

A Comparison of Reality, Knowledge & Awareness in Vedanta and Western Physics

by way of introduction:

The Upanishads are the Indus sacred scriptures which constitute the philosophical or 'knowledge' portions of the ancient scriptures or Vedas. In recent years, teachings in the Vedanta have been strongly coupled to discussions of issues in modern physics: notably those concerning the wholeness of *i-knowing-reality*. Although this Vedanta-Western science dialogue was already becoming established before the turn of the century, there are a large number of difficulties to be faced in it. Both the interest in, and the difficulties stem from comparative treatments of awareness, knowledge and reality. The impasse is that to speak of *reality* rests on criteria of *knowing* which, in turn, rests on the use and trust of awareness. This paper is an examination of the interrelations between these concepts as they appear in these two traditions.

I. INTRODUCTION

I.1 . The Dialogue:

In 1904, before either the publication of Einstein's theory of relativity, or the discovery of the wave-particle duality of matter (which mark the birth of the "new Physics"), Yogi Ramacharaka wrote:

Students will notice, from time to time,
that each new scientific discovery will

point further to this idea ["accepting the Yogi theory of the identity of Matter with Energy or Force"], and how later on, Force and Energy will be recognized as shading and melting into "Mind". Some reader of this lesson, fifty years or more from now, will smile when he reads this "predication" (?) and sees how nearly it has been fulfilled.

("(?)" in original text)

(Ramacharaka 1904, 285)

Fifty two years later, in 1956, the physicist Erwin Schroedinger (who, in 1926 developed the wave equation characterizing the wave-particle duality) stated in a talk:

....I call the arithemathical paradox; the many consciousness egos from whose mental experience the one world is concocted...

There are two ways out of the number paradox, both apparently rather lunatic from the view of present scientific thought...

One is the multiplication of the world...

[the other is] the unification of minds or consciousness. Their multipicilty is only apparent, in truth there is only one mind.

This is the doctrine of the Upanishads <1>.

(Schroedinger [1956] 1980, 138-9)

These quotes mark a great dialogue which couples issues of physics with the cosmologies and principles of eastern mysticism. The dialogue is centered on issues of the wholeness of l-knowing: reality and draws on results and paradoxes of modern physics which concern the apparent dependence of physical reality on observation.

Both the interest in and the difficulties of this dialogue stem from comparative treatments of awareness, knowledge, and reality. The impasse is that to speak of reality rests on criteria of knowing which, in turn, rests on the use and trust of awareness. Resolving the relations between these terms involves

not only comparing implications of scientific observation to those of eastern cosmologies, but also comparing the processes of knowledge and the use of awareness in the two traditions.

Although the start of the dialogue predates the turn of the century (Dobson 1979,39), the purposefulness of it is still in question. To a clear majority of scientists, to seek to converge physical fact and metaphysical teachings is at best a very open issue, and perhaps a false endeavor. Vedanta, characteristic of historically early philosophies, is directly a philosophy of profound subjectivity. It is based on deep introspection/meditation, and rests its discussions of truth, reality, etc., in a language and metaphor of (trans-normal) but sensed experienced.

Margaret Noble (who at the turn of this Century became Sister Nivedita of the Ramakrishna-Vivekananda Order) expands clearly on this Yogi subjectivity. She writes:

"Patanjali's <5> work ...is obviously the final record of a long research carried out, not by a single individual, but by a whole school, experimenting continuously through many generations. Each man's labor was conditioned by the fact that he had no laboratory and no instruments outside his own body, and there can be no doubt that life was sacrificed in the thirst for knowledge."

(Sister Nivedita 1904, 282)

On the other hand, classical physics, is built on 'extraspection', and with its relegation of sensation to the subjective, does not allow directly sensed qualities as fundamental factors, or a priori concepts applicable to discussions of physical reality, truth, etc.

This difference is addressed by the Indian scientist Jayant Narlikar in an article on early Indian science:

For scientific evaluation [arguments that Vedic tests predict scientific and technological knowledge] can at best serve to provide a prima facie case, not a conclusive proof. [This also holds] for instances cited wherein the philosophical ideas expressed in Vedic literature resemble the conclusions or basic premises from modern scientific fields like the quantum theory, relativity, and particle physics <2>. The important difference to note between literature or philosophy on the one hand and science on the other is that the latter makes quantitative statements and provides prescriptions for conducting experiments that any competent scientist can translate into reality.

(Narlinkar 1985, 79)

And it is also addressed by Swami Nikhilananda:

The methods of the modern physical sciences for the discovery of truth are based upon a different notion of how to search than that which directed the rishis in their realization of Brahman. A scientist seeks to understand the universe through reason based on the knowledge derived from the sense organs.....

The rishis on the other hand did not entirely depend upon reason, as the word is usually understood. They developed another faculty of understanding, which is called bodhi, or deeper consciousness.

(Nikhilananda [1949] 1977, 24)

It is in the interest of highlighting some of the issues of both convergence and of divergence that I wish to offer a brief comparison of concepts and approaches to awareness, knowledge, and reality. Although I will approach this comparison from a western vantage which does not directly address spiritual issues, I hope that the points considered here will still make it possible to see other aspects of the dialogue which link issues of science and Vedanta <3>. I also hope that I have not destroyed this further intent by the need of drawing broad

comparisons which perforce neglect the subtlety and completeness of the living issues.

