DEPENDENT CO-ORIGINATION AND INHERENT EXISTENCE: EXTENDED DUAL-ASPECT MONISM

Ram Lakhan Pandey Vimal

Vision Research Institute, 25 Rita Street, Lowell, MA 01854 USA

Abstract

During meditation, consciousness/awareness is usually enhanced because of higher attention and concentration, which inter-dependently co-arise thru appropriate interactions between neural signals. Nāgārjuna rejects 'inherent existence' or 'essence' in favor of co-dependent origination (*Pratītyasamutpāda*), and that is also why he rejects causality; the entities that lack inherent existence dependently co-arise. Causality is a major issue in metaphysical views. The goals of this article are as follows:

(I) Which entities lack 'inherent existence' or 'essence' and which ones inherently exist?

(II) Do the entities that lack inherent existence dependently co-arise and hence can we reject causality as in Nāgārjuna's philosophy?

(III) Do the entities that exist inherently cause entities that lack inherent existence?

(IV) Do structure, function, experience, and environment cause each other? And

(V) We critically analyze, extend, and examine Nāgārjuna's philosophy of dependent co-origination in the extended Dual-Aspect Monism (eDAM) framework.

Our analysis suggests that:

(i) All conventional entities lack inherent existence. However, the dual-aspect unmanifested state of the primal entity (unified information field (UIF), emptiness, Śūnyatā, a neutral entity of Neutral Monism, or *Brahman*) inherently exists. The dual-aspect unmanifested state of UIF has (a) physical unified information field (PUIF, quantum vacuum, 'zero-point field'/ZPF)as physical aspect and (b) unified potential consciousness information field (UPCIF) as the non-physical aspect. The subjective experiences (SEs) of objects and of the subject (self) are the excitations or modes of the UPCIF, so they are derived entities and hence they lack inherent existence. The dual-aspect unmanifested state of UIF/emptiness/Śūnyatā is fundamental and irreducible, and hence it inherently exists.

(ii) The entities that lack inherent existence dependently co-arise, and hence causality for them can be rejected but instead *conditions* (such as efficient, percept-object, immediate, and dominant conditions) are necessary, as in Nāgārjuna's philosophy.

(iii) It is unclear that the dual-aspect primal entity UIF (*Brahman*/emptiness/Śūnyatā) that exists inherently cause entities that lack inherent existence. Most likely, all manifested entities inter-dependently co-arise thru natural laws built-in the UIF when necessary conditions for a manifested entity are satisfied thru interaction among relevant entities.

(iv) It is unclear that *structure, function, experience,* and environment cause each other. A cause must, at the same time, be an effect of another cause. This implies that there is no first cause. Therefore, the *structure, function, and experience* inter-dependently co-arise thru co-evolution, co-development, sensorimotor co-tuning, and the interaction among relevant entities after the necessary conditions of manifestation of a specific entity are satisfied; and they are linked via *conditions*.

(v) In the extended Dual-Aspect Monism (eDAM) framework, the physical aspect of a state of a manifested entity and that of the non-physical aspect (with functional, qualitative, cognitive, and experiential sub-aspects) of the same state of the same entity *inseparably* co-exist in each state of each entity at all levels. However, the degrees of manifestations of inseparable physical and non-physical aspects vary with the states, levels of entities, and contexts. Moreover, manifested entities lack inherent existence. In other words, the physical aspect and that of the non-physical aspect of manifested entities dependently co-arise, co-evolve, co-develop, and co-tuned for sensorimotor system appropriately depending on the levels of entities and contexts, which along with common "effective" information entail the *inseparability* of both aspects. In this sense, the symmetry between physical and non-physical aspects of a state of an entity (such as brain-mind system) is maintained, where the physical aspect (from third person perspective) does not *cause* the *inseparable* non-physical aspect (from first-person perspective) in living systems or *vice-versa*.

Keywords: Causality; conditions; Nāgārjuna; dependently co-origination; pratītya-samutpāda; relational ontology; mind-dependent reality; subject-inclusive reality; mind-independent reality; subject-exclusive reality; māyā; string theory; quantum physics; classical physics; dual-aspect model; functional, qualitative, cognitive, and experiential sub-aspects of non-physical aspect; string; elementary particles; fermions; bosons; experiences; proto-experiences; subjective experiences; self; nirvāṇa; Śūnyatā; emptiness; Big Bang; Big-Freeze; Big-Crunch; Big Bounce; Quantum Bounce.

1. Introduction

Let us first departs from Nāgārjuna's approach to meditation practice for a while and focus on the role of his principle of dependent co-origination and inherent existence in the process of increased awareness/consciousness that is a result of meditation. Briefly, consciousness is

composed of conscious experience, conscious cognition that includes thoughts, conscious qualities, and conscious function from the 1st person perspective. In the extended Dual-Aspect Monism (eDAM) framework, since the states of manifested entities (such as conscious states of our mind-brain system) are derived from the dual-aspect unmanifested state of the primal entity that has inherent existence, the conscious state with consciousness (non-physical aspect) and its neural-physical basis (physical aspect) lacks inherent existence and hence inter-dependently co-arise thru interaction between stimulus-dependent feed-forward signals and cognitive feedback signals. Since manifested entities inter-dependently co-arise, Nāgārjuna rejects causality and instead proposes four conditions (efficient, percept-object, immediate, and dominant conditions). During meditation, consciousness is usually enhanced because of higher attention and concentration, which inter-dependently co-arises thru appropriate interactions between neural signals.

In the debate on the philosophy of meditation, it is unclear if Nāgārjuna assumes a strong view the "Law of Causality" of Buddhism, in which there is no way to escape from the Karma (actions determining future state), or if he assumes a weaker view that we could avoid suffering by means of recognizing that essences are not real (but are mind-dependent attributes). This needs further research; however, Nāgārjuna seems to propose that we should do good karma to escape from suffering because bad karma always leads to suffering in current life or future rebirths (if true!). However, it is unclear what is good and bad karmas or how to decide them; they seem relative, but they should be decided based on fairness; they depend also on culture and society and other contexts. One general rule is that put yourself on your opponent's point of view and introspect how you would feel. If you feel that the opponent's specific karma is fair to you then it may be a good karma for you; otherwise, it is bad karma, i.e., if it were fair to you then it is fair to your opponent and then that specific action is a good karma.

In general, there are 4 noble truths (Section 2.1.4) and 12 nidānas (causal links: Section 2.1.5), which integrates karma theory (Section 2.1.5) and minimize suffering; this is further elaborated in Section 2. Nāgārjuna's approach to meditation is implemented to some extent in various Buddhist techniques, such as popular mindful meditation and vipassana meditation. The current article is adapted from VIMAL (2009c).

1.1. The four major metaphysics, the definition of consciousness, and hard problem

This section is adapted from (VIMAL, 2013). There are 4 groups of metaphysical foundations: materialism/*Cārvāka*, idealism/*Advaita*, dualism/*Sāṅkhya*, and multi-aspect monism (PEREIRA JUNIOR et al., 2016), such as the extended Dual-Aspect Monism (eDAM)/*Dvi-Pakṣa Advaita* (Section 1.2) and triple aspect monism (PEREIRA JR., 2013).

In the eDAM, if primitive/fundamental entity is the unified information field (UIF) with the universal potential consciousness information field (UPCIF) as non-physical aspect and physical unified information field (PUIF) as physical aspect at unmanifested state, then Nāgārjuna's dependent co-origination and inherent existence suggests that UIF at unmanifested state is the only primal entity-state that inherently exists and all manifested states of all entities including SEs and 18 elementary particles inter-dependently co-arise.

There are about forty meanings attributed to the term 'consciousness', which were identified and categorized according to whether they were principally about a *function* or about an *experience* (VIMAL, 2009b). In the eDAM, the definition of consciousness is: *Consciousness is the non-physical aspect of a be able ontological dual-aspect state of a mind-brain-system or a mind-brain-process*. Consciousness has four sub-aspects: a conscious experience (experiential sub-aspect), conscious cognition (cognitive sub-aspect, includes thoughts), conscious qualities (qualitative sub-aspect, such as patterns/forms), and a conscious function (functional sub-aspect) from the 1st person perspective; see also VIMAL (2010b). The eDAM addresses the hard problem of consciousness (how to explain the experiential aspect of consciousness) (VIMAL, 2015a).

1.2. Extended Dual-Aspect Monism (eDAM)

The extended dual-aspect monism (eDAM, *Dvi-Pakṣa Advaita Vedānta*) is a middle way (between materialism and idealism/dualism) framework. The eDAM is elaborated in VIMAL, (2008b, 2010a, 2013, 2015b, 2016b) and summarized in (VIMAL, 2016a).It has five components that are concisely summarized below:

1.2.1. The first component of the eDAM framework: Dual-Aspect Monism

This is elaborated in VIMAL (2008b). Briefly, it is hypothesized that a state of an entity[1] has *inseparable* physical and non-physical (functional, qualitative, cognitive, and experiential)

aspects; non-physical aspect is also called mental aspect in previous articles. This involves the *doctrine of inseparability*, which is our **first postulate**. The two aspects are elaborated further as follows:

1. The non-physical aspect of entity-state includes (a) functions as functional sub-aspect, (b) qualities as qualitative sub-aspect, (c) cognition such as thoughts, intellect/decision-making, memory, attention and so on as cognitive sub-aspect, and (d) our subjective experiences (SEs) as experiential sub-aspect. In living entities, subjective qualitative, cognitive and experiential sub-aspects are from 1st person perspective (1pp). The 1pp-qualitative sub-aspect is further elaborated in Section 5.5 of Chapter 5 of VIMAL (2017).
2. The physical aspect (includes a neural network of a brain and its activities, and 3pp-qualitative sub-aspect) is from the 3rd person perspective (3pp) and is objective.

The degree of manifestation of non-physical aspect and that of the physical aspect *dependently co-arise* (NĀGĀRJUNA; GARFIELD, 1995), co-evolve, co-develop, and sensorimotor co-tuned; this entails the *inseparability* between both aspects.

The state related to the experiential sub-aspect of the non-physical aspect consists of superposed *potential* basis-states (Section 1.2 of VIMAL, 2015b) related to the *potential* primary irreducible SEs representing the existence of the *potentiality* of experiences for living-system and/or conscious artifacts. For example, let us consider the color-related SEs such as redness, greenness, blueness, and so on. A specific color-SE such as redness corresponds to the specific redness-related beable ontic state, which can be considered as a basis state in the Hilbert space; this implies that the number of color-related basis states is equal to the number of color-SEs. The V8/V4/VO neural network (NN) is assigned to color (VIMAL, 2016b). A color-state consists of superposed *potential* color-basis-states. Similarly, we can consider all innumerable basis states related to all innumerable SEs. Then, we can make a statement that a state of a mind-brain system consists of superposed innumerable *potential* basis-states. A specific state of the mind-brain system related to a specific SE is realized/actualized thru the matching and selection mechanism, which is elaborated below in Section 1.2.2.

The state related to the qualitative sub-aspect consists of superposed *potential* basis-states related to forms/*rūpa*, patterns of distribution of matter/energy in space and time, and/or patterns of vibrations for both living and non-living systems (PEREIRA JR.et al, 2016).

The qualitative sub-aspect can be from 1pp and/or from 3pp. For example, the qualitative sub-aspect can be from 1pp for us (as subjects), but this can be considered as a part of our SEs (the experiential sub-aspect of non-physical aspect). For example, suppose we (as trichromatic-subjects from our 1pp) look at a ripe tomato (its 3pp-physical aspect). The form/pattern of the tomato is oval in shape and reflects long wave length light, which are the qualitative sub-aspects from the 3pp of the ripe state of the tomato. We, as the subjects from our 1pp, experience ovalness and redness. In this sense, it is consistent with eastern metaphysics *Sāṅkhya* because *rūpa* (visual form and pattern) is one of the five *tanmātras* (subtle-matter: *rūpa*/form, *śabda*/sound, *sparśa*/touch, *rasa*/taste, and *gandha*/smell), which are the parts of the *Prakṛti* (physical aspect) of *Sāṅkhya*.

Are 3pp-qualitative and 3pp-functional sub-aspects that of non-physical or physical aspect?

We have defined a non-physical entity as an entity that does not have mass, charge, and spin, i.e., it is neither a fermion or a boson. Therefore, 1pp and 3pp qualitative sub-aspect, like 1pp and 3pp functional sub-aspect, should be categorized under the non-physical aspect of a state of an entity.1pp-qualitative and 1pp-functional sub-aspects are really our 1pp-SEs; therefore, they are categorized under 1pp-experiential sub-aspect of the non-physical aspect of the state of the entity. In other words, 3pp-functional and 3pp-qualitative sub-aspects are that of the non-physical aspect of a state of an entity.

The 3pp-physical aspect also includes the appearance of matter and matter-in-itself. Strictly speaking, matter-in-itself, being an entity of 'mind-independent reality' (MIR), is unknown, but we try our best to know it by making models using our minds as in physics.

A conscious state of a mind-brain system has (i) the objective physical aspect such as the neural network of a brain and its activities from the 3pp, and (ii) the related *inseparable* subjective experiential sub-aspect such as experiences from the 1pp.

We have assumed that, in Nature, the subjective experiences (experiential sub-aspect) *potentially co-exist* with its *inseparable* physical aspect (this is our **second postulate**) of a state of an entity; this state consists of the *superposition* of the all possible/potential beable ontological (or ontic) dual-aspect basis states (or eigenstates). In other words, the non-physical aspect of a beable ontic basis state includes relevant *potential* experience and related function and

inseparably co-exists with its physical aspect. For example, a state related to the fundamental irreducible subjective experience redness (a primary color experience, which is experiential sub-aspect) and its neural basis (physical aspect) is a beable ontic basis state (also called eigenstate). The superposition of multiple possible experiential basis states is motivated by the hypothesis: *the non-physical aspect of wave-state is wave-like and is a function of experiences*. This is based on the assumption that a state of matter (wave/particle) has *inseparable non-physical* and physical aspects. As per the principle of superposition, $\psi = \Sigma_i \, a_i \, \phi_i$,, where ψ is a state of an entity and a_i is the probability amplitude of i^{th} basis or eigenstate ϕ_i.

