

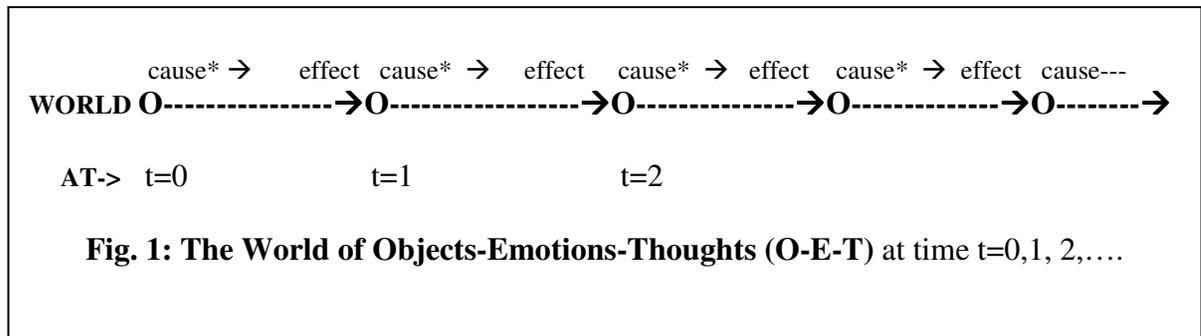
THE MYSTERY OF TIME
Converging Thought Currents from Vedanta, Physics, and Neurosciences

Raju Chidambaram, Ph.D and Shobha Chidambaram, M.D.

SUMMARY: *The cosmological theory of Vedanta and the Relativity Theory of Modern Physics both suggest a timeless universe in which there are no past-present-future distinctions. However, it is common experience that sentient creatures (jeevas) living in the universe do perceive time. A resolution of this inconsistency between the macrocosm and microcosm is possible using concepts in Vedanta as well as some of the emerging views in modern Neurosciences. The resolution presents a picture of the cosmos that will radically alter our common perceptions about the nature of our material existence in the universe, but that picture is consistent with Vedantic teachings about our spiritual nature.*

The Classical View of the Universe:

Until Einstein’s arrival on the scene, time was viewed by most western philosophers and scientists as the firm and solid stage on which the grand drama of the universe was enacted. This classical view (sometimes called the “Newtonian” or “clock work” universe) may be represented graphically as in Fig 1 below.



The state of the universe changes from moment to moment under the pressure of natural forces acting on the various objects and beings of the universe. Whereas physicists generally consider only material objects and their physical states in describing the universe at any given moment, we may also include in our description of the world sentient beings (*jeevas*) and their mental states (of emotions and thoughts). Following a notation made popular by Gurudev Sw. Chinmayananda, the world of Objects-Emotions-Thoughts will be denoted by O-E-T. In Fig. 1, time, *t*, is the substratum on which the changes in O-E-T take place.

Twentieth century physics as well as Vedanta find this classical view deficient and incomplete.

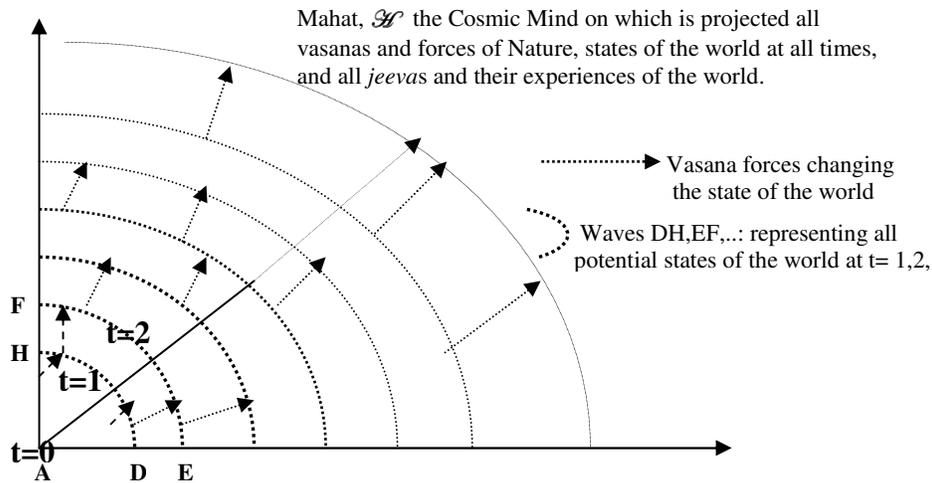
The Vedantic Model

There are primarily two problems that Vedantins will have with the classical view. The first problem is with the suggestion in Fig.1 that the evolution of the world is entirely determined by the laws of nature. There is no room here for a “higher Will” (*Ishwara*) to influence the affairs

of the world. The second problem is that the model does not account adequately for the fact that the world not only exists, but its existence is experienced. The changing world portrayed in Fig. 1 is known and experienced by *jeevas* (that is, conscious beings such as humans.) Now, according to Vedantic principles, an object known and the subject that knows it cannot be one and the same. Therefore, the subject that knows the world cannot be totally part of the world. It must be outside the one-dimensional line in Fig. 1.

This leads us to propose a two-dimensional model shown in Fig. 2.

FIG. 2: The Two-Dimensional Space of Experienced World and Experiencing jeevas



The one dimensional line which was the substratum for the changing world in Fig. 1 is now replaced by a two-dimensional space \mathcal{M} , bound by two axes at right-angle. The changing world, previously resembling beads strung on the time line, now appear as concentric “waves” radiating from the origin A. For example, the wave HD in Fig. 2 with the label $t=1$ indicates the state of the world at time 1, while the wave FE represents the same at the “next” moment, namely $t = 2$.

What cause the world to go from one state at $t=1$ to another state at $t= 2$ are the forces affecting both the gross physical matter and the subtle “mind-intellect” of sentient beings. The forces affecting physical matter, or the “forces of nature”, follow the laws known to science. The forces affecting mind-intellect, called “*vasanas*” or tendencies in Vedanta, are less well understood, but equally real. The physical and “mental” forces are the agents of change in O-E-T and the term “*vasanas*” can be applied for both. For example, under the pressure of the *vasanas* in effect at $t=1$, the world moves to a different state, indicated by the wave EF, at $t=2$. To use a more suggestive language, we may say that the winds of *vasanas* blowing at time $t=1$ changes the wave HD at time 1 into the wave FE at time 2. The arrows in Fig. 2 show the *vasana* pressure behind the waves. This picture of the cosmos echoes faithfully the following beautiful simile employed by Adi Shankara (*Vivekachudamani*. v. 497):

“In me the ocean of unbroken Bliss, endless waves of the universe are created and destroyed by the play of the storm of Maya” (Translation by Sw. Chinmayananda, Ref. 1)

Several points need be made to explain what the “waves” and the field in which they arise are. Each wave, *as a whole*, represents the state of the O-E-T at a particular time: for example the arc DH as a whole is the state of the world at $t=1$. The phrase “as a whole” is used to imply that segments or points on the arc do not have any significance; in particular, they do not represent particular parts or elements of the world. Secondly, the state of the world includes not only an objective description of the physical world at a given time, but also a subjective description of that world from the point of view of each jeeva. The physical world being the same, it is seen by different jeevas differently. What is a happy world to one jeeva may be at the same time a sad one to another. This fact is conceptually accommodated in the model since the state description of the world includes the physical state as well as the emotions and thoughts specific to every jeeva.