I.2 A Note on Terms:

The terms "awareness" and "consciousness" will be distinguished. Awareness will be restricted to consciousness which is grounded with an association of self. The term "consciousness" includes both the 'ordinary' awareness and subconsciousness. (It is the generic "consciousness" of western usage.) Following a general Vedantic Convention, our usual states will be typed in lower case letters. Absolute states will be capitalized, e.g. "Consciousness". In this convention, such western physical concepts of energy, mass, space, and time, will be capitalized when taken as absolutes, even though this is not usually done in western convention.

II. AWARENESS, KNOWLEDGE, AND REALITY

II.1 Starting Points:

Both Vedanta and western physics start with what can be called our "first world" of awareness --our daily perceptions and experiences. This forms a singular starting point. But in this first world paradox and illusion arise. "Is seeing believing?" "Can I trust what I see?" Introspecting on this, we start the path of Vedanta <4> for we begin to watch and sense the very experience of our being aware. Vedanta has thus been described as a science of our complete life. K.A. Krishnaswamy Iyer writes:

"Vedanta is....a science of our own life, that which which we are most familiar, a

view based on intuition and conscious experience leaving out no feature of life in its widest sense.

(Iyer 1965,3)

In Vedanta I am faced with the direct realness of awareness. Reality is inextricably bound to this sensing and cannot be spoken of independently. I need to directly watch the very structure of this sensing which gives rise to my very self. I begin to approach a knowledge of reality through an inward focus on the one fact which stands a priori beyond any qualification of outside proof --my existence, this self-in-awareness.

Distinguished from this root, I may fundamentally mistrust such a focus on my awareness. If I burn my hand in fire I know that I am acted on by forces and matter, and that my sensations are responses to this. Seeking the unique and underlying structure to these forces and matter starts us on the path to western science.

In the whole history of science from Greek philosophy to modern physics there have been constant attempts to reduce the apparent complexity of natural phenomena to some simple fundamental ideas and relations. This is the underlying principle of all natural philosophy.

(Einstein and Infled 1938, 52)

~~At this point we immediately introduce differences in~~
our techniques for obtaining knowledge, in our trust of awarness, and in our choices of phenomena which we are willing to lable as real. Albert Einstein writes:

[The physicist] must content himself with describing the most simple events which can be brought within the domain of our experience; all events of a more complex nature are beyond the power of the human intellect to reconstruct with the subtle accuracy and logical perfection

which the theoretical physicist demands.

(Einstein 1934, 3)

and

[the physicist] demands the highest possible standard of rigorous percision in the description of relations, such as only the use of mathematical language can give.

(Ibid 1934, 3)

These quotes mark differences of philosophy which have not disappeared with the advent of modern physics.

II.2 Awareness and Reality in Vedanta:

Consider first Vedanta. Three daily states of consciousness are recognized, each of which corresponds to a class of reality.

Perhaps one can say that reality is composed of multiple levels existing in, and named corresponding to our fields of attention:

(1) waking, (2) dreaming, (3) deep sleep.

The flow of life is punctuated by the three states of deep sleep, dream, and waking.sleep and dream have hitherto not entered into the calculation of the philosopher who dismisses them with a brief word or two. No marvel, then, that Life remains shrouded in mystery.

(Iyer 1965, 2)

In waking and dreaming, individual self-awareness exists. That is, both dreams and the waking world are full of perceived objects. The waking state has spatial, temporal, and therefore causal continuity. In it, perception and experience can be shared by all who are awake and can be characterized by repeatable and consistent observation and measurement.

The dream state is the reality which is (ordinarily) not framed by causal space and time. Nor does the dreamer (ordinarily) experience vistas which are shared by all

dreamers to the point that the experience can be mutually compared by repeatable and consistent observations and measurements.

In distinction to waking and dreaming, the deep sleep state is the reality of a consciousness which exists without a distinction of a knower knowing. There is no individual. The awareness of a self cannot form itself in this reality.

There is fundamentally no "less realness" about any one state in comparison to any other, since realness must be determined from the basis of experience within the state. However, as we will come to later, both the dream and waking realities are seen as manifesting out of a Pure Consciousness which holds beyond all states of self-awareness. Deep dreamless sleep will be seen as, as it were, an unconscious merging with this Pure Consciousness, or rather, a temporary dropping of the self-distinguishing attention we hold in dreams and wakefulness. (Nikhilananda 1977, 92).

II.3 Awareness and Reality in Classical Physics:

What of western science? In the classical perspective, paradox should not be a fundamental attribute of nature. But in the first world there is paradox between perceptual awareness and measurement, and its resolution brings us to classical physics.

On a daily basis, perceptual awareness gives us our most immediate sense of reality. Measurement perhaps gives us our second. We can both describe the appearance of a table and

measure the table. Indeed, measurement seems to be only one sort of perception. Perception and measurement seem compatible until, in taking them together, they generate an impassible paradox. Two persons could agree on the perceived path of a projectile and on the measurements, the layout, of the foundations for a barn. However, when the path of a projectile is measured, the measured path is not the same as the perceived path and a paradox arises (figure 1.).