The degree of manifestation of the physical aspect ($đ_p$) of a state of an entity is high in both living and non-living systems. In living system (such as our brain-mind system), the degree of manifestation of the 1pp-experiential sub-aspect ($đ_e$) of the non-physical aspect of an awake conscious brain-mind state is high because we have conscious subjective experiences. In non-living system, the degree of manifestation of the functional sub-aspect of the non-physical aspect of a state of an entity is high, but that of the other sub-aspects of the non-physical aspect is latent (or unmanifested or *apparently* absent) to the extent that materialists assume matter (physical aspect) as the only fundamental reality that leads to serious problems such as the well-known explanatory gap problem (LEVINE, 1983): how experiences can arise from matter. Furthermore, the development of specificity of a subjective experience in a specific neural network (such as color in V8/V4/VO visual area) is detailed in VIMAL (2008b).

My **working hypothesis** is as follows: The unmanifested state of the primal entity (*Brahman*) had both *inseparable* physical and non-physical aspects latent before manifestation as in Neutral Monism with the *apparent* aspectless and formless (*nirākārBrahman*) neutral entity. After Big Bang, the manifestation starts from the unmanifested state of the primal entity. First, its physical aspect and functional sub-aspect of non-physical aspect were co-manifested/co-arisen, but its experiential sub-aspect of the non-physical aspect was not yet manifested (meaning the experiential sub-aspect was latent, i.e., the degree $đ_e$ of the manifestation of the experiential sub-aspect was still latent/hidden/unmanifested). This is because experiences are the unique property of living systems and necessary conditions of consciousness (VIMAL, 2016b) are not satisfied; whereas, a structure (physical aspect) and its function (non-physical aspect) are properties of both living and non-living systems. In other words, the physical aspect co-manifested (i.e., co-arose,

co-evolved, co-developed, and sensori-motor co-tuned) with the functional sub-aspect of the non-physical aspect with high degrees $đ_p$ and $đ_f$, respectively. This is because every structure has at least one function (ignoring functionless structures, which are debatable). Functions are non-physical entities because a physical entity is composed of elementary particles (fermions or bosons), each of which has three attributes, namely, mass, charge, and spin as per Standard Model. Functions do not have mass, charge, and spin, so they are considered non-physical entities. Therefore, functions should be included in the non-physical (np) aspect. In other words, the non-physical aspect *appropriately* co-arose, co-evolved, co-originated, and co-developed with physical aspect inter-dependently (i.e., the degree of the manifestation of non-physical aspect, $đ_{np}$, slowly increased from zero along with that of the physical aspect $đ_p$). This is consistent with the Buddhist dependent co-origination (NĀGĀRJUNA; GARFIELD, 1995). Eventually, the degree of manifestation of the non-physical aspect of a conscious state of a mind-brain system becomes high ($0< đ_{np} \leq 1$) in us when we are awake conscious and $đ_e = 1$ at *Samādhi* state of the mind-brain system (see Section 1.2.3 below for further detail for the varying degree of manifestation of non-physical aspect). Furthermore, it is possible to link structure, function, and experience through the *inseparability* of 3pp-physical aspect (structure) and 1pp-nonphysical aspect (function and SE) of a state of a mind-brain system.

The two postulates of the eDAM imply that the *inseparable* physical aspect and the functional sub-aspect of the non-physical aspect of various states of various inert entities co-evolved and co-arose over 10 billion years after Big Bang. We know what happened to physical aspect and the functional sub-aspect (and to some extent qualitative sub-aspect) of the non-physical aspect of the states of galaxies, stars, planets and all non-living and living entities because they all have structure and function. However, the cognitive and experiential sub-aspect of the non-physical aspects during co-evolution needs further elaboration and research.

First, let us first clarify a term *proto-experience* (PE). A proto-experience is defined as the precursor of a *potential* subjective experience (SE). The experiential sub-aspect (its related states carry superposed PEs) and cognitive sub-aspect of the non-physical aspect co-evolved with their *inseparable* physical aspect from one entity to another during the formation of galaxies, stars, planets, etc. and eventually us.

For example, the innumerable beable-ontological states (such as a redness related state) can be introduced in a beable-Hilbert space as basis states, which are superposed in a state of a quantum elementary particle; see also ('t HOOFT, 2015). Each state has *inseparable* non-physical and physical aspects. When the relevant elementary particles are combined appropriately to form, for example, an atomic proton, the remaining (other than *realized* state related to proton) superposed beable-ontological states of elementary particles are appropriately transferred as the superposed beable-ontological states into a state of a proton. Similarly, one could argue for molecules and other aggregates. They are elaborated in Sections 3.14 and 3.15, especially 3.14.101.[1].10.[A], of (VIMAL, 2016a).

To sum up, the cognitive and experiential sub-aspects of the non-physical aspect of a state of an inert entity remained latent to us. However, its function has a higher degree of manifestation so it is not latent to us. Over 10 billion years after Big Bang or about 3.8 billion years ago, when life started, the degrees of manifestation of cognitive and experiential sub-aspects of the non-physical aspect of the states of living entities started increasing from *latent* to higher level. Eventually in us, in conscious states, after 3.8 billion years of co-evolution, the degree of manifestation of (cognitive and experiential sub-aspects of) non-physical aspect is equally high similar to that of the related *inseparable* physical aspect.

1.2.2. The second component of the eDAM framework: the dual mode and conjugate matching and selection mechanisms

This is well developed in VIMAL (2010a). Briefly, the *potentialities* (possibilities) of subjective experiences (SEs: experiential sub-aspect) are *actualized* when neural-networks are formed via *neural Darwinism*, and a specific subjective experience is selected by the self via a *matching* process through the interactions of two modes. The two modes are:

(1) The *non-tilde mode* that is the physical and non-physical aspect of a state of cognition (such as memory and attention) and the "self" related feedback signals in a neural-network (that includes self-related areas such as cortical and sub-cortical midline structures) of the brain, which is the cognitive nearest past approaching towards present; and

(2) The *tilde mode* that is the physical and non-physical aspect of a state of the feed-forward signals due to external environmental input and/or internal endogenous input, which is the

nearest future approaching towards present and is an entropy/time reversed representation of the non-tilde mode.

Furthermore, one could argue that there are quantum (such as dendritic-dendritic microtubule) and non-quantum (such as classical axonal-dendritic neural and astroglial, hydro-ionic) sub-pathways in each of the feed-forward and the feedback pathways for information transfer in the brain dynamics. We propose that:

(i) The *quantum-conjugate matching* (between *experiences* in the experiential sub-aspect of the non-physical aspect of the tilde mode and that of the non-tilde mode) is related more to the non-physical aspect of a state of the quantum sub-pathway and less to that of the non-quantum sub-pathways.

(ii) The classical *matching* between *experiences* in the experiential sub-aspect of the non-physical aspect of a state of the tilde mode and that of the non-tilde mode is related to the non-physical aspect of a state of the non-quantum sub-pathways.

In all cases, a specific SE is selected by the "self" (*not* by any homunculus)(a) when the tilde mode interacts with the non-tilde mode to *match* for a specific SE(if not matched then it is a new stimulus), and (b) when the *necessary* conditions of SEs (Section 1.2.5) are satisfied. When the conjugate match is made between the two modes, *the world-presence* (*Now*) is disclosed; its content is the SE of a subject (self), the SE of objects, and the content of SEs. The self is the experiential sub-aspect of the non-physical aspect of a state of the self-related neural network (such as cortical and sub-cortical midline structures) and its activities that are a part of reentrant feedback signals.

Let us take an example of "looking at a ripe-tomato" to experience its color; the long-wavelength light is reflected from it and enters the eyes of a trichromat and process thru the redness related NN (neural network). The physical aspects (neural signals) in the tilde mode and that in the non-tilde mode are matched to select a specific beable ontic dual-aspect state related to a specific SE (such as redness of a ripe-tomato) and experienced by the self. This selected specific beable ontic state has functional (detection and discrimination of redness from other colors), qualitative (long wavelength pattern/form/rūpa), cognitive (relevant cognition such as memory, attention, thoughts), and experiential (SE redness) sub-aspects of non-physical aspect from 1pp and inseparable physical aspect (structure: redness related V8-NN). In all cases, the

inseparability between aspects and the 1-1-1 relationship among structure-function-experience are maintained within a critical spatiotemporal interval.

In *consciousness electromagnetic information field (Cemi field) theory*, experiences are presumably from the 1pp-experiential sub-aspect of the non-physical aspect of a state of dual-aspect electromagnetic (em) field: "what Chalmers terms *experience* (CHALMERS, 1995, p. 201)… is what complex information encoded in em fields feels like *from the inside*" (MCFADDEN, 2002). In CACHA; POZNANSKI (2014), the concept of *functional field* is used. These fields may have many potential states related to experiences in the superposed form embedded in the field. In that case, it would still be non-conscious processing and then the explanatory gap of materialism remains. However, if these frameworks use the essential matching and selection mechanisms of the eDAM framework to select one specific experience after matching along with necessary conditions of consciousness to be satisfied (Section 1.2.5), and then the gap will be closed.

As per VIMAL (2015a):

- The two modes are stimulus-dependent-feed-forward-signals-related-mode and cognitive-feedback-signals-related-mode. They interact for conjugate matching and then the selection of a specific subjective experience occurs and experienced by the self (BRUZZO; VIMAL, 2007).

- For experiencing a specific SE, there are three major interacting signals: (i) stimulus-dependent feed-forward (FF) signals, (ii) stimuli-related-memory-dependent cognitive feedback (FB) signals, and (iii) self-related signal that is a part of reentrant FB signals.

- The self (a) is the SE of subject (BRUZZO; VIMAL, 2007), (b) consists of proto-self, core-self, and autobiographical-self (DAMASIO, 2010) as active dynamic self (ADS), and invariant passive self (PIS), and (c) is the 1pp experiential sub-aspect of the non-physical aspect of a state of 'self-related neural network (such as cortical and sub-cortical midline structures: (NORTHOFF;BERMPOHL, 2004)) and its activities'.

- The matching/interaction is between FF and FB signals; then the self-related signals interact with the resultant signal representing the matching between the stimulus-related FF signal and cognitive FB signals; thus, there are interactions between the three major signals; this interactive process can be called as 'the specific SE is selected and experienced by the self'.

1.2.3. The third component of the eDAM framework: the concept of the varying degrees of the manifestation of aspects depending on entities and their states, levels, and contexts

The third component of the eDAM is the *varying degrees of manifestation (appearance/strength) of physical and non-physical aspects of a state of an entity depending on the states/levels of entities and contexts, where contexts include entity-state, environment, background, surround, and so on*. This is well developed in (VIMAL, 2013). At each level, the manifestation of aspects is through dependent co-origination (NĀGĀRJUNA; GARFIELD, 1995), i.e., through co-evolution, co-adaptation, natural selection, co-development and sensorimotor co-tuning.

For example, the degree ($đ_e$) of manifestation of the *experiential* sub-aspect of the non-physical aspect of a state of a non-living (inert) non-conscious entity is zero, but that of an awake-conscious state of a living entity is high.

In entities at classical level (such as a non-living macro-object to a molecule and living systems), the physical aspect of a state is from the objective 3pp and the degree ($đ_p$) of its manifestation is high.

The non-physical aspect of a state of a living-system is from the subjective 1pp and the physical aspect is from the objective 3pp; the degrees ($đ_{np}$ and $đ_p$) of manifestation of both aspects are high at a conscious state.

We perceive (from our 1pp) the form, pattern of distribution of matter/energy in space and time, and/or pattern of vibration on a (non-living or living) entity, which indicates the existence of the qualitative sub-aspect from its 3pp; this can be called as 3pp-qualitative sub-aspect of the non-physical aspect of the state of the entity as argued in Section 1.2.1. In other words, the *qualitative* sub-aspect of the non-physical aspect of a state of a living (or non-living) entity, such

as forms and patterns, can be perceived or implicitly inferred from its 3pp. Its degree ($đ_{qp}$) of manifestation is high.

However, the *experiential* sub-aspect of the non-physical aspect of a state of a non-living system is 'latent' to us. In other words, in inert (**non-living**) entities at classical level, such as molecule, the related degrees $đ_p$ (for physical aspect), $đ_f$ (for functional sub-aspect), and $đ_q$ (for qualitative sub-aspect) are high and $đ_c$ (for cognitive sub-aspect) and $đ_e$ (for experiential sub-aspect) are latent to us. This does not mean that nonliving systems have consciousness like us that is hidden. Instead, in a layman's simple language, the non-physical aspect of a state of a nonliving entity carries '*potential* SEs' (or proto-experiences (PEs) that are precursors of SEs). This state is consist of the superposition of the basis states, which is a Nature's mechanism for carrying PEs and for the co-existence of *potential* SEs with its inseparable non-physical and physical aspects. Both aspects of the states of nonliving systems (such as elementary particles, atoms, molecules etc.) need to co-evolve to eventually attain our brain-mind system. It should be noted that the superposition is of the basis states.

Some materialistic biologists' dictionary has only structure and function; such biologists do not like terms, 'non-physical', 'mental', and 'experiential'. Therefore, to communicate with them, we can consider a 'function' as the functional sub-aspect of the non-physical aspect of a state of an entity and the related 'structure' as the physical aspect of the state of the entity.

Furthermore, let:

(i) The $đ_{np}$ indicates the degree of manifestation of the non-physical aspect of a state of an entity, where the manifestation is from the non-physical aspect of unmanifested/latent state of primal entity (*Brahman*); note that qualitative and functional sub-aspects of the non-physical aspect are from the 3pp of the objects; and

(ii) The $đ_p$ designates the degree of manifestation of the *inseparable* 3pp-physical aspect of the state of the entity, where the manifestation is from the 3pp-physical aspect of unmanifested/latent state of primal entity (*Brahman*).

