

Madhyamaka in the Light of Quantum Physics -
A Modern Interpretative Comparison of Dependent
Origination with Quantum Interconnectedness

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- Just as dependent origination requires all involved components to be empty of an own nature (substance nihilism),
- so quantum interrelatedness only works in the absence of locally determined entities.
- In both cases "emptiness" leaves us with a "physical reality" of open dynamic systems that still allows for causality:
 - In the case of physics, this requires following David Bohm in rejecting genuine randomness and subscribe to what is nowadays known as “emergent quantum mechanics” (EmQM).
 - On the side of Buddhist studies, one has to go against the metaphysical nihilism of Madhyamaka interpretations.
- It could be argued that the accordance of a "realist Madhyamaka" with emergent quantum mechanics leads to a mutual strengthening of the respective positions in Buddhism and physics, i.e., substance nihilism and emergent quantum mechanics.

The Essence of Madhyamaka: Dependent Origination and Emptiness

- Dependent origination requires the emptiness of everything involved in the process
- If things (both mental and material) really existed independently in their own right, they could not influence each other.
- Emptiness then is not mere nothingness, but the absence of an independent existence
- According to this interpretation, Nāgārjuna does not reduce dependent origination to a mere nominal construct (metaphysical nihilism)
- But only rules out that *dharmas* have a *svabhāva* (substance nihilism).
- This allows one to understand dependent origination as a dynamic system of interrelatedness which precludes any clean separation between any individual component of the system—or any subsystem that is singled out for observation—and all the rest.

Mūlamadhyamakakārikā I.10:

Since the existence of entities devoid of a *svabhāva* is not found, the formula “when *x* exists, *y* comes to be” is not appropriate.

- The causal clause in the first part of the verse indicates that for Nāgārjuna the concept of existence presupposes an independent existence (*svabhāva*).
- With such an understanding the traditional formula for dependent origination does not work.
- To say *x* exists means *x* exists independently (*svabhāvena*), but an independent *x* cannot have any causal relation to anything.
- If the building blocks of the universe consisted of completely isolated, independent entities, there could be no interaction at all.
- Or else anything could arise from anything else—for instance, like darkness from light—as Candrakīrti explains in *Madhyamakāvatāra* VI.14.
- In other words, when one understands existence as an independent existence and attempts to reify the members of the traditional formula “when *x* exists, *y* comes to be”, the formula does not work anymore.

- *Mūlamadhyamakakārikā* XXIV.18 equates dependent origination with emptiness:

Which is dependent origination — that we call emptiness.

The latter is dependent designation. This is the right middle path.

- Dependent origination is not simply negated, in the sense of only being nominal
- In his *Lokātītastava* 7ab, Nāgārjuna thus endorses a “physical reality” of fire:

If a name and its object were not different, one’s mouth would be burned by [the word] fire.

- In other words, one does not bring something into existence by only saying it.
- My interpretation of MMK XXIV.18: Emptiness makes dependent origination possible
- Nāgārjuna’s return from emptiness to dependent origination in its aspect of dependent designation:

He underlines the role the labeling and conceptualizing mind has as part of the process of a dependently arising world.

