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**Kabbalah and the Physics of David Bohm**

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# Kabbalah and the Physics of David Bohm

HYMAN M. SCHIPPER

*Jewish General Hospital and  
Department of Neurology & Neurosurgery and Department of Medicine  
3999 Cote St. Catherine Road  
McGill University, Montreal, Quebec, H3T 1E2 Canada  
hyman.schipper@mcgill.ca*

The development of quantum physics over the last century has stimulated a *rapprochement* between contemporary science and the Jewish mystical tradition or Kabbalah. Here, evidence is adduced from the classical mystical texts (e.g. the *Zohar*) and the works of leading Kabbalists of the 16<sup>th</sup>-18<sup>th</sup> centuries supporting an hypothesis that pivotal concepts elaborated by the influential physicist, David Bohm (1917-1992) are intrinsic to the Jewish mystical worldview. Specifically, we will demonstrate striking parallels between the “implicate-explicate orders” and “holographic universe” of Bohmian mechanics and the Kabbalistic principles of *Hitlabshut* (ensheathment), *Hitkallelut* (interinclusion) and *Hitkashrut* (interpenetration). Possible implications of these homologies for epistemology, religion and modern physics are discussed.

*Keywords:* Bohm, Consciousness, Enfoldment, Explicate order, Fractal, Hidden variables, Holographic universe, Implicate order, Interinclusion, Interpenetration, Jewish mysticism, Kabbalah, Quantum physics, Unfoldment

## 1. Introduction

The last quarter century has witnessed a burgeoning literature relating contemporary science—and in particular, quantum physics—to the Jewish mystical tradition or Kabbalah [1-7]. In some instances, scientists have extracted from the latter metaphors that clarify, add perspective or lend vividness to scientific concepts, many of which hinge on arcane mathematical formulae, which are often counter-intuitive and difficult to convey in ordinary parlance [3]. On a more profound level, and germane to the thesis of this paper, is the possibility that modern physics and ancient mysticism display unprecedented degrees of confluence because both disciplines—one founded on empirical research, the other anti-empirical and revelation-based—may provide legitimate and complimentary insights into the nature of reality.

The current work contributes to this ongoing dialogue by bringing to light several remarkable parallels between the Kabbalah and the science of the 20<sup>th</sup> century physicist, David Bohm. To develop this theme, we begin by briefly recapitulating the ontology of quantum mechanics (QM), with emphasis on the contributions of Bohm. We then discuss the concepts of

*Hitlabshut*, *Hitkallelut* and *Hitkashrut* in the context of broader Kabbalistic doctrine as elucidated in the classical mystical texts (mainly the *Zohar* and *Etz Chaim*) and the writings of Rabbi (R') Moshe Chaim Luzzatto (1707-1746) and R' Shalom Sharabi (1720-1777). We attempt to demonstrate, notwithstanding the radically different lexicons naturally invoked by these disciplines, a concordance of perspective between the Kabbalistic ideas of *Hitlabshut*, *Hitkallelut* and *Hitkashrut* (defined below) and the ‘implicate order’ and ‘holographic universe’ of David Bohm (1917-1992). We conclude by reflecting on the value of such exercises for the enrichment of both science and religion.

## 2. Clarifications and Disclaimers

The main objective of this exercise is to test an hypothesis that features central to the physics of David Bohm are intrinsic to the mystical worldview of the Kabbalists. Our goal is not to provide sweeping generalizations concerning perceived similarities between Jewish mysticism and contemporary physics. Rather, we focus here on several specific aspects of Bohmian mechanics (the ‘implicate order’ and

'holographic universe') and the Kabbalah (*Hitlabshut*, *Hitkallelut* and *Hitkashrut*) which we believe may cohere both disciplines within a common conceptual framework. Nor do we argue that prescient insight into the underpinnings of physical reality is unique to the Jewish mystical tradition. Indeed, non-Jewish metaphysical systems, e.g. Plotinus's *Enneads* 5, the writings of Thomas Aquinas and various Eastern philosophies, contain motifs that resonate with current scientific thinking. The Kabbalah frequently employs the term, "light" (*Ohr*, in Hebrew) metaphorically to connote spiritual forces which emanate from, and mediate the Will of, the Creator.

