-layered framework that has been conceptualized based on the above mentioned Vedantic texts.



**Figure-1: Pictorial representation of the four-layered framework**

The rectangular & circular shapes and colours are purely hypothetical. The outermost rectangular layer denotes the fundamental, all-inclusive layer of *Brahman* or the Universal Consciousness that encompasses and permeates all other subsequent layers. Inner to that is the layer of *Isvara* and *Maya*, the creative component of Universal Consciousness and its field. The blue rectangle represents the *Hiranyagarbha* - the cosmic mind and the cosmic energy. The green rectangle represents the physical world. The outer layers permeate all the inner layers. The yellow dashed line represents the space-time boundaries. The circular figures represent *jiva*, the individual living being that has a causal, subtle as well as a gross body. The outer circle represents the gross or the physical body, inner blue circle represents the mind (along with other components of the subtle body) and the white circle represents the individual

The four layers and their components, as viewed through the lens of the manifestation process, have been methodically organized in the following table.

**Table 1: The four layers and their components**

Before proceeding further, I would like to clarify the numbering system used by me for the four layers of reality. *Mandukya Upanishad* takes the aspirant, in stages, from waking state to the ultimate state of realization - *Brahman* – and uses the term *Turiya* (fourth) for referring to *Brahman*. However, the objective of this paper is to study the process of manifestation and to

present how Consciousness creates materiality. Therefore, I started from Universal Consciousness (*Brahman*) as the first or the fundamental layer of reality and then numbered the successive layers accordingly.

## 2.2 The First And The Most Fundamental Layer Of Reality: *Brahman* (Universal Consciousness)

In *Vedanta* philosophy the fundamental layer of reality is *Brahman*. In Vedantic texts we frequently come across the term *sat-chit-ananda* to describe this fundamental reality. *Sat* means existence or beingness, *chit* means consciousness and *ananda* means bliss.

“Pure Being is not an inert material entity lacking self-awareness. It is identical with Pure Consciousness, and is All-Bliss.”<sup>5</sup>

Swami Vivekananda explains all the three aspects very succinctly when he says –

“We are ‘Existence, Knowledge, Bliss’ (*Sachchidânanda*). Existence is the last generalisation in the universe; so we exist, we know it; and bliss is the natural result of existence without alloy.”<sup>6</sup>

*Brahman* is also the essential substratum of everything, a principle explicitly stated in the opening verse of *Vedānta-sāra* -

“I take refuge in the Self, the Indivisible, the Existence-Consciousness-Bliss Absolute, beyond the reach of words and thought, and the substratum of all, for the attainment of my cherished desire.”<sup>7</sup>

*Brahman* is described as transcending the limitations of space and time also, embodying omnipresence and eternity. Several references affirm that it exists beyond the spatial and temporal constraints. *Dr. Drshya Viveka* says -

“The entity which is (always) of the same nature and unlimited (by time, space etc.) and which is characterised by Existence-Consciousness-Bliss, is verily *Brahman*.”<sup>8</sup>

According to Swami Vivekananda -

“This Absolute (a) has become the universe (b) by coming through time, space and causation (c).”<sup>9</sup>

The fundamental layer is, therefore, the infinite and eternal substrate with the nature of beingness, consciousness, and bliss. This represents the closest defining characteristics of the fundamental reality within the framework of our conceptual understanding.

It is pertinent to note here that the term Universal Consciousness which is normally used for *Brahman*, may not capture the full meaning in its entirety because it misses the *sat* and *ananda* aspects. However, in the absence of a more suitable term, Universal Consciousness will be used to refer to *Brahman*.

### 2.3 The Second Layer: *Isvara* And *Maya* (Creative Aspect Of Universal Consciousness & Its Field)

The second layer is the creative aspect of the first layer (see Table 1, column 2 to column 4). The first layer changes into a sense of agency at the universal level – the *Isvara*, with qualities of universal lordship, all controlling power etc.<sup>10</sup> Pure subjectivity changes into a single universal subject with the absolute creative power and is the source or field for the manifested world. This power as well as source is known as *Maya*. As a source of the manifested world, it is also called *Prakriti*<sup>11</sup>. *Maya* is composed of three components - *sattva*, *rajas* and *tamas* (collectively they are called *gunas*). The creative power of *Maya* expresses itself through these three components. In fact, *Maya*'s etymological meaning is pointer to this aspect -

“That which measures everything (*miyate anaya iti maya*), i.e., that which apparently confines the Infinite Absolute Reality within the limitations of space-time-causation (*desa-kala-nimitta*), and makes It appear manifold, finite, and measurable through the senses and mind, by its three *gunas* of *sattva-rajas-tamas*.”<sup>12</sup>

The three *gunas* are not the qualities of *Maya* but they are its constituents. They are compared to the three strands of the rope of *Maya*. In the unmanifested state, all three *gunas* are in equilibrium. The process of manifestation of world is initiated when this equilibrium gets disturbed by the will of *Isvara* - “.....this equilibrium is disturbed by the will of the lord”<sup>13</sup>, “.....the desire to be many that is in *Isvara* is the seed of creation”<sup>14</sup>. From the interactions of the three *gunas*, as explained in next sections, various forms are produced. The predominance of a specific *guna* produces its specific effect on the created form. When *sattva* is predominant, the effect is the creation of knowledge. When *rajas* is prominent the effect is activity and energy. When *tamas* is predominant the effect is inactivity and inertia.