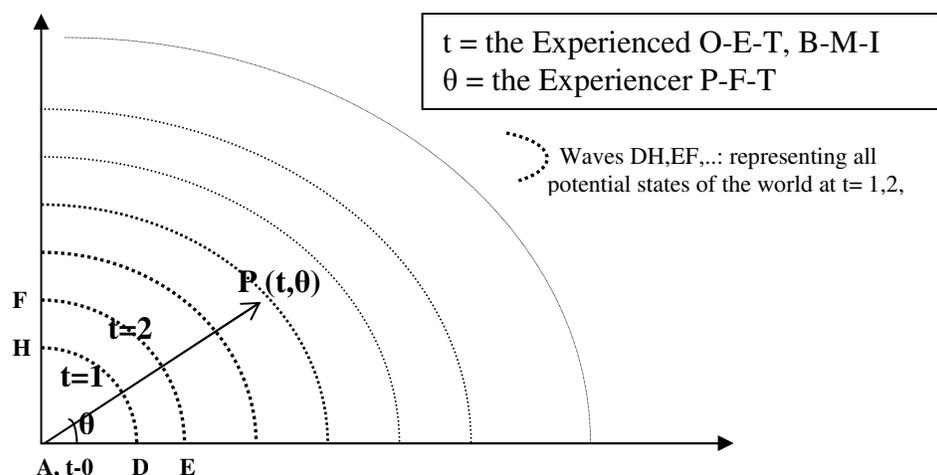
Another point to note is about the role of Creator or God (*Ishwara*) in determining the state of the world at any time. As mentioned earlier the *vasanas*, the forces of nature (*prakriti*), are behind the ever changing state of the world. However, the *vasanas* do not totally determine the changes. This is the conclusion of modern science also. *Vasanas* only suggest the different possible changes that could happen and their relative likelihood. Only one of these possibilities is actually realized and is as willed by *Ishwara*. In Fig. 2, FE, the world at $t=2$, arises due to the *vasanas* in operation at $t=1$ on DH. Knowing the state of the world DH and the *vasanas* in operation, we can at best project the different possible states of the world at $t=2$. FE, the actual state at $t=2$, is chosen from the many possibilities at *Ishwara's* Will. Thus, the evolution of the cosmos, shown as the expanding field of waves in the space \mathcal{M} , is the combined result of *Prakriti's* forces and *Ishwara's* Will.¹

The Experienter

The changing world, represented by the sequence of waves, is what is experienced by the sentient *jeevas* of the cosmos. The “experienced” is shown by the waves at $t=0$, $t=1$, $t=2$ etc, etc. Thus the parameter t represents the world experienced at time t , and not merely the time t . Those familiar with the polar coordinate system for two-dimensional spaces will recognize that t is the “radius vector” with A as the origin. Any point “P” in the space \mathcal{M} can be designated by specifying the wave t on which it is located and the “vectorial angle” θ that the line AP makes to the “initial line” (or “horizontal axis”) AE. See Fig. 3 below.

¹ The waves DH, FE etc shown in Fig. 2 are the actual states of the world that the jeevas experience. Alternatively, we can consider each wave to represent *all* possible states the world can be at that time, and not just the actual state as decided by *Ishwara*. The field \mathcal{M} is now the field of all possible experiences from beginning of creation to its end. This leads to a view similar to the Parallel Universes proposed by some Quantum Physicists.

FIG. 3: Polar Coordinate Designation of \mathcal{M} the Field of Experiences



Since t refers to the experienced, one may expect the other parameter θ to relate to the “experiencers”, or *jeevas*. This indeed is the case, but we need to be clear about the sense in which this is so. The parameter θ does not refer to any physical, mental, or intellectual attributes of the *jeeva* since, by our definition, these are part of the experienced O-E-T. Instead it refers to the *jeeva*’s spiritual detachment, a measure of the spiritual maturity of the *jeeva*². As a *jeeva* progresses spiritually, its spiritual detachment, θ , increases. In our model, θ , measured in radians, can take values from 0 to $\pi/2$. The horizontal and vertical axes in Fig.3 correspond to the lower and upper limits of θ . A *jeeva* at the lower limit of $\theta = 0$ represents a being which is fully attached to the world, ignorant of the Self, and suffering the dualities of pain and pleasure etc. At the upper limit, $\theta = \pi/2$, is a *jeeva* living in full knowledge of Self, remaining in Bliss while merely witnessing the changing world. This characterization is keeping with the basic teachings of Vedanta.

II. The \mathcal{M} Space

The space defined by the coordinates (t, θ) $\{0 \leq t < \infty \text{ and } 0 \leq \theta \leq \pi/2\}$ is the \mathcal{M} space, and is the first quadrant of the two dimensional space. $P(t, \theta)$ represents the point in the \mathcal{M} space where a *jeeva* with detachment θ encounters the world at time t . The result of an encounter of an experiencer with the experienced is an *experience*. The points in space \mathcal{M} are thus points of experience and the space \mathcal{M} as a whole is the space, or field, of all experiences of all *jeevas* from time 0 to infinity. In other words, the \mathcal{M} space represents the entire creation and its evolution over time. According to Vedanta, creation is a projection on *Mahat*, the Cosmic Mind, and therefore the \mathcal{M} space is identified with the *Mahat*. It exists in *Brahman* or Consciousness.

² For details see www.mathematicsofspirituality.com

Co-Existence of Past, Present, and Future in the \mathcal{M} Space

The view of the creation shown in Fig. 3 is not available to any creature, but only to the Creator. Time and Space are part of creation and hence they are in the *Mahat*. On the other hand, the Creator, and the *Mahat* on which the creation is projected, are not in time or space. They are timeless entities and concepts such as past, present, and future, do not apply to them. They are also changeless, since change implies time. Such being the case, one cannot say that the wave DH at time =1 arises first and then disappears before the wave EF at time =2 is born. If this were so, the Creator, who sees one world now and a different one next, is also in time domain. Instead, from the Creator's point of view all the waves must exist together in the \mathcal{M} space. That is to say, the "past, present, and future" worlds co-exist along with all the experiences they have in store for all the jeevas. It is not that the past "was", the present "is" or the future "will be", but in fact the past, present and future all "is". There is only "is"ness in the higher realms of reality associated with Ishwara and *Mahat*. This is the conclusion to be drawn from the timelessness of Ishwara.