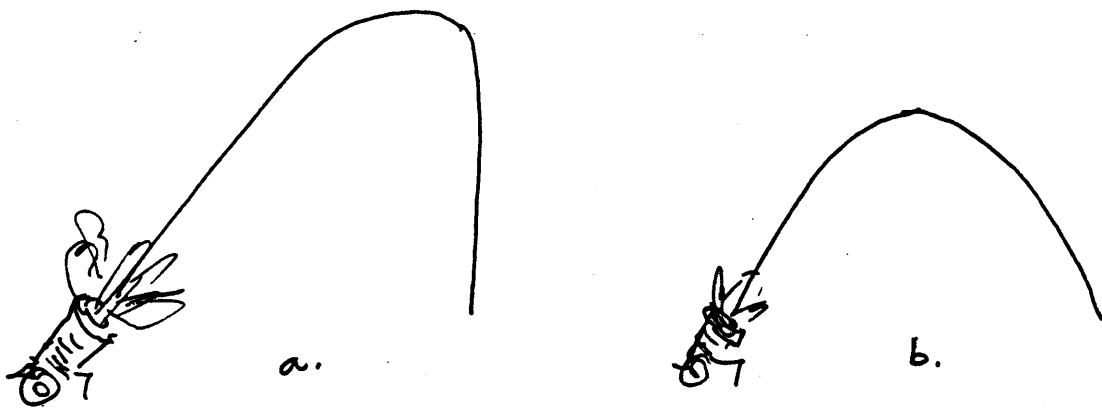


figure 1.

- a. a projectile path from a 16th century woodcut (McClosky 1983, 122). Similar curves are frequently drawn by someone sketching the perceived path of a tossed ball.
- b. the symmetrical (parabolic) path of a projectile as determined by the laws of motion

Which type of observation gives the "truer" knowledge? What is the correct path? A comparison of the descriptions of the path necessarily involves the problem of characterizing time and space, and perception and sensation itself. Historically, starting with Galileo, the description based on measurement was taken as the one which was truer as it was consistently

demonstrably a repeatable process. Classical science had its start with motion and the laws of motion.

In broader description, notions of reality and truth became born out of a choice necessitated by paradox. The paradox could not be resolved within the prior frame of knowing (i.e., perception). The paradox could be (and was) resolved by realizing the existence of a more fundamental structure to nature, which was not apparent to direct perception, but which could be observed through the careful practice of measure, discrimination, and inference. The physicist thus came to seek to uncover and characterize a Reality which exists independently of any act of experience, or of the nature of awareness itself. To use the Hindu analogy, perception (and awareness/sensation in general) gives us an illusory snake, and science attempts to uncover the rope that underlies the illusion.

This stance has been "codified" as the two canons of natural philosophy:

1. There is a real outer world which exists independently of our act of knowing.
2. The real outer world is not directly knowable.
(D'Abro 1951, 14)

The first canon implies that the "Primary reality" is made up of fundamental structural factors and their relations (Galilei [1623] 1957). The second canon dictates that perception and intuition cannot be trusted as a direct method of knowledge.

Since I do not trust sensation, knowledge will need to be operationally defined --based on fundamentally repeatable relations of measurable events. Measurement requires the stable

space/time domain of the waking state. Therefore, I have no basis on which to claim dreaming and dreamless sleep as real. Reality can only be known in the waking state.

Subjectivity and objectivity are clearly defined. Perception is subjective. If there is a conflict between the perceived event and the measurement of the event, the measurement is taken to characterize the actual (real) state. Color is subjective, the electromagnetic spectrum is objective.

The second canon can be restated: Reality exists independently of any awareness (or of any conscious perceiver). The awareness of the observer (including his tested knowledge) cannot affect fundamental reality. This is the second canon of natural philosophy. We must all live by the laws of nature, and do not make her laws. Existence is thus distinguished from manifestation.

In broad schema, this "second world" of physical or "primary" reality is to be complete with respect to the first world. That is, while perception cannot directly resolve the laws that can be verified by the scientific process, the scientific process is expected to resolve the laws of perception, and explain the roots of why perception cannot be trusted.

III. AWARENESS, KNOWLEDGE, AND TRUTH

III.1 Truth and Awareness:

How do we enter knowing in physics and Vedanta? Both science and Vedanta state that the student can experience (and/or reproduce) the truths they state. They offer processes

of knowledge and claim that these processes and methods can be undertaken by nonbelievers and skeptics; but if the process is followed rigorously the student will eventually come to realize the truths.

For both Vedanta and physics, truth is knowledge that satisfies criteria of "proof" or acceptance. Illusion and ignorance is that which does not satisfy criteria of acceptance. But for the western scientist, the term "knowledge" itself must be reserved for true knowledge. If what is thought to be true is not true, it cannot be called knowledge. The criteria for truth are the criteria of knowledge. This is the case in both classical and modern physics.

In Vedantic writing, knowledge is awareness. It does not contain any explicit requirements or test signifying truth.

Swami Satprakashananda writes:

...knowledge is varied and has a beginning and end. It lasts as long as the mental mode lasts
It can be valid (prama) or invalid (aprama)
(Satprakashananda 1965, 89)

and adds in a footnote:

The English word 'knowledge' strictly means 'knowledge of truth' or 'true knowledge', that is, valid cognition (prama), but we have used the word in a wide sense as synonymous with the Sanskrit term "jnanam", which includes both valid and invalid cognition.

(ibid, 89)

This concept, that knowledge is not necessarily qualified by truth, is very similar to that of reality not being singularly independent of different states of awareness.