In the words of Swami Vivekananda -

“Nature, before creation, is called by them *Avyakta*, undefined or indiscrete; that is, in which there is no distinction of form or name, a state in which these three materials are held in perfect balance. Then the balance is disturbed, the three materials begin to mingle in various fashions, and the result is the universe. In every man, also, these three materials exist. When the *Sattva* material prevails, knowledge comes; when *Rajas*, activity; and when *Tamas*, darkness, lassitude, idleness and ignorance.”<sup>15</sup>

In the words of Swami Prabhavananda -

“In the process of evolution, *sattva* is the essence of the form which has to be realized, *tamas* is the inherent obstacle to its realization, and *rajas* is the power by which the obstacle is removed and the essential form made manifest.”<sup>16</sup>

Brajendranath Seal in his book “The Positive Sciences of the Ancient Hindus” has given a very clear description of the *gunas* as follows -

“(1) *Sattva*, the Essence which manifests itself in a phenomenon, and which is characterised by this tendency to manifestation, the Essence, in other words, which serves as the medium for the reflection of Intelligence; (2) *Rajas*, Energy, that which is efficient in a phenomenon, and is characterised by a tendency to do work or overcome resistance; and (3) *Tamas*, Mass or Inertia, which counteracts the tendency of *Rajas* to do work, and of *Sattva* to conscious manifestation.”<sup>17</sup>

He adds further -

“The *Gunas* are always uniting separating uniting again. Everything in the world results from their peculiar arrangement and combination. Varying quantities of Essence, Energy and Mass, in varied groupings, act on one another, and through their mutual interaction and interdependence evolve from the indefinite or qualitatively indeterminate to the definite and qualitatively determinate.”<sup>18</sup>

We can therefore summarise that for any phenomenon to occur or a thing to manifest, *sattva* provides the guiding principle or the intelligence, *rajas* provides the dynamism and energy, *tamas* provides the inertia. In other words, *sattva*, *rajas*, and *tamas* are the foundational aspects that give rise to intelligence, energy, and inertia respectively. It is interesting to note that physics explains the world in terms of energy and matter whereas *Vedanta* philosophy uses the concept of *sattva* in addition to *rajas* (energy) and *tamas* (inertia) to explain the emergence of both the physical world as well as the mental world.

## 2.4 The Third Layer: *Tanmatras* (The Basic Building Blocks)

*Tanmatras* or the subtle elements are the basic building blocks of the third and fourth layers. These are the fundamental units of the manifested world and they have been categorized on the basis of those qualities that interact with our senses.

“From the stand of sense-perception there are only five elementary objects in the universe, namely sound, touch, form, taste, smell. That is why *Vedanta* speaks of five elements only.”<sup>19</sup>



The subtle elements are named as *shabda*, *sparsha*, *rupa*, *rasa* and *gandha tanmatras*. They are related to the sense of sound, touch, sight, taste and smell respectively and has been named accordingly. *Rupa tanmatra* is associated with the sense of sight which perceives the form as well as the colour. That is why *rupa tanmatra* is occasionally translated as *colour tanmatra*. Brajendranath Seal<sup>20</sup> has given a detailed account, based on *Patanjali-Sankhya* system, of how *tanmatras* are created from *Prakriti* (or *Maya*). Based on his explanations, the process of creation of the *tanmatras* has been summarised in Table 2 below.

Stage	Process of creation of <i>tanmatra</i>	Nature of the <i>tanmatra</i>	
		Potential sense stimuli	Potential physical nature
1	2	3	4
1 <sup>st</sup>	<i>Tamas</i> , acted on by <i>rajas</i> of second layer, generates <i>shabda tanmatra</i>	Sound potential	Vibration potential
2 <sup>nd</sup>	The vibration potential (column 4), with accretion of <i>tamas</i> and acted on by <i>rajas</i> of the second layer, generates <i>sparsha tanmatra</i>	Touch potential	Impact potential
3 <sup>rd</sup>	The impact potential (column 4), with accretion of <i>tamas</i> and acted on by <i>rajas</i> , generates <i>rupa tanmatra</i>	Form/colour potential	Light & heat potential
4 <sup>th</sup>	The light and heat potential (column 4), with accretion of <i>tamas</i> generates <i>rasa tanmatra</i>	Taste potential	Viscous attraction potential
5 <sup>th</sup>	The taste potential (column 4), with accretion of <i>tamas</i> generates <i>gandha tanmatra</i>	Smell potential	Cohesive attraction potential

Table 2: The process of creation of the *tanmatras*

The term “potential” has been used in column 3 and column 4 because these are not actual sense stimuli or have actual physical nature; their physicality emerges only after certain transformations which I have described in later sections.

## 2.5 The Third Layer: The Cosmic Aspects - *Hiranyagarbha* (Cosmic Mind And The Cosmic Energy)

The *tanmatras*, as explained in previous section, provide the medium through which cosmic mind and cosmic energies are manifested at this layer. As stated in *Panchikaranam* of Sri Shankaracharya -

“The five unquintuplicated rudimentary elements and their effects, the subtle body, both together constitute what is called the *Hiranyagarbha*.”<sup>21</sup>



The word unquintuplicated (Sanskrit - *apanchikrit*) refers to the *tanmatras* that are in pure form. The details of how these *apanchikrit tanmatras* combine to create the physical world that will be explained in subsequent sections.

We find several references in *Vedanta* that portray the functionality of *Hiranyagarbha* as a cosmic mind or as an outline of the universe. In *Panchadasi*<sup>22</sup> (written by Sri Swami Vidyanaraya- a great scholar after Sri Shankaracharya), which is a comprehensive text of *Advaita Vedanta*, we get a distinct indication of this ‘outline’ aspect of *Hiranyagarbha*. The creation process, in this text, has been compared to the four stages of painting of a picture. Each stage corresponds to each layer of the four-layered framework.

- At first, we should have a cloth, a canvas; similarly, for creation to proceed, we have an unchanging background - the *Brahman*.
- The canvas would have to be straightened or stretched; similarly, the *Brahman* – the unchanging background - gets stiffened and we have, in the second stage, the creative will of *Isvara*.
- In the third stage, the artist draws an outline of the painting on the canvas. Similarly, in the act of creation, the cosmic mind or the *Hiranyagarbha* is the cosmic outline of the universe that helps manifest the universe.
- In the fourth stage, the lines are filled with colour and we have the final painting. Similarly, the universe is created with all the diversity, colour and splendour.

