The Kegon-gyou Universe
A Frameless Inter-Reflecting Effervescence

Prof. Geoffrey Hunt

The basic principles of an ancient Buddhist sutra apparently provide a surprisingly fitting, coherent and fundamental conceptual framework for modern physics. I shall show this with reference to a popular work of modern physics. Both Kegon-gyou and modern physics are extraordinarily complex, and my aim is not to settle any questions but to fire the imagination and open up possibilities for new ways of thinking.

The sutra is known as *Kegon-gyou* in Japanese [華厳経], as the *Avatamsaka Sutra* in Sanskrit, as *Hwa-Yen* in Chinese, and as *The Flower Garland Sutra* in English. The basic principles are known as 'The Six Forms' [六相 roku-sou], which provide an analysis of the fundamental categories of phenomenological experience, and 'The Ten Mysteries' [十玄門 jyuu-gemmon], which manifest the interrelationship of phenomena[1].

I shall simplify these two sets of principles in English. The six forms are: whole (universal) and part (particular), sameness (unity) and difference (diversity), and formation (generation) and dissolution (decay). The ten mysteries, which explicate the six forms, are as follows:

1. Simultaneous mutual arising of phenomena.
2. Large and small phenomena include each other without boundaries.
3. The single phenomenon includes the multiple, and vice versa.
4. Mutual interpenetration of phenomena.
5. The unity of hidden and manifest phenomena.
6. The inconceivably small are of the same fundamental nature as all other phenomena.
7. Phenomena are continuously permeating and reflecting one another (note the metaphor of 'Indra's Net').
8. Any one phenomenon is not more complete (or 'true') than any other.
9. Any point in time (past, present or future) contains any other point in time.
10. At any instant, one phenomenon is principal, but any one can be.

I propose that if one could capture this vision of phenomena in one phrase it might be 'Frameless Inter-Reflecting Effervescence' (FIRE). That is, infinite

'bubbles' rising and falling, in some sense reflecting each other beyond space and time. By 'framelessness' I mean the absence of any absolute reference point such as location in space; by 'inter-reflecting' I mean that every phenomenon reflects every other; and by 'effervescence' I mean a constantly changing, fluid-like appearing and disappearing without end.

I shall try to show how these three philosophical categories seem to give shape to the basic concepts in modern physics, as exemplified in a new physical theory by the M.I.T. professor of physics and 2004 Nobel prize-winner Frank Wilczek. His theory is presented in his recent popular book, 'The Lightness of Being' (Basic Books, New York, 2008).

The main philosophical question that interests me is: how is it possible for an ancient scripture conceived long before the modern scientific age to correspond to such an extent to the basic concepts of the latest theory in the fundamental physics of the material world? Is it because the radical phenomenology of the Buddhist Dharma and the radical examination of physical reality both come together in the very foundations of human experience? What is the limit of the concordance between the three Kegon-gyou categories and modern physics, and what is the nature of this limit? References could be made here to a wide range of philosophers, from Immanuel Kant to Nishida Kitarou.

Abandoning Reductionism

We can see that the Six Forms serve better as a broad conceptual backcloth for modern physics than materialistic reductionism can. Materialist reductionism is a view of the natural world as ultimately composed of, and determined by, matter in motion. It claims to be able to present a complete explanation of the world exclusively in terms of a small set of causal principles. Considering holism, it is now increasingly accepted that any part may at a certain resolution, or for certain purposes, benefit from contextualisation within the whole, for example understanding the behaviour of electrons or genes.

The Cartesian-Newtonian view of the world is already behind us. To caricature that view: the universe is no longer regarded as a deterministic assembly of parts like a clock. A clock has a unity, but it is the unity of a machine made of separate and different parts working upon each other as cause and effect. However, the scientific quest continues for a Grand Unified Theory of Everything (GUTOE) in which all the physical forces are aspects of one primary force, and although this has not yet been achieved there is no reason in principle why it should not be achieved if the appropriate limitations of dualistic understanding are recognised. However, such a theory, it is now increasingly recognised, would in a sense have 'incompleteness' built

into it in so far as it would have to be non-deterministic (stochastic, probabilistic) and incorporate certain other non-traditional assumptions.