Even with this difference, we may still speak of the ultimate truths of (classical and modern) physics and of Vedanta in almost identical language. The "highest" or most fundamental

truths of either Vedanta or physics are timeless and eternal. They hold independent of historical time and cultural bias. The laws of physics must be independent of time if they are the fundamental laws. The very laws which are discovered in our century here on the earth must allow us to extrapolate to events in the greatest distances of the universe and throughout time (even to the origin of the universe) <6>. This is the level at which truth is sought and claimed obtainable.

In Advaita Vedanta, that which is Real must be eternal and changeless. It is in result of this very axiom of Reality that the direct experience of this knowledge must correspond to a state beyond all space, time, and (self)awareness. Truth is ultimately established by identity with that which is known.

The language of Vedanta must be of experience. Instructions for reaching the most fundamental truths must start with prescriptions for life and for relating one's self to one's actions and one's awareness. It must offer the language of inner vision. Because knowledge is awareness, we may increase our knowledge as we increase our awareness. Any knowledge is less "wrong" than it is qualified. At any stage of awareness, what one is aware of is true at that stage. Illusion --to see the apparition of the snake instead of the rope which forms its basis-- is true in itself. To know this is to know both the illusion of the snake and the substratum of the rope <7>.

True, or qualified knowledge, of the multiple states of awareness is obtained by (realized through) three major

processes <8>. The first two are: perception --the literal and concrete forms which may be held in awareness; and inference -- knowing on grounds which can not be directly verified by perception, but which is consistent with the causal structure of perceivable experience. In these two, the perceiving and inferring self is implicit and unquestionably existing in self-awareness.

The third is meditation, including the practice of directly observing this self-awareness. (e.g. the process of quieting all thought forms). Knowledges which are obtainable through these three processes are not mutually redundant. All must be used to shed light on each other. They are also not mutually equivalent in western physics. We have seen that Newtonian physics arose out of the nonequivalence of the first two, and we shall describe how some physicists are beginning to explore the need to consider the third process in order to approach the paradoxes which now arise in modern physics.

III.2 Measurement and Truth:

Number and measure allow the physicist to step out of the perceived trap of perception. Scientists approach nature with measuring instrumentation --equipment made of inanimate physical material. This material is of the form of (the structure of) nature, and changes quantitatively with nature. The primitive act of counting can be done by machines, and so leads us out of solipism. Measure, and the relation of measures thus take on a weight of truth.

Indeed, increasing during the developments of western

physics, and in modern physics itself, reality has become identified with the measure itself--for the measurement is the structure <9>.

There is [a] measure also which is more important for certain problems and which is independent of the particular method and nature of the measuring intellect. This measure is identical with the thing itself. Of course it is not an immediate datum of perception.

(Plank 1959,94)

The process of science and the criteria for truth (and knowing) have not changed between classical and modern physics. Truth is restricted to determinable objective relations which make the characterizable structure of an event more true than any sensation of the event. Perception, intuition, or meditative conscious states may be guides to truth, but only the characterizable structure of the event is compatible with the criteria for confirmation.

III.3 Mathematics and Truth

There is, consequently, a marked distinction between the descriptive (structural) and the interpretive ("what does it mean?") aspects of a physical law. This distinction crystallizes the power of the mathematical form.

The progress of science is marked by the transformation of the qualitative into the quantitative. In this way not only do notions become turned into theories and lay themselves open to precise investigation, but the logical development of the notion becomes, in a sense, automated. Once a notion has been assembled mathematically, then its implications can be tested out in a rational, systematic way.

(Atkins 1984,29)

Mathematically, quantum mechanics and relativity do not show

that the classical laws of physics are in error, but rather that they hold to great precision over a particular range of scale.

In engineering physics --including sending a rocket to the moon-- it is still an excellent approximation to visualize the ultimate world as a Newtonian reference box of space and a clock of time. The mathematical descriptive aspects of both quantum mechanics and relativity converge to those of classical mechanics in the classical (human) range of space, time, and motion.

On the other hand, The interpretation or the meaning of the terms in a law cannot be uniquely defined beyond the measurement/observation process. Even at one scale of phenomena interpretation is not unique, and different sufficient interpretations are possible. Two interpretations can be philosophically inconsistent and apparently paradoxical. For example, regarding three different (classical) formulations of gravity, the physicist Richard Feynman writes:

Newton's Law, the local field method, and the minimum principle, gives exactly the same consequences. ..We can not decide scientifically on one or the other.But psychologically they are very different ...because they are completely different when you are trying to guess new laws.

(Feynman 1965, 53)

Mathematics allows a "transparadoxical" description of observable structure, with an uniqueness transcending philosophical categories.

IV. THE CRISES IN PHYSICS

IV.1 Paradox in Modern Physics:

Just as the canons and metaphysics of physics grew out of solving the paradoxes of perceptual versus measured reality, the current "crisis" in the metaphysics of modern science arises out of the complementary paradox. Measurement as a conscious act of knowing interferes with existence.

The first canon still holds: fundamental reality corresponds to a "numerical [theoretically measurable] naturalness" (Nelson 1985, 60). The new paradox becomes that these measures are directly linked to the consciousness of the observer. In relativity one faces the paradox that the measures called space and time and energy and matter are dependent on the observer, for all of the equations which describe any event depend explicitly on the speed of the event in relation to the observer and to the speed of light.