Swami Vivekananda has very beautifully explained the concept of a cosmic ideation preceding the physical universe. He says -

“In the universe, *Brahma* or *Hiranyagarbha* or the cosmic *Mahat* first manifested himself as name, then as form, i.e., as this universe. All this expressed sensible universe is the form, behind which stands the eternal inexpressible *Sphota*, the manifest as Logos or Word. This eternal *Sphota*, the essential eternal material of all ideas or names, is the power through which the Lord creates the universe, nay, the Lord first becomes conditioned as the *Sphota*, and then evolves Himself out as the yet more concrete sensible universe. This *Sphota* has one word as its only possible symbol, and this is the *Om*.”<sup>23</sup>

By the word *Sphota* he is specifying *Isvara*’s cosmic ideation.

The concept of *Hiranyagarbha* is also associated with the cosmic energy needed to create the physical world. In *Brahmasutra*<sup>24</sup>, *Hiranyagarbha* has been referred to as the Cosmic *Prana*. *Prashna Upanishad*<sup>25</sup> states that the sum total of all *Pranas* (energies) is called *Hiranyagarbha*. In the explanations given in *Aitrei Upanishad*<sup>26</sup>, *Hiranyagarbha* has been specified as cosmic power of knowledge and action implying the cosmic mind and cosmic energy respectively. This *Prana*, according to Swami Vivekananda<sup>27</sup>, is manifesting as different forms of energy and forces in the physical as well as in the mental world.

Hence, at the third layer, the macro level structure of *Hiranyagarbha* incorporates both the cosmic mind (the cosmic ideation) and the cosmic energy (Cosmic *Prana*) needed to create the physical world. The *sattva* and *rajas* components of *tanmatras* seem to play their respective roles in shaping these two aspects of *Hiranyagarbha*.

It is also important to note here that the manifestation of space, time & causation begins from the third layer. The *Maya* of the second layer is characterized as that which restricts the fundamental reality within the boundaries of space, time & causation and it is from the third layer - the layer of *Hiranyagarbha* - that the influence of space, time & causation appears to originate. “.....the *Hiranyagarbha* state when relativity in the form of space-time-causation just begins to sprout.....”<sup>28</sup>

## 2.6 The Third Layer: The Individual Aspects - *Antahkarana* (Mind) And Other Components Of *Jiva*'s Subtle Body

The preceding section explored the cosmic dimensions of the third layer, while this section delves into the individual (*jiva*) aspects. Vedantic texts like Self-knowledge of Sri Shankaracharya and *Vedānta-sāra* of Sadānanda, have very clearly mentioned the process of creation of subtle body of *jiva* consisting of mind (*antahkarana* having *buddhi*, *chitta*, *manas* & *ahamkara*), five organs of perception, five organs of action and five *pranas*. Their process of creation has been briefly depicted in Table 3.

Parts of <i>jiva</i> 's subtle body	Created from
1	2
<i>Buddhi</i> (intellect) including <i>chitta</i> (memory)	<i>Sattva</i> components of five <i>tanmatras</i>
<i>Manas</i> (deliberative mode of the mind) including <i>ahamkara</i> (egoism)	
Five <i>jnanendriyas</i> (organs of perception)	
Five <i>karmendriyas</i> (organs of action)	<i>Rajas</i> components of five <i>tanmatras</i>
Five <i>pranas</i> (flow of energy regulating the physiological and other subtle processes)	

**Table 3: Parts of *jiva*'s subtle body**

The five organs of perception and the five organs of action are not the physical organs but they are the parts of the subtle body and functions through the physical organs. The five organs of perception are the ears, the skin, the eyes, the tongue, and the nose. The five organs of action are the organ of speech, the hands, the feet, and the organs of evacuation and generation.

It would be pertinent here to also explore the process of emergence of individual consciousness. There are two aspects or powers of *Maya* - the power of projection (*viksepa sakti*) and the power of veiling (*avarana sakti*)<sup>29</sup>. The two powers function side by side. The power of projection creates the third and the fourth layers, as explained previously, through the interactions of the three *gunas* - *sattva*, *rajas* and *tamas*. The veiling power of *Maya* is responsible for the creation of a sense of agency or the individual consciousness at the microcosmic level. Explanatory texts on Self-knowledge of Sri Shankaracharya mentions “*Brahman*, or Pure Consciousness, associated with individual ignorance, is called the *jiva*, or individual living soul. The *jiva* dwells in a body”<sup>30</sup> The Universal Consciousness appears to get limited or reflected in the subtlest part of the mind resulting in the emergence of individual consciousness as a living being or the *jiva*.<sup>31</sup> The long red arrow in Table 1 illustrates this association. The *jiva* is endowed with the powers of knowledge, will and activity.<sup>32</sup>

## 2.7 The Fourth Layer: Physical World

This section will delve into the last stage of the four-layered framework - the creation of the physical world. *Tanmatras* have a central role in creation of materiality. In this four-layered framework, the origination of materiality happens in three stages. The process starts from *Maya* or *Prakriti* of the second layer, goes through third layer of *tanmatras* and finally manifests as gross elements and the universe in the fourth layer. The Self-knowledge of Sri Shankaracharya<sup>33</sup>, *Vedānta-sāra* of Sadānanda Yogindra<sup>34</sup> and many other texts have given a detail description about these processes which is summarized in table 4.

Second layer: <i>Maya</i> or <i>Prakriti</i>	Third layer: <i>Tanmatra</i>	Fourth layer: Gross elements
1	2	3
When the three components of <i>Maya</i> ( <i>sattva</i> , <i>rajas</i> , <i>tamas</i> ) are in disequilibrium state, with <i>tamas</i> being prominent, <i>tanmatras</i> of the third layer are created.	The three components of <i>tanmatras</i> ( <i>sattva</i> , <i>rajas</i> , <i>tamas</i> ) interact and with <i>tamas</i> being prominent, gross elements of the fourth layer are created.	From gross elements, the universe is created.