Dependent Origination includes Mind and Matter

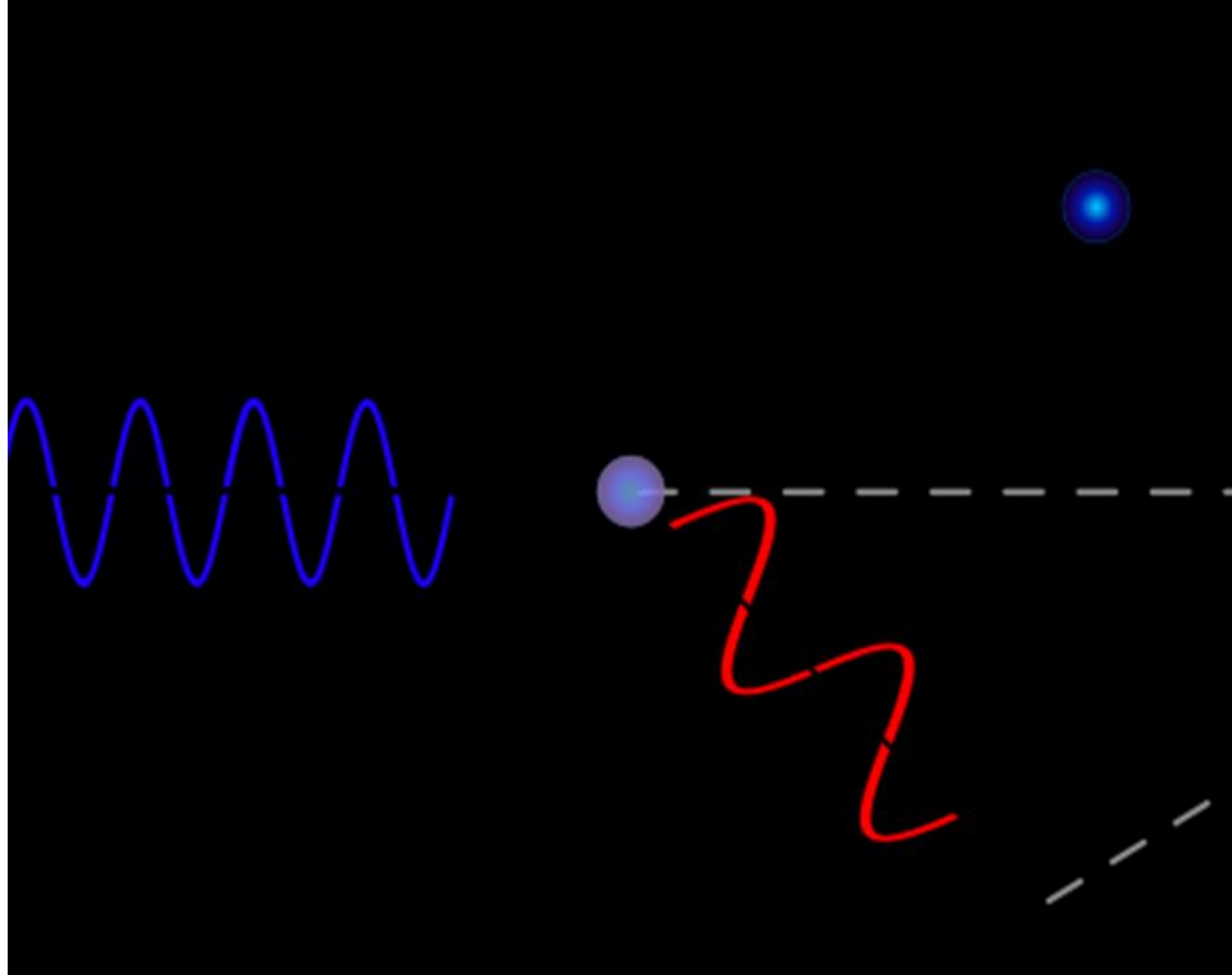
- Mind cannot be reduced to matter
 - If there was no mind, how could we know this?
 - How could we account for intention, free will, and morality?
 - How could we account for advanced stages of meditation, whose observation and investigation can be repeated by anyone ready to apply the technique?
- Matter cannot be reduced to mind

Accepting a physical reality is the most economical way of explaining our common experience of an external world