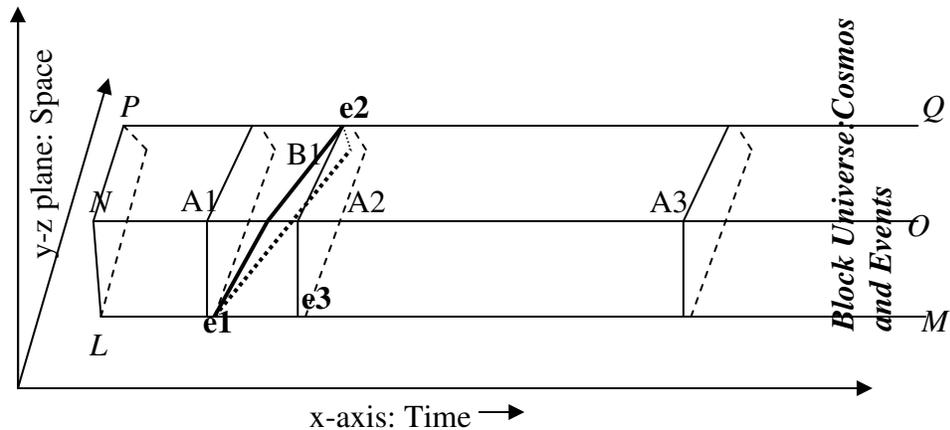
The waves in Fig. 3 have time tags attached to them, such as $t=1$, $t=2$ etc. Since there is no time concept associated with the \mathcal{M} space, the tags do not refer to time as we *jeevas* understand and experience it. We will refer to t as "cosmic time" to differentiate it from ordinary time.

The \mathcal{M} space of Fig. 3, with wave upon wave spreading outwards from the origin A, resembles a modern day CD disc with the entire story of the cosmos recorded on its spiraling tracks. It is a thought shared by other philosophers and mystics, one example being the concept of "akashic records" espoused by Edgar Cayce (1877-1945). But of most interest to us is the similarity of this Vedantic idea to Einstein's Relativity Theory.

The "Block Universe" Model of Relativity Physics

Relativity Physics also views the universe in terms very similar to those of Vedanta. Einstein proposed, and later observations confirmed, that time and space are not independent of each other but form one integral whole, namely the "space-time continuum". Each point in this continuum refers to potential or actual "events". Fig 4, adapted from Prof Brian Green's popular book "The Fabric of Cosmos" (Ref. 2), shows the universe in space-time coordinates as the open rectangular box *LMNOPQ*. Resembling a loaf of bread, this space-time representation is sometimes called as the "Block Universe". Time progresses from left to right along the x-axis. The cross-sections of the block labeled as A1, A2, and A3 (which are like three slices of the loaf of bread) show the universe at three different points in time for some observer A. **e1**, **e2**, and **e3** are three points in the time-space continuum of which **e1** lies in the

Fig. 4 The Block Universe and Space-Time Continuum



time-slice A1 while **e2** and **e3** both are on slice A2. This means that the observer A sees event **e1** first and then sees **e2** and **e3** simultaneously. However, another observer B, who is in uniform motion relative to A, will in effect slice the space-time block at a different angle. Therefore, for this observer, both **e1** and **e2** may be in the same time-slice B1, and **e3** on a subsequent slice B2 (not shown in the Figure). Thus B will see **e1** and **e2** happening at the same time, and **e3** by itself later.

The example illustrates a basic result of the Special Relativity Theory: The timing of events depends on the motion in space and therefore one cannot talk about the “time of an event” purely in terms of some absolute time, but must state this in terms of space-time. The implication is that space and time do not exist independently but only as a single space-time continuum. Referring to Fig. 4, we say that the block exists as a whole with no special significance attached to the different “slices” one may make of it. All events, past, present, and future, coexist in the Block Universe though observers *in* the universe see them sequentially. In fact past, present, and future have no meaning as seen from outside the universe, in this modern conception of the cosmos.

These revelations of Relativity Theory are contrary to our common sense notions of time and space, but most thinkers have come to accept it as the truth in view of experimental evidence supporting the theory. As Einstein himself once observed, *“To us convinced physicists, the distinctions between past, present, and future are illusory, however persistent”*. The famous astronomer Sir Arthur Eddington concurred: *“Events do not happen: they are just there, and we come across them.... (as) the observer on his voyage of exploration.”* . Louise de Broglie, another famous physicist stated the same view thus: *“Each observer, as time passes, discovers, so to speak, new slices of space-time which appear to him as successive aspects of the material world, though in reality the ensemble of events constituting space-time exist prior to his*

*knowledge of them...the aggregate of past, present and future phenomena are in some sense given a priori*³

The “future” is not necessarily known a priori to any observer who is part of the universe, but only to someone who has the view, as in Fig. 4, of the universe from *outside* the space-time continuum. Observers in the universe do not have the timeless view possible from outside and thus are subject to time. Time is an artifact (or illusion, in Einstein’s words) experienced by observers moving through space-time continuum.

Clearly, this space-time continuum picture of the modern day physics shares many similarities with the *MSpace*, or *Mahat*, of Vedanta. However, there is a major difference between the two. In the Vedantic model, the emphasis is on the world as experienced by the *jeevas*. Thus we find one of the two polar coordinates in the Vedantic Model specifically designated for the experiencer. In Physics, on the other hand, the observer is more of an after thought, brought into the picture rather reluctantly only when needed to explain better the physical world. The space-time continuum description treats the observer more like a physical sensing device and less as a conscious entity that may have presence in dimensions other than the space-time continuum. Neuroscientists, who must deal with the world perceived by the sensory organs and the brain, often find themselves positioned somewhere in between the Physicist and the Vedantin. We will see later how at least one neuroscientist has tried to bridge the gap. Before we do that, however, it is instructive to explore further the similarities between the Vedantic and Relativity Physics models.

The Minkowski Metric and the Distance Measure in MSpace

The correspondence between Vedantic concepts and Relativity Theory can be delineated more sharply using the so-called Minkowski’s Metric for time-space continuum. To start the discussions, consider Fig 5 below showing two points of encounter for a jeeva with detachment θ . In this figure, we choose to represent the *MSpace* in Cartesian coordinates (τ, G) where $\tau = t.\cos\theta$ and $G = t.\sin\theta$. These coordinates can be assigned a specific spiritual meaning based on Vedantic theory, as will be seen shortly.

Let AB and CD be two consecutive waves and PQ the vector at angle θ intersecting the two time arcs at P and Q respectively. P and Q are the *jeeva*’s two successive encounters, or experiences, with the world. Let δs denote the distance PQ between P and Q. δs denotes the “duration” of the experience from the *jeeva*’s encounter with the world at P. As noted above the elemental distance δs in *MSpace* is not time, but something more like space-time. Let PR denoted by $\delta\tau$ and RQ denoted by δG be the projections of PQ on the horizontal and vertical axes, respectively. From the geometry, it may be noted that $PR = \delta s.\cos\theta$, $RQ = \delta s.\sin\theta$, and $\delta\tau^2 + \delta G^2 = \delta s^2$. The fact that $\delta\tau$ and δG depend on θ makes it possible to provide a spiritual interpretation of these variables.