Biological organisms can be conscious if the organism's evolutionary development is sufficiently developed or complex and the necessary conditions of consciousness are satisfied

(Section 1.2.5). In **living** systems, at a human level, when we are awake and conscious, both aspects are equally manifested. In other words, inert **nonliving** matter, proteins, neurotransmitters, and neuromodulators including all those entities, which do not satisfy the necessary conditions of consciousness, will not be conscious.

This does not mean that quantum consciousness is not supported; it is supported as long as it is interpreted in terms of the eDAM. In the quantum dendritic-dendritic mechanism, quantum Orch OR is hypothesized to occur in microtubule-network (HAMEROFF; MARCER, 1998), but its metaphysics is Neutral Monism, which has a problem: how physical and non-physical aspect can be derived from the neutral entity that has none of them. If the Neutral Monism is interpreted in the eDAM that both physical and non-physical aspects of the unmanifested state of neutral entity are latent; then the problem is resolved because the degree of manifestation varies with level/state of an entity and the context as elaborated above. Here, a specific SE say *redness* is selected from potential SEs embedded in brain's space time geometry by objective reduction (or collapse used by Orch OR) of *potential* SEs superposed in the non-physical aspect of a state of neural-network.

It is only at the neural-network level (in **living** systems) when these *necessary* conditions (including biological laws, see Section 1.2.5 below) of SEs are satisfied, and when a specific SE (such as *redness*) is selected by the self via the matching process then only a specific SE will occur in a specific neural network (such as *redness* will occur in the red-green V8/V4/VO-neural-network). Even the retina is not privileged to have SEs because it does not satisfy the essential conditions of consciousness, although the retina is essential for vision. The retinal opponent and non-opponent networks (such as red-green and yellow-blue opponent cells and luminance non-opponent cells and related visual channels), however, will have higher specificity (higher degree $đ_e$ of experiential sub-aspect of the non-physical aspect with degree $đ_{np}$) for SEs than cones and rods, which in turn will have higher specificity for SEs than molecules, atoms, and electrons.

Let us examine the degrees ($đ_p$ for physical aspect and $đ_f$, $đ_q$, $đ_c$, and $đ_e$ of $đ_{np}$ for non-physical aspect) of manifestation of aspects from humans to classical inert entities to quantum entities. If we assume that a state of 'entity-in-itself' has *inseparable* dual (non-physical and physical) aspects, then a state of 'human-in-herself' has 3pp-physical aspect (such as body-brain system and its activities including 3pp-qualitative sub-aspect) and inseparable 1pp non-physical aspect

(such as functions in the functional sub-aspect; the qualitative sub-aspect; thoughts, intentions, self, attention, and other cognitions in the cognitive sub-aspect; and SEs in the experiential sub-aspect) with high $đ_p$ and $đ_{np}$ (i.e., $đ_f$, $đ_q$, $đ_c$, and $đ_e$) at conscious state. The states of animals and birds have high $đ_p$ (the degree of manifestation of physical aspects, such as body-brain system and its activities) but their $đ_{np}$ (the degree of manifestation of non-physical aspect) seem to be of different (mostly lower) degree compared to humans. The states of plants have physical aspects such as their roots to branches and activities with high $đ_p$, and their non-physical aspects in term of functions (i.e., *functional* sub-aspect of non-physical aspect) with high $đ_f$ and qualitative sub-aspect with high $đ_q$. However, it is unclear if they have experiences, self, attention, and other human-like cognitions; they may have plant-type proto-experiences, which are latent to us, so their $đ_c$ and $đ_e$ may be very low. The states of dead bodies (of human, animals, birds, and plants), inert entities, and other classical macro and micro (such as elementary particles) entities have high $đ_p$ (the degree of manifestation of physical aspect), $đ_f$ and $đ_q$, but latent $đ_c$ and $đ_e$ (the degree of manifestation of cognitive and *experiential* sub-aspect of the non-physical aspect). By the term 'latent', we mean that the aspect is hidden, unexpressed, 'invisible', recessive (in analogy to a recessive gene), or unmanifested.

When we march on to quantum entities, the degree of manifestation of aspects needs further clarification: we are puzzled on a third person perspective (3pp-physical aspect) and functions (*functional* sub-aspect of the non-physical aspect) as we are unable to visualize and we depend on our models and indirect effects. On top of this, there are over 47 interpretations of quantum mechanics (QM). We will never know what quantum entities experience (if any!); so, the *experiential* sub-aspect of the non-physical aspect of a state of a quantum entity is hidden for us. Therefore, we propose that a state of a quantum entity has a sort of high $đ_p$, $đ_f$, and $đ_q$ and latent $đ_c$ and $đ_e$, somewhat similar to classical inert objects. Quantum physicist Stapp argues for Global Mind and mind like quantum entities (STAPP, 2009a, 2009b, 2013). However, quantum non-physical aspect is not like human mind; rather, the quantum mind like non-physical aspect has to co-evolve with its *inseparable* physical aspect over billions of years, and the end product is human mind (non-physical aspect) and *inseparable* human brain (physical aspect), respectively. The above clearly elaborates the difference between living and nonliving systems.

The degree of manifestation of a pair of sub-aspects of non-physical and physical aspects varies depending on the states of beable ontic entities, levels, and the context. Both aspects co-manifest equally in a synchronous order under all set of circumstances and conditions as justified later. For example, a pair could be (i) the non-physical aspect and (ii) the physical aspect related to the experiential sub-aspect, which must be co-manifested/realized together synchronously thru the IC. There are more than ample pieces of evidence in a conscious state (a large number of fMRI/EEG reports) and also altered states (such as various levels of samādhi states). If astral entities exist (so far, there is no scientific evidence) then the states of their aspects are still dual-aspect with neural-physical basis (NPB) as physical aspect (or astral-physical aspect) at astral/subtle level. If *mokshic* (liberated) state exists, then there it should also have NPB (or *mokshic*-physical aspect) at *mokshic* level. We do not have any scientific evidence for the existence of a soul (that goes out of body), life-after-death, and rebirth. If the existence of a soul is scientifically evident in future then its state will be beable ontic dual-aspect state. At any rate, in all conditions, the inseparability and all postulates of the eDAM must remain valid. It should be noted that all states must be beable ontic states of beable ontic entities. The term "beable ontic" means entities and their states must really exist in the universe out there; they should not be fictitious, imaginary, or probabilistic. The template state of quantum entities before a measurement is not a beable ontic state; it is an observable state. A template/quantum state of a quantum particle is composed of the superposition of beable ontic states as basis states in the Hilbert space, which is an abstract mathematical space we use to store all possible/potential beable ontic states as basis states for building models.

1.2.4. The fourth component of the eDAM framework: Segregation and integration of information

This is discussed in VIMAL (2015b). Briefly, there are two steps: (i) the segregation of information for the analysis of specific stimulus attributes (related to dimensions such as redness, sub-mode such as color, and mode such as vision), and then (ii) the integration of information for the synthesis of all attributes, which results in unified consciousness. In other words, the first stage of processing is the segregation of information (such as the information related to physical and conceptual attributes), which are analyzed and processed for preciseness and specificity in differently specialized neurons of related brain areas. Then, the second stage of processing is the

integration of information (or binding of attributes) (related to different functions, concepts, experiences and so on) in various neural-network-complexes, which results unified consciousness. The term 'differentiation' signifies that there are a large number of possible functions and *potential* experiences; this leads to higher effective information (TONONI, 2004).

I proposed 3 justifications in favor of the eDAM:

(i) The original source is dual-aspect primal structure (dual-aspect Brahman),

(ii) The "effective" information (see below) from the same stimulus source to both aspects, and

(iii) The critical test should show separability (if it exists).

Similar justifications are needed from the supporters of other frameworks.

The ontology of both aspects starts from the ontology of primal dual-aspect structure with the **effective information** between aspects. Here, let us use the term "effective information" instead of information to avoid confusion related to the form of information, information loss during transduction, during information conversion, and during transfer, and passive information not used in the active information. The "effective information" is defined as the information that has the same effect in both aspects, i.e., if there is a change in the information in the 3pp-physical aspect (as in the information in neural signals related to stimulus' neural representation), it should have corresponding change in the inseparable information in the 1pp non-physical aspect and vice versa.

Mathematically, from Section 2.6.1 of VIMAL (2015b), "the *effective information* (EI) between A and B is defined as (TONONI, 2004):

$$EI(A \rightarrow B) = MI(A^{Hmax};B) = H(A^{Hmax}) + H(B) - H(A^{Hmax}B), \qquad (6)$$

Where A^{Hmax} is the source A with maximum entropy to the outputs, B is the target, and $H(A^{Hmax})$is maximum entropy to the outputs from source A (Tononi, 2004). The arrow → in $A \rightarrow B$ represents that the source is A and the target is B; all possible effects of A on B are measured by $EI(A \rightarrow B)$. If the connections between A and B are specialized and strong,

EI($A \rightarrow B$) will be high. The value of EI($A \rightarrow B$) is bounded by A^{Hmax} and B^{Hmax}, whichever is less. In general, EI($A \rightarrow B$) and EI($B \rightarrow A$) are not symmetric. […] The effective information (EI) between A and B measures the repertoire of possible causal effects of A on B and of B on A."

Since effective information is proposed to be the same (i.e., has the same effect) in both aspects at all levels and all conditions, both aspects should be inseparable. Whatever goes on in one aspect is reflected in the other aspect. The contents of aspects look different because the perspectives of viewing are different. For example, physical (light) information (in the form of long wavelength and intensity of light) reflected from a ripe-tomato is transduced into an electrochemical signal in the retina (same effective information but in the form of neural signal), which travels towards cortex. Then the matching and selection mechanisms select a specific SE redness (which is the same effective information but in psychological form) and the "self" experiences it. For convenience, we can propose as follows: The effective information in the external light in physical form = effective physical information in neural form = common effective information in both aspects in abstract physical and non-physical form = non-physical effective information in an experiential/psychological form.

The integrated information theory (IIT) of consciousness (BALDUZZI; TONONI, 2009; TONONI, 2004, 2008, 2012) is based on the materialistic identity theory (consciousness is integrated information) or to some extent panpsychism (TONONI; KOCH, 2014). However, both materialism and panpsychism have serious problems (VIMAL, 2010b, 2013). Therefore, the IIT is re-interpreted in terms of more efficient metaphysics, such as the eDAM framework in VIMAL (2015b), which has the least number of problems; here, an information is a dual-aspect entity.

In the eDAM framework, consciousness [experiential (experiences/experiencer) and cognitive sub-aspects as defined in VIMAL (2010b) and Section 2.1.2] is the 1pp non-physical aspect of a state of related neural network that has a high amount of integrated non-physical information Φ_{np}. Consciousness has two sub-aspects: (a) the *experiential* sub-aspect of the non-physical aspect, such as SEs including feelings, emotion- and thought-related experiences and (b) the *cognitive* sub-aspect of the non-physical aspect, such as related to cognition. The 3pp-physical aspect of this state is the correlated neural-network (such as thalamocortical main complex) and its activity (*qualitative* physical aspect) as its neural substrate that has high amount of integrated physical-information Φ_p, which is close to the term 'integrated information' Φ used in (TONONI, 2004,

2008, 2012) and (BALDUZZI; TONONI, 2009). Since 1pp non-physical and 3pp-physical aspects are *inseparable*, 'non-physical' and 'physical' information related to the same brain-mind state are also *inseparable*.

1.2.5. The fifth component of the eDAM framework: Necessary and Sufficient Conditions of consciousness

This Section is adapted from (VIMAL, 2016b). A beable ontic dual-aspect state of an entity will manifest only when its necessary conditions of manifestation are satisfied. In other words, the criterion for the selection of *necessary conditions* is that if any of them is missing, we will not have consciousness, i.e., the necessary conditions are those conditions that must be satisfied in order to have consciousness. The *sufficient conditions* for consciousness are conditions, if satisfied, guarantee that the entity is conscious. Consciousness can be either *access* (reportable) or *phenomenal* (non-reportable) consciousness (BLOCK, 2005; LAMME, 2003). For *access* consciousness, the interactions are between feed-forward stimulus dependent signals and fronto-parietal feedback attentional signals. For example, the necessary conditions of a beable ontic conscious state of a mind-brain system and for *access* (reportable) consciousness are:

(i) Formation of neural-networks,

(ii) Wakefulness,

(iii) Reentrant interactions among neural populations,

(iv) Fronto-parietal and thalamic-reticular-nucleus attentional signals that modulate consciousness,

(v) Working memory that retains information for consciousness,

(vi) Information integration in 'complex' of neural-network, such as thalamocortical complexes with critical spatiotemporal 'grain-size' (TONONI, 2004, 2008, 2012),[2]

(vii) Stimulus contrast at or above the threshold level, and

(viii) Neural-network potential proto-experiences (PEs) that are pre-cursors of subjective experiences (SEs) embedded in a neural network.

One could further argue for other necessary conditions, such as (ix) higher-order thoughts, (x) executive functions, (xi) neural synchrony, (xii) intrinsic activity (Northoff, 2014), (xiii) active dynamic self (ADS) that is composed of proto-self, core-self and autobiographical self, (xiv)

passive invariant self (PIS), (xv) feature and binding, and so on. Certain neural-network or brain complex (such as thalamocortical 'complex') comparatively has very high integrated information (□). Therefore, it is a privileged area for consciousness. Attention and the ability to report are not necessary for phenomenal consciousness. Therefore, the necessary conditions for the phenomenal consciousness are the same as that for the access consciousness except the fourth condition related to attention. Further research is needed to address if the above necessary conditions of consciousness are also sufficient.

The eDAM framework (a) is parsimonious and has the least number of problems compared to all other frameworks (VIMAL, 2015a), (b) is consistent with psychophysical, biological, and physical laws, and (c) attempts to address the 'hard' problem of consciousness (how to explain SEs) (VIMAL, 2015b).