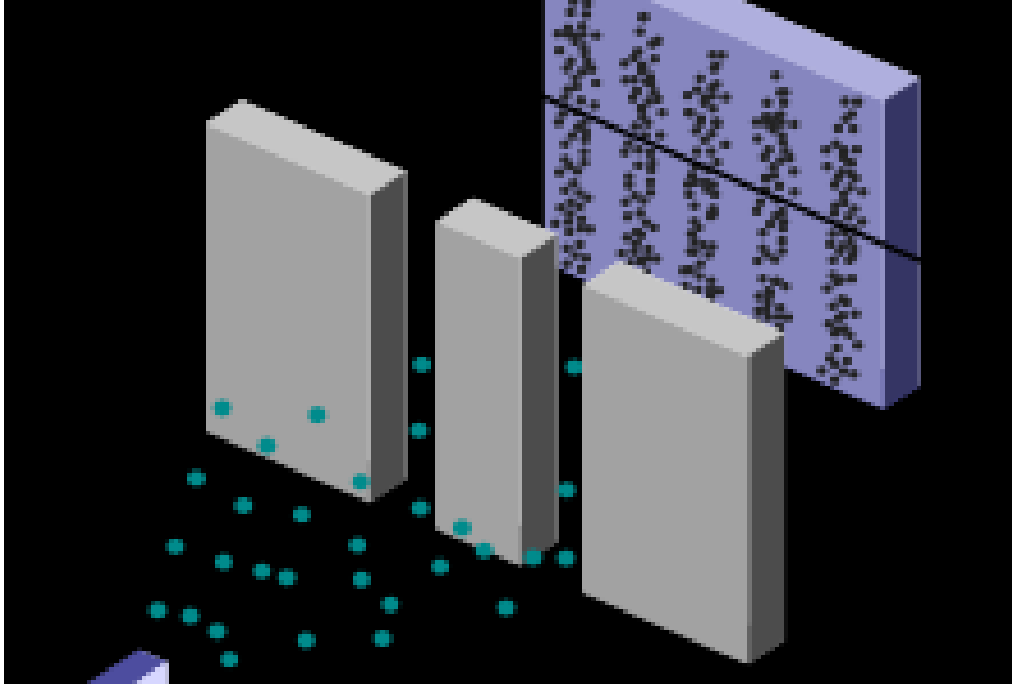
I propose:

- A complementary dualism rather than substance dualism
- Mind and matter are rather relational or complementary.
- Such irreducibility need not be unscientific: The wave and particle character of a photon, for example, are irreducible to each other.

Light Matter Interaction



When a gamma ray hits a gold atom, it must display its particle character in order to transmit impulse, as well as its wave character in order to transmit energy by increasing its wave length.



Only a single particle is emitted at a time

The amazing result is an interference pattern typical of a wave

- Anton Zeilinger: The observer decides whether the particle or wave character of the photon becomes reality.
- Feynman: Each particle makes it through both slits and even traverses every possible trajectory simultaneously
- Emergent Quantum Mechanics:
 - Whether the particle travels through the left or right slit is not random, must depend on slightly variant emission angles, etc.
 - The particle is a resonance phenomenon that interacts with its surrounding space
 - On its trajectory the particle leaves in the quantum vacuum a signature
 - Which interacts with subsequent particles
 - In sum, this could account for the interference pattern

Mind and Life Conference, Dharamsala 1997 (Arthur Zajonc 2004:139-40)

- A. Zeilinger: The photon does not exist on its trajectory between its source and the detector
- A. Zajonc: "If you allow that the photon, or the electron, by nature has that continued existence, then its own intrinsic nature is very strange, and believing this has a big impact on the way you see the world. If you say that it has no continued existence—that only the source, the detector, and certain events exist, and there is nothing that one can say about the particle's intervening existence—that is an easy way to avoid the impact of quantum mechanics. The effects are interesting, but they have no ontological significance. They don't make a statement about reality. For me, I think these experiments make statements about the way the world is."

Testing the Principle of Dependent Origination: Are Mind and Matter Capable of Mutual Interaction?

- Scientific materialists: mind is generated by the neuronal activity of the brain
- No influence of mind on matter is admitted because this would violate the principle of the conservation of mass and energy.
- But: the energy-time uncertainty principle in quantum physics allows for a short violation of energy conservation. (Wallace 2000, 142-43)
- One could thus argue that in principle it is possible for a nonphysical mind to engage with matter

Genuine Randomness and Dependent Origination

- Are individual quantum events truly random?
- Nonphysical causes,
- or even nonlocal interactions within entangled systems for example, cannot be excluded.
- David Bohm's theory of non-local causality: Causal relation of anything could be determined, if the initial state of a quantum event can be known.
- But an initial state or its causes can never be provided, so that in Bohm's model, too, one has the local randomness observed in experiment without abandoning causation altogether.
- From a Buddhist point of view, there would be no problem with that since a beginning with the primary cause of a Big Bang or the like is not postulated.