In quantum mechanics, the paradox can be even more strongly stated. The Heisenberg Uncertainty Principle and the wave/particle duality imply that choices within the very act of measurement (experiment) correspond to and perhaps "cause" the existent form of the thing measured.

A photon emitted many years ago from a distant star makes its way to my eye. Does it exist if my eye is not there to see it? The question is reminiscent of the age-old puzzle, "If a tree falls in a forest and no one is there to hear it, does it make any noise?" The answer appears so obvious: of course it exists. The photon must be there, like the sound waves from the falling tree, whether or not anyone experiences it. At least that's the answer you believe in

classical physics.

But, alas, quantum mechanics does not agree. Accordingly, the photon comes into existence as a spot on my retina only when I see it. Physicists have been more or less "forced" to accept this mystical position because of the uncertainty principle,...

(Wolf 1981, 200)

Beyond even these paradoxes, quantum mechanics and relativity hold implications which are paradoxical to each other. These concern cause and effect, logical inference and even the implication that information (knowing) is not bound by the speed of light (d'Espagnat 1979, 158).

Returning to the Hindu analogy, the rope appears to be of the nature of the illusionary snake itself, for somehow the very act of awareness appears in the very center of the existence of the rope. The cycle of this paradox of awareness can be stated thus: awareness is illusionary and individually subjective. But it can be circumvented by measurement and inference to reach a structure underlying, and independent of, our awareness. But this structure in turn seems to depend on consciousness, perhaps at a fully different level or in a fully different meaning of consciousness for it is at the level of the "illusion" of a universal physical reality.

IV.2 Paradox of Awareness/Consciousness:

The paradox of awareness can be stated as two parts:

1. In the waking state, why does there appear to be a singular and continuous physical world which is well-ordered in time and space, independent of any perceiving individual? That is, how is it possible that an objective world can be defined and determined

unless existence is independent of manifestation?

2. But on the other hand, if existence is the same as manifestation, how is the objective physical world (of the waking state) maintained over all animate and inanimate forms? Is there a different level or a fully different meaning to consciousness at the level of that "illusion" which is physical reality? Is it possible that an objective consciousness (either Absolute or not Absolute) be demonstrated independent of self-centered (individual) awareness?

This paradox collapses into the "arithmetical paradox" of Schroedinger quoted in Section I. The two solutions that Schroedinger indicates take us either into the concepts of multiple worlds, or into the concept of a singular Mind. Both of them arise as possible interpretations under quantum mechanics. The edge of Vedanta shows up in that physics may not be able to free itself from issues of consciousness at its ultimate level.

V. ULTIMATE REALITY

V.1 Interpretation of Ultimate Reality in Physics:

No model of Ultimate Reality is established in physics -- perhaps none can be without changing the form of physics. This issue can be discussed independent of reference to the Vedanta, and we shall thus first continue to consider the case of physics.

Any description of an Ultimate Reality can be taken as a nonprovable philosophy which is consistent with known physical reality. That is, only conjectures of "Ultimate Reality" can be offered, and as already mentioned, such models are not

necessarily mutually consistent. The models can only be sufficient but not necessary since their completion rests outside of physics.

Today, the range of philosophies can perhaps be described as three-fold: 1. those which place (C)consciousness as (the) a primary component of existence. 2. those which place existence as strictly independent of manifestation. 3. those in which modeling Ultimate Reality is useless.

In the first philosophy, physical existence or reality is, in an a priori sense, a manifestation of consciousness. In the second, Ultimate Reality is the structure of the Universe which exists independent of even measurability. The structure is ultimately "mechanical" and what we know of it is limited by the physical nature of consciousness itself. In the third, reality must be defined by measurement and so reality is, by definition, identical to the map of what can be known by the accepted process of knowing. We cannot rule out either an underlying consciousness, or a physical structure which does not produce a realizable effect, but such models are meaningless.

The two solutions of Schroedinger to the arithmetic paradox illustrate possible positions. In 1957, a modern rendering of the multiple world concept was proposed by Everett (Everett 1957, 454; and DeWitt and Graham 1973,). In this interpretation, the multiple possible states of energy/matter allowed by quantum mechanics are all realized in separate, co-existing worlds. We, as individuals, are only aware of our 'own' branch of the Universe. Existence is ultimate, fundamental, and multiple. No consciousness is needed. We do not choose a future, we simply

"bifurcate". Existence precedes manifestation in this or other psychologies which are consistent with either classical physics, or with more complex but still mechanical realities. Life, and its derivative consciousness, arise out the complexity of natural structure. The universe is driven by the second law of thermodynamics --entropy.

...when there is a network of interdependent chemical reactions, each of which is a one-way channel through which the universe can sink into chaos (but cannot return to an earlier state, because the spontaneous reaccumulation of order is so improbable), there may emerge consequences as complex as consciousness.

(Atkins 1984, 197)<10>

on the other hand, One-mind solutions, fundamentally couple consciousness to the existence of the physical world. However, it is not clear (to this author) whether in these solutions, awareness (wakeful perception) is sorted out from possible "objective" states of consciousness which hold universally and beyond ("transcendent to") wakeful awareness. Nor is it clear whether (M)mind (objective consciousness) is to be considered a primal aspect of existence, or rather as an evolutionary aspect of existence.