The unity of sameness and difference captures how for modern physics energy and matter are fundamentally equivalent. They appear different in one perspective and are the same in another ($E=mc^2$). Physics no longer conceives of molecules, atoms and subatomic particles as separate and different clockwork pieces, but more on the model of interacting waves. It is also now acknowledged that fundamental particles are not permanent, or eternal, or indestructible units but go in and out of existence, forming and dissolving continuously.

However, we might say that all of this is coincidence or mere analogy and is epistemologically insignificant. We need to take our analysis deeper.

I shall now show how the FIRE categories accord very well, up to a critical point, with the basic categories of Wilczek's theory. The critical point appears, I maintain, because the physical theory is by its very nature *dualistic*. It is a theory of the 'external world', which despite its doubts and difficulties still assumes an absent subject that can objectively characterise that 'world'. However, Kegon-gyou is at root *nondualistic*, in which subject and object are neither-one-nor-two, and this is the deeper meaning of the Ten Mysteries. The sutra is about *nondual* phenomena, while the scientific theory assumes *objective* entities (energy-packets) in space-time.

Inter-Reflection

The third mystery (many-in-one) captures the idea that anything which can be taken as a single thing may at once be taken as containing all the others. One might say in physics that any energy-packet is potentiated by all other energy-packets.

The fourth mystery (non-separateness) indicates that all phenomena mutually interpenetrate, which in physics shows up for example as waves passing through other waves, both in fluid dynamics and, more esoterically, the superpositions in quantum mechanics. The wave-function is by definition probabilistic and there is no determinate location for the 'particle' concerned. It would appear that quantum mechanics describes an external world that is fundamentally a field of replicating and interfering waves in which nothing is a separate, isolated entity.

The essential idea of inter-reflection is that every phenomenon, on deep analysis, both contains and is contained by every other in some way. 'Contains', of course, suggests a spatial relationship, which is problematic for us. This appears concordant with Wilczek's claim that every "fragment" of the whole 'Grid' (see below) i.e. "each space-time element", has "the same basic properties as every other fragment" (p. 111).

For the purposes of any specific technological investigation, however, we can and do treat relatively stable systems (such as a molecular structure) in isolation. To quote: "Moreover, these systems can be considered in isolation; their properties don't much depend on the state of the world as a whole". But Wilczek has a doubt and he adds in a footnote: "At least, that's a good working hypothesis, and it's justified by its success" (p. 122 n5). That is, "can be *considered*" as isolated, even though they are not absolutely so.

The fifth mystery of 'hidden and manifest' is also quite concordant with waves or fractal sets where we can see that what is hidden may be manifest at another point, or vice versa. Interfering waves may cancel each other out, and 'hide', only to manifest again under slightly changed conditions. This is also illustrated by what is called 'emergence' in Complexity Theory, as when non-manifest (hidden) sand crystals are manifested as sand dunes, or vice versa. At each level of scale, different natural laws come into play, but although they appear different to the laws of the lower level, they are in fact no more than different developments of the lower level laws, i.e. the same.

Effervescence

In classical Buddhism the 'impermanence' of *dhammas* is emphasized; nothing lasts, nothing is substantive or solid; everything is subject to rising and falling away, formation and dissolution, generated and degenerating. Nondual experience is like an infinite bubble factory, and so it seems is the physical universe.

The first 'mystery' (simultaneous arising) captures the idea that at some deep level all phenomena are connected and unified. This might mean that, despite apparent 'buffers' and 'knots' any phenomenon influences or potentially influences any other. That is, a change in one is potentially a change in all others, for there are no hard boundaries between phenomena. The ninth mystery states that this interpenetration or permeation is continuous, rising and falling, forming and dissolving[2].