1.3. Definition of Mind-dependent reality (MDR), and Mind-independent reality (MIR)

Our daily reality is based on our minds and hence it is mind-dependent reality (MDR) or subject-inclusive reality (SIR). Mind-independent reality (MIR) or subject-exclusive reality (SER) is not known as per Kant. However, neo-Kantian view hypothesizes that since the mind is a product of Nature, the findings in MDR should be telling us something partly about MIR. In that case, MIR = physical-objects-in-themselves + mental-objects-in-themselves/subjectivity/SEs + unknown factors. MDR = function of (physical-objects-in-themselves, mental-objects-in-themselves/subjectivity/SEs). Even then physics implicitly assumes that MIR ~ MDR because physicists assume that natural laws although derived from human mind are independent of mind. If somehow we understand MIR and its relationship with MDR, we can get insight into subjectivity (SEs, intentionality, and so on).

2. Nāgārjuna's philosophy of dependent co-origination and the rejection of causality for those entities that lack inherent existence and the eDAM

The texts in Sections 2.1-2.1.9 are adapted from Wikipedia and related links (as of 21 July 2017) with appropriate modifications.

2.1. Pratītyasamutpāda (dependent co-origination)

Āchārya Nāgārjuna (150-250 AD) was an eminent Indian brahmin and was a Māhāyana Buddhist philosopher and the founder of the Mādhyamika school of Mahāyāna Buddhism.

2.1.1. Summary

Pratītyasamutpāda (प्रतीत्यसमुत्) doctrine is commonly translated as dependent origination, inter-dependent co-arising, dependent co-origination, conditioned arising, conditioned genesis, or dependent arising. It proposes that all *dharmas* (phenomena) arise in dependence upon other *dharmas*: "if this exists, that exists; if this ceases to exist, that also ceases to exist". The pragmatic principle is applied (a) to *dukkha* (suffering) and the cessation of *dukkha* and (b) in the twelve links of dependent origination doctrine in Buddhism, which describes the chain of causes which result in rebirth and dukkha (suffering). By breaking the chain, liberation from suffering can be attained. Everything except nirvāṇa is conditioned by *Pratītyasamutpāda*.It complements the doctrines of Anitya (impermanence) and *anātman* (doctrine of non-self: there is no unchanging, permanent self, soul or essence in living beings). Everything, except nirvāṇa (the unmanifested state of primal entity *Śūnyatā or* emptiness), dependently co-arise and lack inherent existence. In general, in the Mahāyāna tradition, *Pratītyasamutpāda* is used to refer to the general principle of inter-dependent causation, whereas in the Theravada tradition,itis used to refer to the twelve nidānas/links. Wayman argues that the idea of dependent co-origination may have been derived from the *Bṛhadāraṇyaka Upaniṣad* and other older Vedic texts.

2.1.2. *Pratītyasamutpāda*uses conditioned causality, not Newtonian causality

The concept of causality and causal efficacy where "cause produces an effect because a property or *svadhā* (energy) is inherent in something", appears extensively in the Indian thought in the Vedic literature of the 2nd millennium BCE, such as the 10thmandala of the *Rigveda* and the Brahmanas layer of the Vedas. The *Pratītyasamutpāda*doctrine asserts neither direct Newtonian-like causality nor a single causality is tenable. Rather, it asserts an indirectly conditioned causality and a plural causality. The concept of causality in Buddhism is referring to conditions created by a plurality of causes that necessarily co-originate phenomena within and across lifetimes, such as karma in one life creating conditions that lead to rebirth in one of the realms of existence for another lifetime.

2.1.3. Dependent co-origination

As per Peter Harvey, *Pratītyasamutpāda* is an ontological principle; that is, a theory to explain the nature and relations of being, becoming, existence and ultimate reality. Buddhism asserts that there is nothing independent, except the state of nirvāṇa. All physical and non-physical states depend on and arise from other pre-existing states, and in turn from them, other dependent states arise while they cease. The 'dependent arisings' have a causal conditioning, and thus *Pratītyasamutpāda* is the Buddhist belief that causality is the basis of ontology, not a creator God nor the ontological Vedic concept called universal Self (Brahman) nor any other 'transcendent creative principle'. There is no 'first cause' from which all beings arose. The *Pratītyasamutpāda* principle asserts that the dependent origination is a necessary and sufficient condition in both directions. This is expressed in Majjhima Nikaya as "When this is, that is; This arising, that arises; When this is not, that is not; This ceasing, that ceases."

According to Stephen Laumakis, *Pratītyasamutpāda* is also an epistemological principle; that is, a theory about how we gain correct and incorrect knowledge about being, becoming, existence and reality. The 'dependent origination' doctrine, states Peter Harvey, "highlights the Buddhist notion that all apparently substantial entities within the world are in fact wrongly perceived. We live under the illusion that terms such as 'I', self, mountain, tree, etc. denote permanent and stable things. The doctrine teaches this is not so." There is nothing permanent (Anitya), nothing substantial, no unique individual self in the nature of becoming and existence (*anātman*), because everything is a result of "dependent origination". There are no independent objects and independent subjects; there is fundamental emptiness (*Śūnyatā*) in all phenomena and experiences. As per Mathieu Boisvert, the *Pratītyasamutpāda* doctrine is a fundamental tenet of Buddhism and it may be considered as "the common denominator of all the Buddhist traditions throughout the world, whether Therāvāda, Mahāyāna or Vajrayāna".

2.1.4. Four Noble Truths and Eight Noble Paths

The Four Noble Truths (there is suffering, cause, cessation, and the eight Noble Paths leading to cessation) are an expression of the principle of dependent origination because they explain the arising of suffering (dukkha) that is dependently originated and the cessation of

dukkha by removing the causes. The Eightfold Path consists of eight practices: right view, right resolve, right speech, right conduct, right livelihood, right effort, right mindfulness, and right *samādhi* (meditative absorption or union).The *pratītyasamutpāda* doctrine connects the Four Noble Truths to the Twelve Nidānas doctrine of Buddhism. The second truth is compatible with the twelve 'dependently originated' links from *Avidyā*to *Jarāmarana* (old-age and death). The third truth is compatible with its reversal, which results from the broken link because of an end to *Avidyā*.

2.1.5. The Twelve Nidānas (causal links or chains)

The Twelve Nidānas are a series of causal links that describe the process of samsāric rebirth and the arising of dukkha. In reverse order, they also describe the way to liberation from saṃsāra. Each of the twelve links illustrates "dependent origination", and they explain the process of rebirth and the arising of dukkha. When certain conditions are present, they give rise to subsequent conditions, which in turn give rise to other conditions; these 'conditioned arising' result in the cyclical nature of rebirths and redeaths in Saṃsāra. The attainment of nirvāṇa, in Buddhist belief, ends the process of rebirth and associated *dukkha*. It is achieved by breaking a link in the twelve nidānas (links) of conditioned co-arising.

The Twelve Nidānas are (1) Ignorance (Avidyā: impermanence and non-self doctrines about reality) → (2) Mental formations (s*aṃskāras:* constructing activities, volitions) → (3) Transmigratory consciousness (vijñāna: rebirth consciousness, mental processes, manas, buddhi, chitta) → (4) Name & Form (nāmarūpa: individual being, psycho-physical organism, mind-and-matter, and mentality-and-materiality) → (5) Six Sense Bases (*Ṣaḍāyatana*: eye/vision, ear/hearing, nose/olfaction, tongue/taste, skin/touch, mind/thought) → (6) Contact(sparśa:touching, sense impression)→ (7) Feeling(*vedanā*: pleasant, unpleasant and neutral sensations) → (8) Craving (tṛṣṇā:thirst, desire, longing, greed) → (9) Clinging(upādāna: attachment) → (10) Becoming (bhāva: continuity of becoming/reincarnating in one of the realms of existence) → (11) Birth (jāti: arising of a new living entity within *saṃsāra* or cyclic existence) → (12) Old Age & Death (jarāmaraṇa: inevitable decay and death). This cycle repeats thru rebirth until ignorance is eliminated thru liberation/moksha after attaining nirvāṇa/samādhi state. Further details are given in VIMAL (2009c).

2.1.6. Karma theory

The Karma theory of Buddhism is integrated into its Twelve Nidānas doctrine and has been extensively commented on by ancient Buddhist scholars such as Nāgārjuna. Karma consists of any intentional action, whether of body or speech or in mind, which can be either advantageous (merit) or disadvantageous (demerit). Both good and bad karma sustain the cycle of saṃsāra (rebirth) and associated dukkha, and both prevent the attainment of nirvāṇa. According to Nāgārjuna, the second causal link (mental formations, volitions, motivations, s*aṃskāras*) and the tenth causal link (*bhava*, gestation) are two karmas through which sentient beings trigger seven sufferings (*duḥkha*[3]) identified in the Twelve Nidānas, and from this arises the revolving rebirth cycles. To be liberated from saṃsāra and dukkha, asserts Buddhism, the 'dependent origination' doctrine implies that the karmic activity must cease. One aspect of this 'causal link breaking' is to destroy the "deeply seated propensities, festering predilections" (asavas) which are karmic causal flow because these lead to rebirth.

2.1.7. Theravāda, twelve nidānas span three temporal divisions, and Sarvāstivāda

Within the Theravāda Buddhist tradition, the twelve nidānas are considered to be the most significant application of the principle of dependent origination. One interpretation holds that the twelve nidānas span three temporal divisions, with the **first two** nidānas (Ignorance/Avidyā and Mental formations/s*aṃskāras*) as chains of causation from past lives, the **third to the tenth**nidānas (Transmigratory consciousness/vijñāna, Name & Form/nāmarūpa,Six Sense Bases/*Ṣaḍāyatana* including mind/thought, Contact/sparśa, Feeling/*vedanā*, Craving/tṛṣṇā, Clinging/upādāna, Becoming/bhāva) relate to present life beginning with the descent of consciousness into the womb, and the **last two**nidānas (Birth/jāti and Old Age & Death/jarāmaraṇa) represent the future lives conditioned by the present causes. These twelve nidānas explain the dependent origination of Skandha (five aggregates). The five aggregates or heaps are: form (or matter or body) (*rupa*), sensations (or feelings, received from form) (*vedana*), perceptions (*samjna*), mental activity or formations (*sankhara*), and consciousness (*vijnana*).
According to Akira Hirakawa and Paul Groner, the "embryological" interpretation which links dependent origination with rebirth was also promoted by the Sarvastivadin school (a north Indian

branch of the Sthavira nikāya) as evidenced by the Abhidharmakosa of Vasubandhu. All Buddhist-traditions accept the rebirth and dependent origination doctrines. Another Theravada interpretation of the twelve links sees them as explaining psychological or phenomenological processes in the present moment. In Buddhaghosa's Sammohavinodani, a commentary to the Vibhanga of the Abhidhamma Pitaka, the principle of Dependent Origination is explained as occurring entirely within the space of one mind moment. According to Prayudh Payutto there is material in the Vibhanga, which discusses both models: the three lifetimes model and the phenomenological mind moment model.

As per Bhikkhu Buddhadasa's interpretation, Birth and Death refer not to physical birth and death, but to the birth and death of our self-concept, the "emergence of the ego". According to Buddhadhasa: “dependent arising is a phenomenon that lasts an instant; it is impermanent. Therefore, Birth and Death must be explained as phenomena within the process of dependent arising in the everyday life of ordinary people. Right Mindfulness is lost during contacts of the Roots and surroundings. Thereafter, when vexation due to greed, anger, and ignorance is experienced, the ego has already been born. It is considered as one ‘birth’”. The Abhidharmakosa also outlines three other models of the 12 links that were used by the Sarvāstivāda schools apart from the three lifetimes model:

1. Instantaneous - All 12 links are present in the same instant.
2. Prolonged - The interdependence and causal relationship of dharmas or phenomenal events arising at different times.
3. Serial - The causal relationship of the twelve links arising and ceasing in a continuous series of moments.

Discussing the three lifetimes model, Alex Wayman states that it is different from the Vajrayana view because Theravadins denied *bardo* or an intermediate state between death and rebirth. This denial necessitated placing the first two nidānas of the "dependent origination" chain into the past life. The Tibetan Buddhism tradition allocates the twelve nidānas differently between various lives.

2.1.8. Mahāyāna

As per Wikipedia (as of 13 July 2018 with minor modifications), "Mahāyāna also refers to the path of the Bodhisattva seeking complete enlightenment for the benefit of all sentient beings, also called 'Bodhisattvayāna', or the 'Bodhisattva Vehicle' […] Mahāyāna Buddhists teach that enlightenment can be attained in a single lifetime, and this can be accomplished even by a layperson. […] Mahāyāna constitutes an inclusive tradition characterized by plurality and the adoption of new Mahayana sutras in addition to the earlier āgamas. Mahāyāna sees itself as penetrating further and more profoundly into the Buddha's Dharma. […] The fundamental principles of Mahāyāna doctrine were based on the possibility of universal liberation from dukkha for all beings … and the existence of Buddhas and bodhisattvas embodying Buddha-nature. The Pure Land school of Mahāyāna simplifies the expression of faith by allowing salvation to be alternatively obtained through the grace of the Buddha Amitābha by having faith and devoting oneself to mindfulness of the Buddha. […] Most Mahāyāna schools believe in supernatural bodhisattvas who devote themselves to the pāramitās, ultimate knowledge (Skt. *sarvajñāna*), and the liberation of all sentient beings." There are four doctrines: Bodhisattva, Expedient means, Liberation, and Buddha nature.

1. Does soul exist as per Buddha nature?

As per Ātman (Buddhism), "Most Buddhist traditions and texts reject the premise of a permanent, unchanging *atman* (self, soul). However, in some Buddhist schools, sutras and tantras present the notion of an *atman* or permanent 'Self', although mostly referring to an Absolute and not to a personal self."