**Table 4: Deriving Materiality from Consciousness**

As mentioned in section 2.5, the overall process of creation of the physical world of the fourth layer is guided by the cosmic ideation of the third layer, i.e., the layer of the *Hiranyagarbha*. The origination of materiality, as mentioned in the *Patanjali-Sankhya* system, has been analysed exhaustively by Brajendranath Seal. He says -

“Three stages clearly stand out in the genesis of Matter:- (1) the original infinitesimal units of Mass or inertia, absolutely homogeneous and ubiquitous, on which Energy does work, when the original equilibrium come to an end (*Bhutadi*) (2) the infra-atomic unit-potentials, charged with different kinds of Energy, which result from the action of Energy on the original units of Mass (*Tanmatra*); and (3) the five different classes of atoms, the minutest divisions of which gross matter is capable, but which are themselves complex *Tanmatric* systems (*Sthulbhutaparamanu*).”<sup>35</sup>

The actual creation process of the five gross elements and the universe, has been explained in detail by Seal<sup>36</sup>. The five subtle elements evolve into five *bhutas* or gross elements - *akasha*, *vayu*, *tejas*, *ap*, *prthivi*. Additionally, the sequence of creation of gross elements aligns with the stages of creation of the universe as specified in modern cosmology. The detail process is as follows

- The first *tanmatra* - the *shabda tanmatra* or “the vibration potential” gets more accretion of *tamas* and generates the first physical element - *akasha bhuta* (equivalent to physical space) which is “...ubiquitous and all-enveloping”.
- The *shabda tanmatra* or the “vibration potential” combines with the *sparsha tanmatra* or the “impact potential” and the second physical element the *vayu* (gaseous state) is created. This element “...by aggregation formed a gaseous envelop”.
- The first three *tanmatric* energies (*shabda*, *sparsha* and *rupa*) then add up and we get the *tejas* (fire) element “...which by aggregation enveloped the gaseous world in huge flames”.
- In the fourth stage, the first four *tanmatric* energies (*shabda*, *sparsha*, *rupa* and *rasa*) add up and we get the *ap* (fluid) element. “The flaming gases were precipitated into cosmic masses of viscous fluid matters”.
- Finally, all the five *tanmatric* energies add up we have the solidification of the fluid state. It is the state represented by *prthivi* (earth-solid). “Thus the viscous fluid matters were condensed and transformed into the Earth-Bhuta....”

It may be mentioned that that these *bhutas* are not the elements of chemistry but they “.....stand for a classification of substances on the basis of their generic properties..... a classification more physical than chemical...”<sup>37</sup> A particular *bhuta* class may have different chemical elements due to different combinations of *sattva*, *rajas* and *tamas* in them.<sup>38</sup>

The *tanmatras*, corresponding *bhutas* (gross elements) and the stages of evolution of the universe are summarized in table 5.

Name of the <i>tanmatra</i> (subtle element)	Nature of the <i>tanmatra</i>		Corresponding <i>bhuta</i> class (gross element) created	Stages of evolution of the universe
	Potential sense stimuli	Potential physical nature		
1	2	3	4	5
<i>Shabda tanmatra</i>	Sound	Vibration	<i>Akasha</i> (space)	“...ubiquitous and all-enveloping” medium
<i>Sparsha tanmatra</i>	Touch	Impact or mechanical pressure	<i>Vayu</i> (gaseous state)	“...by aggregation formed a gaseous envelop”
<i>Rupa tanmatra</i>	Form/colour	Heat and light	<i>Tejas</i> (fire)	“...which by aggregation enveloped the gaseous world in huge flames”.
<i>Rasa tanmatra</i>	Taste	Viscous attraction/ liquidity	<i>Ap</i> (liquid/fluid)	“The flaming gases were thus precipitated into cosmic masses of viscous fluid matters”
<i>Gandha tanmatra</i>	Smell	Cohesive attraction/ hardness/ solidity	<i>Prthivi</i> (earth/solid)	“...the viscous fluid matters were condensed and transformed into the <i>Earth-bhuta</i> ”

**Table 5: *Tanmatras*, *Bhutas* and the stages of evolution of the universe**

However, there is a different view, as mentioned by Sri Shankaracharya and explained in detail by Sri Suresvaracharya<sup>39</sup>, regarding the actual creation process of gross elements from subtle elements. It is the *panchikarana* (quintuplication) process. The equation for this transformation process is as follows-

Gross element 1 =  $1/2(\text{subtle element 1}) + 1/8(\text{subtle element 2} + \text{subtle element 3} + \text{subtle element 4} + \text{subtle element 5})$

This equation has been generalized from the equations described by Swami Satprakashananda in his book “The Universe, God, and God-Realization”.<sup>40</sup>

It is worth noting here that *Vedanta* offers very useful insights into the connection between space and materiality. The equilibrium state of *Maya* (the second layer) is beyond the web of

space or time. After the equilibrium is broken, *rajas* working on *tamas* gives rise to the vibrational *tanmatra* of the third layer, and this *tanmatra*, with further accretion of *tamas*, creates the first gross element – *akasha* or the space. The concept of space emerges from the first subtle element or the vibration *tanmatra*. *Akasha* or space has vibration as its genesis; hence it is a dynamic quantity and gets its sustenance of materiality from *tamas*. It is the first evolve in the cosmic evolution and as described earlier, materiality of the grosser forms evolves from it.

## 2.8 Putting It All Together In The Form Of Postulates

This section consolidates the descriptions of the four-layered framework, presenting them systematically in five distinct postulates.

- |             |   |
|-------------|---|
| Postulate 1 | <i>Brahman</i> or the Universal Consciousness is the first and the fundamental layer which is all-pervasive and eternal.  |
| Postulate 2 | The second layer represents the creative aspect of the first layer. The first layer changes into a sense of agency at the universal level and its associated field – the <i>Isvara</i> and <i>Maya</i> . <i>Maya</i> consists of three components – <i>sattva</i> , <i>rajas</i> and <i>tamas</i> (foundational aspects of intelligence, energy and inertia). Additionally, <i>Maya</i> possesses both the projection and veiling powers.   |
| Postulate 3 | The interactions of the three components, with <i>tamas</i> taking precedence, results in the formation of the five subtle elements which serve as the foundational building blocks for the third and the fourth layers. The three components reemerge within the subtle elements and continue to interact with one another. When the <i>sattva</i> dominates, the cosmic mind (a blueprint or the ideation for the universe) and individual minds are formed. When the <i>rajas</i> takes precedence, cosmic energy and individual vital energies come into existence. |
| Postulate 4 | When <i>tamas</i> components of the five subtle elements dominate, the physical world and the individual physical bodies of the fourth layer are formed, guided by the cosmic ideation of the third layer. All these manifestations arise from the projecting power of <i>Maya</i> .  |
| Postulate 5 | The veiling power of <i>Maya</i> veils the Universal Consciousness which gets limited in the subtlest part of the individual's mind and appears as individual consciousness. This gives the impression of individual consciousness being generated and being confined within the mind/brain of a living being.  |

