**Journey towards *Sunyata* from Quantum Mechanics**

 Debajyoti Gangopadhyay\*

**[**A slightly modified version of the Article published in Ramaranjan Mukherjee and Buddhadev Bhattacharya ( eds ) **Dimensions of Buddhism and Jainism** .. Professor Suniti Kumar Pathak felicitation volume II , Sept 2009 , Sanskrit Book Depot’ Kolkata , pp 281-289 . This was written keeping mainly in view a audience of Buddhist Philosophers interested in Quantum foundations, but not expected to be technically equipped with Quantum formalism. Here I ignored the *diacriticals* in writing the Sanskrit words.**]**

**ABSTRACT:** In this article we have tried basically to lay out an outline of possible overlap between the metaphysical standpoints of the Madhyamik Buddhism with the so called Copenhagen interpretation of quantum mechanics. We argued here that , both Madhyamik Buddhism as well as Copenhagen develop some common grounds of skepticism or *cautionary notes* against the classical intuitive Realist ideology committed to *ontological priority of individual* . So , though the presiding contexts of Madhyamik Buddhism and quantum mechanics are admittedly very different , we can still judge the ontological merit/ implications of ‘the cautions’ on comparative grounds .. And we have argued on this basis here about the possibility to sculpt out some *norms of justification* for starting a meaningful Dialog between Buddhism and modern Physical science.

[Key words: Madhyamik Buddhism, quantum mechanics, Copenhagen interpretation, science-philosophy Dialog ]

**I: Introduction**

 Professor Suniti Kumar Pathak has always followed with great attention the investigation in the borderline area of Buddhism and Science. His interest in the subject and his deep remarks, besides having represented a valuable encouragement for us involved in such a borderline investigation, has stimulated the clarification of many points. In fact exact interdisciplinary investigation in our country is still in its infancy and most often fraught with the dangers of being misled and even misunderstood. Investigation in a remote subclass of it like the borderline area of Buddhism and Science is naturally fraught much acutely with the same dangers. Real advance in proper direction can only be made with *communications as much as possible* between Buddhist Scholars and Scientists. But at the same time the practical difficulties should also be kept in mind - a successful dialogue between the Tradition and Modernity is not easy to build up primarily because of the very *different Psycholinguistic set up of* the Traditional and Modern scholars, which is due to commitments to two entirely different Worldviews. And in view of this apparent Two World view, the entire program of *'investigating overlaps ...’* may seem to be hopeless, at least at the surface level. This 'intellectual gap' continues to exist for a long time, though the need to look for 'overlaps' gradually became a *social priority* for us in India ever since the early 19th century. We are not going here into the intriguing colonial history of partially reconstructing a fractured knowledge dynamics ..,, particularly in 19th century Bengal .

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* Dpt of Physics , Annada College , VBU , India ,

email – debajyoti@nalanda-dialogforum.org

But in spite of this socially prioritized background of nearly 200 years, the investigation to drawing parallels between Science and Eastern thought is mainly confined within a few popular reconstructions based on some superficial (and often misleading also ) analogies. The works of writers like Fritjof kapra , Michael Talbot and like though aroused great popular interest, but, diverted at the same time the focus elsewhere far from the area of *nontrivial synthesis.* Only very recently during the last decade some investigation of drawing the parallel started, which seems to be directed to some meaningful areas [1]. This introductory essay, which I am going to present here in honor of Prof. Suniti Kumar Pathak , is basically a preparatory part of a long term program initiated recently(December, 2005) very much under his intellectual patronage, in collaboration of *Sambhasha\** and Nava Nalanda Mahavihar, Nalanda - a program to explore the non-trivial overlaps between *Mudhyamik Buddhism and Modern Science.*

 **II**

1. **A problem that continues to remain undefeatable during the last 80 years!**

 Quantum mechanics , developed during the first three decades of 20th century, is believed to have provided an appropriate framework for describing events ranging from the cosmological down to the microscopic scale. But in spite of its spectacular success in prediction, interpretation of the theory, that is to say, what the theory tells us about the underlying structure of quantum phenomena (furniture of the world - Ontology), remains dissatisfactory. These all dissatisfactory features can be described to be as parts of the so called *Measurement problem* in quantum mechanics.[2] Though there is no dearth of suggestions, ranging from moderate to awe-inspiring , during the last 85 years, a conclusive end (if at all any!) *of Measurement problem* seems to be far way off.