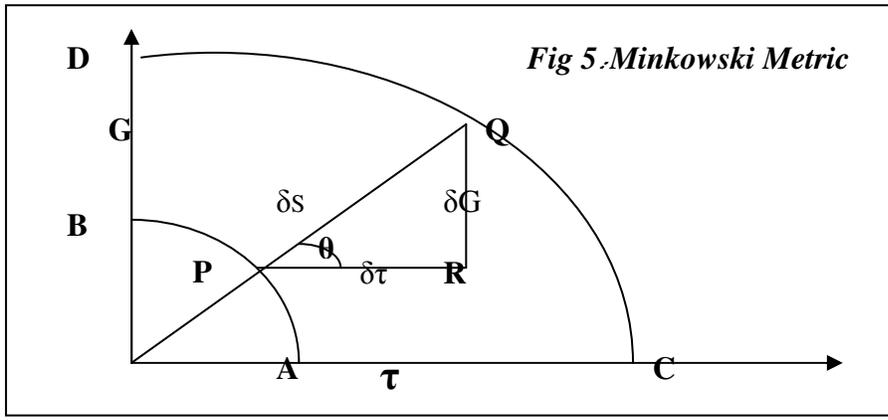
If a *jeeva* is fully attached to the world, its spiritual detachment θ is zero and hence

³ Both quotes are as given in an article by J.Smythies (Ref. 3). Einstein’s quote is from Brian Greene’s book “The Fabric of Cosmos” (Ref. 2)

PR= $\delta\tau = \delta s$ whereas $\delta G = 0$. That is, the projection of PQ is wholly on the horizontal axis, which is the axis of zero detachment or total worldliness. Ignorant of Self and totally lacking in detachment, such a jeeva is fully attached to the experience from its encounter with the world at P. The experience can be pleasant or unpleasant, but whichever it may be, the jeeva has to “suffer” it due to its total attachment to world at the time of the encounter. $\delta\tau$ is thus a measure of the “incremental suffering” of the jeeva. On the other hand if it were a fully detached jeeva, i.e. $\theta = \pi/2$, then PR = 0 and RQ = $\delta G = \delta s$. The projection is fully on the vertical axis, the axis of Knowledge. Established in the Blissful Self, this jeeva merely witnesses its encounter with the world at P and therefore does not “suffer” the experience at P. Actions performed at point P also do not add to the jeeva’s bondage, instead they can exhaust the vasanas. Thus the experience at P, represented by δs , adds to the spiritual knowledge and virtues of the fully detached jeeva. δG is thus seen to be a measure of the “incremental merit” gained by the jeeva.

For a jeeva with spiritual detachment somewhere between zero and $\pi/2$, $\delta\tau$ and δG will be both non-zero. We can surmise that there will be some incremental suffering as well as some incremental merit accruing to the jeeva due to its encounter at P with the world. The suffering will be less than that of a totally ignorant, fully attached jeeva while the incremental merit will be less than that of a jeeva in the witnessing mode during the same interval⁴.

$\delta\tau$ can also be interpreted as the “incremental experienced time”. Time is experienced when a jeeva, identifying with the world it encounters, experiences a changing world. Since $\delta\tau$ represents the extent to which the jeeva is attached to the world during the interval δs , it serves to measure incremental time experienced by the jeeva. A later section in this paper will address the difference between cosmic time, experienced time, and physical time.



As pointed out, we have the relation

$$\delta s^2 = \delta G^2 + \delta \tau^2 \dots\dots (1)$$

Now, the Minkowski Metric for the 4 dimensional time-space continuum is δd defined as:

⁴ A detailed discussion of the variables $\delta\tau$ and δG , is in Ref . 4.

$$\delta d^2 = \delta s^2 - \delta t^2 \text{ ----- (2)}$$

where δs = the distance in the ordinary three dimensional space, and $\delta t = c$. incremental time, c being the speed of light. For convenience, the units of measurement of time and space may be set such that $c = 1$. Equation (2) shows the mathematical relationship between time and space.

Physicists sometimes explain this basic relationship in a way that is particularly helpful to our discussions (Ref. 2). Everything in this universe can be thought of as constantly moving through the time-space continuum at the speed of light⁵. Even objects stationary in space are also traveling at that speed, except that their travel is in time dimension only. They are moving through time at the fastest speed possible, namely speed of light. We may say that time moves at the fastest for these objects. When something or somebody is moving through space, it is in effect diverting part of its speed in the time dimension to accomplish travel in the three dimensional space. Because of this diversion, its speed in time is reduced; that is “time slows down” for it. In the extreme, time stops for an object moving through space itself at the speed of light.

We can re-write Eq. (2) as follows:

$$\delta d^2 = \delta s^2 + (\delta i.t)^2 \text{ ----- (3)}$$

where $i = \sqrt{-1}$ is the unit imaginary number. Comparing equations (1) and (3), we see the correspondence between the following pairs of terms:

- a) The four dimensional time-space continuum \mathbf{d} with the space \mathcal{M} ,
- b) Imaginary time $\mathbf{i.t}$ with experienced time τ on the horizontal axis; and
- c) Three dimensional Euclidean space \mathbf{s} with \mathbf{G} , the vertical axis representing Goodness and Knowledge associated with Self, Pure Consciousness.

Using this correspondence, the time-space relationship given above readily translates into a fundamental law of spirituality.

Fundamental Law of Spirituality

Everything and every jeeva is in the *Mahat* (\mathcal{M} space) and all move constantly at a uniform speed across this space, just as everything in the material world is moving at the speed of light in the time-space continuum. In the Fig 5 above, for example, the world, which is at arc AB at a certain time, is at arc CD after the elapse of δs units of cosmic time. All things and beings “move” in the \mathcal{M} space with the universe. However, spiritual beings, or *jeevas*, by virtue of their detachment, divert part of this speed to advance in the dimension of Knowledge of Self & Goodness along the vertical axis. This reduces their speed in the dimension of “experienced time” or “suffering” τ (along the horizontal axis).

⁵ To talk about movement in space-time continuum may sound like a contradiction of the “static” universe. The timeless, static view is however strictly an “outside” view; observers within the universe do experience time and movement.

The speed component along the vertical axis, $\delta G/\delta s$, corresponds to the speed in space in the physical world. It equals $\sin\theta$ which in Ref 4 is defined as the “Relative Awareness”, a comparative measure of the Goodness and Knowledge of the jeeva relative to that of a fully Realized “Perfect Being”. The “Goodness and Knowledge” manifests in a Perfect Being as unconditional love for all beings, based on a full understanding of the oneness of all beings. Therefore, higher the vertical speed component of a jeeva, higher is the love and understanding it manifests, and lower is its horizontal speed component signifying worldly suffering. This leads to the “Fundamental Law of Spirituality” expressing the inverse relationship between Love and Suffering:

“As a jeeva gains more and more in universal, unconditional love and understanding, it suffers less and less in the world”

This relationship, which in mathematical terms is identical to the relationship between time and space, deserves to be called the Fundamental Law of Spirituality in view of the importance given in all spiritual and religious traditions to Unconditional Love.

