ZEN AND MODERN PHYSICS

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Old science looks at the world like an external object

Until the beginning of our century, the scientific approach widespread in the Western World has always been based on the observation of the external phenomena which surround us, followed by a logical approach under the form of theories or models. Mankind was observing the world like an object of study separated from his own self. The reality of our world was perceived like an entity ruled by eternal laws unknown so far, by laws escaping our knowledge at the moment but whose discovery was considered as unavoidable and depending only on the progresses to get in our future observation means. Many people share anyway this opinion, thinking that any reality can be discovered provided that the telescopes or the microscopes become powerful enough.

This approach has the enormous disadvantage to entertain a separation between mankind itself and the surrounding universe. This separation is the main cause of the troubles of our world in the domains of ecology and human relationships.

Meditative and intuitive approach

The meditative approach, like in particular the zen, is considered by many people as non scientific. It is an integrated approach, that is to say, at the same time, of the self and of the world to which we belong, immediate, spontaneous and direct. It is easy to understand its basis given the fact that our cells are similar to all cells in the universe; we are of course constituted by the same atoms as everything in our observable universe. In that sense, the observation of the self, of the life which inhabits us, is the observation of one part of the whole thing, leading to the opening of a larger knowledge, spreading to our entire world.

This talk is simply to suggest that the two approaches should not be looked at as contradictory but on the contrary quite complementary, immediate and integrated knowledge and knowledge based on the external observation and logic. Often, the results of both approaches drive us to a unique and global perception of our universe. In that sense bringing them together, still in recognizing their own limits, intuition needing verification, observation limited to a fragmentary approach, is interesting, every man having, I believe, the desire to integrate the scientific and the religious dimensions. I will then give you few hints for your own reflection.

Revolution of quantum physics: external world and observation are not independent

The appearance of quantum physics has been an essential revolution in the way mankind sees the world. The point here is to try to suggest, and not to completely explain, the parallelism between the teaching of the ancient Masters and what appears to be agreed in quantum physics.

The macroscopic world which surrounds us is ruled by laws of causes and consequences, effects. In this world, matter is matter and waves, for example radio waves or light, are waves and waves are not material. In the microscopic world of quantum physics, this distinction is not so clear. The duality to which we are accustomed between waves and matter is broken up. Quantum physics has demonstrated that the duality between the waves, not material, and the particles, material, should be overruled. The observation of some immediate phenomena has also shaken up our certainties.

What happened? Light does not exist at rest but is the propagation of a wave, of course at the speed of light. It is then not material; it would not be possible to have a table made of light because light does not exist at rest. On the other hand, the electron which is a small particle is not a wave; it is a grain of matter. It so happens in the microscopic world that light acts at the same time like a wave and like a particle. The electrons, particles of matter, behave also like waves and not like particles. Then what is reality? Is light a wave or a particle of matter and is electron a particle or a wave? It all depends on the way we observe it.

In quantum physics, the way we observe a phenomenon defines the state in which it is projected in our macroscopic world. This corresponded to a fundamental revolution in the way we see the external world: before quantum physics it was separated from us, after it is fully linked, world and observer are no longer separated. What is then the fundamental reality of things, if our observation itself defines it either under the form of matter or the form of a wave, without any material consistence? The simple reality to which we are used must be overcome and a new level of reality must emerge, in which this duality can be resolved. It is difficult for the mind to grab that; the human mind would like to conclude to the existence of a single reality. That is not the case: the nature of things is embedded in this apparent contradiction. The revolution was then to have to admit that contradictions have to be overcome by a larger concept.

Apparition of the first main contradiction in physics, other similar contradictions

In quantum physics, the energy has a discrete structure, discontinuous. Its building block is the quantum of energy. The spectrum of energy, or of matter in our world, is not continuous but is quantized. Every matter is made by an integer number of quanta. That corresponds to a real revolution. We are used to a continuous world, made of relationship of causes to effects, of interactions from one place to another and of a linear time. How then can we understand a world made of discontinuous entities: the quanta. How can we understand that in between two levels of energy there is nothing, no particles, just nothing? In physics a bizarre situation is established, our macroscopic world is continuous and the one of quantum physics, quantized, are still not brought together. This contradictory situation brings many problems in the understanding of our world.

We have also seen that the duality between material particles and waves leads, if not resolved, to a direct contradiction. To overcome it, one is lead to conclude that they are at the same time waves and particles, or are neither waves nor particles. The quantum objects are controlled by the laws of quantum physics, in rupture with the laws of the macroscopic world. There are two levels of reality. The simple logic where something and its contrary exist only separately should be overcome. The introduction of a new level, more general, of reality allows us to overcome this contradiction. It is a bit like the apparent contradiction between brain and thought, or body and mind.