As per Wikipedia on Mahāyāna's Buddha nature (as of 22 May 2017) somewhat argues for soul: "The essential idea, articulated in the Buddha nature sūtras, but not accepted by all Mahāyānists, is that no being is without a concealed but indestructible interior link to the awakening of *bodhi* and that this link is an uncreated element (*dhātu*) or principle deep inside each being, which constitutes the deathless, diamond-like "essence of the self". The *Mahāyāna Mahāparinirvāṇa Sūtra* states: "The essence of the Self (*ātman*) is the subtle Buddha nature" while the later *Laṅkāvatāra Sūtra* states that the Buddha nature might be taken to be self (*ātman*),

but it is not. In the *sagathakam* section of that same sutra, however, the Tathagatagarbha as the Self is not denied, but affirmed: "The *Ātmā* [Self] characterized with purity is the state of self-realization; this is the Tathāgata's Womb (*garbha*), which does not belong to the realm of the theorizers." In the Buddha nature class of sūtras, the word "self" (*ātman*) is used in a way defined by and specific to these sūtras. According to some scholars, the Buddha nature discussed in some Mahāyāna sūtras does not represent a substantial self (*ātman*); rather, it is a **positive language and expression of emptiness** (*śūnyatā*) and represents the potentiality to realize Buddhahood through Buddhist practices. It is the "true self" in representing the innate aspect of the individual that makes actualizing the ultimate personality possible. The actual "seeing and knowing" of this Buddha essence is said to usher in *nirvāṇic* liberation. Prior to the period of these sūtras, Mahāyāna metaphysics was dominated by teachings on emptiness, in the form of Mādhyamika philosophy. The language used by this approach is primarily negative, and the Buddha nature genre of sūtras can be seen as an attempt to state orthodox Buddhist teachings of dependent origination and on the mysterious reality of nirvāṇa using positive language instead, to prevent people from being turned away from Buddhism by a false impression of nihilism. In these sūtras the perfection of the wisdom of not-self is stated to be the true self; the ultimate goal of the path is then characterized using a range of positive language that had been used in Indian philosophy previously by essentialist philosophers, but was now transmuted into a new Buddhist vocabulary that described as being who has successfully completed the Buddhist path."

2. Is Buddhist centrist framework consistent with the eDAM

Wallace (personal communication, 6-Feb-2008) commented, "*Mahāyāna* Buddhism, especially in accordance with the *Madhyamika* view, rejects the substantial nature of all phenomena, so it does not accept a substance dualism between body and mind along the lines proposed by Descartes. As I have argued in my book (WALLACE, 2007), Buddhism as a whole asserts the existence of a 'form realm' (*rupa-dhātu*) that exists prior to and at a more fundamental level than our human conceptual constructs of 'mind' and 'matter'. On a deeper level, *Vajrayāna* Buddhism asserts the existence of 'absolute space of phenomena' (*dharma-dhātu*), which transcends all conceptual categories, including those of mind and matter. So that view, too, rejects any notion of substance dualism in favor of aspect dualism, similar to what you propose

[in the eDAM].” Thus, Buddhist centrist framework (WALLACE, 1989) does not contradict the extended Dual-Aspect Monism (eDAM) framework.

3. Mādhyamika

In the Mādhyamika, (intermediate), to say that an object is "empty" is synonymous with saying that it is dependently originated. Nāgārjuna equates emptiness with dependent origination in MūlaMādhyamikakārikā 24:18: “Whatever arises dependently Is explained as empty. Thus dependent attribution Is the middle way.” “Since there is nothing whatever That is not dependently existent, For that reason there is nothing Whatsoever that is not empty.”In his analysis, **any enduring essential nature (svabhāva) would prevent the process of dependent origination**, would prevent any kind of origination at all, for things would simply always have been and will always continue to be, i.e., as existents (bhāva). Mādhyamika suggests that impermanent collections of causes and conditions are designated by mere conceptual labels, which also applies to the causes and conditions themselves and even the principle of causality itself since *everything* is dependently originated (i.e. empty). If unaware of this, things may seem to arise as existents, remain for a time and then subsequently perish.

4. Dzogchen

In the Dzogchen tradition of Tibetan Buddhism, the concept of dependent origination is considered to be complementary to the concept of emptiness. Specifically, this tradition emphasizes the indivisibility of appearance and emptiness—also known as the relative and absolute aspects of reality:

- Appearance (relative truth) refers to the concept that all appearances are dependently originated;
- Emptiness (absolute or ultimate truth) refers to the concept that the ‘nature’ of all phenomena is emptiness—lacking inherent existence.

In Mipham Rinpoche’s *Beacon of Certainty*, this relationship is explained using the metaphor of the reflection of the moon in water. According to this metaphor:

- The *nature* of all phenomena is like the reflection of the moon in water completely lacking inherent existence. However,

- The *appearance* of the moon in the water is an expression of dependent origination—the appearance is completely dependent upon causes and conditions.

Sogyal Rinpoche states **all things, when seen and understood in their true relation, are not independent but interdependent with all other things**. A tree, for example, cannot be isolated from anything else. It has no independent existence, states Rinpoche.

5.Hua Yen School

The Huayan school taught the doctrine of the mutual containment and interpenetration of all phenomena, as expressed in **Indra's net. One thing contains all other existing things, and all existing things contain that one thing.** This philosophy is based on the tradition of the great Mādhyamika scholar Nāgārjuna and, more specifically, on the Avatamsaka Sutra. Regarded by D.T. Suzuki as the crowning achievement of Buddhist philosophy, the *AvatamsakaSutra* elaborates in great detail on the principle of dependent origination. This sutra describes a cosmos of infinite realms upon realms, mutually containing one another.

6. Zen

Thich Nhat Hanh states, "*Pratītyasamutpāda* is sometimes called the teaching of cause and effect, but that can be misleading, because we usually think of cause and effect as separate entities, with cause always preceding effect, and one cause leading to one effect. **According to the teaching of Interdependent Co-Arising, cause and effect co-arise (*samutpāda*) and everything is a result of multiple causes and conditions.** […]In the sutras, this image is given: "Three cut reeds can stand only by leaning on one another. If you take one away, the other two will fall." In Buddhist texts, one cause is never enough to bring about an effect. A cause must, at the same time, be an effect, and every effect must also be the cause of something else. **This is the basis, states Hanh, for the idea that there is no first and only cause, something that does not itself need a cause.**

7. Scholarly interpretations

Jay Garfield states that Mūlamadhyamakakārikā uses the causal relation to understand the nature of reality, and of our relation to it. This attempt is similar to the use of causation by Hume, Kant, and Schopenhauer as they present their arguments. Nāgārjuna uses causation to present his

arguments on how one individualizes objects, orders one's experience of the world, and understands agency in the world. The concept of *pratītyasamutpāda* has also been compared to the Western philosophy of metaphysics, the study of the nature of being and ultimate reality. Schilbrack states that the doctrine of interdependent origination seems to fit the definition of a metaphysical teaching, by questioning whether there is anything at all. Hoffman disagrees, and asserts that pratītyasamutpāda should not be considered a metaphysical doctrine in the strictest sense, since **it does not confirm nor deny specific entities or realities**. Noa Ronkin states that while Buddha suspends all views regarding certain metaphysical questions, he is not an anti-metaphysician: nothing in the texts suggests that metaphysical questions are completely meaningless, instead Buddha taught that sentient experience is dependently originated and that whatever is dependently originated is conditioned, impermanent, subject to change, and lacking independent selfhood.

2.1.9. Transcendental Dependent Arising

As per Wikipedia (as of 26 April 2018 with minor modification), the 12 Nidānas are the analysis of arising of suffering and Transcendental Dependent Arising is the analysis of supramundane transcendence of suffering according to Bhikkhu Bodhi thru *Upanisa Sutta* (Upaniṣad*Sūtra:* SN 12.23). This *Sūtra* connects the supramundane form of dependent arising to familiar worldly (samsāric) counterpart. It uses the principle of conditionality to support and explain both the process of compulsive involvement which is the origin of suffering and the process of disengagement which leads to deliverance from suffering.

The *Upanisa Sutta* outlines the process of transcendental dependent arising (origination)in the 11 stages: Faith (śraddhā), Joy (*pāmojja*), Rapture (*pīti*), Tranquility (*passaddhi*),Happiness (*sukha*), Concentration (*samādhi*), *Yathābhūta-ñānadassana* (Knowledge and vision of things as they really are), Disenchantment (*nibbidā*), Dispassion (*virāga*), Freedom (*vimutti*), and *Āsava-khaye-ñāna* (Knowledge of destruction of craving, mental defilements of sensual pleasures, and ignorance). Further details are given in VIMAL (2009c).

2.2. Nāgārjuna: causes and conditions

From an eastern perspective, Nāgārjuna argued that the *real causes* should have powers as their essential properties should have inherent existence.[4] The causes that do not have these attributes cannot be *real causes*. Therefore, he proposes four 'conditions' (efficient, percept-object, immediate, and dominant conditions) instead of such apparent causality to explain phenomena in conventional reality:

(i) An efficient condition explains the occurrence of successive events;

(ii) An object is the percept-object condition for its perception;

(iii) An immediate condition explains the various steps involved in a phenomenon;

(iv) A dominant condition is the purpose for which an action is undertaken.

As per (NĀGĀRJUNA; GARFIELD, 1995, p. 105-113), "[I.] 2. There are four conditions: efficient condition; Percept-object condition; immediate condition; Dominant condition, just so. There is no fifth condition. […] 4. Power to act does not have conditions. There is no power to act without conditions. There are no conditions without power to act. Nor do any have the power to act. […] **Efficient conditions** are those salient events that explain the occurrence of subsequent events: Striking a match is the efficient condition for its lighting. […] The **percept-object condition** is in its primary sense the object in the environment that is the condition for a mind's perception of it. So when you see a tree, the physical tree in the environment is the percept-object condition of your perceptual state. […] The **dominant condition** is the purpose or end for which an action is undertaken. My hope for understanding of Mādhyamika might be the dominant condition for my reading Nāgārjuna's text, its presence before my eyes the percept-object condition, and the reflected light striking my eyes the efficient condition. The **immediate conditions** are the countless intermediary phenomena that emerge upon the analysis of a causal chain, in this case, the photons striking my retina, the excitation of photoreceptor cells, and so forth. "

Furthermore, "all phenomena come into being in dependence upon conditions, remain in existence dependent upon conditions, and cease to exist dependent upon conditions"(NĀGĀRJUNA; GARFIELD, 1995, p. 160). Nāgārjuna can grant "that effects are dependent upon [the] collection of conditions, it cannot be that those collections or that

dependence exist inherently"(NĀGĀRJUNA; GARFIELD, 1995, p. 266). Moreover, individual conditions and their effects, the combination of conditions, and the inherent dependence of any phenomenon on the combination of all of its conditions lack inherent existence (NĀGĀRJUNA; GARFIELD, 1995, p.258-266).

2.3. Do the entities that exist inherently cause entities that lack inherent existence?

It is unclear that the dual-aspect unmanifested state of the primal entity UIF (*Brahman*) has inherent existence or it is also empty of inherent existence like other manifested entities. If it is empty/*Śūnya* of inherent existence, then it also inter-dependently co-arises.

If it inherently exists, then it is unclear if it has enough "*real"* causal power to cause entities that lack inherent existence. Perhaps, we can speculate that the UIF may have enough *real* causal power to cause at least the initial state of manifestation. Then all later stages of manifested entities inter-dependently co-arise thru natural laws built-in the UIF and thru some or all of the Nāgārjuna's four conditions.

If the inherently existing UIF/*Śūnyatā* is also completely empty of *real* causal power then obviously all manifested entities must inter-dependently co-arise. In that case, the dual-aspect unmanifested state of the UIF has the UPCIF as non-physical aspect and PUIF as the physical aspect. In addition, the unmanifested state of the UIF is composed of the superposition of all potential innumerable beable ontic states as basis states of the related Hilbert space. For example, when a trichromat look at a ripe-tomato, the redness related beable ontic conscious state of our mind-brain system is selected thru matching between FF (feed-forward) and FB (feedback) signals (this is an unpacking of collapse process: see VIMAL (2013) and Section 1.2) and experienced by the "self" thru inter-dependent co-origination, co-evolution, co-development, and sensorimotor co-tuning starting from the UIF level to current conscious level, which presumably took over 13.8 billion years.

2.4. Nāgārjuna's conventional and ultimate reality, MDR, and MIR

According to Nāgārjuna, there are two types of realities: conventional and ultimate;[5] each has existence and nonexistence. The Nāgārjuna's conventional reality is basically mind-dependent reality (MDR), and his ultimate reality seems to be the reality experienced at the state of *Nirvāṇa*

(detailed later). Ultimate reality may not be mind-independent reality (MIR). The conventional reality of external objects is structured by an individual-mind, so it is MDR. When the mind/subject is excluded from the reality, then that reality is MIR. For example, the falling of a tree in a forest, where there is nobody to witness or hear, is MIR. This is because the falling tree generates sound vibration in the air, but nobody hears it, and hence there is no subjectivity and this will come under MIR. Ultimate reality is MDR at *Samādhi*/*Nirvāṇa* state; therefore, one could argue for including it under MDR as u-MDR compared to conventional c-MDR. However, at the highest *NirvikalpaSamādhi/Nirvāṇa* state, mind/thought is at minimal (close to zero), so one could argue that Ultimate reality is close to mind-independent reality (such as consciousness-in-itself or matter-in-itself) so u-MDR ~ MIR.

2.5. Nāgārjuna's argument for dependent co-origination and against inherent existence, MDR and MIR, and the eDAM

Nāgārjuna's argument for dependent co-origination and against inherent existence can be explained as follows. If an entity inherently exists then it is independent and it has an essence; it cannot be produced or destroyed; it needs no conditions for its production; it is eternal. However, most entities (such as structures and functions) in conventional/mind-dependent reality are produced and destroyed; therefore, they lack inherent existence, they are essenceless, and hence they dependently co-arise.[6]The hypothesis that a function is caused by (or arises/emerges from) the related structure (materialism) or vice-versa (idealism) is rejected because both lack inherent existence; instead, the function inter-dependently co-arise thru interaction among the structure and other necessary entities and when necessary conditions are satisfied.