The Many Similarities between Vedanta and Relativity Physics

The many similarities between the material realm described by Relativity Physics and the spiritual realm as conceived in Vedanta are listed in a Table below

Concept in the Material Realm of Relativity Physics	Concept in the Spiritual Realm of Vedanta
Space-Time Continuum, with co-existing past, present, and future	<i>Mahat</i> or Field of Experiences, with co-existing past, present, and future
Space (3-dimensional)	The vertical axis, G, of Knowledge, and Goodness (associated with Self or Consciousness)
Speed in space	Extent of establishment in Self, or Knowledge of Self, given by $\sin\theta$, “speed” in G
Stationary in Space; zero speed in space*	$\sin\theta=0$, $\theta=0$, totally attached to world, Ignorant of Self
Maximum speed in space, $c=1$, is attained by light	Fully established state in Self, $\sin(\pi/2)=1$, is attained by the Enlightened (Realized .)
To attain speed of light, a particle must have no mass	To attain Enlightenment, a jeeva must have no ego
An observer stationary in space is in the domain of time. But time comes to a stop for one moving at speed of light*	A jeeva ignorant of Self, is bound to time and suffers the changes that time brings. But an Enlightened jeeva goes beyond time and attains immortality.
Space contracts to zero in the direction of travel for one traveling at speed of light. Thus, there is no further forward to go.*	Everything is known by a jeeva that realizes Self. Thus, there is nothing more to be known.

(* relative to some fixed frame of reference)

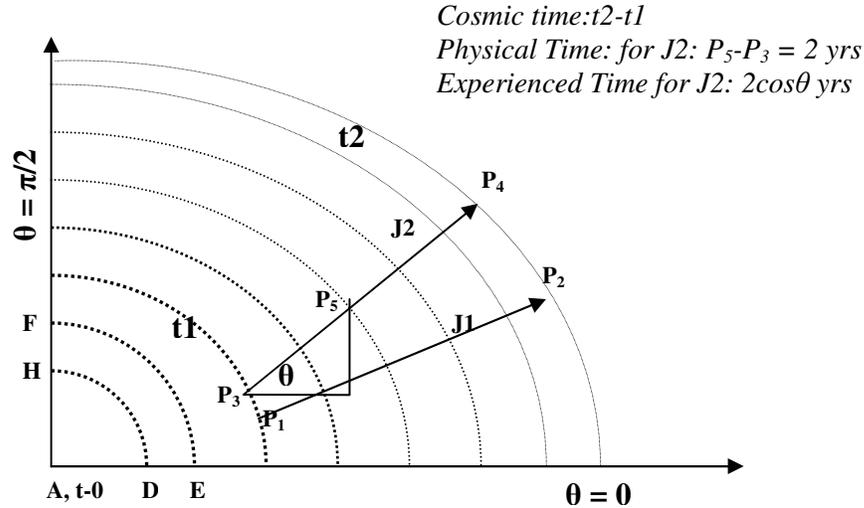
The similarities are striking, but they gain even more significance in view of the fact that the terms “Consciousness” and “Space” are considered in Vedanta as synonymous. Similarly “Knowledge” is often equated with “Light”. This may be just a coincidence, or, may be the seers of Upanishads did have an intuitive understanding of Einstein’s time and space.

Cosmic Time, Physical Time, and Experienced Time

The distance between two consecutive waves in Fig. 3 can be considered as a unit “cosmic time” since this is the interval between the cosmos “now” and the cosmos “next”. The term “cosmic time” is somewhat arbitrary since, as we saw earlier, the interval between two waves is not time but more like the Minkowski measure of distance in space-time. There is no concept of time when viewed from a point outside the Field of Experiences of Fig. 3 or outside the Space-Time Continuum of Fig. 4. There is no clock in the cosmos that can measure the cosmic time. But time *is* experienced by sentient beings within the Space-Time Continuum or the Field of Experiences. The time measured by a sentient observer within the physical realm of space-time continuum depends on its motion in space and may be called “physical time” or “personal time”. It is measured by a physical clock which is stationary relative to the observer. The time experienced by a jeeva in the spiritual realm is yet another concept, different from both cosmic time and physical time. It depends on the *jeeva*’s spiritual detachment. This “experienced time” is more mental or psychological and cannot be measured by a physical clock.

We may illustrate the three different time concepts with the example of twin siblings sometimes employed in teaching Relativity Physics. John and Jay are twins who are together at time t_1 celebrating their 19th birthday. The same day Jay leaves for a distant galaxy, traveling at a very high speed. After reaching the galaxy Jay turns around instantly and returns back to earth at t_2 . Because of his high relative motion in space, physical time for Jay runs 60% slower than for John. Five years have passed on earth when Jay returns just in time for the twins to celebrate their birthdays together again. But now there is a big difference: it is the 24th birthday for John and 21st for Jay. All this can be shown in Fig. 6 by plotting the locations of J1 (for John) and J2 (for Jay) at the two birthday party events. At time t_1 , J1 and J2 are at the points P1 and P3 respectively, and at time t_2 they are at P2 and P4. Though J1 and J2 will be co-located in space-time continuum at the two birthday events, they are in different locations in the \mathcal{M} space in view of their different spiritual detachment. This underscores the fact that the \mathcal{M} space is not the same as Space-Time Continuum, though the two have similarities.

FIG. 6: Cosmic, Physical, and Experienced Time



Cosmic time between the two birthday events is the interval (t_2-t_1) between the two waves. As emphasized earlier, we call this interval as time only for sake of convenience. The physical time corresponding to this cosmic time is different for the two brothers. For J1, bound to earth, physical time elapsed is 5 years whereas for J2 it is 2 years. This difference is due to the effects of relative motion in space-time continuum. The cosmic interval (t_2-t_1) is itself neither 5 years nor 2 years. We cannot measure it in time. It is just that the interval P_2-P_1 in the J1's trajectory translates into 5 years, but the interval P_4-P_3 translates into 2 years. We may show this disparity in Fig. 6 by locating J2 at a point P_5 which is $2/5$ the distance from P_3 as P_4 is from P_3 . It is as if J2 has moved from P_3 to P_5 during the interval (t_2-t_1) when J1 moves from P_1 to P_2 . This representation compromises the "outside" view of the cosmos since a wave is not now associated with a definite cosmic time. But it may be more suitable to describe a jeeva's "inside" personal view of the world it encounters.

The time we *experience* is a function of our mind and it is more psychological than physical. Clearly, it is not the same as the time registered by the watch we wear. In deep sleep, for example, we are not with the world nor are we aware of time, but the watch keeps ticking. More generally speaking, the degree to which a jeeva is identified with the world, (as given by the jeeva's spiritual detachment) is a determinant of its experienced time. In Fig 6, physical time is 2 years for J2, but his experienced time, defined as the projection of the physical time on the horizontal axis, is $2.\cos\theta$ yrs. In the proposed mathematical model of spirituality (Ref. 4.), "experienced time" is a proxy for a jeeva's suffering in the world. The logical link between experienced time and suffering is provided by the fact that it is changes experienced by a jeeva that give rise to both suffering and the notion of time. When one is able to rise totally above changes through spiritual detachment, there is neither suffering nor time. This is also the logic behind the memorable illustration in the Mundaka Upanishad featuring the bird that eats versus the bird that merely witnesses.

There are two questions of major significance which remain to be addressed: 1) How is that sentient observers (jeevas) experience time when there is no such thing as time in creation *per se*? 2) If past, present, and future co-exist, does it not deny the free will for the jeevas to change the future by what they do now?