- David Bohm and Basil J. Hiley (1993) accept the existence of the quantum world only under the provision that a locally determined existence is excluded.
- Following this position, Jan Walleczek and Gerhard Grössing (2016:2) propose a “*quantum interconnectedness*, e.g., in the form of *non-local influences* across the universe.”
- According to EmQM, the quantum is a particle in terms of an emergent resonance phenomenon, which is inseparably connected with its surrounding vacuum (i.e. zero point field).
- To be sure, such particles do not exist in an isolated way, i.e., independent of their surrounding vacuum (Grössing et al. 2012:422).
- This interpretation is in opposition to orthodox quantum theory, in which any ontological reality on the level of the quantum is negated.

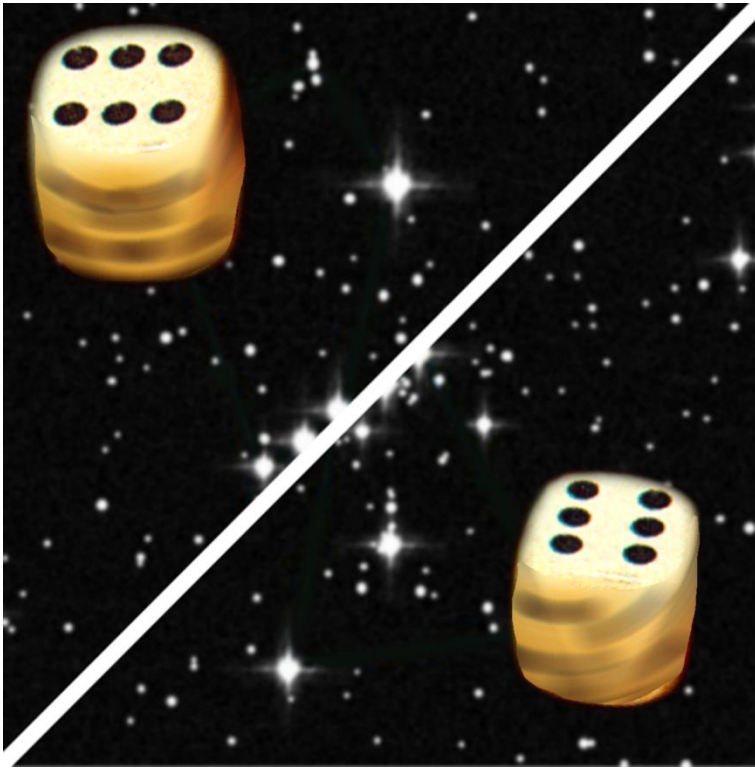
Emergent Quantum Mechanics (EmQM) (according to Walleczek and Grössing)

- Standard physics fails to unify quantum theory and general relativity theory
- Indeterminism and non-causality in orthodox quantum theory stand against causality and determinism in general relativity theory
- This metaphysical contradiction implies physical contradiction
- The concept of emergence helps advancing a common foundation, an inter-theory unification
- Entangled systems were first described by Einstein, Rosen and Podolsky as a *reductio ad absurdum*
- But now they are going to be used in encoding technology and a new generation of quantum computers

Entanglement

- Particles which have interacted physically remain under certain conditions entangled even after they have become separated. The shared state of polarization or spin remains indefinite until measurement.
- This calls into question our common sense view of a universe built up from locally determined real entities.
- Niels Bohr (1934) came to the conclusion that “isolated material particles are abstractions, their properties being definable and observable only through their interaction with other systems.”
- Foucault’s pendulum: only the most distant galaxies do not drift away from its initial plane of swing.
- Mach’s principle: the amount of resistance to movement comes from the influence of the whole universe
- This presupposes an universal interrelatedness