### 3. APPLICATIONS OF THIS FOUR-LAYERED FRAMEWORK

The four-layered framework described in previous sections will now be applied in to examine three questions – First, I will show how this framework provides a solution to the reverse ‘hard problem’. Next, I will do a brief comparative analysis of this framework with some popular consciousness theories like those proposed by David Chalmers, Roger Penrose, Stuart Hameroff, Donald Hoffman and Giulio Tononi. Finally, I will discuss the consonance of the layers & structures of this framework with some of the significant physical phenomena and laws of nature.

#### 3.1 Solution To The Reverse ‘Hard Problem’

The ‘hard problem’ of consciousness deals with the basic question - how consciousness arises from matter. This has been the key focus of the Consciousness Studies. However, it has not been solved till date. In this paper I reversed the ‘hard problem’ and started with the premise that we cannot deduce consciousness from materiality; rather materiality evolves from consciousness. I presented a four-layered Vedantic framework as a solution to this reverse ‘hard problem’. In the previous sections, I have described this framework which starts from Universal Consciousness at the fundamental level and then, in stages, evolves to create cosmic mind, individual mind, individual consciousness and the physical world, thus providing a solution to the reverse ‘hard problem’ - Deriving Materiality from Consciousness.

#### 3.2 A Brief Discussion On Some Of The Popular Consciousness Theories In The Light Of The Four-Layered Framework

##### 3.2.1 David Chalmers’ ‘Conscious Experience’ As A Fundamental Feature Of The World

According to David Chalmers (1995)<sup>41</sup>, ‘conscious experience’ cannot be explained in terms of the physical. He takes the experience itself as one of the fundamental features of the world in addition to mass, charge, etc.

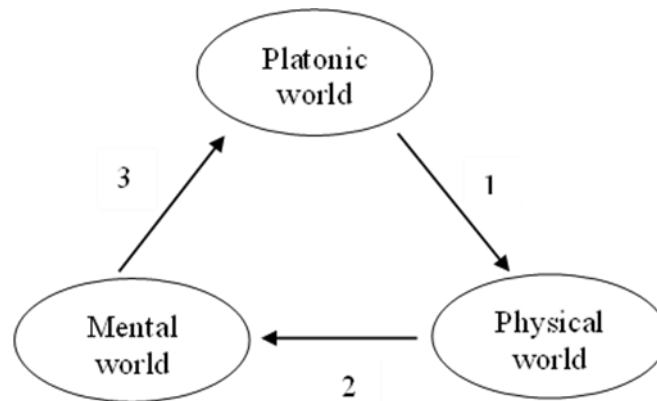
According to the four-layered framework, the subtle body, which includes the mind (seat of experience) belongs to the third layer while the physical world belongs to the fourth layer. This framework does not consider them to be the fundamental features of reality. Instead, these layers evolve from *Brahman* - the fundamental layer of reality

##### 3.2.2 Roger Penrose’s Three Worlds

Roger Penrose, in his book “Shadows of the mind”<sup>42</sup> visualized the reality in terms of three worlds - the Platonic mathematical world, the physical world and the mental world. The



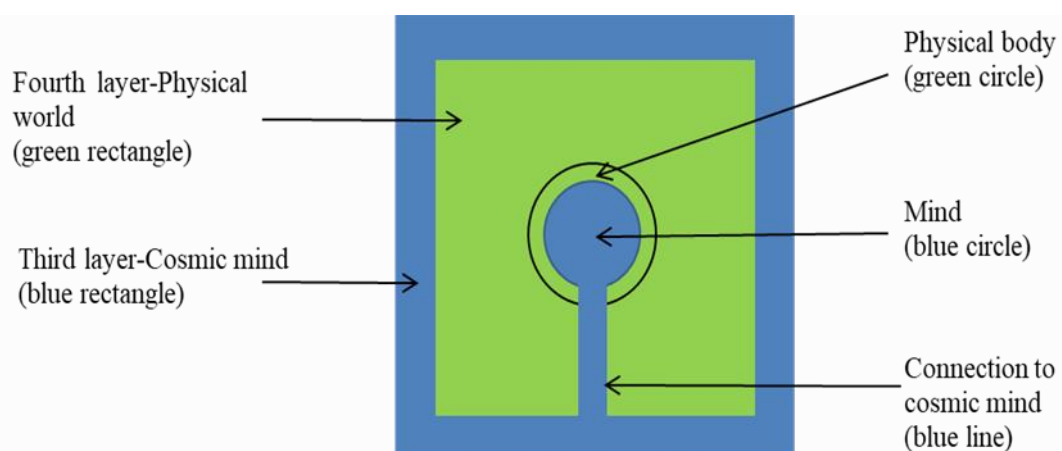
three worlds of Penrose may be redrawn, leaving out the details, in a very simplified way as depicted in figure 2.



**Figure 2: The three worlds**

Penrose says that there are three mysteries in the three respective connections between them. The first mystery is that the world of physical reality seems to emerge out of the Platonic world of mathematics. The second mystery is how “perceiving beings” with its mental world come out of the physical world and the third and final mystery is as to how our minds access the Platonic mathematical world.

An attempt can be made for solving these mysteries based on the four-layered framework. If the first and second layers are removed from figure 1, then the remaining layers and components become equivalent to the three worlds of Penrose. The Platonic world will be equivalent to the cosmic mind of the third layer, the mental world is equivalent to the individual mind of the same layer and the term physical world is the same in both the frameworks. However, the arrangements of the three worlds of Penrose gets changed. It is illustrated in figure 3 below.



