

AFSCET

9 ième congress of the Systems Science European Union

Valencia, Spain, 15-17 octobre 2014

Workshop organized by AFSCET

**Modélisation Mathématique des Systèmes Complexes
Mathematical Modelling of Complex Systems**

Towards a quantum model for meditation

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28 november 2014

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28 november 2014 ¹

Abstract.

We study the meditative states of human beings from the conceptual framework provided by the fractaquantum hypothesis : analogously to an atom, Man can from his “quiet” base state explores various states of higher energy as loving or mystical state. We then look what energy states are explored during meditation: is it the “hyperfine” structure of his base state? is there a love ecstatic state? a very high energy structure mystical state? On one hand we illustrate these hypothesis from the experience of a large part of mystical traditions such as Hinduism or Buddhism and on another hand from contemporary cognitive sciences. In addition, quantum mechanics indicates that any interaction between energy levels is mediated by a boson of exchange. So we aim to identify the nature of this boson linking the various human being energy levels.

Vers un modèle quantique pour la méditation

Résumé.

Nous étudions les états méditatifs de l'être humain à partir du cadre conceptuel fourni par l'hypothèse fractaquantique : de façon analogue à un atome, l'Homme peut à partir de son état fondamental “tranquille” explorer divers états de plus haute énergie comme l'état amoureux ou l'état mystique. Nous cherchons ensuite quels états d'énergie sont explorés lors de la méditation : s'agit-il de la structure “hyperfine” de son état fondamental ou bien s'agit-il d'états d'extase amoureuse voire d'un état mystique de très haute énergie? Nous illustrons ces hypothèses à partir de l'expérience d'une part des grandes traditions mystiques comme l'hindouisme ou le bouddhisme et d'autre part des sciences cognitives contemporaines. De plus, la physique quantique indique que toute interaction entre niveaux d'énergie est médiatisée par un boson d'échange. Nous posons donc la question d'identifier la nature de ce boson d'interaction qui relie les divers niveaux d'énergie de l'être humain.

Key words: fractaquantum hypothesis

¹ This contribution was first presented at the symposium “Mathematical Modelling of Complex Systems” during the ninth congress of the European Union of Systemics, Valencia, Spain, 16 oct. 2014. The english translation is a collaboration with Claire Couratier.

Fundamental state and fractaquantum hypothesis

- This work is placed in the context of the fractaquantum hypothesis: the quantum approach is applicable to all indivisible scales in Nature, regardless of their size [19]. In addition, the underlying question is that of a quantum model for humans, knowing that a quantum model is not interested in specific individuals, but rather to what they have in common, and makes them “indistinguishable” through this approach.

- We are guided by the atomic analogy. It is known that an atom is, from the quantum point of view, correctly described by its energy levels. These can be calculated as the eigenvalues of the Hamiltonian operator describing the interaction between the atom and the electromagnetic environment outside. Thus, the atom has energy levels as proposed by Niels Bohr [7] and exactly calculable (at least for the hydrogen atom) with the quantum mechanics methods; we refer *e.g.* the book of Cohen-Tannoudji *et al* [12]. The fundamental level $|0\rangle$, a first excited level $|1\rangle$, a second noted as $|2\rangle$, *etc.* When the atom passes from the level $|0\rangle$ to the level $|1\rangle$, it absorbs the energy gap corresponding to an absorbing wave of frequency ν according to the relation

$$(1) \quad h\nu = \varepsilon_1 - \varepsilon_0,$$

where h is Planck’s constant. When the atom moves from level $|1\rangle$ to the basic level $|0\rangle$, it forwards a ν frequency wave according to the (1) equation.

- In this quantum description, the initial analogy recalled here is located in the human being excited levels. We admit that everyday life, with joys, sorrows, desires and frustrations, is in fact a sum of a fundamental state modulations. This base state could be defined in a first approach, implicitly compared to all states of greater excitement. It is the “current state” of the profane or everyday life, made of low excitations, unstable discontinuous changes according to the every moment exchange of energy made with the outside world, without the usual subject being necessarily aware. These can be closer to what Christophe André [1] calls “states of mind” these mixtures of feelings, thoughts and emotions match each time to a state of temporary power of my relationship to the world, changing during each new configuration, thus being replaced by another state, with both fluctuations and matching micro energy jumps. We call this fundamental state of weakness and disorganized excitement of everyday life, the “daily agitated state”, noted $|0\rangle$, as we will later see.

- This basic structure is referred to an atom (known technically as molecular orbital) and Physics tells us that a “fine structure” (see *e.g.* the book [12]) exists for each level. The difference of energy between sublevels that forms this fine structure is much smaller than the difference $\varepsilon_1 - \varepsilon_0$ of the relation (1). Still in the same analogy, we propose that a succession of energy states $|0, j\rangle$ and levels $\tilde{\varepsilon}_j$ actually compose the fundamental level $|0\rangle$. As for the atom, it is a “fine structure” even though we cannot yet offer any explicit representation. But as evoked earlier, different feelings, anger, sadness, desires, *etc.* are all “understate of excitation” of the base state. We know that anger requires energy then falls, such as desires and their accomplishments, or sadness and fear.