According to SMETHAM (2010, p. 168), "The fact that the electrons which take part in Albert's experiment [(Albert, 1992)], and any other quantum experiment, do not have an 'intrinsic character' has certainly turned out to be correct. Furthermore, they cannot 'abide as their own entities' because they alter their characteristics in dependence on the overall pattern of manifestation; this means that the characteristics that the electrons display depend on what the other electrons manifest. So these electrons, as they exist at their most fundamental level, quite dramatically exemplify the characteristics of emptiness, insofar as one of the characteristics of emptiness is to lack definite intrinsic characteristics. And this situation clearly threatens to

undermine any grip on the reality of the notion of independent entities and their characteristics."In my discussion with him, he further argues that "from the point of view of physics all of the appearances of the 'classical' realm emerge from the quantum realm of potentiality so from an 'ultimate' point of view all experienced entities are quantum in nature; from an ultimate quantum point of view the whole operation is a quantum illusion so to speak."

Nāgārjuna rejects 'inherent existence' or 'essence' and proposes co-dependent origination instead (NĀGĀRJUNA; GARFIELD, 1995). This may be the reason for rejecting causality. The entities that lack inherent existence dependently co-arise, and hence causality for them can be rejected but instead, *conditions* (such as efficient, percept-object, immediate, and dominant conditions) might be necessary, as in Nāgārjuna's philosophy.

Nāgārjuna rejects causality because it leads to incompatibility with inherent existence. For example, causality leads to phenomena having essences, which is incoherent because it forces to assert that phenomena have inherent existence whereas they lack essence in conventional reality or MDR.

In addition, Nāgārjuna argues, "if we want to assert that the cause, instead of changing from a cause to a noncause, simply ceases at the moment when it produces its effect, we still have problem. Because by the time the effect emerges, the cause will have vanished, and the effect will then have emerged without a cause and so will be a causeless effect." (NĀGĀRJUNA; GARFIELD, 1995, p. 260-262).[7]

On the other hand, the dependent co-arisen view does not have this problem because phenomena depend on conditions, do not have an essence, do not have causal power, and are merely conventionally existent. If the dependent co-origination is rejected, then the lack of inherent existence has to be rejected; this would contradict conventional reality, no action will be appropriate, there would be an action that did not begin, and there would be an agent without action.[8]

The dependent co-origination view or middle path of Nāgārjuna is between reification and nihilism or between inherent existence and complete nonexistence (NĀGĀRJUNA; GARFIELD, 1995). In science, we use the concept of cause and effect. Therefore, it would be surprising and hard to accept the rejection of causality.

The rejection of classical causality is somewhat consistent with Bohr's complementarity in quantum mechanics. For example, as per (Hilgevoord & Uffink, 2012), "A causal description of the process cannot be attained; we have to content ourselves with complementary descriptions. 'The viewpoint of complementarity may be regarded', according to Bohr, 'as a rational generalization of the very idea of causality' […] 'These so-called indeterminacy relations explicitly bear out the limitation of causal analysis, but it is important to recognize that no unambiguous interpretation of such a relation can be given in words suited to describe a situation in which physical attributes are objectified in a classical way.' (BOHR, 1948, p.315)".

The conventional reality (or MDR) entails that conventional/mind-dependent entities lack inherent existence and hence lack a causal power. For Nāgārjuna, "Effects lacking inherent existence depend precisely upon conditions that themselves lack inherent existence" (NĀGĀRJUNA; GARFIELD, 1995, p. 121). This entails dependent co-origination (or interdependent arising) for conventional reality (or MDR), which lacks inherent existence. In other words, phenomena in MDR are conventionally existent but empty of inherent existence.[9] Nāgārjuna asserts that "a thing is empty or that it is dependently [co-arisen], one is not contrasting their status with the status of some other things that are inherently existent. Nor is one asserting that they are *merely* dependent on some more fundamental independent thing. Rather as far as one analyzes, one finds only dependence, relativity, and emptiness, and their dependence, relativity, and emptiness."(NĀGĀRJUNA; GARFIELD, 1995, p. 177).

In physics, we assume that MIR is MDR when observations are successfully replicated at any laboratory and at any time, and they are not significantly different from each other, i.e., when the observations are independent of space and time. However, it is still MDR, not MIR. MDR is consistent with dependent co-origination from the Nāgārjuna's four conditions (efficient, percept-object, immediate, and dominant conditions), which entails emptiness (lack of essence) of causation. MDR is an illusion (*māyā* = that which is not) in the sense of lack of inherent existence; MDR ~ MIR + (mind, subjectivity, or SEs); MIR ~ MDR □ mind.[10]If we minimize the fluctuations of thoughts thru meditation then the effect of mind is minimized such as in Nirvikalpa Samadhi (NS) state subjective experiences; then MIR ~ MDR (at NS state) ~ consciousness-in-itself (during eyes-closed meditation at NS state) or ~ matter-in-it-self (during open-eye meditation at NS state). The selection of a specific SE in the eDAM framework

(VIMAL, 2008b, 2010a, 2013, 2015b, 2016b) and enlightenment are also inherently non-existent and co-arise dependently from the inherently existent unified information field (UIF) at dual-aspect unmanifested state, which has non-physical aspect (universal potential consciousness information field: UPCIF) and inseparable physical aspect (physical unified information field: PUIF); SEs are excitations/modes of UPCIF. In other words, only inherently existent entity is UIF at unmanifested state (*Śūnyatā*, primal entity, Brahman), where both aspects are latent (in unmanifested sense); only random quantum fluctuations (QFs) in the PUIF and consciousness fluctuations (CFs) in the UPCIF occurs, which presumably leads to Big Bang thru dependently co-originates. All the manifestations of UIF lack inherent existence and dependently co-arise; they are born so they have to die one day and return back to UIF. If dependent co-origination is denied, action and resultant change would be pointless, life would not have real meaning, and MDR would not exist.

MIR is very hard to know because any process of knowing always involves mind. However, some insight into MIR and ultimate reality can be gained through MDR's reasoning, language, deep thinking process, meditation, and so on. To gain some insight into ultimate reality, Nāgārjuna suggests that one should acquire the state of *Nirvāṇa* (via meditation).[11] Moreover, "if *Nirvāṇa* is liberation from cyclic existence[12] and hence from arising and ceasing, it follows that, from the ultimate standpoint, all things in saṃsāra [MDR] are actually just as they are in *Nirvāṇa* … everything is both conventionally real and ultimately unreal. [p.250] […] That is, independent of conceptual imputation there are no objects, no identities, and so, no distinctions [i.e., the ultimate nature of things is inexpressible, inconceivable, and uncharacterizable, but one might directly perceive it in *Nirvāṇa* state of mind] [p.251] " (NĀGĀRJUNA; GARFIELD, 1995). Nirvāṇa is a complete cessation of saṃsāra; saṃsāra includes grasping (including Nirvāṇa itself), delusion, attachment, craving, suffering, and the cyclic existence. Both Nirvāṇa and saṃsāra are not inherently existent. It appears that the ultimate reality is experienced in the state of Nirvāṇa. Then what is inherently existent? **Only *Śūnyatā/emptiness* inherently exists**, which is dual-aspect UIF (primal entity or *Brahman*) at unmanifested state with QFs in PUIF and CFs in the UPCIF.

By the very long, very time-consuming, and tedious process of achieving Nirvāṇa, a yogi (meditator), firmly entrenched in *śūnyatā*[13]and silence, gains some insight to ultimate reality by

direct apprehension (consciousness-as-such) in meditation. However, the yogi is unable to describe in words (it is ineffable) because language fails to describe ultimate reality: "When we try to say something coherent about the nature of things from an ultimate standpoint, we end up talking nonsense" (NĀGĀRJUNA; GARFIELD, 1995, p. 330-331). With this limitation, in Nirvāṇa state of mind, "nothing is present to consciousness but emptiness itself. For such a consciousness, there literally is no object [presumably this happens in closed-eye mediation at Nirvāṇa or Nirvikalpa samādhi state] since there is in such a consciousness no reification of the kind that gives rise to subject-object duality. Moreover, since such a consciousness is directed only upon what can be found ultimately to exist and since nothing can be found, there is literally nothing toward which such as consciousness can be directed." (NĀGĀRJUNA; GARFIELD, 1995, p.355).

In addition, with the above limitations, Nāgārjuna described the nature of ultimate truth as follows:

(i) "Empty things exist conventionally; but about their ultimate status, nothing can be literally said [non-assertion of a position is the best]" (NĀGĀRJUNA; GARFIELD, 1995, p.281).

(ii) None of the objects of the conventional world or persons exists "from its own side (independently of the convention)" (NĀGĀRJUNA; GARFIELD, 1995, p. 275).

(iii) "There are no individual objects or relations between them." (NĀGĀRJUNA; GARFIELD, 1995, p. 275).

(iv) In *Nirvāṇa* state of mind, "one ceases to identify a self and aggregates" (NĀGĀRJUNA; GARFIELD, 1995, p. 281).

(v) Ultimately, "one must see things independently of categories that determine an ontology of entities and a dichotomy of existence and nonexistence. That this is unconceivable to us, for Nāgārjuna only indicates the fact that we are trapped in conventional reality through the force of the delusion of reification [implying to understand the ultimate truth, one has to enter into *Nirvāṇa* state]. […] **Emptiness is the final nature of all things, from rocks to dogs to human beings to buddhas**." (NĀGĀRJUNA; GARFIELD, 1995, p. 282).

In addition, ultimate reality seems to be

(i) Conventional reality when the observer, the observed, and the process of observation all merge or unify (presumably happens in open-eye mediation at *Samādhi*state),

(ii) Ineffable and unknowable,

(iii) Merely the essenceless essence of conventional reality,

(iv) Conventional reality seen as it is, and

(v) Conventional reality without reification, without subjectivity, without attachment, without delusion.

Furthermore, MIR seems to be MDR without subjectivity (SEs). There is no difference in the entity between MDR and MIR. The physics and its laws presumably more or less remain the same in MDR and MIR. An alternative method for getting insight into MIR needs further research; for example, just imagine you are in the sea of EMR (electromagnetic radiation) but all your sensory systems are shut down.

In the eDAM framework (VIMAL, 2008b, 2010a, 2013, 2015b, 2016b), *Śūnyatā/emptiness*is the UIF at dual-aspect unmanifested state with CFs in UPCIF (non-physical aspect) and QFs in the inseparable PUIF (physical aspect), which inherently exists. The mind (including the selection of a specific SE (an excitation/mode of UPCIF) and all sensory systems such as seeing, hearing, smelling, tasting, and touching) co-arise inter-dependently during the interaction of environment (or environment-like) and organism (such as neural net). The endogenously generated mind (such as self = SE of the subject) also co-arises inter-dependently. In addition, all of the conventional phenomena in the world including elementary particles (as they can be derived from PUIF), the environment, and the organism co-arise inter-dependently. For example, “Vision and its subjects are thus relational, dependent phenomena and not substantial or independent entities. So neither seeing nor seer nor the seen (conceived of as the object of sense perception) can be posited as entities with inherent existence.” (NĀGĀRJUNA; GARFIELD, 1995, p. 140). In addition, Nāgārjuna argues that entities and their characteristics are not inherently existent and they inter-dependently co-arise. As per (NĀGĀRJUNA; GARFIELD, 1995, p. 152).“From this it follows that there is no characterized and no existing characteristic. Nor is there any entity Other than the characterized and the characteristic.”

2.6. Inter-dependent co-arising (IC) and unus mundus

1. How does the manifestation of aspects start from the unmanifested state of the aspectless primal entity thru IC? (Sehgal): The unified informational energy field (UIEF) can be considered as unus mundus (primal entity, Brahman); see also (PEREIRA JUNIOR; VIMAL; PREGNOLATO, 2016) and (PEREIRA JUNIOR et al., 2018) for energy and (PEPPERELL, 2018) and references therein such as (LOGAN, 2012) for energy and information as complementary processes. The mechanism of IC of entities/aspects kicks in thru the eternal random quantum fluctuations (QFs) in physical aspect reflected as consciousness fluctuations (CFs) in the inseparable non-physical aspect of the unmanifested state of the primal entity as follows. In our conventional reality, the manifested entities and their states lack inherent existence. The neutral primal entity is fundamental dual-aspect 'unified informational energy field (UIEF)' (many names such as Brahman, Śūnyatā, emptiness, unus mundus); so it has inherent existence, therefore, it does not dependently co-arise because it already inherently exists. One should not think that Śūnyatā/emptiness is literally "nothing"; it appears nothing because both aspects are latent, hidden, undetectable and unmeasurable. However, we postulate that its physical aspect of the unmanifested state has eternal random QFs in quantum vacuum/emptiness, which is reflected as CFs in its non-physical aspect. It should be noted that whatever (such as QFs) goes on in the physical aspect is 36 automatically and immediately reflected in non-physical aspect (such as corresponding fluctuations in UPCIEF as CFs: see cosmology as elaborated in Bṛhadāraṇyaka Upaniṣad (VIMAL, 2012). The unmanifested state of UIEF has 'physical UIEF' (PUIEF) as the physical aspect and the 'universal potential consciousness informational energy field' (UPCIEF) as the inseparable non-physical aspect. The QFs in quantum vacuum are included in PUIEF. The unmanifested state is composed of the superposition of all possible innumerable beable ontic states in the past, present, and future as basis states in the Hilbert space. The IC starts the manifestation thru for example Big Bang because of the many interdependent interactions between QFs/CFs in the dual-aspect UIEF generate enough "pressure" to break the symmetry related to physical and non-physical aspects. The Big Bang model (BBM) is one of 25 cosmological models (Vaas, 2004) and there is no consensus on any model, but BBM dominates. A manifested beable ontic dual-aspect state with its inseparable aspects interdependently co-arise

from the unmanifested state when necessary conditions are satisfied because manifested states of entities lack inherent existence.