**Figure 3: Equivalent layers of four-layered model and Penrose's three worlds**

The first mystery can be solved if we consider the point (explained in section 2.5) that the fourth layer do emerge out according to the cosmic ideation of the third layer. Repeating the quote of Swami Vivekananda again..... “In the universe, Brahma or *Hiranyagarbha* or the cosmic Mahat first manifested himself as name, then as form, i.e., as this universe....”. Regarding the second mystery, it is not that the “perceiving beings” with its mental world come out of the physical world, it is the *jiva*’s subtle body that develops its gross body<sup>43</sup>. The third and final mystery of how our minds access the Platonic mathematical can be solved simply if we accept the premise that the individual mind is a part of the cosmic mind and consequently it can access the cosmic mind.

### 3.2.3 Penrose-Hameroff ‘Orch OR’ Theory Of Consciousness

According to this theory<sup>44</sup>, the quantum mechanical effects in the microtubule structures inside the neuron are linked with the fluctuations of the corresponding space-time geometry. Further, proto-consciousness “lacking cognition & meaningful content” are supposed to exist at the Planck scale space time geometry. Orchestrated Objective Reduction (Orch OR) of the quantum state converts the proto-consciousness into a “stream of consciousness”. In the four-layered framework, *Maya* “measures” (refer to section 2.3) or apparently confines the Universal Consciousness within the limitations of space, time and causation, creating the individual consciousness. The Orch-OR process, it seems, may represent some similarities with the processes of *Maya*. However, there is a basic difference between these two processes. Orch OR model creates the stream of consciousness from proto-consciousness in a bottom-up approach where as in the four-layered framework, it is a top-down process. Universal-Consciousness, which is eternal, infinite and complete in itself, gets limited by *Maya* and from that limitation, individual consciousness emerges.

### 3.2.4 Donald Hoffman’s Conscious Agent

In Hoffman’s theory<sup>45</sup> as well as in the four-layered framework presented here, consciousness is fundamental and matter is derivative. Hoffman’s conscious agent has three processes - perception, decision and action. Similarly, the *jiva* (an embodied individual consciousness) is endowed with the powers of knowledge, will and activity (section 2.6).

In Hoffman’s theory, there are different types of conscious agents starting from the experiencing conscious agents to the experience creating conscious agents. In the four-layered framework, however, there are *jivas* as the experiencing conscious agents and different forms that are experienced by the *jivas*. The psycho-physical structure of a *jiva* as well as the different forms that are experienced by the *jiva*- both are created from the interactions of *sattva*, *rajas* and *tamas* of the *tanmatras*.

There is another aspect in Hoffman’s theory which is very similar to what Swami Vivekananda has stated about the process of perception. Although I have kept the process of perception out of scope of discussion in this paper, I believe that it is important to mention it in this context. In Hoffman’s theory, objects that are experienced by a conscious agent are

just icons in its perceptual interface and not the actual things. Swami Vivekananda says “Take this book; as a book it does not exist outside, what exists outside is unknown and unknowable. The unknowable furnishes the suggestion that gives a blow to the mind, and the mind gives out the reaction in the form of a book .....”<sup>46</sup>

### 3.2.5 Giulio Tononi’s Integrated Information Theory

Tononi’s Integrated Information Theory<sup>47</sup> also begins with consciousness/experience as its foundation, though it approaches the subject in a different manner. The theory tries to identify the essential features of consciousness as axioms then postulates about the properties a physical system must contain so as to account for those features. It then uses those postulates to find out whether a system has consciousness.

The two features of Integrated Information Theory and the four-layered framework that are similar are shared below.

The first axiom of Integrated Information Theory states “Consciousness exists”. It closely resembles the first two aspects of *Brahman* or Universal Consciousness i.e. *sat* and *chit* as explained in section 2.2. Universal Consciousness exists and is self-aware.

Further, Integrated Information Theory defines a cause-effect space and says “.....an experience is a ‘form’ in cause-effect space”. Tononi’s above concept very closely resembles what Swami Vivekananda had stated (section 2.5), “In the universe, *Brahma* or *Hiranyagarbha* or the cosmic *Mahat* first manifested himself as name, then as form, i.e., as this universe”. In the four-layered framework, the cosmic mind or the *Hiranyagarbha* of the third layer, described in section 2.5, serves as the blueprint or the cosmic ideation of the universe. Various forms in the physical universe manifest based on this cosmic ideation.

## 3.3 Consonance With Various Physical Phenomena & The Laws Of Nature And Suggestions For Further Research

The four-layered framework’s consonance with various physical phenomena and the laws of nature will now be briefly outlined. Further research is needed in these areas so that more clarity may be obtained.

### 3.3.1 A Theory Uniting Subjectivity And Objectivity

Attempts are being made for a unified theory involving all types of matter and forces. But for a truly unified theory, we also have to unite (in addition to matter and forces) the mind as well as consciousness into a single system. As mentioned by Stephen Hawking, in his book ‘A brief history of time’<sup>48</sup>, “A complete, consistent, unified theory is only the first step: our goal is a complete *understanding* of the events around us as, and of our own existence”. *Brahman* or the Universal Consciousness is that fundamental reality, a unifying ground, from which mentality as well as materiality emerge.

### 3.3.2 *Rajas & Tamas: Dark Energy, Dark Matter?*

In sections 2.4 and 2.7 it was stated that *rajas* working on *tamas* of the second layer gives rise to the vibrational *tanmatra* (*shabda tanmatra*) of the third layer, and this *tanmatra*, with further accretion of *tamas* creates the first gross element - *akasha* or the space. It gets its sustenance of materiality from *tamas*. From *akasha* or space, materiality of grosser forms evolves. Hence *tamas* may have some correspondences with the concept of dark matter which provides the missing mass of the universe. Dark energy, on the other hand is responsible for universe's accelerating expansion. It resembles the *rajas* which incessantly provides the dynamism required for the creation of the third and the fourth layer.