- A real spectroscopist work starts here, classifying energy gaps of these states. Following Descartes, Spinoza was the first to go this route, since his whole ethics is to show how ethics invites to deviate from the resentmentfull sad passions towards Joy thus corresponding to the maximum intensity of being, as presented by Damasio [14]. The wheel of emotions of Plutchik [45] shows how the eight basic emotions (joy, fear, disgust, anger, sadness, surprise, trust, anticipation) can each pass through three degrees or intensity. Moreover, Descartes opened the way with his *Treatise on the Passions*, where he quoted six basic emotions: admiration, hate, love, desire, joy, sadness. From irritation to anger then rage just as apprehension, from right to fear, or in a positive way from serenity to joy then extasy there is always a fluctuation going along with possible macro-jumps of energy.
- The Lauri Nummenmaa *et al.* Finnish study of the Aalto university [43] recently deepened and nuanced this classification of emotions, showing in Spinoza's way, that they affect more or less subjective and energy body according to their nature. More than seven hundred volunteers from several countries were asked to show on a human silhouette the parts of their bodies that were superactivated, or otherwise impaired, while feeling one of the seven emotions, including the five emotions currently recognized as primary by researchers: joy, sadness, anger, fear, disgust. The results show that the body activation is "very low" to "low" when passing from depression to sadness, contempt or shame, every time with a lower limbs sub-activation and a slight activation of the upper body. Conversely when going from disgust to fear and anger, the body activation becomes stronger, mainly in the upper areas of the body. Both emotions of happiness and especially love match the strongest activations, this time of the entire body.
- Let's observe how energy, atomic levels energy differences, and by extension Man's excitation levels are of the same nature as an engine's mechanical energy. This physical concept is well understood since Sadi Carnot [9] and Josiah Gibbs [29] pioneering works during the 19th century.

From base state to love and mystical states

- If we now focus on excited states above the base state, we assume that the first excited state $|1\rangle$ is love. Like the equation (1) it "gives energy", places the individual in a very specific state. We all have experienced it and know that after a while, passion time, one falls from the state of love to the natural state. It has been described by all cultures over the course of time. As we write these lines in Trouville, we believe the Christian Bobin books (we refer *e. g.* to the two fundamental *La part manquante* or *Le Très-Bas* [6]), to Alain de Botton, Swiss-born English writer who develops a Philosophy of love [8], to Pierre de Ronsart : "Mignonne allons voir si la rose..." [49]. To the disappointment in love, staying in the love state $|1\rangle$, while the other is no longer in the relationship, we refer to the works of poets, popular singers and *e.g.* to "l'écharpe" of de Maurice Fanon [28] or to the famous french song "mon amant de Saint Jean" [28].

- Our idea is not to stop the quantum description to the two previous states, the fundamental state and the being in love. Doesn't Plato, in the $\Sigma\nu\mu\pi\sigma\iota\omicron\nu$ (the Sumpóision), invite us to see the desire, or Eros to see the being in love as a springboard in the quest for the Beauty, the Good and the True, higher states of contemplation, involving most unconscious couples? We propose that the mystical state would be considered "second excited state" of Man and noted $|2\rangle$. The mystical state experience is more rare than the being in love. A very poetic description is given by Teresa of Avila [3] or John of the Cross [35] in the Christian culture, among the Sufi poets, or closer to us by Karlfried Graf Dürkheim [21] or Jiddu Krishnamurti [36]. We believe that the mystic state is as natural as the being in love. A more "excited" state: the mystics often speak about being "delighted" transported out of them, the body sometimes trembling, approaching the trance phenomena, due to such an excitement. Most of the time these experiences are fleeting and fragile as these state are difficult to reconcile with the agitation and violence of everyday life. A priori, this state is limited in time and John of the Cross speaks of "La noche oscura" to describe the shock of returning to the "fundamental" state.
- We think possible to exceed the mystical state, beyond the level $|2\rangle$ to state $|3\rangle\dots$ What happens then to the over-excitement we were talking about? Will it dilute to an appeased base state no longer crossed by any micro-excitation, or will it immerse in a higher energy state? Is it only an excitement modulation experience, not such as a fine structure, but rather as "hyperfine" structure as in quantum physics.
- In addition to their fine structure, Atoms have a hyperfine structure involving the coupling the proton magnetic moment with the electron orbital moment and spin of the electron with other quantum effects and an additional coupling being the contact between the electron and the "frontier" of proton, see Cohen-Tannoudji *et al. op cit.*. These famous couplings are widely studied transitions by atomic physicists. Should we now speak of a hyperfine structure of mystical excitement, or a new comparable quantum jump towards a state of excitement or a peaceful energy stage higher level $|3\rangle$?
- To go forward, we propose no longer to focus on ecstatic mystics experiences, but to consider the already mapped meditation experiences, for over two thousand years, with the multiple mindmaps that a regularly trained spirit can experience and more with the recent development of neuroscience, Meditation is itself becomes the subject of numerous scientific researches.