conventional, physical light. Similar uppercase lettering or italics is employed for "Space", "Time", "Before", "After", "Above" "Below", etc. when purely metaphysical constructs best conveyed by such terms are intended. Key passages cited from the Hebrew and Aramaic literatures are reproduced (in transliteration) to allow interested readers to render their own interpretations. A glossary of the relevant Kabbalistic terms is provided in Table 1. The author was granted a *Heter* (Rabbinic assent) from the *Posek* (adjudicator), Rabbi Ephraim Goldstein (Brooklyn, NY) to proceed with this initiative.

Table 1

<i>Abba</i> : Father; a <i>Partzuf</i>
<i>Adam Kadmon</i> (A"K): Primordial Man; a World
<i>Arich Anpin</i> (A"Y): Long Countenance; a <i>Partzuf</i>
<i>Asiyah</i> : the World of Action
<i>Atik Yomin</i> (A"Y): Ancient of Days; a <i>Partzuf</i>
<i>Atzilut</i> : World of Emanation
<i>B'chira</i> : free will
<i>Binah</i> : Understanding; a <i>Sefirah</i>
<i>Briah</i> : the World of Creation
<i>Chesed</i> : Lovingkindness/Expansiveness; a <i>Sefirah</i>
<i>Chalal</i> : empty "space" (also <i>Makom Panoy</i> )
<i>Chochmah</i> : Wisdom; a <i>Sefirah</i>
<i>Da'at</i> : Knowledge; a <i>Sefirah</i>
<i>Ein Sof</i> : the Infinite (Godhead)
<i>Etz Ha'chaim</i> : Tree of Life; Kabbalistic superstructure
<i>Gematriyah</i> : sum of numerical values of letters comprising a Hebrew word or phrase
<i>Gevurah</i> : Strength/Restriction; a <i>Sefirah</i>
<i>Gilui</i> : revelation
<i>Havdalah</i> : concluding Sabbath blessings (Jewish liturgy)
<i>He'elam</i> : concealment
<i>Hitkallelut</i> : interinclusion
<i>Hitkashrut</i> : interpenetration
<i>Hitlabshut</i> : enclothment; ensheathment; overlap
<i>Hod</i> : Splendor; a <i>Sefirah</i>
<i>Imma</i> : Mother; a <i>Partzuf</i>
<i>Kav</i> : line or ray (of the <i>Ohr Ein Sof</i> )
<i>Keli</i> : "vessel" of a <i>Sefirah</i> that holds its share of <i>Ohr</i> (Light)
<i>Keter</i> : Crown/Divine Will; a <i>Sefirah</i>
<i>Klal</i> : whole/wholeness; generality
<i>L'vush</i> : "clothing"
<i>Makom Panoy</i> : empty "space" (also <i>Chalal</i> )

Table 1

<i>Malchut</i> : Kingship; a <i>Sefirah</i>
<i>Mashpiah</i> : donor; connotes Masculine influence
<i>Midrashic</i> : homiletic
<i>Mispar Katan</i> : numerical diminutive of a <i>Gematriyah</i>
<i>Mitzvah</i> ( <i>Mitzvot</i> , pl.): positive deed
<i>Miyut Ha'yareach</i> : diminishment of the Moon
<i>Mochin</i> : "brains" ( <i>Sefirot</i> of a higher <i>Partzuf</i> which 'animate/control' a lower <i>Partzuf</i> )
<i>Netzach</i> : Victory/Eternity; a <i>Sefirah</i>
<i>Nukva</i> : Feminine; a <i>Partzuf</i>
<i>Ohr</i> : Light (metaphysical)
<i>Oivi</i> : "horizontal", often implying 'ascent' into greater wholeness
<i>Orech</i> : "verticality", often implying 'descent' into greater separateness
<i>Partzuf</i> ( <i>Partzufim</i> , pl.): face/visage/countenance; a configuration of <i>Sefirot</i>
<i>Pirud</i> : divisiveness/separateness
<i>Prat</i> ( <i>Pratim</i> ; pl.): part/particular
<i>Raisha D'Lo Ityadah</i> ( <i>Radla</i> ): The Unknowable Head (aspect of A"Y)
<i>Reshimu</i> : residue (of the <i>Ohr Ein Sof</i> )
<i>Seder Hishtalshelut</i> : Causal hierarchy within the Kabbalistic superstructure
<i>Sefirah</i> ( <i>Sefirot</i> , pl.): metaphysical Force or Attribute of the <i>Ein Sof</i>
<i>Shlaymut</i> : wholeness
<i>Tiferet</i> : Beauty/Harmony/Truth; a <i>Sefirah</i>
<i>Tikkun</i> ( <i>Tikkunim</i> , pl.): rectification
<i>Tzimtzum</i> : retraction (of the <i>Ohr Ein Sof</i> )
<i>Yesod</i> : Foundation; a <i>Sefirah</i>
<i>Yetzirah</i> : the World of Formation
<i>Ze'ir Anpin</i> (Z"Y): Small Countenance; a <i>Partzuf</i>
<i>Zivug</i> : union