A one-mind solution is approached by the Copenhagen Interpretation of quantum mechanics. In it, the most fundamental description of Nature is one of probability functions. These functions are interpreted as not describing anything which exists in space-time. Perception and awareness bring an object into existence in space-time and the ultimate level of description is thus a "third or intermediate reality" between that of intellectual ideas and that of massive matter (Wolf 1981,

141).

For the smallest bits of matter are, in fact, not physical objects in the ordinary sense of the word; they are forms, structures or --in Plato's sense --ideas, which can be unambiguously spoken of only in the language of mathematics.

(Heisenberg [1955] 1984)

Pointing even more directly to a fundamental role of consciousness, the physicist Eugene Wigner underscores that the nonseparation of conscious knowledge and mathematically described reality requires that consciousness is the creative element of the universe (Wigner, 1967 and Capra 1977)

Science is fraught with difficulties in dealing scientifically with direct sensation and consciousness. Space, time, matter, and energy are the acceptable primitives which can be used in describing reality. The truthfulness of statements on the fundamental self existence of consciousness cannot be expressed in these primitives. Furthermore, the truthfulness cannot be acceptably established on inner experience alone. Authoritative descriptions of such experiences fall outside of the accepted criteria of verifiability. Direct authority is not given the weight of authority in Vedanta (taken as a spiritual record) (Ganeswarananda 1957,3).

V.2 Ultimate Reality in Vedanta:

In distinction to this, and in its "very opening pages", Vedanta offers discussions on Ultimate Reality. Two structural terms are call-on (needed) in describing reality. The first is a fundamental spaceless, timeless "Potential." The second is a "Power-of-Being as manifested existence (including physical,

mental (internal) and gross perceptual states). The Power may be seen either as the 'outfolding' of the Potential, or as distinct from it <11>. Various "relative" realities arise as the knowable (experiential) relations of these terms to each other and to our own consciousness. Out of this, one Absolute and two relative realities arise. The three, stated as classes of metaphysics, are: nondualism, qualified nondualism, and dualism. Since knowledge is identity-with, these three metaphysics can also be thought of as describing three states of identity within reality, and also as three qualifications of truth.

Nondualism identifies the first aspect (Potential) as the Ultimate spaceless/timeless/changeless Reality. This initial "Potential" is Eternal Pure Consciousness. It stands alone. It is without attribute. It is the Absolute. It is the Ultimate "Potential" into which our own consciousness may merge beyond the limitations of the waking, dreaming, and dreamless states.

[It] is not that which is conscious of the internal (subjective) world, nor that which is conscious of the external (objective) world, nor that which is conscious of both, nor that which is a mass of sentiency, nor that which is simple consciousness, nor that which is insentient. It is unperceived (by any sense-organ), not related (to anything), incomprehensible (to the mind), uninferable, unthinkable, indescribable.

(from the Mandukya Upanishad as translated and notated by Nikhilananda 1940, 29)

But the knowable universe is characterized by space, time, and causation which may be seen as arising out of the Power of the Potential. A metaphysics of Ultimate Reality involving both Potential and its unfolding Power is essentially Qualified Nondualism. All manifestations arise only as name and forms, and

to this extent the Potential is both (simultaneously) indicated, and hidden by this out-folding Power, and so appears self-limited. These two aspects of Potential are more correctly identified as the two aspects of Brahman (Nirguna and Saguna Brahman respectively) <12>.

Brahman is apprehended under two forms: in the first place, as qualified by limiting conditions owing to the multiformity of the evolution of name and form; in the second place, as being the opposite of this, that is to say, as being free of all limiting conditions whatever.

(Nikhilananda 1940, 26) <13>

A possible Occidental analogy for the relationship between these two aspects is given by potential and kinetic energy in physics. In classical usage, the potential energy (of say, a brick balanced on a pole) is not directly experiential (or at least, not obvious). The potential which measures the effect the brick might have if it falls can only be inferred in terms of the relative spatial positions of the brick and the floor. On the other hand, a falling brick --carrying kinetic energy-- is easily experienced as perceived motion. The original potential is transformed into (manifest in terms of) experienced motion which seems to be associated to the brick itself in space, whether or not it appears relatively near anything. Motion then arises out of the "Power" of the "Potential." This analogy is further outlined in figure 2.

Since this nondual Potential is hidden by manifestation itself, the manifest forms of existence, including physical reality, are "illusion" --simultaneously existent and

nonexistent (Vivekananda 1937, chps 4 and 7). Illusion and contradiction rest on the nature of our own consciousness, for it is our consciousness which is our own (self-centered) entrance into manifested existence. This Power is Nature in all her manifestations, and is the Dance of Maya. To know beyond Maya is to transcend all states of self-referenced consciousness (Nikhilananda 1949, 52,53).

figure 2. POTENTIAL/POWER

	Physics analogue	Brahman/ Maya	Hindu metaphor
Potential:	Potential energy	Pure Consciousness	ocean (still, deep)
effects of Power	motion	name and form	waves
Question:	how does this motion arise?	from what does time/space/ causation arise?	what is the substratum of these various wave forms?

As in waking and dreaming; dualism and qualified nondualism are referenced to states of self-awareness --to a knower who self-appears separate from what is known. In dualism, the subject/object distinction of existence is fundamental. One is only aware of oneself as being aware of objects and forces. Consciousness (my self) is a separate entity, of many, within existence itself. As a dualist, my whole world may appear made up of polarized concepts. I can make sense of time and space, of good and bad, of man and God. But space-time, true-false, good-bad, and man-God are paradoxical and contradictions in terms.