The different stages and experiences of meditation

- What is meditation? According to Francisco Varela [17], who identified the common structures between Buddhist meditations, Sufi, and Orthodox prayers, we always find the same movement of mobilization and attention refocusing, done in three steps: first suspending the attention focus to the world watched as an external object that constantly comes, thus leading to focus (*samatha* in Buddhism) calmly, back to oneself and especially on breath. Second, this suspension allows to change the sight and flow of attention, re-directing it towards internal feelings, to all the body or mental micro-excitations that occur

at any moment while observing (*vipassana*) according to Michel Bitbol [5], their variations as small as unpermanents without being caught by them. By maintaining this self redirected attention a new state is created marking a real break from the usual excitement state level. According to Varela and Bitbol, it is then characterized by the third step as being inherent to any meditation practice: attention becomes just open and available as a single “host state”. This is, according to them and to the experiences of people engaged in meditation, a open standby state, object and knowledge free and independent of any excitation trace. This relative vacuum time can be very brief, lasting a few seconds or hundredths of seconds, several minutes if not more, time for new objects or stimuli to inevitably come in the field of consciousness. According to Bitbol who incorporates the terms of Romano [46], the most confusing and sometimes scaring for beginners meditation is to approach this terra incognita of the internal events without knowing in advance what will happen, to accept this short vacuum time that will leave emerge, to getin a “immersed in the seem”, rather than in a “taking reflective distance” (see [5], *op. cit.*).

- What is happening now, during meditation? Everything... and nothing! Thoughts, emotions, pleasant or painful sensations arise, drowsiness or mental agitation threatens. The main thing is to learn not to get caught by them, gradually discovering that there are several possible stages in meditation, each one with interesting correlations to brain.
- We can see these thoughts as “virtual bosons”, as a classical concept for quantum field theory calculus. If there is communication or exchange between two partners two entities, a interaction boson is transmitted and received (see *e.g.* [34]). In the case of non-communication, such as the thought of a subject without explicit communication, the boson is emitted and reabsorbed by the same entity, which is characteristic of the virtual bosons, as described *e.g.* in [20].

A first type of meditative experience, exploration of the base state

- In the first stage, meditation opens to the discovery of internal micro-sensations which are not usually under attention. Still, away from the stress of the outside world, indeed attention drops unconsciously from the level of ordinary consciousness to a succession of moods and multiple excitations, a state of mindfulness to inner events. This is not an external posture of the observer, analytically decomposing internal sensations as many objects to observe, but it is using intuitive ability to self-presence, falling below the subject-object cutoff as written by Michel Bitbol [4]. We learn to see in the field of consciousness, without getting caught by them, internal micro-physical sensations, emotions and partial impulses, that come and go, fleeting as bosons, without leaving trace.
- This ability to carefully observe the emergence, deployment and loss of multiple emotions or sensations that pass through our bodies every moment without being drawn by them corresponds to a change in the normal work of the brain. Current neuroscientists studies show that during full conscience Mindfulness meditation, rational areas of thought (Broca’s and Wernicke’s) are less active, while internal perceptions areas of our own body are instead stimulated and overactive: the fronto-limbic cortex and fronto-parietal cortex

that promotes interoceptive perception of internal sensations, the anterior cingulate cortex, which helps strengthen body sensations and pain responses as presented in summary of various neuroscience studies about the effects of meditation on the brain including Katya Rubia's, of the university of London [50], the left prefrontal cortex that promotes stress management and emotional well-being, particularly in response to negative emotions such as sadness. The more you meditate and become "expert", the more changes occur in the brain, which reshapes, with, among others, a decrease in the amygdala which is the place of the automatic stress reactions, but also a sensible thickening of the gray matter for a better control of the cortex, an elongation of telomeres responsible for maintaining cell life (stress instead shortening the telomeres and the matching duration of cells life), and a better capacity for sustained attention focus.

- When the meditator is able to install a certain stability in his mind, we make the assumption that this very fine meditative observation of his internal energy states corresponds, according to the quantum physics model, to a lowering of the daily agitated state, to what we call a "quiet state", in which it is possible to become aware of the fine and even hyperfine structures Man's base state and micro-sensations and excitations which always succeed in him. Similar observations occur in quantum physics and common Buddhist meditation: there is no streaming, but discrete and ephemeral appearances, followed by disappearances and new energy emergencies, whenever discontinued.
- From the restless state to the exploration of micro-movements and fine or hyperfine structures of the base state, involves attention gymnastics, which gradually through the meditations, instills a four steps new cycle and cognitive mechanism leading different areas of the brain power to work together (see Antoine Lutz [38]), gradually calming and fixing attention as shown in a IRM study of Wendy Hasenkamp *et al.* from Atlanta university [33]. Mental vagrancy which usually occurs by "default" brain operation in automatic mode at the sensory and motor cortices, the meditation, awareness of this mental wandering is followed by a conscious awareness in the cingulate cortex, somatosensory cortex and anterior insula, which allows to pause for a moment the always prevailing elsewhere mind flows. This awareness allows attention to detach the object vagrancy, mobilizing this time the dorsolateral prefrontal cortex and anterior parietal regions. It can then re-focus, sustained and quiet, in the prefrontal cortex, with the setting of a broad and open attentive presence to what is happening.