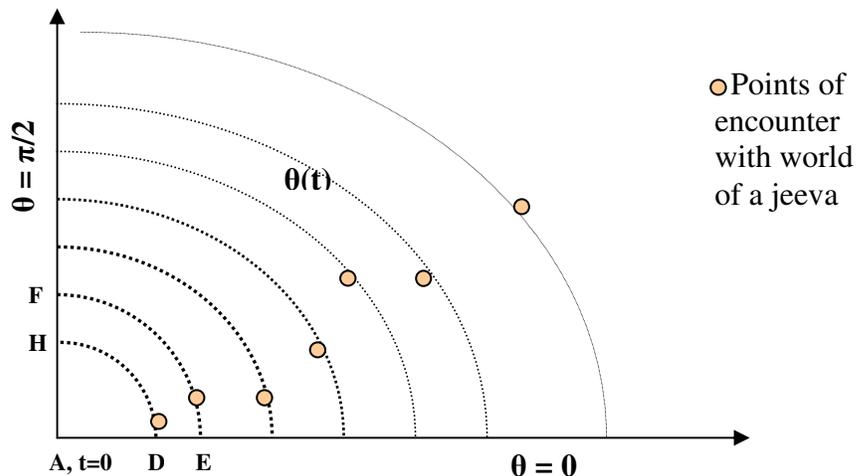
Perception of Time

The concept of time remains an enigma to science to this day. But Vedanta, which views liberation as the passage from mortality to immortality, must necessarily have a good understanding of the meaning of time. The Vedantic view of time is clearly expressed in the following statement of Sri Ramana:

“What is time? It posits a state, one’s recognition of it, and also the changes that affect it. The interval between two states is called time.” (Page 454, Ref. 5)

It follows from this definition that, for time to be experienced, there must be changes and also there must be recognition of the changes by some cognizant being. Where there is no change, there is no sense of time. Brahman, or Self, is changeless and hence it is timeless and immortal. On the other hand, from the perspective of jeevas, the world of Objects-Emotions-Thoughts, is always in a state of flux. Jeevas experience the states of the world and perceive the interval between the experiences as time. The successive states of the world were shown in Fig. 3 by a series of waves. A jeeva’s encounters with the successive states of the world can be shown, as in Fig. 7 below, as a point on each wave⁶. As the jeeva moves from one wave to the next, it experiences the changing

FIG. 7: Jeeva’s Encounters with the World



states of the world, and the experience of changes results in the perception of time.

⁶ The location of the point on the wave depends on the jeeva’s spiritual detachment. Since the wave as a whole represents the state of the world, the location does not affect *what* the jeeva encounters. However, the spiritual detachment does determine *how* well spiritually the jeeva handles the particular encounter.

What propels a jeeva, one may ask, from one wave to the next? In other words, what keeps a jeeva bound to time and to the changing world? From the point of view of science, worldly life is all there is and hence question is irrelevant. From a spiritual point of view, on the other hand, it is a very valid question. Vedanta says it is *maaya* that keeps the jeeva bound to world by its power of delusion. It is the same *maaya* that Ishwara, the Creator, wields to project the world on the Cosmic Mind. The difference is that, *maaya* is under the control of Ishwara, whereas jeevas are controlled by *maaya*.

What Moves from Wave to Wave?

What exactly do we mean when we say a jeeva moves from wave to wave? The answer Vedanta gives, as well as what some neuroscientists now suggest, challenge some of the deepest beliefs we have about ourselves and the world we live in.

According to Vedanta, a jeeva has three bodies: a *gross* (physical) body, a *subtle* body constituted of mind and intellect, and a *causal* body constituted of its “*vasanas*” (or inherent tendencies.) All three bodies are part of the creation and therefore part of what the waves represent. Hence these bodies cannot be what moves from wave to wave in Fig.7 to produce the life’s experiences for the jeeva. None of these three bodies is sentient and therefore none, by itself, can be the primary instrument of our experiences. Scriptures suggest that the sentient jeeva is born when the Atman or Self “enters” the individual body-mind-intellect complex; that is, sentiency in an otherwise insentient body-mind-intellect complex is produced by its association with the Self, which is of the nature of Consciousness. Some Vedantins make this process a little bit more specific with the “*pratibimba vaada*” or the Theory of Reflected Consciousness. They suggest that Consciousness reflecting off the intellect (*buddhi*) produces the “beam of intelligence” in the light of which a jeeva recognizes the world of objects-emotions-thoughts. According to Adi Shankara “*buddhi*” is the determinative faculty in us. An object is recognized when the *buddhi* determines what that object is.

The jeeva cognizes and experiences the state of the world represented by a wave in the beam of reflected consciousness. This is what we mean by descriptions such as “jeeva encountering a wave” or “jeeva meeting the world”. The wave and the state of the world it implies for the jeeva have been there forever as though patiently waiting to be illumined. A stream of experiences is produced as the beam of reflected consciousness illumines wave after wave. This stream of experiences is life and its sequential character is the source of the experience of time. In this respect, the waves are like tracks of music recorded on a CD and the reflected consciousness of the jeeva is like the laser “read head” moving over the recorded tracks to make life come alive.

The Grand View and the Science to Support It

There are a countless number of jeevas in the cosmos, ranging from plants and animals to humans and *devas* or demigods. Each *jeeva* has a unique view of the world, its experience at any time being unlike that of any other *jeeva*. A happy moment for one *jeeva* can be a painful one for another. The grand picture that emerges is that of a multitude of *jeevas* moving from wave to wave, each experiencing what is in store for itself. It is a picture that sharply differs

from what we generally believe: That the future is yet to be born, that we create the future by what we do “now” and that what we do now is according to our will. The truth, we find, is that we experience only what is always existent and we can do nothing “now” that has not already been done through us. We are not the authors of what we do.

Science is also veering towards similar views in its effort to explain how there can be the dynamic experience of time and changes in a timeless, static universe. The explanation, as the following quotations from three scientists show, usually invokes consciousness⁷.

Russell Stannard (Physicist, Open University of UK):

Physics itself recognizes no special moment called ‘now’—the moment that acts as the focus of ‘becoming’ and divides the ‘past’ from the ‘future’. In four-dimensional space-time nothing changes, there is no flow of time, everything simply IS . . . It is only in consciousness that we come across the particular time known as ‘now’ . . . It is only in the context of mental time that it makes sense to say that all of physical space-time IS. (1987)

Hermann Weyl (Mathematician-Physicist, Advanced Institute of Science, Princeton): *‘The objective world simply IS, it does not happen. Only to the gaze of my consciousness crawling upward along the life-line [world line] of my body does a section of this world come to life as a fleeting image.’* (1922)

Roger Penrose (Mathematician) “. . . particles do not even move, being represented by “static” curves drawn in space–time. Thus what we perceive as moving 3D objects are really successive cross-sections of immobile 4D objects past which our field of observation is sweeping”. (1994)

Consciousness figures prominently in the above statements. This is least surprising to a Vedantin. After all, “Prajnaanam Brahma” (or Consciousness is Brahman) is the first of the four “great statements” of the Vedas. Everything in creation arise, live, and dissolve in Consciousness.