When used in this context throughout the manuscript, "Light" is capitalized to distinguish it from

### 3. Quantum Physics

An historical account of key developments in quantum physics, with particular emphasis on Heisenberg's Uncertainty Principle (UP), was previously published in the *Torah u-Madda Journal* [8]. Quantum mechanics (QM) is an enormously insightful branch of physics that builds upon and transcends classical (Newtonian) notions of material existence [9, 10]. Many have identified the origins of QM with the discovery of "blackbody radiation" (the delivery of energy in discrete packets, or "quanta") by Max Planck in 1900. A quantum mechanical understanding of matter, energy, space and time unfolded apace with the seminal contributions of Ernest Rutherford, Niels Bohr, Albert Einstein, Werner Heisenberg, Erwin Schrodinger and others in the first half of the 20<sup>th</sup> century. During the last sixty years, input from pioneers such as Murray Gell-Mann, Richard Feynman, Steven Weinberg and Eugene Wigner have enabled further refinements of quantum theory, a marriage of particle physics and cosmology, and the advent of numerous 'disruptive' technologies based on this knowledge. Interested readers are referred elsewhere for further details concerning the history of quantum physics and a timeline of key discoveries which have punctuated the field [9-11].

The tenets of QM differ profoundly from those of classical physics in ways that often appear paradoxical and highly counter-intuitive. In classical physics, it is theoretically possible to ascertain the position and momentum of every particle in the universe and thereby accurately determine the future. In contemporary QM, it is fundamentally impossible to predict future events because one can never attain full knowledge of the position and momentum of even a *single* particle. In the standard (Copenhagen) interpretation of QM, every possible outcome for an event, represented mathematically as a statistical wavefunction, exists in the unobserved state. The act of observation elicits a "collapse of the wavefunction," whereby one of these many potential outcomes is "selected" as the reality actually experienced [12].

Germane to the current thesis, a considerable body of quantum theory and experimental evidence implies that (i) all particles emerging from the Big Bang singularity maintain an indefinite 'connectedness' with one another, (ii) each particle therefore 'knows' about the existence of every other particle, and (iii) due to preserved complementarity, the properties of one particle (e.g. position, momentum, spin, etc.) change instantaneously and commensurate with changes in a 'partner' particle regardless of the extent of their physical separation (Einstein's whimsical "spooky action at a distance"). For the latter to arise by classical causal interaction, information would need to pass from

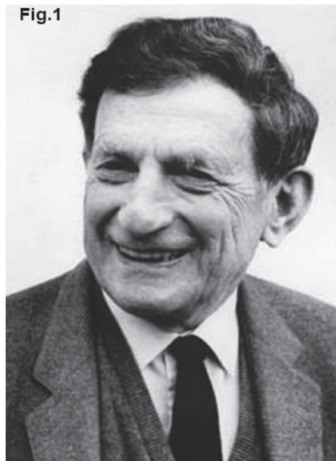
particle A to particle B at impossible supraluminal speeds. Quantum theory dictates that the particles' shared history forever "locks" them in a reciprocal dance ("quantum entanglement") that does not obligate the transmission of new information between them ("acausality"). Citing examples from the physical and biological sciences, Edgar Mitchell maintains that "the non-local attribute of nature is much more than just a curious artifact of subatomic particle interactions, but rather is a more fundamental phenomenon that appears at all scale sizes" and that "any waves reverberating through the universe remain coherent with the waves at the source, and are thus sufficient to serve as the reference to decode the holographic information of any quantum hologram emanating from remote locations [13]." Bohm brings the notion of the Universe's interconnectedness to an entirely new level by injecting into QM the concepts of an 'implicate order' and a 'holographic' design, as described below.