### 3.3.3 *Rajas & Tamas: Similarities With String Vibrations*

In string theory, the basic building blocks are the one-dimensional vibrating strings of highly concentrated mass-energy which vibrate like the strings of a musical instrument and each vibrational mode generates a particle. In the four-layered framework, a similar process has been described. *Rajas* (energy) and *tamas* (inertia) along with *sattva* (medium for reflection of intelligence) vibrate and interact among themselves that creates the *tanmatras*, cosmic and individual mind, physical world etc.

### 3.3.4 *Tanmatras: Quantum Fields?*

The quantum fields may have some correlations with the *tanmatras* of the third layer of the four-layered framework. Both describe the fundamental, subtle realities underlying the manifest world. Both undergo certain excitations or vibrations after which materiality is manifested.

### 3.3.5 *Sequence Of Creation Of Gross Elements And Its Similarities With Modern Cosmology*

The sequence of creation of gross elements matches the process of evolution of the universe as described by modern cosmology. The process of creation (section 2.7) unfolds in the following manner. Initially there is the vibration (represented by *akasha bhuta*) which is "...ubiquitous and all enveloping" medium. The vibration causes friction or impact (represented by *vayu bhuta*) which "...by aggregation formed a gaseous envelop". The friction or impact gives rise to heat & light (represented by *tejas bhuta*) "...which by aggregation enveloped the gaseous world in huge flames". The heat and light cools down & we have liquefaction and get the fluid matter (*Ap bhuta*); "The flaming gases were thus precipitated into cosmic masses of viscous fluid matters". Finally, we have the solidification of the fluid state (*prthivi bhuta*) "...the viscous fluid matters were thus condensed and transformed into earth *bhuta*".

### 3.3.6 *Relation Of Space & Cosmic Ideation*

It is the third layer where we see the simultaneous emergence of space (through *shabda tanmatra* and then *akasha*) as well as the cosmic ideation or the blueprint for the universe.

This phenomenon suggests that the code for evolution of universe may have been embedded in the fabric of space in some hidden dimensions.

### 3.3.7 Parallels Between The Measurement Processes In Quantum Mechanics And Vedanta

In quantum mechanics, measurement causes the collapse of the wave function, leading to the emergence of finiteness. In *Vedanta* philosophy we find several instances where it is stated that measurement of infinite or undifferentiated causes finiteness to appear. The etymological meaning of *maya* (section 2.3), is closely associated with the process of measurement.

“That which measures everything (*miyate Anaya iti maya*), i.e., that which apparently confines the infinite absolute Reality within the limitations of space-time-causation (*desa-kala-nimitta*), and makes It appear manifold, finite, and measurable through the senses and mind, by its three *gunas* of *sattva-rajas-tamas*”

The process of measurement has also been mentioned in the 11<sup>th</sup> mantra of the *Mandukya Upanishad*.

“*Prajna* with the sphere of activity in sleep state is m, the third letter of Om, because of measuring or because of absorption.....”<sup>49</sup>

According to *Mandukya Upanishad*, *prajna* is the deep sleep state, purely undifferentiated. This state is the doorway to the discrete experiences of the *taijasa* or the dream state and the *visva* or the waking state. It is, as if, dream and waking states are measured out by a measuring vessel from the undifferentiated sleep state.

### 3.3.8 Debating The Possibility Of Machine Consciousness

The debate over whether consciousness can emerge from machines having artificial intelligence can be placed in proper perspective if we base our arguments on figure 1 and associated descriptions. Individual consciousness, as has been depicted in figure 1, is not an isolated one. It is deeply connected to the Universal Consciousness that transcends the boundaries of space and time and exists in a non-dual realm. An AI system that exists in a physical hardware situated within the boundaries of the physical world cannot access or capture the non-dual, unchanging, non-algorithmic and non-computational realm of consciousness. AI systems may be able to simulate the behavioural aspects of consciousness but it will not be able to become conscious merely on the basis of algorithms and computational processes.

## 4. CONCLUSION

This four-layered framework provides a broad and holistic perspective on reality, rooted in Vedantic philosophy, and presents a solution to the reverse hard problem. The first and the second layers of this four-layered framework cannot be experimentally verified; their essence has been realized by the *rishis* in their profound states of meditation. However, if these initial layers are accepted as it is, the subsequent layers and structures unfold logically and sequentially. Some of its layers and structures have comparable features with those of several prominent consciousness theories. Moreover, the outer layers of this framework align with some key physical phenomena and natural laws, providing meaningful insights into their nature. This attribute makes the framework an ideal platform for the convergence of spiritual and scientific domains.

\*\*\*\*\*

### Brief Profile of the Author:

**Goutam Ghosh** did his Master's in Physics and then completed a PG Diploma in Computer Applications. He taught Physics for a few years and later joined the Planning & Development Department, Govt. of Bihar, and looked after the IT operations for the department. His interest in Consciousness Studies, which was initiated during his university days, continued simultaneously and to gain an experiential insight, he completed a PG Diploma in Yogic Studies. After working for 24 years in the Planning & Development Department, he took early retirement and followed his passion for Consciousness Studies as an Independent Researcher.

He has been presenting his views on Consciousness in various Conferences and Forums. Some notable among them were - "Models of Brain & Mind" Conference by the Saha Institute of Nuclear Physics, Kolkata (2006); "World Congress on Psychology & Spirituality" Conference organized by the Association for Transpersonal Psychology & other groups in Delhi (2008); "Science of Consciousness" Online Conference organized by the Centre for Consciousness Studies, University of Arizona (2020); Conference on "Machine, Mind and Consciousness" organized by the Bhaktivedanta Institute in Bengaluru (2024), etc. He is associated with several groups who are working on the diverse areas of Consciousness Studies and on advancement of Indian Knowledge Systems. He is based in Bengaluru.

**Statements and Declaration:** This paper is an extension of the ideas and concepts presented by the author at various conferences and forums. The author declares he has no conflict of interest with anybody in publishing this paper. No financial support was received for the work within this paper.