In the same way, how can we understand the relationship between the time which flows away and the instant? How much time is there in between two instants? Is time a succession of instants? How to embrace at the same time the time which flows and the discontinuity of the instants?

The appearance of a level of reality where contradictions are overcome is essential. From all times this level of reality pertains to the essence of knowledge in Buddhism. During zazen, the apparent duality between body and mind is overcome by an integrated consciousness of the body-mind. This intuitive and integrated approach becomes an essential component of our way to look at things in our everyday life. We live, and consequently we can say that our time is flowing, but also we live only at each instant. If we remain in a single level of reality, we cannot bring the two together. During zazen, this contradiction disappears, the consciousness of time and instant are unified. It is an integrated approach, at the same time of the self and of the world to which we belong, immediate, spontaneous and direct; it is an approach in which the self and the world which surrounds us are reunified. That represents

probably a great hope for humankind, the essence of ecology, the respect and the compassion for all the beings.

Vacuity: view of physics and view of zen, ku

In all times, zen Masters have expressed that matter is the form, the phenomena (the wave, the electron) and that the form, the phenomena are matter (the electron, the wave). The fundamental nature of everything, matter, phenomena, is the vacuity, named ku. Everything, all phenomena, including the phenomena of the mind, is in essence ku, comes from ku and go back to ku. “Shiki soku ze ku, ku soku ze shiki”, as mentioned in the Hannya Shingyo sutra. The matter itself is a phenomenon and does not have any intrinsic existence, its essence is ku. Ku, although impossible to translate, suggests in a single word the vacuity, potentially inhabited by energy. In physics, the vacuity is inhabited by interactive fields which materialize themselves when traversed by a perturbation. A field is the scientific concept of ku, mentioned in Buddhism from the oldest times. The concept of particles or waves is replaced by fields. On the same way that ku cannot be observed by itself, fields cannot be observed but they manifest themselves under different ways depending of the method of observation, of the way they are projected in our macroscopic world.

So the essence of this new physics was already contained in the intuition of the zen Masters. Today the intuitive and scientific approaches join each other: the immediate perception of zen, complete and expressed in terms full of imagery, the other one providing a verification of the first one by observations realized in our real world. The zen approach is the direct and intuitive approach of ku, the scientific approach, after multiple observations, deductions and contradictions to overcome, has found back this concept by another way.

During billions of years our world by cooling itself off became a world of matter. Like a form of energy at rest, it defines the contours, the form, of a visible and tangible world. Our common perception allows us then to identify what we call the full and the vacuum. The full is constituted in our mind by the matter, the vacuum by what is around it, the first one taking its definition from the other one on a relative way. There is no full without vacuum, and no vacuum without full. This form of dualism, intrinsic to a world made of matter, finds also itself in a transposed manner between every material and invisible component, like for example the brain and the thought, the body and the mind, the eyes and the sight or the ear and the listening. What we can call vacuity is largely beyond the dualism of the vacuum and the full, being itself not only a concept but also a physical reality, unique in itself, calling for no relative definition.

From the beginning of the twentieth century quantum physics has been developed, from observation as well as from an intuitive approach. The smallest form of measurable energy is then a unique quantum, everything else being constituted by multiples of quanta. As soon as a form of energy goes above a quantum unity it springs out in the visible world, that we can call the full.

However it is legitimate to think that in between two quanta of energy a form not directly measurable exists. Every observation would then have as a consequence to project this invisible world in the world of matter. The world of matter being the world of the form, the forms that these energetic fields will take when they will be projected in this world will be diverse, depending on how this projection, this observation is made. In this sense, every observation, or observer, depending on the method that he will use will change the reality of the material world. This remark can by the way also be applied to other domains such as the consciousness or the thought.

We would then be dealing with a sort of ocean of an infinitively spread out energy, invisible like ku, for which no manifestation would pierce directly in our real world; an ocean of energy, without any aspect, without form, without reality. And however this world, below of a unique quantum, exists although it is not observable directly. In addition it cannot be considered as empty, as it contains energetic fields. From this world, constantly spring out quanta of visible energy, or of matter such as the elementary particles. In this sense ku becomes the phenomenon, from the vacuity spring out the material phenomenon. On the same way during the interactions or the annihilations of particles, the energy corresponding to their masses goes back in this infinite ocean of energy and disappears from our vision. The phenomenon go back to ku, the elementary particles go back to the vacuity. This is the nature of the vacuity seen from an approach of the quantum physics.