Entanglement (Erwin Schrödinger 1935)



- “Real non-locality” is proposed in the de Broglie-Bohm Theory
- John Bell succeeded in proving that no quantum theory based on the joint assumptions of reality and locality could be successful
- The Bell theorem leaves open the possibility that reality might be ontologically nonlocal in nature
- Walleczek & Grössing (2016):
 - EmQM is such a ontological, realist approach to quantum mechanics
 - Instead of “quantum randomness” there is “quantum interconnectedness”
 - Bell: What you do here, has immediate consequences in remote places
 - Bell: A real synthesis of quantum and relativity theories requires not just technical developments but radical conceptual renewal

Continued

- Emergent events are characterized by sensitive dependencies on initial conditions in combination with evolving boundary conditions
- This accounts for the rise of global macroscopic order from local microscopic randomness
- Involving top-down and bottom-up causal flows
- Quantum unpredictability could be explained as a consequence of the intrinsically self-referential nature of the governing dynamics
- It is possible that the universe is deterministic , i.e., nonlocally causal in non-local correlations (entanglement)
- Emergence theory still allows the universe to have an open future

- If we take Nāgārjuna to only deny the *svabhāva* of *dharmas*, i.e., locally determined factors of existence, his philosophy can be brought in line with the position of emergent quantum mechanics.
- The common ground would be then a “physical reality” of dependent origination that can be compared to quantum interconnectedness.
- What is left, then is a dynamic reality that is possible because of
 - its emptiness of *svabhāva* (Buddhism)
 - or its absence of locally determined particles (physics).
- In Buddhism this is realized by refraining from any form of reification, i.e., wrong denial and superimposition.
- Candrakīrti (ca. 600 – ca. 650 CE) and much later also Maitrīpa (986-1063) refer to this as wisdom.
- The *dharmas* (“factors of existence”) that still constitute in their interconnectedness true reality, then, are *buddhadharmas* (i.e., Buddha qualities). (see *Samādhirājasūtra* XXXII.8ab (SRS 195₂₄): “All *dharmas* are *buddha-dharmas* [for those] who are trained in *dharmatā*.”

Buddhism and Physics – Some Final Thoughts

- On top of presenting models of reality that are based on logical principles
- Both of them profit from a continued corrective
 - In Buddhism, statements about the nature of mind etc. must be verified or falsified on the basis of one's own studies, critical analysis, and meditation ("Rely on wisdom, not ordinary consciousness")
 - In physics, theorems are based on empirical data gained from experiments. They are only valid as long as counter-evidence is observed
- But can the first person method of Buddhism be compared to physical experiments?
- In Buddhism, only a mind that is not overpowered by ignorance, hatred and attachment, is capable of gaining insight into the true nature of mind and things
- Is a Western scientist then at all capable of valid insights, or do expensive particle accelerators etc. make up for the deficit?

- Scientists, on the other hand could question the first person method of Buddhism
- Still there are these puzzling similarities between quantum physics and Madhyamaka
- True, quantum genuine randomness contradicts dependent origination.
- But new theories that try to unify quantum mechanics and general relativity theory, work with non-local causal flows, that allow for local microscopic randomness.
- The non-local causal flows could be compared to Nāgārjuna's dependent origination
- And microscopic randomness to nonarising from self, other etc.

- In conclusion, I suggest that the emptiness of dependent origination, does not necessarily entail a nihilistic position.
- In my opinion, emptiness should not be compared to the nothingness of a vacuum in classical physics,
- but rather to a quantum vacuum with infinite potentiality.
- This not only means that emptiness has the potential to manifest the manifold appearances of the world,
- but also that its realization discloses the primordial Buddha qualities, as explained in the *Tathāgatagarbhasūtras*.
- Depending on whether one's mind is in a mode of reifying or not, it is *saṃsāra* and *nirvāṇa* that emerge from emptiness.