Wilczek's main idea is that the universe is one unifying thing: energy. His work is a critique of the idea of matter as a substantive thing separate from energy. Hence the 'lightness' of being. He says,

> "The mass of ordinary matter is the embodied energy of more basic building blocks themselves lacking mass. Nor is space what it appears to be. What appears to our eyes as empty space is revealed to our minds as a complex medium full of spontaneous activity" (p. 1).

So his fundamental problem is a philosophical one: what fundamentally <u>is</u> 'reality' or the external world? The difference between matter and energy in

traditional physics is that the former has *mass* (p. 9). But modern physics challenges this division:

> "The new theory sees a world based on a multiplicity of space-filling ethers, a totality I call the Grid ... Our mass emerges ... from a recipe involving relativity, quantum field theory, and chromodynamics — the specific laws governing the behaviour of quarks and gluons" (p. 10).

The Grid is more fundamental than particles (or waves), for it is by its spontaneous activity that particles are created and dissolved. Wilczek explains how the attempt to understand atomic nuclei in terms of proton-neutron relations failed, but "instead uncovered a bewildering new world of transformation and instability" (p. 26).

For Wilczek "the most important lesson we learn from QCD [Quantum Chromodynamics, which is the theory of the strong interaction] is that what we perceive as empty space is in reality a powerful medium whose activity moulds the world" (p. 73). We might say that the Grid is alive with the effervescent 'bubbles' of quantum activity. *Quantum* activity has special characteristics: it is spontaneous and ultimately unpredictable; waves/particles appearing and disappearing, a kind of effervescence. So, "··· the entity we call empty space is an exotic kind of superconductor" (p. 96). But we do not know what kind of ether could do the conducting (as electrons do the conducting in ordinary superconductors). It is speculated that it is made of a new kind quantum particle, the Higgs-particle, but there could be many more kinds, so (I suggest) we may have one day to accept a never-ending multiplicity, as envisaged by the Kegon-gyou. Wilczek himself says, "Taken at face value, the most promising unified theories seem to predict the existence of all kinds of particles we haven't yet observed" (p. 97):

> "Quantum mechanics works with wave functions that represent many possible configurations of the fields at once... What's more, the things we are trying to calculate — the particles we observe — constitute small ripples in a turbulent sea of fluctuating Grid. To find the particles, numerically, we have to model the whole sea, and then hunt out the tiny disturbances" (p. 114).

The world is now seen, in Wilczek's words as a "tremendous multiple infinity of qubits" and an "infinity of infinities" (p. 120). If a 'googol' is 1^{100}, which is more than all the atoms in the visible universe, he says, then the Grid of space would be many googols of googols! In any case, the Grid is not just full of countless particles, but of fluctuations i.e. continuous and

indeterminate changes, with particles appearing and disappearing. As the Kegon-gyou says,

"I knew the number of atoms
In the ground where I walked,
And saw in each atom
As many lands as atoms in lands." (Cleary edn., p. 1315)

Framelessness

With the framelessness category of the Kegon-gyou we reach that critical point at which comparisons with modern physics become problematic, but in an illuminating manner. There is a fundamental contrast here. Without a frame of reference science is impossible. With a frame of reference, even vestigial, enlightenment is impossible. How does one negotiate the interface between the frameless and the framed?

In the second mystery (about 'large and small') we are told that not only does the large contain the small, which we know, but also that the small contains the large. At first sight this counter-intuitive notion baffles us, and we struggle to find a mental 'picture' of how this could be so, e.g. by some trick of perspective (such as the moon framed in a window); by mirror-like reflection (the moon in a bucket of water); by influencing and changing the large (a bacterium kills a human being); or by growth (the seed contains the tree). In terms of modern physics we may think of Einsteinian relativistic effects as when one body is travelling at near to the speed of light and the other apparently 'shrinks' .