2. If both the aspects were unmanifested, in what form did the early necessary conditions exist? (Sehgal): The early necessary conditions were (a) eternal random QFs/CFs, (b) interactions between many QFs/CFs, which (c) generated enough 'pressure' to break the aspect-related symmetry of unus mundus. This led to Big Bang and further co-manifestations/co-realization of dual-aspect beable ontic states of entities. The co-realization/co-actualization of a specific beable ontic dual-aspect state is thru the collapse of the superposed innumerable beable ontic dual-aspect basis states.

3. How or who fulfilled the necessary conditions for the manifestation of the earlier entities? (Sehgal): The necessary conditions might be fulfilled by the unus mundus which has the potentiality for the self-awareness (as the extrapolation of introspection and self-consciousness of a conscious state in our mundane life), self-organization, self-manifestation, autopoiesis (self-producing: extrapolation of our reductive system), a self-referring system with latent dual-aspect. There is no external agent (such as God or manifested cosmic consciousness: MCC) because it is a self-sufficient closed system. (Poznanski et al., 2018) argues that the NCC and the unidirectional (from matter to mind) proposal leads to externalism/dualism. In place of NCC, one can argue for NPB (neural-physical basis). They argue that experiences arise from it (i.e., experiences are brain-based so they seem to argue for internalism. However, NCC can be interpreted in terms of all frameworks in their own ways. The unidirectional information transfer (from matter to mind) is just an assumption, without any empirical evidence. Intention and attention (both are parts of cognition) do affect neural activities. Therefore, on what basis are they rejecting externalism? To reject external agent (such as MCC, God etc), one has to show that the system is closed, i.e., the system can do everything without any external help. This means that the 'unus mundus' must have potentiality at least for self-awareness and self-organization with QFs/CFs for breaking the aspect-related symmetry. Then only external agent (such as God or MCC) is not needed because the system (our universe) is a self-sufficient closed system. 37

4. How were both aspects manifested together (co-manifested) for the first time? (Sehgal): The aspects were latent at the unmanifested state of the primal entity. The QFs/CFs thru the interdependent co-arising led to the Cosmic Fire (Big Bang), which broke the aspect-related symmetry of unus mundus and both aspects emerged. This is how both aspects were co-manifested for the first time.

3. Conclusion

1. It seems multiple causes are involved in Nāgārjuna's inter-dependent co-arising. He seems to call them four "conditions" instead of four "causes" because "cause" to him means a real independent single cause which has "real power" to cause the specific manifested entity.

For example, the match, the stick, the possessing agent (call it "striker", which could be a human or some artifact), and other necessary entities, must have already inter-dependently co-arisen. In addition, we need relevant natural laws (such as how to strike) built-in the system (containing all necessary entities and processes). Another example: the soil is one of the multiple causes for the construction of pot, but the soil is also an effect of its multiple causes because soil lacks inherent existence and dependently co-arises.

As per Hanh, a cause must, at the same time, be an effect of another cause. This is the basis for the idea that there is no first and only cause (something that does not itself need a cause). The so-called prime cause is also an effect of its multiple causes. In other words, postulating Puruṣa/OOO-God in Sāṅkhya is the prime cause and He is causeless has no meaning for Nāgārjuna. This implies that only *Śūnyatā/emptiness* inherently exists because all other entities lack inherent existence; there is no entity that has inherent existence. "Emptiness is the final nature of all things, from rocks to dogs to human beings to buddhas." (NĀGĀRJUNA; GARFIELD, 1995, p. 282).

This concept is similar to physics' quantum vacuum. But then how is the universe including us manifested? This is where random QFs/CFs are introduced. The quantum fluctuations (QFs) are in the quantum vacuum. The hypothesis is that the universe arose from "nothing". However, the term "nothing" does not mean absolutely nothing because it has QFs. The fluctuations in consciousness (CFs) were already well established in well-known *Bṛhadāraṇyaka Upaniṣad*,

which is the origin of Vedas and Vedanta. To sum up, only *Śūnyatā/emptiness* inherently exists, which is dual-aspect UIF (primal entity or *Brahman*) at unmanifested state with QFs in PUIF and CFs in the UPCIF. In other words, Nāgārjuna's emptiness = quantum vacuum with QFs, which entails Big Band or Mini Bangs = physical aspect in the eDAM framework. Since physical and non-physical aspects are inseparable, whatever happens in the physical aspect is automatically reflected appropriately in the non-physical aspect.

2.All conventional entities lack inherent existence. The dual-aspect unmanifested state of the primal entity (unified information field (UIF) or *Brahman*) as *Śūnyatā/emptiness* inherently exists. The primal entity with unified potential consciousness information field (UPCIF) as non-physical aspect and the physical unified information field (PUIF) as the physical aspect of the dual-aspect unmanifested state is the fundamental entity, which cannot be derived from any other entity. The UIF is equivalent to Buddhist *Śūnyatā/emptiness*nirvāṇa state and it certainly inherently exists. The UPCIF has consciousness fluctuations (CFs) and PUIF has quantum fluctuations (QFs), which appear different because perspectives of viewing are different.

3. The subjective experiences (SEs) are excitations/modes of UPCIF so they (SEs of objects and SE of subject or self) lack inherent existence and inter-dependently co-arise. For example, the "self" is composed of active dynamic self (ADS, which consists of proto-self, core-self, and autobiographical self) and passive invariant self (PIS) over subject's lifetime. Each of the sub-components of self (experiential sub-aspect of non-physical aspect) has a neural-physical basis (physical aspect: such as cortical and sub-cortical midline structures), which is elaborated in Vimal (2013). Both aspects inter-dependently co-arise starting from UPCIF (non-physical aspect) and PUIF (physical aspect) of inherently existing unmanifested state of UIF over 13.8 billion years of co-evolution, co-development, and sensorimotor co-tuning. The "self" (SE of the subject) also is an excitation/mode of UPCIF. Similarly, one can argue that the SEs of objects, all 18 elementary particles and their composites lack inherent existence and hence they inter-dependently co-arise.

Acknowledgments

The work was partly supported by VP-Research Foundation Trust and Vision Research Institute research Fund. Author is also affiliated with Dristi Anusandhana Sansthana, A-60 Umed Park, Sola Road, Ahmedabad-61, Gujrat, India; Dristi Anusandhana Sansthana, c/o NiceTech Computer Education Institute, Pendra, Bilaspur, C.G. 495119, India; and Dristi Anusandhana Sansthana, Sai Niwas, East of Hanuman Mandir, Betiahata, Gorakhpur, U.P. 273001 India. URL: http://sites.google.com/site/rlpvimal/Home. Email: rlpvimal@yahoo.co.in. Author would like to thank reviewers, Alfredo Pereira Jr. and Leonardo Ferreira Almada for their critical comments, and suggestion, and Alan B. Wallace for the email communication.

Competing interests statement

The author declares that he has no competing financial interests.

References

't HOOFT, G. *The cellular automaton interpretation of quantum mechanics*. Utrecht : Institute for Theoretical Physics Utrecht University, 2015. 259 p. Available from: <http://arxiv.org/pdf/1405.1548v3>. Acess in: 26 sept. 2018.

BALDUZZI, D.; TONONI, G. Qualia: the geometry of integrated information. *PLoS Computational Biology*, v. 5, n. 8, p. e1000462, 2009.

BLOCK, N. Two neural correlates of consciousness. *Trends in Cognitive Sciences*, v. 9, n. 2, p. 47-52, 2005.

BOHR, N. On the notions of causality and complementarity. *Dialectica*, v. 2, n. 3-4, p. 312-319, 1948.

BRUZZO, A. A.; VIMAL, R. L. P. Self: an adaptive pressure arising from self-organization, chaotic dynamics, and neural Darwinism. *Journal of Integrative Neuroscience*,v. 6, n. 4, p. 541-566, 2007. Available from: <http://sites.google.com/site/rlpvimal/Home/2007-Bruzzo-Vimal-self-JIN-p541-566.pdf>. Acess in: 26 sept. 2018.

CACHA, L. A.; POZNANSKI, R. R. Genomic instantiation of consciousness in neurons through a biophoton field theory. *Journal of Integrative Neuroscience*, v. 13, n. 3, p. 1-40, 2014.

CHALMERS, D. J. Facing up to the problem of consciousness. *Journal of Consciousness Studies*, v. 2, n. 3, p. 200-219, 1995. Available from: <http://consc.net/papers/facing.html>. Acess in: 26 sept. 2018.

DAMASIO, A. *Self comes to mind*: constructing the conscious brain. New York: Pantheon Books, 2010.

HAMEROFF, S.; MARCER, P. Quantum computation in brain microtubules? The Penrose–Hameroff 'Orch OR' model of consciousness. *Philosophical Transactions of the Royal Society of London. Series A. Containing Papers of a Mathematical or Physical*, v. 356, p. 1869-1896, 1998.

HILGEVOORD, J.; UFFINK, J. The uncertainty principle. In: ZALTA, E. N. (Ed.). *The Stanford Encyclopedia of Philosophy (Summer 2012 Edition).* Stanford: Stanford University, 2012. Available from: <http://plato.stanford.edu/archives/sum2012/entries/qt-uncertainty/>. Acess in: 8 nov. 2018.

LAMME, V. A. Why visual attention and awareness are different. *Trends in Cognitive Sciences*, v. 7, n. 1, p. 12-18, 2003.

LEVINE, J. Materialism and qualia: the explanatory gap. *Pacific Philosophical Quarterly*, v. 64, p. 354-361, 1983.

LOGAN, R. What Is Information? Why is it relativistic and what is its relationship to materiality, meaning and organization. *Information, v. 3*, p. 68-91, 2012.

LOY, D. Enlightenment in buddhism and advaita vedanta: are nirvana and moksha the same? *International Philosophical Quarterly*, v. 23, n. 1, p. 65-74, 1982.

MACGREGOR, R. J.; VIMAL, R. L. P. Consciousness and the structure of matter. *Journal of Integrative Neuroscience*, v. 7, n. 1, p. 75-116, 2008.

MCFADDEN, J. The Conscious Electromagnetic Information (Cemi) field theory: the hard problem made easy? *Journal of Consciousness Studies*, v. 9, n. 8, p. 45-60, 2002.

NĀGĀRJUNA, M.; GARFIELD, J. L. *The fundamental wisdom of the middle way:* Nāgārjuna's Mūlamadhyamakakārikā. Translation Jay L. Garfield. Oxford: Oxford University Press, 1995. Available from: <https://books.google.com/books?id=XylwAgAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false>. Acess in: 26 sept. 2018.

NORTHOFF, G.; BERMPOHL, F. Cortical midline structures and the self. *Trends in Cognitive Sciences*, v. 8, n. 3, p. 102-107, 2004. Available from: <http://www.imhr.ca/research/northofflab/documents/cms_and_the_self.pdf >. Acess in: 26 sept. 2018.

NORTHOFF, G. *Unlocking the Brain.* Oxford: Oxford University Press, 2014. v. 2: Consciousness.

PEPPERELL, R. Consciousness as a physical process caused by the organization of energy in the brain. Cardiff: Cardiff Metropolitan University, 2018. Available from:<https://www.researchgate.net/publication/327894353_Consciousness_as_a_physical_process_caused_by_the_organization_of_energy_in_the_brain>. Acess in: 26 sept. 2018.

PEREIRA JUNIOR, A. Triple-aspect monism: a conceptual framework for the science of human consciousness. In: PEREIRA JUNIOR, A.; LEHMANN, D. (Ed.). *The unity of mind, brain and world*: current perspectives on a science of consciousness. Cambridge: Cambridge University Press, 2013. p. 299-337.

PEREIRA JUNIOR, A. et al. Consciousness and cosmos building an ontological framework. *Journal of Consciousness Studies*, v. 25, n. 3-4, p. 181-205, 2018.

PEREIRA JUNIOR, A.; VIMAL, R. L. P.; PREGNOLATO, M. Can qualitative biophysics solve the hard problem? In: POZNANSKI, R. R.; TUSZYNSKI, J. A.; FEINBERG, T. E. (Ed.). *Biophysics of consciousness*: a foundational approach. Singapore: World Scientific Publishing Co Pte Ltd, 2016. Available from: <http://sites.google.com/site/rlpvimal/Home/2016-Pereira-Vimal-Pregnolato-Qualitative-Biophysics.pdf>.Acess in: 26 sept. 2018.

POZNANSKI, R. R. et al. On Intrinsic information content of the physical mind in quantized space: against externalism. *Axiomathes*, p. 1-11, aug. 2018. *f*orthcoming. Available from: <https://link.springer.com/article/10.1007%2Fs10516-018-9395-1>. Acess in: 26 sept. 2018.

SMETHAM, G. P. *Quantum Buddhism*: dancing in emptiness - reality revealed at the interface of quantum physics and buddhist philosophy. Brighton: Shunyata Press, 2010. Available from: <https://books.google.com/books?isbn=1445294303>. Acess in 26 sept. 2018.

STAPP, H. P. Nondual quantum duality. In: MARIN CONFERENCE "SCIENCE AND NONDUALITY", 2009, San Francisco. *Plenary talk…* San Francisco, 2009a. Available from: <http://www-physics.lbl.gov/~stapp/NondualQuantumDuality.pdf>. Acess in: 26 sept. 2018.

STAPP, H. P. Quantum reality and mind. *Journal of Cosmology*, v. 3, p. 570-579, 2009b. Available from: <http://journalofcosmology.com/QuantumConsciousness105.html>. Acess in: 26 sept. 2018.

STAPP, H. P. *On the nature of things*: thoughts, actions, and the fundamentally mental character of nature. 2013. Available from: <hpstapp@lbl.gov>. Acess in: 26 sept. 2018.

TONONI, G. An information integration theory of consciousness. *BMC Neuroscience*, v. 5, n. 1, p. 42, 2004.

TONONI, G. Consciousness as integrated information: a provisional manifesto. *Biological Bulletin*, v. 215, n. 3, p. 216-242, 2008.