A Neuroscientist’s View of Reality

Scientists, however, are not yet ready to accord the same supreme status to Consciousness as Vedanta does. The field of cognitive science and neuroscience is a very active one today and teems with a number of different hypotheses about consciousness and its purpose, but there is little by way of consensus or deep insight to be found . The situation after decades of research on the part of neuroscientists, psychologists and philosophers has been summed in a recent book thus: *“Only one proposition about how the brain makes us conscious...has emerged unchallenged: we don’t have a clue”*. (Ref. 6)

This conclusion is very discouraging to those who hope to explain consciousness in terms of the physical brain and its activities. But other scientists who approach the study of consciousness with an open mind are not daunted by the negative results. For example, the views of John Smythies, a neuroscientist from University of California at San Diego, are illuminating and very relevant to our discussions. In his paper on “Time, Space, and Consciousness”, Smythies makes three key points:

⁷ The quotations are taken from the paper by J. Smythie (Ref.3)

- 1) What we perceive is only a representation of the external world constructed by the brain and not the external world itself. There is a “physical world” out there and a corresponding, but separate, “phenomenal” world inside. To quote the author “*Phenomenal objects, together with the space in which they are located, are constructs of the central nervous system and in no sense are they direct views of the external objects that they represent. the results of a large number of experiments in psychophysics.... demonstrate beyond any doubt that, in vision, we do not perceive the world as it actually is, but as the brain computes it most probably to be*”.
- 2) The phenomenal space, or the space in which the phenomenal objects are located, is different from the 4-dimensional space-time of physics. Smythies refers to the 11 dimensional space and “branes” proposed by string theorists and suggests that the “*phenomenal space and physical space are simply different spaces, different parallel universes whose contents are causally related.*” That is, the phenomenal space lies on a multi-dimensional “brane” separate from the physical 4-dimensional space-time. Smythies does not define or explain consciousness, but suggests that “consciousness is in this brane and not in the brain”. That is, consciousness is associated with the mental or phenomenal world and not with the brain which is part of the physical world.
- 3) The physical and phenomenal worlds, though in separate dimensions, are causally related and therefore affect one another. The physical space-time is static with co-existent past, present, and future. But the phenomenal world is dynamic since there is perception of changes. Smythies suggests that the *perception of time is generated by the motion of the phenomenal space relative to the physical space.* The “now” is the point of contact between the two spaces. Compare this with the Vedantic model where the “now” is the point of contact between jeeva, the experiencer, and world, the experienced.

The general picture that Smythies paints of Reality is similar to the view presented in Fig. 3 earlier. This is remarkable given that the starting point for Fig.3 was the Vedantic teachings, whereas Smythies bases his views on Relativity Physics and modern Neuroscience. It is noteworthy that a neuroscientist with intensive clinical experience should admit that mind is not the brain and propose that consciousness and mind are in a space altogether separate from the physical space of the brain. Also, his proposal that the “now” is the point of contact between the physical and phenomenal spaces is similar to the Vedantic model (Fig. 7) where “now” is the point of contact between the sentient jeeva and the insentient O-E-T. The physical and phenomenal worlds correspond to the *Virat* and *Hiranyagarbha* respectively of Vedanta.

There are differences, however. Smythies suggests that consciousness is in the phenomenal space or “brane”. Vedanta denies absolute reality to the physical and phenomenal world, Consciousness being the only Reality. Therefore Consciousness is not in the brane of phenomenal space; rather the brane, as well as the physical space is in Mahat, the Cosmic Mind, which itself is in Consciousness. Secondly, there is a question about the nature of the “brane” and the individual observer’s phenomenal space. Vedanta asserts that there is only one Consciousness but with many individual reflections. Smythies seems to suggest that there is one brane in which there are many individual “consciousness modules”. A final significant difference is in regards to the spiritual dimension of our existence. Smythies, keeping his discussion within the traditional confines of science, does not talk about spirituality. However,

if reality is the timeless, changeless universe physicists say it is, and if individual experience of time is (to use Einstein's words) only an illusion, then should not awakening from this illusion to that timeless reality be a goal of all individuals, especially when the cause of suffering is this illusion?

This in fact is the goal of spirituality as repeatedly stated in Upanishads. We turn our attention to this goal and the role of Free Will in achieving the goal in the final sections of this paper.

Free Will

In the cosmic scenarios shown in Figs. 3 and 4, the world of the future co-exists with the present. Hence what a jeeva will meet at the "next" moment is beyond its power to change by what it may do "now". This basically denies any role for personal free will in our life. If a jeeva has personal free will, it can exercise that will to engage now in actions that would change the world at the next moment. Since this possibility is negated, one must also negate, or at least greatly restrict, the free will attributable to jeevas. No doubt denial of personal free will is very unpalatable to our usual way of thinking, but, for reasons discussed below, a fact nevertheless.

It is not uncommon for us to sometimes surprise ourselves by what we do. Our act may be contrary to what we generally believe in and we may never quite understand why we did what we did. There are also situations where we have to make a decision quickly without having any time to reason it through. This shows that our decisions are not necessarily dependent on our conscious will. But it may come as a shock to many to know that our decisions even in other cases are not ours. Yet our scriptures, logic, science, and seers all seem to proclaim this as the truth.

Scriptures: "Akartaham" ("I am not the doer") is a phrase heard again and again in Vedanta. In Bhagavat Gita, the Lord calls those who consider themselves as the doers of their actions as "deluded", reminding us that all actions are in fact accomplished by the forces of Prakriti. "Prakte: kriyamaanaani gunair karmani sarvasah, ahamkara vimoodatma kartaham iti manyate" (Bh. Gita, III, v. 27)

Elsewhere in the Gita we are also told that Ishwara, seated in the "heart" of all things and beings, controls them.

"Iswara sarvabhutaanaam hrddese-rjuna thistathi, bhraamayan sarva bhoothni yantraroodaniva maayaya" (Bh. Gita XVIII, v 61)

Thus, the notion we have that what we do is a result of our individual will, ignores the truth that all actions issue out of the forces of Prakriti and Will of Ishwara⁸.

⁸ There is a free will affecting the evolution of the world but it belongs to the Ishwara. Vedanta views Ishwara as the supreme controller of all things and beings. Ishwara exercises the divine Will while remaining within the bounds of Prakriti's laws. This is the Prakriti-Ishwara Paradigm. (Ref. 7) For a full discussion, see the article on "Unraveling Uncertainty" in www.mathematicsofspirituality.com. This article is due for publication as part of the proceedings of the 5th International WAVES Conference, Washington, DC, July 2004.

Logic: There is a logical fallacy behind the presumption of personal will. This is highlighted by Einstein when he pointedly asks “*Do we will to will?*” The implication of the question is that willing is not a conscious action. Any conscious action requires a conscious decision to perform the action, otherwise it is a spontaneous, unconscious or reflexive action. Therefore, if willing were a conscious action, we should have consciously willed to will. If we willed to will, the same logic suggests that we should have “willed to will to will” and so forth, ad infinitum. But this process cannot go endlessly and should end somewhere in a spontaneous “unwilled” decision. Willing, we therefore conclude, involves an “unconscious” decision arising somewhere deep inside us. In other words, *willing is not really something we do, but something done to us*. This place “deep inside us” is what is indicated as the “heart” in the Upanishads and in the above quotation from the Gita.