A second type of meditative experience, parallel with the being in love

- If learning meditation is a deepening of Man's finest base state, certain types of meditation help in many traditions, exploring new, more excited states, which would probably refer to love states previously presented, offering all the features of the $|1\rangle$ step of love or $|2\rangle$ step of mystic experience. To support our hypothesis we take examples drawing on two often opposed major Eastern traditions: Hinduism and Buddhism.

- In Hinduism, the *bhakti* yoga meditation, or path of devotion, is famous since it was themed for the first time in the *Bhagavad Gita* [27], between the 5th and 1st century BC. Primarily oriented towards Vishnu or Krishna this *bhakti* allows to develop and grow, in everyday life and in meditation, a state of love transport with one's heart divinity. The *bhakti* implies in fact a complete abandonment to the divinity, installing a person to person relationship to the God, the devotee receiving or discovering an energy and intensity of love far from with the usual feelings of the secular world.
- As one might expect, in the most advanced stages, such a loving devotion naturally extends towards a mystical state, since it is then to unite and merge into the infinite love of the God, devotees of Vishnu or Krishna sometimes being remarked in the streets by real love and energy transport while they chant and meditate, seeking to perpetuate this state of ecstasy in love before it fatally falls as this dark night described by St John of the Cross. In pathological cases, and specially in the Bengali *bhakti* as noted by Esnoul [26] (p. 152), these second fervor states may exceed the meditation framework and overflow crowds of jubilant devotees phenomenons with nervous or functional disorders caused by extreme emotional stimuli.
- In Buddhism, the compassion and kindness loving meditations highlighted by Matthieu Ricard [48] for Tibetan Buddhism, are to develop a feeling of infinite love, without limit, extending the feeling of kindness, empathy and compassionate love, even to people we do not like or comply. During these meditations cultivating compassion, meditator goes through strong and sometimes unpleasant thrills leading through into mental intensity and higher energy states, with strong activations in certain areas of brain, measured by neurociences. During the kindness love meditation, Richard Davidson and Antoine Lutz [15] (from CERN) have registered a higher activation in brain regions that manage empathy for the suffering of others: the anterior insula and the anterior cingulate cortex, but also the three areas that allow us to put ourselves in the place of others (medial prefrontal cortex, superior temporal sulcus, temporoparietal junction).
- Experienced meditators feel even more compassion and suffering of others, with additional activation of the somatosensory cortex that makes them part of their own body. According to Matthieu Ricard [48], other studies about this loving kindness meditation testify logically from the decreased activity of the amygdala, which manages aggression and fear, while areas related to empathy as the insula were more active, increase in size, creating more neural connections and thus reshaping the brain. The feeling of kindness love goes even further than a simple increasing empathy, according to studies reported by Matthieu Ricard, particularly by promoting and developing oxytocin, this maternal love peptide produced by hypothalamus.

A third type of meditative experience, approaching the mystical state

- If these meditations based on love seem to scale up from the base state to the love state level $| 1 \rangle$, even to the mystical state $| 2 \rangle$, are there non devotional meditative

practices which would specifically lift to the so called mystic level $| 2 \rangle$? It seems that this is the case of advanced *dhyana samadhi* states of concentration and contemplation, which have been cataloged in all meditation traditions of the two great Hindu and Buddhist currents. For over two thousand years, these states of consciousness were indeed widely listed and presented, sometimes in Hinduism as the accession to new energy strata and higher conscience, sometimes in Buddhism as stages of consciousness, obtaining advanced powers to keep beware of without stopping. In Hinduism: the yoga *sutras*, between -200 and +500, codified and compiled for probably several centuries experiences and stages developed by yogis during their yoga exercises and meditation. In Buddhism: the Abhidharma, between first and 5th century, is still an impressive collection of texts and reviews about psychological and philosophical experiences experienced by the Buddha and Buddhist meditators. Michel Bitbol, in his research on consciousness, builds among others on this corpus.