It is not possible here to give even a brief non-technical survey of the different alternative interpretations of Measurement Problem during the last 80 years or so. Instead, we will concentrate on Copenhagen Interpretation only, based much on the writings of Niels Bohr **[3].** Here 1 will argue that the Measurement problem area, as interpreted by Bohr and his followers like Heisenberg, Pauli, can be understood to have provided points of contact with the Buddhist concerns of *Sunyata,* comparatively better than other interpretations. Put otherwise, *Sunyata,* if approached from within the windows of Copenhagen interpretation as starting point, there is a fair chance to figure out a meaningful overlap to discuss further some issues of profound significance from foundational point of view .

1. **Copenhagen caution against our 'classical intuition’**

 Rather than starting with the description of Quantum Mechanical formalism itself and showing how Measurement problem arises out of it as a consequence, let us start with Bohr's Standpoint *about* it. It may seem a bit awkward way of presenting things, but let us try that way!

According to Bohr, Measurement problem is a major one so far one is faithful to his / her 'classical intuition1. And as the prime ingredients of this classical (Realist) intuition, Bohr pointed out over and over again to our conception of 'object', 'the knowing subject' and like. He kept insisting, in one way or another, that, all major obstacles in *understanding* quantum mechanics are rooted, as Catherine Chevalley pointed out, in her survey of Bohr’s Philosophical standpoint, *"in our former way of thinking :* that is, in the way we form images of the objects, in the way we formalize the physical systems, in the way we conceive of the knowing subjects, in the way we think of space and time, of objectivity, of nature, etc." **[4]**

To make more sense of these lines let us look at Bohr’s matured position during the 50s expressed in 200th anniversary of Columbia University - "Complementarity means in no way an abandonment of our position as *detached observers* ( italics mine ). It should , on the contrary, be seen as a *logical expression of our situation concerning objective description in the area of experience ( italics mine ).* The realization that the interaction between measuring devices and the physical systems forms an integrating part of quantum phenomena, has not only revealed an unexpected limitation of the mechanistic view of nature which attributes well defined properties to the objects themselves, but it has forced us to give special attention to the problem of observation when ordering the experiences**".[5]**

This sounds tricky as Bohr is talking about a 'detached observation' and at the same time, insists upon ***"our*** situation concerning objective description in the area of experience'. Frankly, it is difficult to understand the proper implication of this position. However, referring to 'our situation concerning objective description ....', he can possibly be read to have pointed out to the *general structure of our language.* What further sense can be made? Particularly, what can be thought to have been possibly meant by 'our situation'? There is no logical injunction to think it as *our psycho cognitive situation - the conceptual scheme under which our normal mind works . Our* ordinary language as well as any mode of logical expression, historically developed through the process of evolution in a slowly varying environment, must have been endorsed bythis *scheme.*

What can be pointed out as *particular manifestations* of the endorsement? Of course, these are the *presuppositions* about the way we ‘use’ language; that is to say, the presuppositions *about the ontologically prior status of ‘objects’ described in that language.*

Close to what Bohr could have possibly meant by '... Our situation concerning *objective description in the area* of experience’? This is likely to be something pertaining to the *presuppositions* compatible to the conceptual scheme under which a normal human mind (not only a quantum theorist's mind!) works in order to make realist ontological sense of our sense experience . In fact , Quantum mechanics , right from its beginning during 20s of the last century evoked counterintuitive questions about ‘what constitutes Measurement or observation?’ . As a consequence the ongoing debate among the founding fathers happened to be centered around, in one way or another.. , the role of observer as well as the ‘formal recipe of this role ...’ Bohr’s response mentioned above should be seen as a part of debate with Pauli during 50s concerning the question of ‘detached observer **‘.. [6] .** In fact , any observation or faithful measurement , as we normally understand , is an enquiry about *some preexisting properties* ( in terms of numerical values , so far the purpose of Physics is concerned ) which we describe within the framework of *our Language* . But quantum mechanics imposes a caution against this most obviously held intuitive expectation!!