Neuroscience: Experiments done in 1977 by Dr.Libet, of University of California, demonstrated that choices made by subjects were registered by the brain half-a-second *before* the subjects were aware that they have made a choice. Similar experiments, repeated more recently using state-of-the-art fMRI techniques, have produced evidence of even longer delays before subjects become aware of their choices. The results are consistent with the notion that we are not the real authors of our decisions⁹.

Spiritual Evolution of Jeevas

Does it mean that jeevas have absolutely no free will? That is not the case, according to Maharishi Sri Ramana, the great spiritual Master of our times. “Everything that happens in the world”, says Sri Ramana, “happens at the Will of Ishwara”. A jeeva must submit to that Will and accept whatever is ordained by Ishwara. But, adds Sri Ramana, the jeeva has one precious freedom to exercise its personal will. The jeeva has no control over *what* it meets in life, but it has control over *how* it meets life. Basically it has two options at any given time: 1) Identify with the world and “eat” (i.e. suffer or enjoy) the experience or 2) Identify with the Self and be a mere “witness” to the experience. This choice presents itself every moment of our life and our choice will determine whether we advance in our Knowledge of Self or merely prolong our suffering in the world. In effect Sri Ramana teaches us that, while our material life is totally controlled by Ishwara, our spiritual destiny is something we can and must control. Indeed it is our “*purushaartha*” or bounden duty as a sentient being to do so.

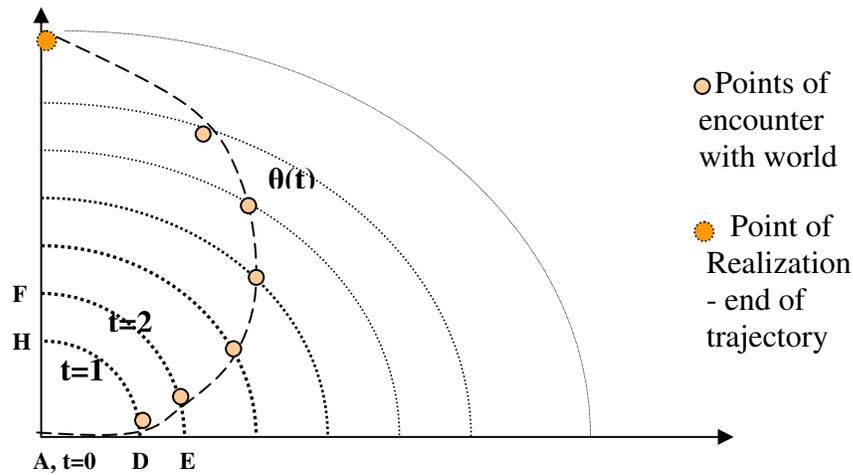
The spiritual detachment of the jeeva at time t , denoted by $\theta(t)$, determines which of these two options the jeeva is likely to choose at time t . For example, in the mathematical model in Ref. 8, the probability that a *jeeva* with spiritual detachment $\theta(t)$ will choose to identify with the Self is $\sin^2\theta(t)$ and the probability that it will identify with the world is $\cos^2\theta(t)$. As noted earlier, $\theta(t)$ itself depends on the jeeva’s *vasanas*. So, in effect, the *vasanas* determine the likelihood of choosing either option. The actual option chosen depends on the *jeeva*’s will power. For example, at a moment when *tamasic* *vasanas* dominate, spiritual detachment will be close to zero, and it is much more likely that the jeeva will identify with the world. However, given

⁹ Our common belief is that we do follows from what we decide to do. That is, what is done is the effect and what we decide is its cause. The results of these experiments suggest that this may not be the case. Both the action and the decision to act are effects of the brain state which itself is caused by nature as per the Prakriti- Ishwara paradigm.

sufficient will power, even this jeeva can overcome the pull of the lowly vasanas and identify instead with the witnessing Self. Will power is a primary requirement for spiritual progress.

The function $\theta(t)$ describes the spiritual evolution of a jeeva over time. This function takes values in the range $(0, \pi/2)$, with the convention that at the beginning every jeeva is in delusion; i.e. $\theta(0) = 0$. The life's experiences gradually bestow knowledge on the jeeva, giving it increased detachment until, in some future birth, the jeeva attains total detachment (i.e. $\theta = \pi/2$) or Realization. Plotted in the \mathcal{M} space, the function is a curve starting from the origin and ending on the vertical axis at the time of Realization. (see Fig. 8.)

FIG. 8: Path of Spiritual Evolution in the \mathcal{M} Space (Polar Coordinates)



Conclusion

Both Vedanta and modern science suggest a picture of the cosmos that is unlike anything we generally take to be the truth. A good analogy to describe that picture happens to be an audio CD and the way it is played back. The hundreds of spiraling tracks burned on the disc contain music. When the CD is played (that is, when the laser head reads the information coded on the tracks and converts it to audible sound), the music comes to life. We hear the beginning notes followed by the subsequent notes until the final notes are sounded. We hear the beat of the music and sense the movement in the melody. Altogether, when the CD is played back, there is vivid experience of time. But if we were to just look at the CD we will not hear the melody nor feel the beat of music in it which lie hidden in it.

Similarly, the waves in the \mathcal{M} space are records of the state of the world from beginning of creation till its end, and include the past, present, and future lives of every jeeva. From the point of view of the creator there is no sense of time associated with \mathcal{M} space or creation. The sense of time is experienced by a jeeva when its light of (reflected) consciousness illumines wave after wave to bring to life the particular experience recorded in it. Thus does a *jeeva*

proceed from experience to experience in its life. Instead of knowing itself to be just the illuminating factor, when the jeeva takes the experiences to be its own, it “suffers” life. However the jeeva does slowly gain Knowledge and increased detachment by the lessons learnt from worldly suffering and also by Grace of God in the form of a Guru that it meets in due course. The power of *Maaya* keeps the *jeeva* going forward on its spiritual journey until, at long last, it matures in Knowledge and attains Realization.

REFERENCES:

1. Swami Chinmayananda “*The Crest Jewel of Discrimination- Comments on Adi Shankara’s Vivekachudamani*”, Central Chinmaya Mission Trust, Bombay, 1978
2. Brian Greene “*The Fabric of the Cosmos*”, Random House, NY, 2004
3. J.Smythies (Ref. 3) “*Time, Space, Consciousness*”, Journal of Consciousness Studies, Vol.10, No. 3 , 2003.
4. Raju Chidambaram “*Towards A Mathematical Theory of Spirituality Based on Advaita Vedanta- Parts I and II*”, Sixth International WAVES Conference, July 2006, Houston, TX*
5. Sri Ramana Ashram “*Talks With Sri Ramana Maharshi*”, Inner Directions Publishing, California (2000)
6. Alva Noe “*Out of Our Heads: Why You Are Not Your Brain and Other Lessons From the Biology of Consciousness*”, Hill and Wang, 2009. (As quoted in a review of the book in Scientific American, March 2009.)
7. Raju Chidambaram “*Unraveling Uncertainty*”, Fifth International WAVES Conference, July 2004, Washington, DC*
8. Raju Chidambaram: “*Towards A Mathematical Model of Spirituality Based on Advaita Vedanta- Parts III & IV*”, Seventh International WAVES Conference, June 2008, Orlando, FL.*

* These papers are available online at www.mathematicsofspirituality.com