This approach of the vacuity and the apparition of the form can also be made in the domain of the thought – the form – and the no-thought. On the same way as the ocean of the subjacent energy to the material world, exists also the ocean of the thought without aspect, without form, what we can call the no-thought. The thought is obvious to know, often taking the form of images, or reflections. However the world of the no-thought “exists” also, always in a subjacent way, taking no differentiated aspect; it stays at the latent stage, swimming in the totality of our body. The practice of zazen allows us to come closer, without touching it, to this vacuity of the thought. That could be put in perspective with what Dogen has called thinking without thinking, the first term alluding to the conscious thought, the other one staying invisible in the world of the no-thought, “existing” however by itself. In a similar way

as the elementary particles spring out locally from the physical vacuity, the thoughts appear in the instant from the world infinite of the no- or sub-thought. The intimate relationship with our body allows us, not to make it appear, as it would then belong to the domain of the thought, but to feel it in a non expressed way, like the bottom of an ocean of which we would only see the waves at the surface.

A similar approach can also be conducted for other concepts: for example humankind and the whole of the human beings. The whole of the beings is to be put in relation with multiple individuals, like drops of water; humankind itself makes reference to a unique entity, non separable, impossible to describe with words, similar to an infinite ocean. In this sense the sentence of Buddha making reference to the salvation of all the beings suggests not only a salvation of humankind but also the one of all the individuals. At the end they cannot be separated. This can translate itself at the same time by the desire to save the entire humankind as well as by doing good everyday to save the individuals. To save only the humankind without the individuals would be without meaning and saving the individuals without any reference to the entire humankind would contain no universal signification. On the same way elementary particles, namely matter, cannot exist without the subjacent ocean of infinite energy, and the ocean of infinite energy existing only through its manifestations in the material world.

Interdependence

Let us take a second example. Let us start this time from the zen approach concerning inter-dependence. This inter-dependence is conceived as immediate and global. For example that can be translated in the following sentence: a person who practices zazen modifies the entire universe. Understand this sentence by contemplating an interaction which propagates itself first within our close environment, and then farther and farther is certainly justified. However it contains also a notion of immediate and universal action calling for no interaction propagating itself gradually, like if our whole universe were one, entirely linked and in complete inter-dependence. A priori, that seems to be in contradiction with the fact that in our world no interaction can propagate itself at a faster speed than the speed of light. According to this condition, billions of years would be needed until the influence of a person in zazen propagates itself to the frontiers of our universe. However in the last tears, a new phenomenon was fully verified and established in physics, proving that a bound system in its initial conditions stays bounded, and that changing one of its elements immediately modifies the other ones.

Two particles of light coming from the decay of an atom are emitted. These two particles of light are sent in opposite directions in kilometers of optical fibers. Although separated by kilometers their state stays bounded, that is to say that a modification of the state of one of the particles is immediately observable on the other one, without any time for a signal to propagate itself, at the speed of light, from one to the other. The phenomenon is immediate, no spatial separation exists. That is a new level of reality. This experiment displays what the zen Masters had sensed in talking about inter-dependence among all beings, immediate inter-dependence, without any spatial separation. There are then in our universe phenomena which staid for a long time unknown from the scientific world, and which come closer of what was expressed from the beginning of Buddhism.

Both approaches are complementary in the sense that intuition is certainly correct but can profit from the scientific observation to be. The scientific approach itself can help the human being to understand the profound nature of things. Like Buddha was saying: if I tell you that I have a diamond in my closed fist, you would have to believe me. If I open my hand, you can see it. In that sense the scientific approach towards the understanding of our universe helps to open the hand, so everybody can see the diamond.

Time, relative concept, instant and eternity

It is enough to ask sincerely this question to realize that time is a concept which lives with us. Time has no being and is then not measurable by itself. It is perceived in function of things, in function of the human beings for example. In physics, time has been cleared of everything which makes its importance for us, its concept has been completely simplified, like just a mathematical variable. For example, in physics, the time variable is without direction, past and future do not exist.

We have kept in our minds this concept of linear time which flows away. It is real, that is enough just to observe the flow of our own life. But our consciousness of a time flowing in a regular and universal manner has profoundly changed in modern time.