 If someone is still in doubt that what exactly in our 'former way of thinking' is at stake, I would like to refer him / her to Heisenberg. It is according to him, "The Reality concept of classical Physics, or more generally expressed, the ontology of materialism : that is an objectively real world whose smallest parts exists objectively in the same way as stones and trees, independently of whether or not we observe them ......'**"[7]**

We can also cite Whitehead in this context. Though not a member of Copenhagen group, neither was very much aware of Quantum Mechanics, he seems to have pointed out a similar caution while exclaiming that the belief in an *independently existing entity* is the central delusion of 2000 years of Western Thoughts**.[8]**

In fact, it is really interesting to note that in West it took surprisingly long time for the Philosophers to doubt that the 'notion of thing' may not be forced on us by Nature, but on the contrary may represent a *construction imposed on Nature by ‘our’ mind.*

***2.1:* Copenhagen caution reformulated in terms of a problem in Part and Whole relation or Problem in attributing properties —**

 Accepting this as the core of Copenhagen caution while understanding [Quantum] measurement problem, we can now ask the next question -

*What constitute the presuppositions about the ontologically prior status of ‘object ‘[described in language] ?* Or in other words, *what is the most obvious formal ontological expression of this presupposition?*

It does not, however, need a great theoretical effort to note that the 'presuppositions' primarily reflect themselves in *our faith* in Part and Whole relation in standard intuitive form that can be expressed in terms of Cantorian set; that is to say, in terms of a faith that *parts 'taken together'* can constitute the *Whole / Whole* can be analyzed exhaustively in terms of *Parts* . In fact Cantor's 1883 definition of set is one of the best expressions possible about the scheme under which a normal mind seems to works - *"A set is a many which allows itself to be thought as* one**"[9]**

This 'faith' entails at the same time *that whole can be exhausted / completely understood in terms of the properties actually exhibited by its parts*

 *AND*

It is within the intuitive jurisdiction of part and whole relation in this form , any linguistic description *presupposes some kind of recurrence* or *persistence of the objects (parts) described.* This is the inevitable metaphysical options we are usually led to with these presuppositions. In fact we can understand the situation from any way around - Part / Whole relation in Cantorian from entails or demands persistence / recurrence / count ability / separability of the 'parts', i.e. *what is taken together* ...... and vice versa.

**3. An unbridgeable dualism in sight ?**

 So the profound significance of Quantum Mechanics lies in the fact that, its formal structure does not in any way accommodate part and whole relation in standard intuitive ‘ Cantorean’ form, and (obviously) the metaphysics associated with it !

So far we have not described what Measurement problem actually is. Now. with this description we are brought in a position to appreciate what it could be .

 If our intuition, based to a great extent upon our normal everyday experience, is very much about a world where Part / Whole relation is true **(**at least it seems to be! Indeed needless to say, that all of us are classical observer carrying *an* intrinsic intuitive obligation to Part / Whole relation in standard form....; before being a Quantum Theorist we are *classical language user* committed to Part/ Whole relation in standard form**)** ..... and Quantum Mechanical formalism demands that it is not so , we are forced to admit a *CUT or a*  strong dualism unless we are able to show the **two worlds/ realities** as aspects of some *single primordial one . Which world is likely to be more true ?* Our everyday world, where our normal mind (itself being part of the classical world ....) functions admitting Part and Whole relation in standard intuitive form ? *Then Quantum Reality is mere a formal fiction!* On the other hand , if Quantum Mechanics is really True and applicable from cosmological down the atomic level (as is indeed the case!), then what about the truth of our world? Is it illusory? Any measurement must possibly *ends up* with a well defined number which can be added together with another to form always a bigger confirming Cantor's definition of Many/ Countable plurality ...., But Quantum Mechanical formalism indicates a situation where such numerical qualification can't be attributed as a result of failure of the standard Part / Whole relation! Then wherefrom the *definiteness of numbers* comes into being! Simply measurement creates it (as opposed to discover)? Standard quantum mechanics invokes an ad hoc *projection ( from quantum world to ours !) postulate* to save theory as well as our perception !