### 4. The Physics of David Bohm

Bohm's physics cannot be considered 'mainstream' in so far as it deviated from the classical Copenhagen interpretation of quantum mechanics. Yet, Einstein openly acknowledged Bohm as one of his intellectual successors [14]. Indeed, Bohm's imprint not only regarding physics but on many fields of science, philosophy and sociology has endured and even gained in popularity with the passage of time [15]. In this section, we present a brief overview of Bohm's life and describe his seminal contributions to physics with emphasis on his 'implicate order' and 'holographic universe'. In Section 5-6, we argue that these Bohmian themes are highly concordant with a world-view ensconced in earlier Kabbalistic literature.

#### 4.1. Biosketch

David's father, Shmuel (Sam) was raised in an Orthodox Jewish (Chassidic) home in Munkacs, Hungary and immigrated to America with his family towards the end of the First World War. David Joseph Bohm (Fig. 1) was born in Wilkes-Barre, a small Pennsylvania mining town, in 1917. Although displaying no particular intellectual proclivities in his childhood years, his imagination for the physical sciences was purportedly fired by a science fiction article on inter-planetary travel he read at age ten. He became obsessed with astronomy, the harmonious motion of celestial bodies, hidden dimensions, and the nature of light. An introverted and physically awkward boy, David cultivated his leisure wandering in the forests and hills surrounding his town after school while his classmates played baseball [14].



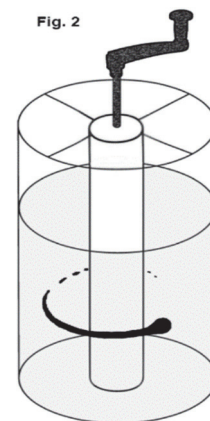
**Figure 1.** David Joseph Bohm (1917-1992). [©Mark Edwards/Still Pictures]

In his later teenage years, Bohm became fascinated with the logic of mathematical proofs as applied to geometry and algebra. He spent tranquil college years at Penn State contemplating a 4-dimensional cosmology which differed substantially from Einstein's Theory of Relativity. In college, he also developed an interest in politics with strong socialist leanings. His political views were destined to become curiously interwoven with his burgeoning scientific conjectures, and also bring him unwelcome scrutiny from the American government. Bohm went on to study physics at the prestigious California Institute of Technology. Despite receiving kudos for displays of mathematical brilliance, he regarded the ambience at CalTech as competitive, stifling and uninspiring. Bohm therefore abandoned CalTech in mid-curriculum to join a theoretical physics group headed by the renowned J. Robert Oppenheimer at the University of California (Berkeley) which he found liberating. There, his scientific creativity blossomed in areas ranging from the physics of particle collisions to high-energy plasmas. But it was afterwards, at Princeton and beyond, that the iconoclastic Bohm withdrew from mainstream physics to develop his theory of 'hidden variables' and the 'implicate order'. He was particularly disappointed in the way Niels Bohr and other leading physicists dealt with matters of interconnectedness and causality [16]. More and more, his conceptualization of Nature adopted a holism more reminiscent of Eastern religious philosophies than the prevailing science of his time. The physicist's rich and protracted correspondence with the Indian teacher and mystic, Jiddu Krishnamurti, whom Bohm revered, undoubtedly helped shape the emerging Bohmian *umwelt*. Bohm's perspective on Wholeness and of the universe as Hologram represented a startling departure

from conventional physics with profound implications for the neurosciences, psychology, consciousness and religion. The following sections elaborate on several key themes of Bohmian mechanics which, we believe, have compelling homologues in the Kabbalistic literature.