TONONI, G. Integrated information theory of consciousness: an updated account. *Archives Italiennes de Biologie*,v. 150, n. 4, p. 293-329, 2012. Available from: <http://www.architalbiol.org/aib/article/viewFile/15056/23165867>. Acess in: 26 sept. 2018.

TONONI, G.; KOCH, C. Consciousness: here, there but not everywhere. *Philosophical Transaction Royal Society B*, v. 370, p. 20140167, 2015. doi: http://dx.doi.org/10.1098/rstb.2014.0167

VAAS, R. Time before Time: Classifications of universes in contemporary cosmology, and how to avoid the antinomy of the beginning and eternity of the world. *Bild der Wissenschaft*, v. 10 , p. 32-41, 2004. Available from: https://arxiv.org/pdf/physics/0408111. Acess in: 26 sept. 2018.

VIMAL, R. L. P. Proto-experiences and subjective experiences: classical and quantum concepts. *Journal of Integrative Neuroscience*, v. 7, n. 1, p. 49-73, 2008b. Available from: <http://sites.google.com/site/rlpvimal/Home/2008-Vimal-PE-SE-classical-quantum-JIN-0701-P49.pdf>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. Nāgārjuna's dependent co-origination and inherent existence, buddhism, and extended dual-aspect monism. *Vision Research Institute Living Vision and Consciousness Research*, v. 7, n. 2, p. 1-85, 2009c. Available from: <http://sites.google.com/site/rlpvimal/Home/2018-Vimal-Coorigination-LVCR-7-2.pdf>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. Matching and selection of a specific subjective experience: conjugate matching and subjective experience. *Journal of Integrative Neuroscience*, v. 9, n. 2, p. 193-251, 2010a. Available from: <http://sites.google.com/site/rlpvimal/Home/2013-Vimal-Matching-Selection-LVCR-3-1.pdf>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. On the quest of defining consciousness. *Mind Matter*, v. 8, n. 1, p. 93-121, 2010b. Available from: <http://sites.google.com/site/rlpvimal/Home/2010-Vimal-DefineC-LVCR-3-2.pdf>. Acess in 26 sept. 2018.

VIMAL, R. L. P. Emergence in dual-aspect monism. In: PEREIRA JUNIOR, A.; LEHMANN, D. (Ed.). *The unity of mind, brain and world*: current perspectives on a science of consciousness. Cambridge: Cambridge University Press, 2013. p. 149-181. Available from: <http://sites.google.com/site/rlpvimal/Home/2012-Vimal-Emergence-UMBW-CUP.pdf >. Acess in: 26 sept. 2018.

VIMAL, R. L. P. Biological naturalism in extended dual-aspect monism and conscious robots. *Vision Research Institute Living Vision and Consciousness Research*, v. 7, n. 3, p. 1-23, 2015a. doi:http://dx.doi.org/10.13140/RG.2.1.2326.6008.

VIMAL, R. L. P. Segregation and integration of information: extended Dual-Aspect Monism framework. *Vision Research Institute Living Vision and Consciousness Research*, v.7, n. 2, p. 1-39, 2015b. doi: http://dx.doi.org/10.13140/RG.2.1.1974.3445.

VIMAL, R. L. P. A framework for neuroscience and consciousness: extended dual-aspect monism (Dvi-Pakṣa Advaita). *Vision Research Institute: Living Vision and Consciousness Research*, v. 8, n. 4, p. 1-369, 2016a. doi: http://dx.doi.org/10.13140/RG.2.1.2464.2009.

VIMAL, R. L. P. Necessary and sufficient conditions for consciousness: extended dual-aspect monism framework. *Vision Research Institute Living Vision and Consciousness Research*, v. 8, n. 5, p. 1-141, 2016b. Available from: <http://sites.google.com/site/rlpvimal/Home/2016-Vimal-Necessary-sufficient-conditions-Conciousness-LVCR-8-5.pdf>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. Buddhism, hinduism, and science-based extended dual-aspect monism. *Vision Research Institute Living Vision and Consciousness Research*, v. 9, n. 3, 2017. Available from: <http://sites.google.com/site/rlpvimal/Home/2017-Vimal-Buddhism-and-eDAM-Book-6.pdf>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. Attention and emotion. *The Annual Review of Biomedical Sciences (ARBS), v. 10*, p. 84-104, 2008a.

VIMAL, R. L. P. Linking dynamic systems theory & fractal catalytic theory with standard representation theory using PE-SE framework. *Vision Research Institute: Living Vision and Consciousness Research*, v. 2, n. 6, p. 1-50, 2009a.

VIMAL, R. L. P. Meanings attributed to the term 'consciousness': an overview. *Journal Consciousness Studies, v. 16, n.* 5, p. 9-27, 2009b.

VIMAL, R. L. P. Nāgārjuna's dependent co-origination and inherent existence, buddhism, and extended dual-aspect monism. *Vision Research Institute: Living Vision and Consciousness Research,* v. 7, n. 2, p. 1-85, 2009c.

VIMAL, R. L. P. Necessary ingredients of consciousness: integration of psychophysical, neurophysiological, and consciousness research for the red-green channel. *Vision Research Institute: Living Vision and Consciousness Research*, v. 2, n. 1, p. 1-40, 2009d. Available from: <http://sites.google.com/site/rlpvimal/Home/2009-Vimal-Necessary-Ingredients-Conciousness-LVCR-2-1.pdf>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. On quest for the definition of consciousness. *Mind & Matter*, v. 8, n. 1, p. 93–121 , 2010. Available from:<https://www.researchgate.net/publication/233955238_On_the_Quest_of_Defining_Consciousness>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. Subjective experience aspect of consciousness Part I - Integration of Classical, quantum, and subquantum concepts. *NeuroQuantology*, v. 7, n. 3, p. 390-410, 2009f.

VIMAL, R. L. P. Subjective experience aspect of consciousness part II: integration of classical and quantum concepts for emergence hypothesis. *NeuroQuantology*, v. 7, n. 3, p. 411-434, 2009g.

VIMAL, R. L. P. Scientific Hinduism: bringing science and the spiritual aspect of hinduism closer via extended dual-aspect monism (*Dvi-Pakṣa Advaita*). *Vision Research Institute: Living Vision and Consciousness Research,* v. 5, n. 4, p. 1-689, 2012. Available from: <http://sites.google.com/site/rlpvimal/Home/2016-Vimal-Scientific-Hinduism-Bringing-Science-and-Hinduism-closer-eDAM-5-4-book.pdf>. Acess in: 26 sept. 2018.

VIMAL, R. L. P. A Framework for Neuroscience and Consciousness: extended Dual-Aspect Monism (Dvi-Pakṣa Advaita). *Vision Research Institute: Living Vision and Consciousness Research,* v. 8, n. 4, p. 1-369, 2016a. Available from: <http://sites.google.com/site/rlpvimal/Home/2016-Vimal-eDAM-DPA-LVCR-8-4.pdf >. Acess in: 26 sept. 2018.

VIMAL, R. L. P. The extended dual-aspect monism framework: an attempt to solve the hard problem. *Vision Research Institute: Living Vision and Consciousness Research,* v. 7, n. 4, p. 1-26, 2015a.doi: 10.13140/RG.2.1.4292.6806

VIMAL, R. L. P. The extended dual-aspect monism framework: segregation and integration of information, and the critical test for the inseparability between aspects. 2019b. *Submitted for publication. Available from:* <http://sites.google.com/site/rlpvimal/Home/2019-Vimal-eDAM-IIT-Crtical-Test.pdf >. Acess in: 26 sept. 2018.

VIMAL, R. L. P.; DAVIA, C. J. How long is a piece of time? - Phenomenal time and quantum coherence - toward a solution. *Quantum Biosystems*, v. 2, p. 102-151, 2008. Available from: <http://sites.google.com/site/rlpvimal/Home/2008-Vimal-Davia-PhenomenalTime-QBS2-20102-151.pdf >. Acess in: 26 sept. 2018.

WALLACE, B. A. A contemplative view of the mind. In: _____. *Choosing reality*: a buddhist view of physics and the mind. Ithaca: Snow Lion, 1989. Available from: <http://www.alanwallace.org/ChoosingReality23.pdf.>. Acess in: 26 sept. 2018.

WALLACE, B. A. H*idden dimensions*: the unification of physics and consciousness. New York: Columbia University Press, 2007.

Endnotes

[1] In general, an entity could be anything such as elementary particles/fields to genes to cells/neurons to neural networks to brains to families to societies to cities to countries to the whole universe.

[2] Certain neural-network or brain complex, such as thalamocortical 'complex', comparatively has very high integrated information (□), so it is a privileged area for consciousness.

[3]Various sutras sum up how life in this "mundane world" is regarded to be *dukkha*, starting with *saṃsāra*, the ongoing process of death and rebirth itself:

1. Birth is dukkha, aging is dukkha, illness is dukkha, death is dukkha;
2. Sorrow, lamentation, pain, grief, and despair are dukkha;
3. Association with the unbeloved is dukkha; separation from the loved is dukkha;
4. Not getting what is wanted is dukkha.
5. In conclusion, the five clinging-aggregates are dukkha.

[4] Nāgārjuna rejects 'inherent existence' or 'essence' in favor of co-dependent origination, and that is also why he rejects causality. As per (Blumenthal, 2009), "Thus, an object's lack of, or emptiness of having an inherently existent nature is an ultimate truth for Śāntarakṣita. […] Thus an object's lack of an inherent nature is an ultimate truth."

[5] Nāgārjuna discusses the two truths or realities, "[XXIV.] 8. The Buddha's teaching of the Dharma Is based on two truths: A truth of worldly convention And an ultimate truth. […] 9. Those who do not understand The distinction drawn between these two truths Do not understand The Buddha's profound truth. […] 10. Without a foundation in the conventional truth, The

significance of the ultimate cannot be taught. Without understanding the significance of ultimate, Liberation is not achieved. […] 11. Without a foundation in the conventional truth, The significance of the ultimate cannot be taught. Without understanding the significance of the ultimate, Liberation is not achieved." (Nāgārjuna & Garfield, 1995).p.298-9.

[6] He examines the existence of things and related conditions, "[I.]6. For neither an existent nor a nonexistent thing Is a condition appropriate. If a thing is nonexistent, how could it have a condition? If a thing is already existent, what would a condition do? […] 8. An existent entity (mental episode) Has no object. Since a mental episode is without an object, How could there be any percept-object condition?" (Nāgārjuna & Garfield, 1995).p.116-7. He examines the essence in things and effects, "[I.]10. If things did not exist Without essence, The phrase, "When this exists so this will be," Would not be acceptable. […] 13. If the effect's essence is the conditions, But the conditions don't have their own essence, How could an effect whose essence in the conditions Come from something that is essenceless?" (Nāgārjuna & Garfield, 1995).p.119-21.

[7] Nāgārjuna gives more reasons for rejecting causality: "5. If the cause, in having its effect, Ceased to have its causal status, There would be two kinds of cause: With and without causal status. […] 6. If the cause, not yet having Produced its effect, ceased, Then having arisen from a ceased cause, The effect would be without a cause. […] 10. How can a cause, having ceased and dissolved, Give rise to a produced effect? How can a cause joined with its effect produce it If they persist together? […] Causes, whether single or composite, cannot precede, coincide with, or follow their effects; causes cannot produce their effects in isolation, nor can collections of causes inherently produce their effects. " (Nāgārjuna & Garfield, 1995)- p.260-2.

[8] Nāgārjuna discusses the dependent co-origination and the consequences if it is rejected, "[XXIV.] 18. Whatever is dependent co-arisen[.] That is explained to be emptiness. That, being a dependent designation, Is itself the middle way. […] 19. Something that is not dependently arisen, Such a thing does not exist. Therefore, a nonempty thing Does not exist. […] 36. If dependent arising is denied, Emptiness itself is rejected. This would contradict All of the worldly conventions. […] If emptiness itself is rejected, No action will be appropriate. There would be

action which did not begin, And there would be agent without action." (Nāgārjuna & Garfield, 1995).p.304-13.

[9] Nāgārjuna argues: "All phenomena are arisen, but arise as empty, and as dependent. [p.169] […] arising, abiding, and ceasing are not entities at all—they are mere relations […] the self as pure subject does not exist—nor do perception or perceptual objects exist as entities—yet want to affirm the conventional reality of perception, perceivers, and perceived, in general, we want to deny the inherent existence of phenomena and affirm their conventional reality. . [p.176]" (Nāgārjuna & Garfield, 1995).

[10]Here, MIR ~ MDR – mind, where 'mind' is SEs; in general mind includes functions (such as detection, discrimination, cognition, intentionality, thinking process, reasoning, language, and so on) and SEs.

[11]Nāgārjuna described Nirvāṇa: "[XXV.]3. Unrelinquished, unattained, Unannihilated, not permanent, Unarisen, unceased: This is how Nirvāṇa is described. […] 9. That which comes and goes Is dependent and changing. That, when it is not dependent and changing, Is taught to be Nirvāṇa. […] 17. Having passed into Nirvāṇa, the Victorious Conqueror Is neither said to be existent Nor said to nonexistent. Neither both or neither are said. […] 20. Whatever is the limit of Nirvāṇa, That is the limit of cyclic existence. There is not the slightest difference Between them, Or even the subtlest thing." (Nāgārjuna & Garfield, 1995)-p.323-331.

[12] The term 'cyclic existence' refers to the cycle of arising (birth), abiding (life), and ceasing (death) of an entity, a process, or relation for conventional truth (MDR). For example, (i) the cycle of suffering and happiness, (ii) the cycle of our birth, life, and death, (iii) the cycle of birth of universe at Big Bang, its life over billions of years, and its death during Big Freeze/Big Crunch, and so on. For ultimate truth, there is no cyclic existence. Thus, cyclic existence is not inherently existent in time and space for MDR.

[13]The *śūnyatā* is equivalent to Vedāntic OOO (omnipotent, omnipresent, and omniscient) manifested Brahman as (Loy, 1982) argues although they appear just opposite.