The sixth mystery (the inconceivably small) speaks of what is so tiny that one cannot even imagine the size, indicating the infinity and multiplicity of phenomena and that one can never reach 'the bottom'. It is true that in the physical world nanoparticles are unimaginably small, and some molecules are even smaller, and atoms even smaller, and electrons and protons even smaller, and quarks and gluons even smaller. And what is beyond the quark, and is that a meaningful question?[4]

The eighth mystery is also a principle of framelessness: there is no privileged position, no definitive vantage point. One thing is not more complete (truer) than another, as in a fractal. The tenth principle is connected with the eighth, because if no point is ultimately privileged, then *any* point *can* be privileged at any moment. Any single thing can be taken as the main, principal or central one, since anything can serve as a vantage point or frame of reference.

Time is one aspect of the physical frame, revolutionised by Einstein's theories of relativity. Philosophers have shown a particularly intense interest

in 'time' for many centuries. The realist or Newtonian view is that time is real i.e. an actual dimension of the physical world , and Einstein takes space-time to be an 'objective fact'. It could be vizualised perhaps as a kind of container, containing happenings (i.e. putting them in sequence). The conceptualist view (Kant and Leibniz) is that time is not a dimension of reality at all, but instead a fundamental structure of our minds which we impose on the physical world to make sense of it. Leibniz was sensitive to the issue of frame of reference and in some ways pre-figured Einstein, for his position implied that there is no absolute location of an event or thing in either space or time, but only one relative to some other event or thing. At least one modern physicist has gone even further: David Bohm has struggled with a notion of a relation between time and timelessness, temporal and atemporal (Bohm, 2003).

The ninth mystery tells us that any time-location 'contains' any and every other. This is the counterpart of any space-location containing any other i.e. inter-reflection. It is striking that Bohm should also write: "..in any given period of time, the whole of time may be enfolded" (op.cit., p. 148).

Even relativity theory, which Wilczek assumes, cannot be put to any use without the selection of reference points. In modern physics these ultimate reference points are: energy, the speed of light in a vacuum, Planck's constant and Newton's gravitational constant. Speed, of course, presupposes time, as well as space, as an objective factor or dimension. Wilczek like all other physicists presupposes (and must presuppose) a spatio-temporal dimension as his frame of reference. Indeed, his central idea is 'The Grid', which fills time and space. It is difficult to see how physics could be formulated at all without a frame of reference of some sort. Without that he would no longer be doing physics but perhaps slide into the Dharma insight of nothingness (dharmadhātu)[3].

But Kegon-gyou is precisely a vision of 'no reference frame'; the absence of any absolute reference point, a 'nothingness'. Surely, in the framelessness mysteries, the Kegon-gyou is not speaking of 'external', 'physical' or 'material world' at all, but of a 'cosmos' in which spatial and temporal dimensions are absent or, if you prefer, inapplicable. That is, dimension (distance, duration) is absent. Only this 'no reference point' could elucidate the counter-intuitive idea that the smallest could contain the largest. Our conception that only the larger can contain the smaller is dependent on a spatial referent i.e. size. What is being described here, in Dharma terms, is the loss of materiality ('form-perception'), from which flows the loss of all causal reference points.

Here we come up against our own version of 'same and different': the ten mysteries and the framework of modern physics appear to be the same,

but are also quite different. As for the inconceivably small, the emphasis here may be on the term 'inconceivably' rather than on 'small'. It is a reminder that the Dharma cannot be 'conceived', for that by which it might be conceived (time, space, objects) are absent — no reference frame. So, a specific size is insignificant, in the sense that there is no frame by which one can judge between it and larger or smaller scales. There is no possibility of distinguishing between large and small.

Duality

Unsurprisingly, an implicit assumption underlying Wilczek's work is philosophical dualism. At certain points in his book one senses that he is up against this assumption, grappling with it, without understanding its epistemological nature. He takes for granted that there must be a something that is, to use his words, 'unavoidably there', that is independent of any observer, although he acknowledges the so-called observer effect (p. 74). This something is what he calls 'The Grid' which is not empty space but a kind of effervescing quantum soup, not unlike the 'ether' of older theories.