#### 4.2. *Hidden Variables and the Implicate Order*

Bohm's theorising and mathematical platform led him to consider the Cosmos and its myriad contents and processes as an emergent property of an indivisible Wholeness which he termed the "holomovement". Bohm conceptualized the holomovement as manifesting two major incarnations: (i) a familiar reality or 'explicate order' consisting of all things and events which are amenable to our senses directly or via instrumentation and (ii) an 'implicate order' comprising layer upon layer of 'hidden variables' beyond our perception. He viewed each deeper layer as more abstract than, but ultimately causative for, the dimension mapping immediately superficial to it, with the most proximate hidden layer giving rise to the explicate order. Bohm construed every perceptible object and event as rooted in a vast, possibly infinitely regressing series of causal matrices that ultimately originate from a state of absolute and inconceivable Wholeness. Bohm envisioned a highly dynamic interaction between the implicate and explicate orders. In Bohmian mechanics, shifts designated 'enfoldments' periodically make implicate that which was previously explicate – while 'unfoldment' of certain hidden variables renders them explicate and within the purview of human awareness [17, 18].



**Figure 2.** The implicate and explicate orders. Represented by Bohm as an ink drop in a rotating, glycerin-filled cylinder (see text for details). [From <http://forumserver.twoplustwo.com/137/religion-godtheology/alpha-omega-gravity-order-899479>, with modifications.]



To illustrate these points and their implications, Bohm invoked relatively simple analogies derived from everyday physical phenomena: 1) *Explicate and implicate orders*: Picture two concentric cylinders separated by a translucent viscous material such as glycerin (Fig. 2) [18]. Add a drop of black ink to the glycerin. While the cylinders are stationary, the ink is clearly visible as a dark spot within the glycerin (explicate order). Rapidly rotate the inner cylinder about its long axis. The black dot first stretches into a thin dark filament (still explicate) but soon disappears from view entirely (implicate order). Although the ink is now implicate, the information ‘coding’ for the original black spot is not lost. Indeed, if the motion of the cylinder ceases and is then resumed in the opposite direction, the dispersed, imperceptible particles of ink coalesce to reform the dark filaments and eventually the original ink spot itself (explicate order). Bohm would refer to the initial disappearance of the ink spot/filament as ‘enfoldment’ within the holomovement, and its re-emergence as ‘unfoldment’. 2) *Motion*: The standard interpretation of motion is that of an object moving from point A to B within the experiential (Bohm’s explicate) realm. In Bohm’s model, again drawing on the glycerin cylinder analogy, two drops of ink, A and B, are added to the rotating glycerin separated by time and space, e.g. 5 seconds and 5 millimeters apart. The inner cylinder is rotated until both spots become implicate, with Spot B disappearing 5 seconds after Spot A. At this juncture, the myriad particles belonging to Spots A and B are extensively inter-mingled, although the ‘memory’ of each particle’s trajectory from its original ink spot is conserved as described above. The cylinder is then immobilized and spun at the same rate in the opposite direction. After a defined number of turns, spot B materializes (becomes explicate), followed 5 seconds later by the appearance of Spot A. As the cylinder rotates further, Spot B now becomes implicate and Spot A remains visible for an additional 5 seconds until it, too, enfolds. If this experiment is repeated with the reverse rotation conducted at much greater speeds, it will seem as if a single ink spot emerges and moves 5 millimeters from position B to position A before disappearing. Thus, according to Bohm, the linear motion of objects (be they electrons or elephants) we perceive in the experiential world is an illusion resulting from complex cycles of unfoldment-enfoldment between the implicate and explicate orders. [The latter should not be confused with the motion-like illusion provoked by a row of neon lights blinking in rapid succession as such phenomenon, in Bohm’s terminology, requires no enfoldment and is entirely manifest within the explicate order.] In the foreword to Michael Talbot’s popular book *The Holographic Universe* [19], Lynne McTaggart, citing

Talbot, writes: “Bohm believes the reason subatomic particles are able to remain in contact with one another (see Section 3) is not because they are sending some sort of mysterious signal back and forth, but because their separateness is an illusion...at some deeper level of reality such particles are not individual entities, but are actually extensions of the same fundamental something.” McTaggart goes on to state that “Bohm considered the universe a giant information headquarters of ‘unbroken wholeness’, in which everything in the universe is already present in some invisible domain beyond time and space – a field of all possibility – there to be called forth and made ‘explicate’, or manifest, when necessary.”