- Let's present now the first advanced states of consciousness found in these various traditions, stopping for the convenience on the terms and stages described by Buddhism (see *e.g.* [37], p. 442), and more specifically in the *dhyanas* or *jhanas*, more or less ultimate absorbing states which can reach after long meditations and *samadhi* concentrations. The first *dhyana* state that seems to be the very definition of the mystical state given at the beginning of this article is first the experimentation of a pure inner energy or *virya* excitement state, excitement feeling arising in the depths of oneself. This burst of excitement and energy can be experienced with weak signs as heat, tingling, creepy, or cause, as with the mystics, most violent movements that literally carry the meditator, almost out of himself, giving the impression of being transported until almost levitating or feel of emerging from his own body in a state of *priti passadhi* rapture and pure joy which then shows access to the second state.
- This state of joy can almost naturally lead to a third pure happiness state free of body sensation or excitement, again with a mental experience level break, and the access to a fourth *prasadhi* equanimity state, of serenity and immutable peace. Which can then lead to be completely absorbed into new *dhyana* or *jhana* more subtle states according to the texts: the fifth stage, dilution or absorption in an unlimited space; sixth, absorption in a state of unlimited consciousness; seven and eight, the absorption in other areas be empty or all of any form, perfectly silent, beyond perceptions and non-perceptions.
- Hindu texts and the different stages of yoga present variations and terms inversions, distinguishing such as Mircea Eliade [23] after concentration *dhyana*, and the more and more refined *samadhi*: first, an enstasis or standard limits liberation in *samadhi* with support, still maintaining the support of the meditation object. Thus leading to miraculous yogic powers [44], and finally when exceeded to the ultimate *samadhi* without any support, which is a perfect and sudden enlightenment, a most deep inside enstasis, in a higher state of consciousness, “a total and saturated by direct intuition be”. We refer to Mircea Eliade [24] (p. 70) and to Zimmer's description [52] (p. 342) about these states of

samadhi, according to the great Vedanta philosopher Cankara at 8th century.

- It is not surprising that these absorption states reached through meditation find the states evidenced by the mystics. In her spiritual journey, St. Teresa and reached in the fifth home of her soul a pure attention succeeding an infinite bliss, which is according to Bitbol [5] (p. 175), the third *dhyana* Buddhist, removing the awareness of body sensations to become a pure attention, just after a feeling of joy and bliss. Hatching such states requires, ability to focus attention, then let go with abandon, are essential as observed too by Jeanne Guyon, 13th century mystical: “Surrender is the key to the the inner” [31].
- Regardless the difference stages and terms in yoga or Buddhism, favoring *samadhi* or *dhyana*. The main thing is to realize that these two traditions mapped these mystical level “two” states quantum of our assumptions for a long while, each time with the same degree of change, a break level, an extension and intensification of energy awareness in both aspects physiological and cognitive.
- Physiological studies in neuroscience allow, again, to approach indirectly and by comparison the energy transformations that probably occur in the brain, when such statements are reached in meditation for a short or long period. Measures that were conducted on trained meditators [11] show indeed both increased alpha and theta waves of deep relaxation and REM (rapid eye movement) sleep, but also the increase of gamma waves thus reflecting the activation and mobilization of neural resources allowing mental effort and the emergence of a global intuitive flash. As they allow, according Chaskalson [11] (p. 113), to daily accumulate sound, visual and cognitive data, to suddenly understand by example in a flash: it is a train, the same waves that cause these flashes of intuitive understanding known by the great scientists, artists and meditators. This is the “aha!”, the “Eureka” that last a few milliseconds, which suddenly allows to see the reality otherwise. According Chaskalson, even without speaking of the states of *samadhi* or *dhyana* we have presented, the mental meditation training allows monks to have the same type of illumination and intuitive flash, with a broad and comprehensive vision that can last up to five minutes.
- How to explain or account for neuroscience? Studies by Lutz in his research laboratory at the University of Wisconsin [38], on expert meditators who have accumulated more than 10,000 hours of meditation, show that stress areas located in the amygdala are much less mobilized, even with an objective stress (sending aggressive sounds), then providing them an attentional and emotional stability. In other studies on more experienced meditators, totaling more than 50,000 hours of meditation, Antoine Lutz [39] also shows that synchronization of gamma waves is actually much sharper than in average individuals, which indicates levels of “increased” consciousness with more integration of the different brain areas beginning to work in synergy, more smoothly and open...

Paradoxes of mystical states: third state, or return to the base state?