 Attempts to account for this puzzling situation constitute the central core of the solutions proposed to resolve Measurement Problem. Indeed there are tricky ingenious ways to evade these uncomfortable puzzling features .....; but neither of them are universally accepted, nor are they beyond all sorts of theoretical troubles. Rather, in view of the results of the experiments started being designed ever since 80s of the last century .... it seems that Quantum Theory in whatever form - keeping the *formalism as it is,* or *modifying it accordingly,* must preserve the *peculiar feature of failure of Part / Whole relation and consequent problem in attributing properties to an individual (problem in predication) in its own right .*

Thus the *cut or a strong* ***dualism*** continues to exist between *'observer's situation'* (faithful to Part / Whole relation in standard form) and *'what is observed'* (a quantum system governed by the non standard formalism, described first by Schrödinger’s Equation in 1926)

 So, in view of these all, we can justify Bohr's frequent insistence to look at the general situation of language in question of this *cut* between ‘observer’ and the ‘observed’ (object). In fact, it is our classical presuppositions, underlying the *concept of ‘* ***disturbance‘ ,*** *that* is inevitably reflected in the languages like *projection, creations. . ..* we use to describe quantum mechanical situation in ‘*our everyday linguistic’* terms . Indeed ‘disturbance’presupposes something like an objective substratum providing in-eliminable hostage to some properties ready to be *revealed or discovered,* if disturbed by the observing agent. Bohr became increasingly aware of the situation as he noticed in 1954 "...One sometimes speaks of 'disturbance of phenomena by observation' or 'creation of physical attributes to atomic objects by measurement'. Such phrases, however, are apt to cause confusion". **[10]**

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 **III**

**4. Where does all this leave us? The basic ontological crises......**

 So the basic ontological crisis in Quantum Mechanics, as pointed out by Bohr, Heisenberg *et.al.* can be stated in various ways -

 It is almost all about the problem in materialistic-mechanistic *status of individual .*Stated in other words , it is against the ontology of 'parts' within the framework of a reductive ideology and against different aspects of the 'delusion' (in Whitehead’s coinage) rooted in this ideology. Bohr's anticipation for almost a *metaphysical importance of language* can be made sense in this perspective (of the 2000 years of Western thought indulging this delusion!)

In yet another words**,** these all are about a problem in predication. In view of the problem in straightforward attribution of properties to a Quantum system it can also be described as against simple minded *possessed value realism.... or* so on in different ways....

**5. Close to appreciate Sunya?**

 With this brief exposition as starting point.... the question is now open that... , whether this account of quantum mechanics (Measurement problem) has brought us any close to the *traditional concerns of Sunyta* ? So far I have understood the traditional concerns of Sunya, through numerous discussions with Prof. Pathak and other Buddhist scholars.... and also from the expositions of T.R.V.Murti and others, ***it*** *does .* Though, there are friends among my Buddhist colleagues who insist that *sunya* can even be perceived (!) and moreover, perception *of sunya*  at the level of experience has a tremendous therapeutic value , 1 should admit frankly here that it is not possible for me to apprehend what appears to the mind after gaining non-conceptual insight into Emptiness. The phenomenal world might cease to exist! In fact, Prof. Pathak himself is also much akin to stress on *Meditation (Zen, C’han..,.)* prior to mere rational analysis in question of understanding of *sunya.*

This insistence raises a very important epistemological question about the nature of knowledge / philosophy of mind , which I would like to put it this way — does the whole mindscape has unique correspondence with Physical reality? That is to say, does the entire totality (however fuzzy) of our mental reality has counterparts , in some yet unknown sense, in Physical reality? Enumerable verses can be cited from the *Tantra literature connoting the psycho-spiritual epistemology that the whole universe is encapsulated* in human body ( the so-called *Pinda-Brahmandavada* ). But this is not the place to go into the psycho-spiritual epistemology entailed by it. I can only say that , what emerged as a part of my discussions and reading expositions of Buddhist Texts is that — **it is misleading to construe *Sunya* as a physical vacuum *or Abhava***....and instead of assigning any ontological status to it as transcendental grounds of being , it is safer to understand *Sunya rather* as a *limitation of predication. In other words,* the problem hard core of *Sunya* is very much about a caution **against the *status of individual as well as any mental construction ( vikalpa )* in connection with *our common sense understanding***