He goes on to say that quarks and gluons are not 'just another layer'. So at this point we do not have just another layer of material stuff, but it turns into something mental!

> "When properly understood, they change our understanding of the nature of physical reality in a fundamental way. For quarks and gluons are bits in another and much deeper sense, the sense we use when we speak of bits of information. To an extent that is qualitatively new in science, they are *embodied ideas*" (p. 33, italics in original).

At this point 'matter' seems to have disappeared and all we are left with are certain equations known as the Yang-Mills equations (in the Standard Model, i.e without gravity included). So, he says, 'quarks and gluons, or more precisely their fields, are mathematically complete and perfect objects. You can describe their properties completely using concepts alone, without having to supply samples or make any measurements'. (pp. 33-34)

Surely, this is a very curious thing for a physical scientist to say. It is as though he is up against a new kind of limit, an epistemological one, in which we look intently into reality and what we find there are the pure motions of our own minds, although he does not express it that way. Objective reality and subjective mind are united in those equations (unless one assumes there is a third, mathematical, reality). I am reminded of Zen master, Dōgen, who wrote, 'I came to realize clearly that mind is no other than mountains, rivers, and the great wide earth, the sun and the moon and

stars'. However, Wilczek cannot as a physicist pursue this line of thought into nondualism.

Indeed, his attachment to dualism underlies his "ideal for theoretical science", which is as follows:

> "We try to find mathematical structures that mirror reality so completely that no meaningful aspect escapes them. Solving the equations tells us both what exists and how it behaves. By achieving such a correspondence, we put reality in a form we can manipulate with our minds" (p. 112).

'Reality' is on one side, the mind is on the other trying to mirror it precisely. He thinks this resolves the longstanding materialist-idealist dualism of philosophy as a new materialist-mathematics union. In fact, it is still dualism.

His dualism is clear in his view of time, and differs radically from talk of time in the Kegon-gyou. He reverts to the Newtonian objectivist view: "Not that minds are necessary for time — I don't think many physicists would accept that (and the equations of physics certainly don't)". But in the very next breath he recognises that this depends entirely on a frame of reference: "But if the metric field vaporizes, with it goes the standard of time" (p. 104). The framelessness of Kegon-gyou does precisely that: it 'vaporizes' time. It is David Bohm that goes that extra step and confronts the difficulty (see above) .

Nonduality

It seems to me that there are two ways to approach the attempt to make sense of the (limited) concordance between the FIRE vision of the Ten Mysteries and the framework of modern physics. Either we begin from physics and look at the Mysteries, or we begin from the Mysteries in their true context and then look at physics. I would argue for the latter.

Physics: we begin with a view of the physical world, and then we imagine it stripped of all reference points, i.e. all frames, so that there can be no vantage point from any location in space and time. A frameless world, in which substantive matter, time and space were completely absent would perhaps have some concordance with this Kegon vision. So it could be thought that what the Ten Mysteries are doing is describing a physical world in process of being stripped of all reference points. One question is whether such a world would still be a 'physical world'.

Dharma: we begin with the actual experience of *samadhi* or absolute absorption in meditation, noting the arising and falling away of all 'things'

(now regarded nondually as 'phenomena'), that is meditational experience with no frame of reference, no separate subject and object. It is the standpoint of 'Emptiness' or 'Nothingness' in the Dharma teachings.

In both cases there is a loss of any frame or point of reference. The interesting question is whether there is (and if so, why there should be) any correspondence between the physics thought-experiment and the *samadhi* account. I think this is a key question that takes us from a dualistic to a nondualistic understanding of existence. From the point of view of physics we have to ask whether the historical logic of the scientific investigation of matter ('reality') must lead us to a referenceless world. In a sense, physics ultimately destroys itself.