- If the existence of mystical states corresponding to a “jump” into a higher energy level seems to be demonstrated that these become mystical states: they can exceed that in a later stage we would call a quantum state level $|3\rangle$, or they eventually return to the base state?
- Hinduism and yoga seem to militate in favor of the possibility of reaching a final status level $|3\rangle$. In Hinduism, mystical peak condition naturally to contemplation, to the union or merger in a higher power or divine, which goes beyond feelings states absorption described above. This was already revealed in the most ancient Hindu texts, Bitbol reminder that the Chandogya Upanishad already stated that six centuries BC “*Dhyana* meditation is more than consciousness” (see [5], p. 181). For Hindus, the ultimate experience is the effect of the fusion and resorption in the primordial ocean, conceived on the model of the wave or the water drop (atman or ultimate principle in itself), which returns blend into the primordial ocean the Absolute (Brahman). Cankara, large non-dualistic philosopher who belongs to the Hindu tradition Vedanta to 8th century AD, will be part of the same line when his distinguished according Zimmer commentator different *samadhi* with and without support, to finally end with a oceanic fusion in the absolute: “In the first type of *samadhi savikalpa* with mindfulness the subject-object duality, the oscillating vitality of consciousness assumes the form of Brahman, but remains conscious of itself, has a beneficial ecstasy... *nirvikalpa samadhi*, absorption without consciousness is immersed in the Self, without distinction about objects, such as waves vanish in the water” (see Zimmer [52], p. 342).
- But this merger in the infinite seems quantum level $|2\rangle$ or $|3\rangle$, is it not the same resorption time in a base state, naturally peaceful and informal, which refers to the paradox of a new level $|0\rangle$? This is what seems to indicate for which Buddhism different stages of *dhyana* absorption are not an end in itself: they simply allow to abandon the game categories and normal mental projections, to evade excitations which continue to occur without one is now assigned or forced to react by simply return to a peaceful state originally, where we show the world just leaves appear here and now, in a perpetual present. Nirvana simply means extinction, blow and quench the thirst and the projection of his desires, to let appear the phenomena as they are, in their “like this being” (just as well, *Tathagata*, the epithet enlightened Buddha, literally meaning: and went, and came, or more exactly according Bitbol: standing in the well). This is what allows Bitbol to write: “The state of absorption once pushed into its ends, leading to a territory which is not a stranger, and that seems unusual because he has been stripped of its grid cadastral: what is, as it is” (see [5], p. 180). In this sense, it is just an awakening to what is presented to each moment, as if pondering managed to reverse in the original and fundamental quantum field which emerge discrete events or appearances, which immediately effaced, as strange bosons enigmatic. To speak of this final state, the Tibetan tradition of talk “Open

presence” and the Zen tradition back to an originally awake and calm the conscience, conscience hishiryō of non-thought, before any thought of where the boundary between the self and the world continues to find itself in what is sometimes mistakenly called the “nature of Buddha” (nature of what is just, well).

- Our thinking leads to a strange paradox: how to reconcile the Hindu metaphor the drop of water that melts into an infinite ocean of energy, with the Buddhist image of the empty mirror dust, which has nothing to reflect? Maybe he should accept the aporia as the place and the reverse of the same coin, and that the ultimate mystical state is ultimately nothing more than a return to the base state “appeased” rights, ie the base state within the structure hyperfine state quiet day. That is the common point between the “semi-silent Buddhist and theological verb: they look like each other to prepare the mind to meet the unprecedented and the unnamed themselves, evoking in a case like a proto-type, and the painting in the other case under the guise of an over-kind” (see [5], p. 170). Compared to our quantum assumptions, this would imply that the quantum leap inducing a change of consciousness is thinner in what is called metaphorically an ocean of energy, would be correlative or followed by a return of consciousness ordinary that we named the base state appeased by letting go and extinction apprehensions and tensions of the ego...

Transition from one state to another and quantum physics

- At the end of this presentation, meditative states seem to respond well to different intensity scales, and to a lesser extent the affective and emotional states of the human spirit can, within the scope of increased excitement, split from a low state to an average state, then exacerbated - such as frustration, anger and rage. But if, for the emotional states of Plutchik, we understand that the external stimulus makes suddenly switch from one state to another, how will the transition occur with a much stronger meditative state $|0\rangle$ to $|1\rangle$, $|2\rangle$ or even $|3\rangle$ while the meditator seeks to abstract from any external stimulus? We will try to approach this issue from three aspects: the relationships dynamics, bosons, and finally heat exchanges, which each help to determine whether the changes produced by meditation fully meet the requirements of quantum physics.

What dynamics of relationships, what breaking levels ?

- In this second part, it is therefore to ask how the transition from one stage to another can be explained. We know that during meditation, thoughts come and go, such as interaction bosons, light, photon to the electromagnetic field. Are thoughts bosons that occasionally emerge from the quantum field of a self-refocused and soothed consciousness? This hypothesis probably deserves further developments! One can also imagine that they are the result of a measurement made by our conscience, the trace of a reduction of the wave packet, the trace of the interaction between the macroscopic observer which is our conscience and microscopic phenomena of our body, specially our brain.

- Let's recall that we have identified three different scales in energy levels structuring the human psyche. We start from the everyday agitated state, the ordinary mental state of everyday social exchanges. With a high energy input, one goes to the love state then beyond to the mystical state that allows to shift to a contemplation state. The “daily hectic” state itself is made of myriad of sub-states, fine structure of the energy system. Of these, joy, anger, etc. as many levels of excitations in the daily regular. In this new spectral system fine structure, the “quiet” state is fundamental for us. The “quiet” state is the reference state of the meditator who gradually descends towards “hyperfine” sub-levels to lead to a new appeased base state, we may call “vacuum state”, in analogy with the vacuum of a photon free electromagnetic field. So we have three interlocked structures for the psychic structure, with levels of energy exchanges inside each similar subsystem, but at very different levels between subsystems.
- As always in quantum mechanics, the relationship between energy levels is carried by discrete jumps, transfers with a definite energy, such as the photo-electric effect introduced with the relation (1) at the beginning of this contribution. In this case, the interaction mediator, the “boson” as called by the physicists is the photon, unbreakable grain light provided in 1905 by Albert Einstein [22]. To extend the analogy between the atomic system and human psyche, to develop our attempt of spectroscopy of the human psyche, we must now search this boson of interaction between energy levels of the psyche. It is known that looking for a boson is still a “big deal” in physics. The understanding of the weak interaction with the Weinberg-Salam model [30] allowed to hypothesize the “intermediate boson”, highlighted at CERN in 1984 [41]. More recently, the unification of the electro-weak interaction with the strong interaction that binds protons and neutrons in the atomic nucleus [10] led to the discovery of a boson planned in 1964 by Robert Brout, François Englert, Peter Higgs [25] and probably many others! We here suggest the book of Gilles Cohen Tannoudji and Michel Spiro [13] to the reader.