In a chapter of the Shobogenzo, Uji, Master Dogen talks about the being-time. Until these last decades, time was considered in the western societies like an absolute entity. Time or moreover its measurement is extremely well defined. However in one hand, in the 13th century Master Dogen talked about the being-time, that is to say expressing the fact that outside of beings, outside of ourselves in particular, or more generally outside of any presence of matter, time does not exist. Time is completely linked to beings. On the other hand within our century, Einstein has demonstrated that time is a relative concept, depending

on the referential from which we observe it. Time has fallen from its pedestal of absolute variable.

In the absolute nothingness (called kakunen musho in the zen documents), time does not exist, first thing. In that sense one could say that our universe has materialized suddenly from the infinity of time; that our universe and the time are born simultaneously. In Buddhism, the concept of time separating the birth of a universe from its extinction is very vague and corresponds to the idea of kalpa. A kalpa is by the way also the time of a blink of an eye of Buddha, expressing this way that it does not have any real content or cannot be measured in an absolute way.

The measurement of the change, of the rotation of the earth, the seasons, days and nights, the phases of the moon of these natural phenomenon's, is called the time. It only has to do with a measure of the change, with a segmentation of time, today extremely exact, of everything which is subject to evolution. Again in an absolute vacuum, time does not exist. No activity is present, nothing changes, no measurement is then necessary, time does not make sense. If our universe has sprung from vacuity, time is born with it. Without universe there is no time. If this is true, what does the eternity mean, for us who are living in a temporal world? Eternity would then be defined outside of time; in fact eternity would be what there is when time does not exist. At the contrary if our universe comes from an eternal evolution of pre-universes, disappearing and being born, time existed before our world. Eternity is then conceivable as a temporal notion, an infinite time. It is either or either: either matter, space, universes have been present, changing and renewed, in an eternal way and time contains eternity, either it is not the case and eternity is outside time. Does it exist in reality or is it only defined in the absolute vacuum?

Instant also brings a paradox. How should we consider an instant compare with the time which flows by. An instant is immediate, when it reaches our consciousness, it is already passed. We can know about time, but not about the instant. In a conception of the time flowing in a continuous way, the instant cannot be conceived. How much time is separating two successive instants even if they are infinitively close to each other? The instant seems then to be outside time. Or we should consider that the time is made of successive instants which follow each other, so close that it appears as a continuous phenomenon at our macroscopic scale. But what would be the natural dynamics which would make it pass from one instant to another? Again two things: either time is linear and it cannot contain the instant, or time is quantified and we do not know what gives birth to time.

What is this all about then? We see that we get older; we say time is passing by. Dogen says: we are beings-time. As far as our life is concerned, time gets born and disappears with us. So at the end, eternity, instant, are only words for us. We have invented these words which express no reality, except in our mind, words which do not correspond to any being.

Views on universe: multiple in Buddhism, big-bang and pre-universes

Ancient Buddhism talks about a multitude of universes appearing and disappearing during countless kalpas. Like if each of these universes was similar to a bubble which grows, explodes and disappears, followed by other bubbles. Ourselves, we can only know our own bubble, which does not exclude that there could be other bubbles which will remain unknown to us, other universes for ever separated by the frontier of nothingness. At the contrary, the western science talked only about our own universe. Our universe, although it appears to us naively infinite, finds its natural frontier at the point where the influence of the masses which form it finishes. In that sense, it can be perceived as finite or infinite, because this frontier is vague. Our universe, taken in its totality, could be considered like an enormous black hole.

Nothing opposes the presence of multiple and countless universes, each of them being a complete stranger for the other, having neither spatial nor time connection with any other. Universes are separated by nothingness, although in fact the concept of separation does not have any sense at all, because it cannot be measured by anything. The universes are disjoint. To talk about distance in between these universes does not mean anything. The human being can only know or apprehend the universe in which he lives, the one which generated his own atoms and his own cells, like the ones of his brain for example. That does not prevent him to be able to suspect that his universe is not unique, even so if for himself his universe is in fact unique. The other universes remain for ever unknown to us; in that sense our own universe is unique.

There is no way to know if our universe is unique or not. But to think that it is unique, that it is the only one, cannot be verified and is mind limited.

Conclusion

Looking at these remarks, it is probable that the human being starts to perceive infinity in a much higher dimension than the he considered so far. The universe of zen is infinite, people say. This infinity, macroscopic or microscopic was sensed from the most

ancient times, from the intuition of ku. In our century this perception can be backed up by the scientific logic.

The third millennium and in particular the 21st century will see more and more the unification of science and, lets say, of the religious world, of the integrated understanding of our universe, both marching hand to hand. That was the prediction of Master Deshimaru, school to which Master Myoken and I belong.