Indeed, the point can hardly be overlooked that Buddhist ontology in Nagarjuna's version was free from the 2000 years of delusion of West. Nagarjuna's equating *mutual dependence* with *Emptiness or* *lack of inherent existence* is difficult to interpret otherwise. So phenomenon merely reflects a *predicate possessed by* the object is quite dubious to maintain from Nagarjuna's point of view... And we have seen that similar caution can also be figured out from Copenhagen account of measurements problem based on Bohr's writings**...![11]**

**IV : Instead of a conclusion— Prospects for future works**

 These all attempts to draw *parallel* can provoke someone to say - *so what?* If something of nearly 2000 years back .seems to have some accidental parallel with modern understanding, how can it meaningfully matters to any modern enquiry! Why should we take the trouble to look back at the development happened so earlier? Physics seems to have rediscovered these all almost independently? Complete answer, 1 would apologize again, cannot be given here within the scope of this essay. I would indulge the readers to construct their own norms of justification of refutation. I would give a brief outline of justification of my own.

Now we can ask with reference to the works of Bohr, Heisenberg, *et. at.* in the one hand and Nagarjuna on the other, that, if the problem hardcore lies very much *in the ontologically prior status of individual,* what alternative can we expect? Heisenberg must not have meant as an alternative that, the world exists only when we look at it! He probably indicated a problem in maintaining an universal ontology valid for all scales. This can form the central hard core of a quantum theorist's query to the Buddhist philosophers as this is turned out to be an area of common interest and mutual benefit - Buddhist view in the light of recent developments and vice versa. So a joint program with an aim to setup a dialogue may be most likely to be a *program of constructing an alternative ontology of individual on the basis of parallels between Bohr et. al and Nagarjuna and* exploring the collateral issues those will come directly as a part of it.

\* An interdisciplinary forum devoted to open dialogue between Tradition and Modernity. Prof. Pathak was one of the founder members of *Sambhasha.* Being founded in 2001, *Sambhasha* eventually matured as **Nalanda Dialog Forum… (Please visit** [**http://www.nalandadialogforum.org**](http://www.nalandadialogforum.org) **)**

**References**

1. Buddhism and Science (Motilal Banarsidass, 2003). Edited by B. Alan Wallace.

2. There are many excellent non technical account of Measurement problem accessible to people of other study areas..for example:-

i) Quantum Physics: Illusion or Reality (Cambridge University Press. 1986) by A. Rae.

ii) The Emperor's New Mind (Oxford University Press, 1989) by Roger Penrose.

iii) The Ghost in the Atom (Cambridge, 1986) Edited by P.C.W. Davies and J.R.Brown.

3. Here we need not go into the debate that whether Copenhagen interpretation really is a name got struck to a logically coherent body of thought subscribed by many like Bohr, Heisenberg, Pauli *et al* It is indeed true that, use of the term 'Copenhagen interpretation' emerged in mid 1950s long after the orthodox Quantum mechanics had been ‘formally’ settled ...... and also the 'wider issues', addressed by these prominent trio of this so called Copenhagen group diverged over different themes; but still the common name perhaps owes its origin to the fact that the chief architects of this group shared a common post-Kantian attitude developed in the late 19th century German.

4. Catherine Chevalley, *Why do we find Bohr Obscure?*  in **Institute Vienna Circle Year Book**, 1999.

5. N. Bohr: Die Einheit der Wissenschaft (The Unity of Science); Lecture held on the occasion of 200th anniversary of Columbia University.

6. “ Since we can regard the measuring instruments as a kind of extension of the observer’s sensory organs , I see the unpredictables change of the state through the individual observation- in spite of the objective character of every observation under the same circumstances – as a rejection of the idea of the detachment of the observer from the course of physical events outside of himself “ … , Pauli’s letter to Bohr ; 15th Feb , 1955

7. W. Heisenberg: The Development of Interpretation in quantum mechanics in W. Pauli, I. Rosenfield, V. Weisskoph (ed.) *Niles Bohr and The Development of Physics,* London, 1955.