A boson for meditation

- In quantum physics, the change in energy level for the system is possible if a quantum of energy is exchanged with the outside world. A photon, elementary particle of light, allows the transition between energy E_0 and energy E_1 if (and only if!) its frequency ν is exactly compatible with the two previous energies through the equation (1). Reciprocally, when the atom descends from E_1 level to E_0 level, it emits a ν frequency photon. The photon is the interaction boson, which mediates the exchange between the atom and the outside world.
- The question now, as part of a quantum model for humans, is to understand what these energy grains are, these interaction bosons that allow for example to move from the ordinary state to the being in love. This transition generally occurs abruptly; This is the famous “lightning strike”, whose name recalls the exchange of light within the atomic system. But the matter is also to understand what are these micro-energy exchanges that allow the mediator to explore the hyperfine structure of the human spectrum, and to grad-

ually descend towards the base level, called “vacuum” in the case of the system obtained by quantifying the entire electromagnetic field. In the case of meditation, reversing the outside world look towards the inner being allows the progressive exploration. But it’s probably a simple “quiet state” overall support framework avoiding the strongest disturbances of everyday life. The precise shift from an energy level to the following one should happen (if the quantum framework of this model is correct) through a very low energy expense of the subject. The outside world disturbance (better: a disturbance from the outside world) results in a still possible energy contribution moving the meditator from an energy level to a more agitated level.

- What is the nature of this energy input? let’s first recall that it must exactly be on a tuned frequency, as the photon, through a compatibility relationship similar to the (1) relation. If the outside world sends detuned energy grains, even on much larger frequencies, the system state does not change. This is a great discovery of Albert Einstein in 1905 while he made the assumption of photon. Considering the very complex structure of human being, we believe that we should not look for this energy exchange in pure electromagnetism as for the atoms, but probably rather in a still to highlight assembly of bio- molecular structures ultimately organizing trade within the human psyche.
- We can hypothesize in line with Théodule Ribot [47] that a “lightning strike” results of the resonance between an unconscious remembrance buried in the memory and a glimpse of present, with a previous incubation and updating work on the buried memory. So this exchange of information, whom the subject is generally unaware, causes the “lightning strike”, the shift from of the “Daily Status” to the being in love. Is the thought making this exchange of information? It seems clear that thinking requires an energy expenditure (see *e.g.* the work of Giuseppe Vitiello [51]) and results in the exchange of information within the bio-physical body system. But it is likely that the resonant equation harmony (1) is not reached and that thought does not allow such a transition. It seems instead that, if one refers to the assumption made for the “lightning strike” during the appearance of the being in love, that the transition between two states escapes the consciousness of the subject. No one chooses to fall in love and neither not to be in love. We should probably seek the exchange of energy between the states of consciousness, hyperfine energy levels similar to those the atom’s in a non conscious process. Of course, this process is stimulated by the thought that controls the aware mental state; but the transition itself is beyond thought. We can assume it is produced by an exchange boson. Boson which needs to be highlighted. Boson allowing the transition between two states of consciousness. Boson unconsciously emitted by the body bio-physical system. Universal boson which would not depend on the individual: everything could then be explained by reference to a biological level to a neurotransmitter being an interaction boson, not that far from what happens when you’re in love, which cause and match the change of states we are interested in.
- The lighting of what is happening in the state changes during meditation helps to bring other complementary lightings, surprisingly finding what happens in the love state.

Changing of state to leave the daily agitated state, requires at least three conditions: First, as seen with Varela, a suspension of the link engaged in to the world and a redirection of sight to the pre-reflective life then the setting of that we have called a quiet state, especially with the techniques of concentration on the breath that allow you to install a minimum of stability within discontinuous appearance / disappearance of various excitations and events; finally, a necessary control of attention, which tirelessly leads intentional thought ready to escape to outside, and inside, to turn into a simple and intuitive attentive presence, open and available at what is happening at every moment. This important and even decisive role of attention as a third factor is confirmed by studies in neuroscience that highlight the importance of the prefrontal cortex mobilization, being, among others, the seat of the thought control by the attention. But what is interesting is that these three factors are necessary conditions but not sufficient for a significant change of state in meditation. Neither introspective sight redirection nor installing a state of tranquility or opening a wide attention as a welcoming and 360 degrees acceptance as stated Bitbol, is sufficient to explain or cause a change of state, the daily agitated state to a mystical state, or emptiness or welcoming: that change will never be determined and causally provoked, most of the time it appears suddenly and discontinuously, even brutally, as in the state of love.