Modern science is moving towards unification, which now 'nanoscience' too amply illustrates through its necessarily transdisciplinary and convergent character. This unification is a letting go of a multiplicity of human-centred assumptions, reducing them to the minimal set required to still function as an account of an 'external world'. Dharma meditation goes one step further, in a sense, on the path of unification. It is a letting go of the minimal set, attaining a unity by a letting go of the multiplicity of the phenomena of sense-experience.

Conclusion

The last step of letting go is a very large one, from science to Dharma, from dualism to nondualism, from minimal frame to framelessness, from foundation to no-foundation, from a perennial asymptotic incompleteness to an absolute completeness, from subject *and* object to subject-object, not-one-not two (dharmadhātu).

Thus subject and object appear to contradict one another at every point, and yet must be a unity, a contradictory identity. So, we leave the last word to the Japanese philosopher, Nishida Kitaro, on his life's work: "Some people will say that my logic of contradictory identity is not a logic. They may dismiss it as a religious experience. I ask them, however — what is logic?" (Nishida, 1987, p. 125).

References

Bohm, D. *The Essential David Bohm*, Edited by Lee Nichol, Routledge, London, 2003.

Chang, G C C. *The Buddhist Teaching of Totality: The Philosophy of Hwa Yen Buddhism.* Pennsylvania State U. P., 1971.

Cleary, T. (trans) *The Flower Ornament Scripture: A Translation of the Avatamsaka Sutra.* Shambhala Publications, Boston, 1993 (1984).

Mumford, D, Series, C, & Wright, D. *Indra's Pearls: The Vision of Felix Klein*, by Cambridge University Press, 2002.
Nishida Kitarou, 'Concerning my Logic' in his *Last Writings: Nothingness & the Religious Worldview*, Trans. D A Dilworth, University of Hawaii Press, Honolulu, 1987.
Wilczek, F. *The Lightness of Being*, Basic Books, NY, 2008.

Notes

1 'Mystery' is not a good translation, for it has irrelevant connotations in English. 'Profundities', or a phrase like 'dharma-gates', might better convey the idea.

2 A fractal or holographic object in motion would be a good demonstration of this. This could also be expressed by fractal development, since a portion at t_1 will duplicate a portion at t_2. So a fractal is a kind of change without change, unless one insists on fixing a vantage point. There is a difference between one level of the object and another, but it is a difference without a distinction. Fractal processes are common in the physical world.

3 The Mahayana concept of dharmadhātu (法界) means the realm of the Dharma or ultimate truth, an 'emptiness' in which phenomenon and noumenon (in Kantian terms) are one.

4 Prof. Leach (acknowledged below) informs me that 'most GUTOEs (e.g. string theory) predict that the smallest possible length is the Planck length, or 10^{-34} m, so they would say that this is a meaningful question'.

Acknowledgements

I am grateful to Prof. Richard Leach, a physicist at the National Physical Laboratory, UK, for his comments and corrections on an earlier draft. (The reader should not assume he is in agreement with everything I say here.) I also thank Prof. Eto Hiroyuki of Tohoku University and Prof. Matsuda Masami of University of Shizuoka for their translations. In my presentation for the Japanese Society for Comparative Philosophy, University of Shizuoka, Japan, 13th June 2009 I concluded with a 'Kleinian group' movie reproduced with permission from Prof. David Wright, Oklahoma State University, USA. http://klein.math.okstate.edu/IndrasPearls

APPENDIX: Translations of technical terms

Ten Mysteries, 各門の原語
In Chinese:
1 同時具足相応門

2　広狭自在無礙門（諸蔵純雑具徳門）
3　一多相容不同門
4　諸法相即自在門
5　隠密顕了俱成門（秘密隠顕俱成門）
6　微細相容安立門
7　因陀羅網法界門（因陀羅微細境界門）
8　託事顕法生解門
9　十世隔法異成門
10　主伴円明具徳門（唯心廻転善成門）

Kegon-gyou　華厳経

Jyu-gemmon　十玄門

School of Philosophy, Theology & History
St Mary's University College
Twickenham, London TW1 4SX
United Kingdom
huntg@smuc.ac.uk