## References:

1. Swami Gambhirananda. *Eight Upanishads, With the Commentary of Sri Shankaracharya, Volume Two*. Advaita Ashrama, Mayavati, Uttarakhand, from its Publication House, Kolkata, WB, 1958
2. Swami Nikhilananda. *Self-Knowledge of Sri Shankaracharya*. Sri Ramakrishna Math, Mylapore, Chennai, 1947
3. Swami Nikhilananda. *Vedānta-sāra of Sadānanda Yogindra*. Advaita Ashrama, Mayavati, Uttarakhand, from its Publication House, Kolkata, WB, 2014
4. Swami Bhajananda. *Knowledge and consciousness: an integral approach. Published in Understanding Consciousness: recent advances*. Ramakrishna Mission Institute of Culture Gol Park, Kolkata - 700029. 2009. pp. 53-54
5. Swami Satprakashananda. *The Universe, God, and God-Realization*. Sri Ramakrishna Math, Mylapore Chennai, 2004. p. 41
6. <https://englishbooks.rkmm.org/s/tsv/m/the-complete-works-of-swami-vivekananda/a/8-1-1-iii-discourses-on-jn%C4%81na-yoga>
7. Op. cit., *Vedānta-sāra of Sadānanda Yogindra*. p. 13
8. Swami Nikhilananda. *Drg Drsyā Viveka*. Advaita Ashrama, 5 Dehi Entally Road, Kolkata 700014. 2006. p. 54
9. <https://englishbooks.rkmm.org/s/tsv/m/the-complete-works-of-swami-vivekananda/a/2-5-6-the-absolute-and-manifestation>
10. Op. cit., *Vedānta-sāra of Sadānanda Yogindra*. p. 42
11. Op. cit., *The Universe, God, and God-Realization*. p. 78
12. Swami Mukhyananda. *Shri Shankaracharya Life and Philosophy*. Advaita Ashrama, Mayavati, Champawat, Uttaranchal, India. 2006. p. 134
13. Op. cit., *Self-Knowledge of Sri Shankaracharya*. p. 55
14. Swami Sunirmalananda. *Insights into Vedanta: Tattvabodha*. Sri Ramakrishna Math, Chennai, India. 2005. p. 232
15. <https://englishbooks.rkmm.org/s/tsv/m/the-complete-works-of-swami-vivekananda/a/1-3-9-2-concentration-its-practice>
16. Swami Prabhavananda and Christopher Isherwood. *The Yoga Aphorisms of Patanjali*. Sri Ramakrishna Math, Mylapore, Chennai. p. 16
17. Brajendranath Seal. *The Positive Sciences of the Ancient Hindus*. Motilal Banarsidass Publishers Limited, Delhi. 1985. p. 3
18. Ibid., p. 4
19. Op. cit., *Self-Knowledge of Sri Shankaracharya*. p. 72
20. Op. cit., *The Positive Sciences of the Ancient Hindus*. p. 37-38
21. *Panchikaranam of Sri Shankaracharya*. Advaita Ashrama, 5 Dehi Entally Road, Kolkata 700014. 2018. p. 2
22. Swami Krishnananda. *Commentary on Panchadasi*. The Divine Life Society, Sivananda Ashram, Rishikesh, India. p. 308-310  
swami-krishnananda.org
23. <https://englishbooks.rkmm.org/s/tsv/m/the-complete-works-of-swami-vivekananda/a/3-2-7-the-mantra-om-word-and-wisdom>
24. Swami Vireswarananda. *Brahma-Sutras, According to Sri Shankaracharya*. Advaita Ashrama, Mayavati, Champawat, Himalayas. 1936. p. 255
25. Op. cit., *Eight Upanishads Volume Two*. p. 497
26. Op. cit., *Eight Upanishads Volume Two*. p. 3



27. <https://englishbooks.rkmm.org/s/tsv/m/the-complete-works-of-swami-vivekananda/a/1-3-3-prana>
28. Swami Atmapriyananda. *Bhavamukha-Sri Ramakrishna's unique contribution to the science of consciousness. Published in Consciousness: A Deeper Scientific Search.* Ramakrishna Mission Institute of Culture Gol Park, Kolkata - 700029. 2006. p. 288
29. Op. cit., *Drg Drsya Viveka*. p. 37
30. Op. cit., *Self-Knowledge of Sri Shankaracharya*. p. 62
31. Ibid., p. 74
32. Ibid., p. 76
33. Ibid.
34. Op. cit., *Vedānta-sāra of Sadānanda Yogindra*.
35. Op. cit., *The Positive Sciences of the Ancient Hindus*. p. 24
36. Ibid., p. 38-41
37. Ibid., p. 40
38. Ibid., p. 44
39. Op. cit., *Panchikaranam of Sri Shankaracharya*
40. Op. cit., *The Universe, God, and God-Realization*. p. 120
41. David J. Chalmers. *Facing Up to the Problem of Consciousness*. Journal of Consciousness Studies, Volume 2 Number 3, Imprint Academic, Exeter, UK. 1995
42. Roger Penrose. *Shadows of the Mind*. Vintage Books, London. 2005. p. 411-417
43. Op. cit., *The Universe, God, and God-Realization*. p. 125
44. Stuart Hameroff and Roger Penrose. *Consciousness in the Universe A Review of the 'Orch OR' Theory*. Physics of Life Reviews Volume 11 Issue 1. 2014  
<https://doi.org/10.1016/j.plrev.2013.08.002>  
<https://www.sciencedirect.com/science/article/pii/S1571064513001188>
45. Donald D. Hoffman and Chetan Prakash. *Objects of Consciousness*. Frontiers in Psychology. 2014.  
<https://doi.org/10.3389/fpsyg.2014.00577>  
<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2014.00577/full>
46. <https://englishbooks.rkmm.org/s/tsv/m/the-complete-works-of-swami-vivekananda/a/1-3-9-concentration-its-spiritual-uses-chapter-1>
47. Giulio Tononi. *Integrated Information Theory*. Scholarpedia, 2015  
<http://dx.doi.org/10.4249/scholarpedia.4164>  
[http://www.scholarpedia.org/article/Integrated\\_information\\_theory](http://www.scholarpedia.org/article/Integrated_information_theory)
48. Stephen W. Hawking. *A Brief History of Time*, Bantam Books, New York, 1989. p. 179
49. Op. cit., *Eight Upanishads Volume Two*. p. 217