- In Soto Zen, it is said that you can just promote the enlightenment emergence, but cause it in no case: it will happen spontaneously, naturally, automatically and unconsciously as liked to say Deshimaru [16], without any intervention of man. Under a neurotransmitter biological influence, a sudden compatibility of relationship or, to resume Zen terminology, when mysteriously body, mind and breath finally get synchronized and reunited in a “fair” posture, in synch, then, along with the “Letting go”, a sudden illumination may occur.
- Rinzai Zen is even more radical, by not advocating a progressive illumination that can be prepared as in the Soto Zen, but a sudden illumination. Pai-Chang Huai-Hai, T’Chan eighth century Chinese Master (the Chinese T’Chan is the original form that will create the Japanese zen), was thus responding to a disciple who asked him how to reach the issue: “It can only be reached by the sudden illumination” [32]. Hence the further development of koans, these seemingly absurd riddles that teachers offer their disciple. When the student finally drops his intellectual efforts to understand, a sudden illumination, satori, may occur, which leads him to another level of reality or consciousness. “Satori is a spiritual experience; it describes the sudden click of Buddhist enlightenment. If it is difficult to describe to the uninitiated, the intellectual approach is easily accessible. Just imagine Archimedes in his bathtub discovering the same name famous thrust: “Eureka!”. He experiences a cognitive process in which violence is like an illumination. Suddenly the incomprehensible lights in front of the mind flash. This is a sudden process whose instantaneous contrasts with the heaviness of a verbal explanation”, as suggested in the ABC-book “Ombres nippones” on the website kichigai.com.

- In the Hindu and Vedanta tradition, access to *samadhi* and ultimate levels of consciousness can only, in the same way, occur suddenly, with a sharp break of ontological level of consciousness, as noted by Mircea Eliade [23] (page 70): “The level break India aims to achieve is in the samaddhi, which is the paradoxical way from knowing to be... This enstasis is in fact a rapture, since it is experienced without being provoqued... The enstasis is equivalent to a reintegration of different modes towards the real mode: primary non-duality, before the bipartition of the real into subject-object, undifferentiated fullness... (with feeling of) unit and bliss. There is a return to the origin, but enriched by dimensions of freedom and trans-awareness (or consciousness).”

State changes and thermal changes

- During meditation, the subject navigates among the hyperfine structures of the quiet state. We want to establish statistics relating to the occupation of each of the energy levels. But we can not talk about temperature because a priori we study a single subject. However, one can imagine averaging up the time the subject spends in each state. This approach is a little daring because there is a real state change dynamic over time. Some tried to describe it with thermostatic statistical tools, which implies invariance in time throughout the experiment. However, let’s try continue this analogy. The n_j population of the ε_j level of statistical physics now represents the time θ_j spent in the E_j state of energy. Then we can through the partition function “ Z ” (see *e.g.* the book of Bernard Diu *et al.* [18]) defining a “temperature” of the meditator, *modulo* this transformation by considering the population of n_j states during a time θ_j :

$$(2) \quad Z = \sum_j \exp\left(-\frac{\varepsilon_j}{kT}\right), \quad n_j = \frac{1}{Z} \exp\left(-\frac{\varepsilon_j}{kT}\right).$$

We then observe on the equation (2) that the psychic temperature is negative (!) if the subject spends more time in the excited state than in the base state.

- In meditations, it would also implies that when going from daily agitated state to quiet state, there should be a decrease in temperature and a regulation of vital functions. Or this is exactly what we see as neuroscience studies on the subject show that meditation causes almost mechanically a decrease in the release of stress cortisol, a regulation of blood pressure and heart rythm, an elevation of immune defenses [39], and for some types of meditation, a decrease in skin temperature as presented by Manocha *et al.* [40]. Other Tibetan meditation or yoga can also focus on increasing the temperature of the skin to fight against the cold.

Conclusion

- In conclusion, if we take the fractaquantum hypothesis in its very maximum, the analogy observed between the atomic system and the psychic system can continue: just as the photon allows moving from one atomic system state to another, there should be a boson (still to identify!) which would be the direct cause of the transition between two

states of mind. This boson could be chemical or electromagnetic or purely physical or biophysical.

- Without going to such a prediction, the fractaquantum hypothesis can minimally and by analogy notice the existence of a same mechanism explaining the process and state changes to quantum level and psychological level particularly in meditation. Meditation, when it reaches a stable and peaceful state of attention would thus reach or experience a contentfree underlying quantum field, which manifests itself locally and occasionally by small bursts or quanta of energy, fragments of thoughts, emotions or fleeting sensations appearing then disappearing immediately, which may ultimately lead to a state of joy and soothed presence. As if those changes and modulations tiny lived during meditation, were musical notes reflecting a fundamental quantum field, quantum song, a canticle of joy...

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