8. Alfred North Whitehead is perhaps best known for his leadership in the development of formal languages that were first introduced by Frege and Peano in THE late 19th century with the intention of making mathematical proof more rigorous. The *Principia Mathematica* (1908) of Russell and Whitehead was a great attempt to carry out the formalization of mathematics. But what is of much greater relevance in context of our discussion here is that, the metaphysical motivation behind the formal strategy there can be interpreted as something close to the Buddhist Metaphysics of *Ksanabhanga .* Their formal strategy, as Russell discussed in *The Problems of Philosophy* (Appendix: Forward to the German Translation; 1924) ".....*Whitehead convinced me that the concept of matter is a logical fiction of this superfluous type, i.e. a piece of matter can be treated as a system of connected events in various parts of the space-time continuum. There are various methods of carrying this out between which it is so far very hard to choose. Whitehead followed one in his Principles of Natural Knowledge and in his Concept of Nature; I followed another in my book, ‘Our Knowledge of the External World..’......."*

 People interested in formalizing Buddhist thought should go through these books. But I must caution, that readers much interested in epistemological aspects should try to understand these books in continuation of late 19"1 century German epistemology.

9. Georg Cantor, *Gesammelte Abhandhmgen,* p. 204: *"Unter einer 'Mannigfaltigkeit' order 'Menge' verstehe ich namlich allgemein jedes Viele, welches sich ah Eines denken lasst. "* In 1895, Cantor restated this definition as follows: "By a 'set’ we mean any gathering into a whole M of distinct perceptual objects m (which are called the 'elements' of M)". A very good discussion of these and other definitions of "set" appears in Chapter VI of Wang's *From Mathematics to Philosophy.* The word "set" also has, of course, very many non-mathematical meanings. As a matter of fact, "set" has the longest definition of any word appearing in the *Oxford English Dictionary.*

10.Catherine Chevalley in the same article (we mentioned here) rightly claimed that Bohr's view can be made perfectly intelligible in perspective of the lexicon of post-Kantian epistemology. Indeed, recognizing the idea of an *independently existing entity* as delusion was one of the central achievements of this post-Kantian epistemology - the way gradually a new mathematical epistemology was developed following the development of new concepts of logic primarily based on denial of object-concept identification. In fact, the whole historio-epistemic perspective of 19lhcentury development started with Frege helps to relate the problem in *status of individual* with the *problem of object-concept (Thing-attribute) identification.* Bohr's increasing awareness, developed later, against the normal semantics of the concepts like *Disturbance, Measurement* and like was possibly rooted in several aspects of the *epistemic cautions* developed against object –concept identification in late 19th century Neo-Kantian epistemology.

 11. I should not pretend to have gone through the first hand sources of Nagarjuna's exposition! But the second hand sources abound and I relied on those. I have developed my understanding *of Sunyata* primarily from the books like

 i) T.R.V. Murti, The Central Philosophy of Buddhism (London, Alien and Unwin, 1955)

 And,

 Definitely in course of numerous discussions with my Buddhist colleagues..

**Post script 2015 , or a brief updating note:**

I concluded this article nearly 5 years back with a hope to figure out ingredients from the suggested overlap to develop an alternative **ontology of Individual**.. But I was perhaps mistaken in some sense! A true *Madhyamik Buddhist* can’t possibly indulge so.. In fact within the true spirit of Nagarjuna, one should possibly invite him/herself to an *endless (!)Debate* **to deconstructing any ontological picture he/she is enticed to get stuck** ! Any ontological picture, according to Nagarjuna , I realized later, is likely to be shown as vulnerable from the point of view of any of the four possible kinds of logical justifications ( *catuskoti* )..

 This is quite challenging, as human being can’t normally wish away these constructions. But Nagarjuna advocated *contradiction to lurk behind all the four logically possible means of acquiring knowledge* ... and hence True Reality ( as this must not involve contradiction in any way ) is beyond this - *catuskotibinirmukto..* The advocated framework of showing **contradiction** is obviously *Pratityasamutpada* – the theory of dependent co origination preached by the Buddha himself .

 Of course Bohr and his followers are sometimes thought to have spoken about something like ‘No-ontology’ …, ‘there is no quantum Reality’ like stuff. But that is not quite about imposing a permanent ban to any alternative ontological picture like Nagarjuna . In fact Physics would collapse without relying on mental construction (of course empirically testable directly or indirectly)... But Buddhism, unlike Physics, was spiritually motivated and aspired to go beyond *vikalpas...*