V.3 Divinity:

Divinity, Value, and the spiritual arise within the very context of Reality within Vedanta, and cannot be separated from issues of "Ultimate Physics." This is a consequence of the ultimate identity of Reality as the Conscious "Potential" of Existence which includes, inseparably, our own existence and consciousness.

As divinity arises within the context of the physics, ultimate True Knowledge is Identity with the Divine. That is why earlier I spoke of reality as three qualifications of truth.

The relation of the three states within divinity can be illustrated by the story of the night Hriday's spiritual sight opened. Hriday, the cousin of the 19th Century Hindu saint Sri Ramakrishna, was following Ramakrishna across temple grounds toward the Panchavati.

He saw the figure of Ramakrishna become luminous as it walked ahead of him. This was no longer a figure of a human being; it was made of light. ... Then Hriday looked down at his own body and saw that it, too, was shining and full of light. And he became aware that this light was not other than the light which formed Ramakrishna. Light had merely detached itself from light, in order that the master might have someone to serve him. ... 'Oh, Ramakrishna,' he cried, 'you and I are the same!...'

(Isherwood 1963, 136)

Hriday's normal awareness was dualistic --as is ours. To see his own light as broken off to serve Ramakrishna was qualified nondualist. If his awareness of light and separated light had held as One, beyond even his knowing "You and I are the same!", all would have collapsed into nondualism.

In nondualism, Identity comes to rest in Brahman; beyond

name and description, beyond all self-awareness the self is absorbed. That is, even Brahman is "Brahmanless", for knowing disappears into the Very Reality. This is ultimately the state of highest samadhi.

V.4 I-Knowing-Reality;

As we have seen, the three terms, "I", "knowing", "reality", and their inseparability, are given basic recognition within Vedanta. Ontology, epistemology, and self cannot be separated, and I-knowing-reality forms an inseparable triad manifesting as (out of) Conscious "Potential." This recognition is condensed into a single epithet for Brahman. Where in the early Upanishads the essence of Brahman is described by such separate phrases as Absolute Being, Absolute Consciousness, and Absolute Bliss, these are later combined into the epithet "Sat-Chid-Ananda" meaning Absolute Being-Knowledge-Bliss <14>.

This epithet also seems a valid description of the "ground" state of subjectivity which is sought through yogic practices: namely (1) the recognition of experiential epistemology as reality and (2) identification of the individual consciousness as in Reality the Self which is one with That which Is. This is illustrated in figure 2.

Figure 2. Sat-Chid-Ananda

for Brahman;

Sat	Chid	Ananda
Absolute Existence	Absolute Knowledge	Absolute Bliss

and for the individual;

that which is	knowing	I-ness identified beyond all self identity
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VI. NONDUALISM AND SCIENCE:

Seen from this perspective of Vedanta, the "paradoxical" pair-terms of modern physics -- those of space-time, energy-mass, wave-particle, and the paradox of awareness-consciousness -- bring the western physicist to the realm of qualified nondualism as an explorative description of the phenomenal world. Perhaps the notion of the Idea as Ultimate begins to approach the formal structure of Nondualism, but the scientific form of knowing cannot itself collapse into nondualism <15>. As of yet, no model of physics is reduced to a starting concept of Pure Consciousness of or Divinity. The position of physics can be described as that of discovering the laws of Maya <16>. And in seeing Maya, physics sees a possible nondualism but cannot resolve its fundamental character --whether or not it is Consciousness.

From within the scientific process, the awareness/ (C)consciousness paradox can only be observed in reflection, that is, as it is reflected in the structure of physical measure. Perhaps it is almost a fear-filled concern to some scientists to consider that this paradox might imply a fundamental limit to the scientific process with respect to its own ultimate goal, a limit akin to that between perception and measurement. Certain paradoxes must irrefutably exist before such a conclusion is completely unavoidable. These paradoxes notably include the fundamental one of not being able to get around a coupling of Mind and quantum mechanics, as well as the implied question of

what constitutes existence before awareness? <17>.

Although the inseparability of the triad I-knowing-reality may become a requirement in physics, it cannot limit the established domain of objective physics. Rather, it places stiffer requirements on demonstrating whether there are fundamental "objective" aspects of consciousness. For example, current work on the development of "artificial intelligence" continues to proceed on a confidence based on the premise that the attributes of consciousness arise out of complex natural systems -- consciousness is reducible to structure. Genetic engineering has as its base a confidence in the existence of a physical substratum to life. Both of these endeavors can proceed within a metaphysical framework (personal attitudes) consistent with the attitudes of reductionism and mechanism of classical physics.

In physics, the potential for considering intrinsic divinity only arises in the first class of models -- those in which an objective Consciousness is a primary component of existence. Although the careful scientist will admit to a paradox of consciousness/reality, (s)he may not yet admit a paradox of spirit/consciousness <18>.

As persons in a western culture, we still hold strongly to dualism in our classical assumptions of awareness versus existence, in our classical reasoning, and most clearly in the majority of our ethetical, moral and spiritual reasoning and beliefs.

VII. CONCLUSIONS AND NOTES ON MEDITATION

Meditation can perhaps be described briefly (at starting levels) as direct witnessing of the experience

~~I-knowing-reality~~, Clearly at present, the inner state itself falls outside the processes of physics, although the structure (physiological changes) can and is being measured and characterized.