### 4.3. *The Holographic Universe*

Holography was discovered in the 1940s by the Hungarian-Jewish mathematician, Dennis Gabor for which he was awarded the 1971 Nobel Prize in Physics [20,21]. The Merriam-Webster dictionary defines ‘hologram’ as “a 3-dimensional image reproduced from a pattern of interference produced by a split coherent beam of radiation (as a laser) [22]”. Essentially, a hologram is a 2-dimensional recording of an interference pattern within a light field which, when appropriately illuminated (e.g. by laser), reconstructs a 3-dimensional image of the object originally captured within that field (Fig. 3). Unlike conventional photographs, holograms exhibit parallax and other visual depth cues that vary in a realistic manner with changes in the vantage point of the observer. Holograms also differ from the former in another, rather dramatic way: If one cuts out the left, bottom quarter of a standard photograph depicting a woman, the excised segment may contain an image of only her right leg. Subject the latter to the same procedure and perhaps only her right ankle will be visible in the smaller fragment. In the case of a hologram, however, the isolated portions reconstitute an image of the *entire* woman, albeit in miniature. This pattern repeats itself unendingly, producing smaller and smaller – but intact – women (or as per the case depicted in Fig. 3, globes), as the holographic image is progressively dissected. Simply put, in holograms the whole is recapitulated in each of its parts. According to the principles of quantum physics, this counter-intuitive phenomenon is based on the *non-local* nature of the interference pattern of light (see Section 3) which conveys the information needed to re-assemble the holographic image.

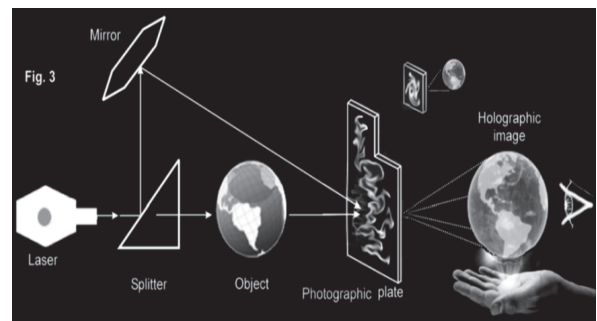
In addition to, and incorporating the concept of implicate and explicate orders, Bohmian mechanics posits that the entire Cosmos is based on a grand holographic design – with each part containing (enfolding) a miniature replica of the entire universe!

Bohm considered the existence of each component to hinge upon its intimate relationship to the whole, implying that individuality is only feasible if it unfolds from wholeness. In Bohm's words: "Quantum physics reveals a basic oneness of the universe" [23]; "The world acts more like a single indivisible unit, in which even the 'intrinsic' nature of each part (wave or particle) depends . . . on its relationship to its surroundings" [24]; and "The inseparable quantum interconnectedness of the whole universe is the fundamental reality, and [the] relatively independent behaving parts are merely particular and contingent forms within this whole" [25]. According to Bohm, our conventional notions of space, time, distance and separation apply only to the 'surface' of things as they are revealed within the explicate order. Akin to a hologram, two physical objects may be separated by vast expanses of space and time in the linear, explicate order, while little or no such separation may exist between their hidden components enfolded within the implicate order [26]. Evidence in support of Bohm's 'holographic universe' has been adduced in fields as disparate as astrophysics, molecular biology and the neurosciences [13, 16, 27-29]. One such intriguing report was published in 2007 by Jacob Bekenstein in *Scientific American* based on a theoretical analysis of 'black holes'. A black hole is a region of spacetime, thought to arise from the collapse of a star, with matter so dense and gravitational forces so powerful that nothing—not even light—can escape from inside it. According to Bekenstein, the mathematics underpinning certain behaviors of black holes suggest that all information in the universe, as in a hologram, is encoded on 2-dimensional (flat) surfaces and then transduced ('read out') by our minds as 4-dimensional spacetime [30]. Supported by experimentation in humans, animals and isolated nerve cells in culture [31-33], the Stanford neuroscientist Karl Pribram concluded, independently of Bohm (whom he later consulted), that aspects of the human brain may operate holographically ("holonomic brain theory"). Pribram's findings led him to dispute vigorously theories of topographically-discrete localization of brain functions favored by Wilder Penfield and others. Pribram argued that many functions of the central nervous system, e.g. memory storage/retrieval, sensory perception and consciousness, are at least partly non-localizing and better understood as enfoldments/unfoldments within a complex implicate neural order [14, 16, 18, 34-37]. Citing the work of Marcer & Schempp [28], Mitchell hypothesized that in the act of perception the brain behaves as a "quantum computer which utilizes both quantum and space/time information [13]". Some have even conjectured that human intuition, paranormal phenomena such as telepathy, clairvoyance and telekinesis, and certain