To approach meditation, we face the possibility of expanding the scientific instruction to include inner states. Clearly the first way this can occur is with respect to inner states with verifiable or measurable manifestations.

Perhaps the Vedantist can help greatly in this dialogue by guiding a formally secular re-investigation of the processes of Raja Yoga. Today, perhaps in the Oriental as well as in the Occidental cultures, the power of science and technology have acted (are acting) to reduce the understandability of the meaning of spiritual truths. At one point in western history, the limits of religion helped force the rise of science. Today, spiritual insight which is based on demonstratable process can be the profound guide to science.

Does the paradox of consciousness begin to bring us to a new vision of existence? Here in the West some writers see a new Renaissance. In Indian culture, it has been said that the phenomenon of Sri Ramakrishna in the mid-late 1800's marks the first seeds of the start of the Satya Yuga within the end of the Kali Yuga <19>. And the western historian Arnold Toynbee has stated that historians will in the future see the mid/late 20th century as the time when the greatest influence on Western culture appeared as a seed, from India and her philosophies (Swahananda 1985).

So is dialogue born in subtle vision.

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ENDNOTES

1. The Upanishads are the sacred scriptures which constitute the concluding philosophical or 'knowledge' portions of the ancient Hindu scriptures or Vedas. The suffix anta means end or culmination, and hence Vedanta, as the culmination of the Vedas is referent to the Upanishads.
2. here he makes explicit reference to such work as Capra's book Tao of Physics, see reference list here
3. for a detailed effort to do this see Dobson 1979.
4. or more strictly Jnana and Raja Yoga paths within Vedanta. As a true spiritual practice, Vedanta offers instructions to the realization of the Divine Self, and it offers "different" teachings for each path. As the same Truth arises in following each path to its end, the student or devotee may start with emotion/love (Bhakti Yoga), action and service (Karma Yoga), with psychological introspection (Raja Yoga), or with discrimination (Jnana yoga). Neither Jnana nor Raja yogas claim the need to start with spiritual belief to pursue them.
5. Patanjali was the author of the Yoga System, one of the six systems of orthodox Hindu philosophy. His aphorisms form the "text-book" of Raja-yoga. His work dates to ca. 4th or 5th century AD.
6. as a current limit to this hypothesis and its implication of timeless Platonic laws, the question of the meaning or existence of physical laws before the onset of physical existence has been raised by the questions of the big-bang origin of the universe and of time-evolution of physical and biological phenomena. see for example (Sheldrake 1981)
7. In Advaita Vedanta the critical test of valid knowledge is non-contradictedness. Hence, once the rope is recognized, this is valid knowledge and the snake is the illusion (Satprakashananda 1965, 117).
8. In some schema, up to seven processes are distinguished. Also, I've chosen processes rather than sources in order to emphasize practices or disciplines. Authority, considered as a prime source of knowledge, is discussed briefly later.

9. For example, Newton's need for an absolute Reference to which motion, time, and position could be referred was met by his theological axiom of Absolute Space and Absolute Time. Later, in the physics of relativity, light became knowable as the measure of Newton's Absolutes. Light is the structure of the Newton's "box", and in our measurement of light, the Absolute Box disappears. See the first chapters in Einstein ([1934] 1961) for a clear discussion of measure as space and time.

10. The classical interpretation of entropy is essentially nihilistic. However, recently, biologists have begun to look increasingly at non-equilibrium thermodynamics as a positive force of life formation, indeed being compatible with the Hindu concepts of Maya and Nondualism (Wicken 1984)

11. These western "neutral" terms are used at present so that general statements can be made initially free of metaphysical implication.

12. In this paper I am not making explicit distinction between the Personal and Impersonal forms of Brahman, or of the differences between various Vedantic schools. However, I am implicitly emphasizing the Impersonal.

13. this quote is adapted from Sankaracharya's commentary on the Brahman Sutra. Nikhilananda further points out that in the Sutras, the unlimited and limited aspects of Brahman may be indicated within the same text by use of neuter and masculine gender respectively (Nikhilananda [1949] 1977, 28).

14. For emphasis I have followed the translation of Swami Gnaneshwarananda (1975) and used Chid = Knowledge rather than the more usual Chit = Consciousness. Since knowledge and awareness are equated, these forms of expressions converge. This is also the English form used by Swami Vivekananda ([1937] 1980).

15. There are, of course, current efforts by some scientists to model wholeness and consciousness as physical structure. See Bohm (1980) and Shelldrake (1981).

16. ~~I believe that here I am paraphrasing a statement by Swami Ramacharka (Ramacharka [1904] 1931).~~

17. remindful of the Zen Koan of 'what is your face before your mother and father were born?'

18. It becomes reasonable that as light is the measure of time and space, that Newton's "box" of absolute space and time vanishes for light defines the structure of the box itself. Perhaps Mind is the measure of the light's ultimate reality and so as noted (page 17,18) the photon vanishes for perception gives rise to the photon itself. But how can we yet in science jump to the conclusion that "knowing" at the level of the Ultimate Reality must be absorption of awareness into Divinity, into an

Eternal Consciousness?

19. Yugas are the four ages into which the duration of the world is subdivided according to Hindu mythology. The Satya Yuga is predominated by righteousness. The Kali Yuga (the present period) is the most violent and evil and ends one cycle of the world.

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