neuropsychiatric states (e.g. schizophrenia) may be products of nonlocal quantum neuroholography [13, 16, 38-40].

## 5. The Kabbalah

The Kabbalah teaches about a hierarchy of interlocking spiritual domains which progressively 'descend' in holiness, beginning with the unfathomable Godhead, traversing fractal-like through a system of 'coarsening' immaterial worlds, and culminating in the Creation of the physical universe. In addition to elaborating an ontology for all existence, the Kabbalah explains, often allegorically, the hidden ways by which God continuously guides the unfolding universe and the dynamic systems that are in place to interact with Nature and humanity. As depicted in the Kabbalah, the universe is governed by a complex system of "Lights" or forces which, through myriad interactions, provoke chain reactions that ultimately impact humans and their physical surroundings [8, 41]. Central to the Kabbalistic viewpoint is the absolute unity of the Creation at its core, with all semblances of separateness and differentiation becoming apparent only after "filtration" of the one Infinite Light (*Ohr Ein Sof*) through the various *Sefirot* (defined below).

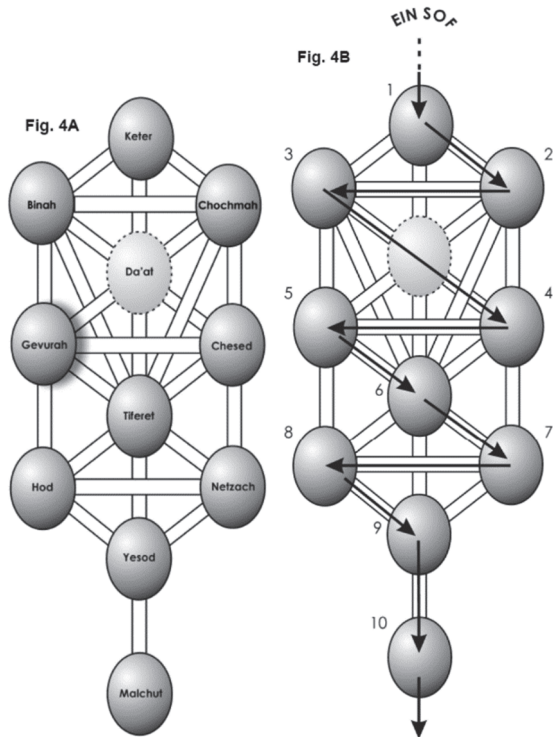


**Figure 3.** Laser holography. See text for details.

The primary Kabbalistic texts we have consulted are the *Zohar* (Book of Radiance), the teachings of R' Yitzhak Luria (the *Arizal*; 1534-1572) as transmitted by his student R' Chaim Vital (1543-1620), and the works of R' Moshe Chaim Luzzatto (*Ramchal*; 1707-1746) and R' Shalom Sharabi (*Rashash*; 1720-1777). The *Arizal* elaborated all the main concepts of the Kabbalah and provided innovative explanations of the *Sefirot* and *Partzufim* ("configurations" – see below). The corpus *Etz Chaim* (Tree of Life), compiled by R' Vital, encompasses the teachings of the *Arizal* and remains the major reference text of Lurianic Kabbalah. In eighteenth century Europe, the *Ramchal* and *Rashash* greatly



facilitated the contemporary understanding of the Kabbalah by re-organizing and explicating many cryptic passages of the *Zohar* and *Etz Chaim* [8, 41]. The *Rashash*, in his major texts *Nahar Hashalom* (River of Peace) and *Rehovot Hanahar* (Roads of the River), was particularly instrumental in developing the themes of *Hitlabshut*, *Hitkallelut* and *Hitkashrut* (see below) which we submit resonate closely with the physics of Bohm.



**Figure 4.** A. The ten *Sefirot* (*Da'at* is included when *Keter* is not). B. *Seder Hishtalshelut* (Kabbalistic causal hierarchy). Bars indicate potential interactions among the *Sefirot*. Arrows denote standard pathway for the 'descent' of Divine influence.

### 5.1. *Sefirot, Partzufim and Worlds*

Although the Light (emanation) of the Infinite is a unified whole, each of ten *Sefirot* (Fig. 4) represents a "filter" that holds and transforms a certain part of this Light into a particular force, attribute or action. The ten *Sefirot* are: *Keter* (crown/Divine Will), *Chochmah* (wisdom), *Binah* (*understanding*) - alternatively, *Chochmah*, *Binah*, *Da'at* (*knowledge*) - *Chesed* (lovingkindness/expansiveness), *Gevurah* (strength/restriction), *Tiferet* (beauty/harmony/truth), *Netzach* (victory/eternity), *Hod* (splendor), *Yesod* (foundation) and *Malchut* (kingship). Each *Sefirah* is composed of a vessel (*Keli*) which retains its part of Light (*Ohr*). There

is no differentiation of the *Ohr* within the *Keli* itself, as it is part and parcel of the original, undivided Light; differences emerge from the particularity or position of the *Sefirah's Keli*. According to the Kabbalah, arrangements of ten *Sefirot* are the blueprint of all things created, and everything that exists is ultimately comprised of these ten "forces".

A *Partzuf* (face, visage, or countenance) is a configuration of *Sefirot* acting in coordination or towards a defined purpose. The six main *Partzufim* (in "descending" spiritual order) are:

*Atik Yomin* (*A"Y*)—Ancient of Days  
*Arich Anpin* (*A"A*)—Long Countenance  
*Abba*—Father  
*Imma*—Mother  
*Ze'ir Anpin* (*Z"A*)—Small Countenance  
*Nukva*—Feminine

To allow for the Creation and its spiritual and material contents, the *Ohr Ein Sof* "retracted" in a process known as *Tzimtzum*, thereby establishing a *Chalal* or *Makom Panoy* ("empty space").

The Kabbalah teaches that, in actuality, a faint glimmer of residual Holiness, deemed the *Reshimu*, lined the "interior" of the *Makom Panoy* and served as the primordial *Malchut/Nukvah/Feminine* component of all things destined to be created. A "ray" of Divine Light (*Kav*), emanating from the surrounding *Ohr Ein Sof*, penetrated the *Makom Panoy* to unite with the *Reshimu*. From this union (*Zivug*) was created all *Sephirot*, *Partzufim* and Worlds. The first, most lofty and therefore cognitively least accessible World created within the *Makom Panoy* is termed *Adam Kadmon* (*A"K*; Primordial Man). "Below" *A"K*, and growing progressively more remote from God's Essence, is *Atzilut* (the World of Emanation), *Briah* (the World of Creation), *Yetzirah* (the World of Formation) and *Asiyah* (the World of Action), commonly abbreviated as *ABY"A*. Each World possesses unique qualities which are beyond the scope of this essay. What is important here are the following concepts: (i) Each World comprises the six aforementioned *Partzufim*; each *Partzuf* is composed of the ten *Sefirot*; and each individual *Sefirah* is itself made of 10 "miniature" *Sefirot* in a recursive, fractal-like manner ("Their measure is ten, yet infinite [42]") (ii) The *Partzufim* overlap one another such that the three lower *Sefirot* (*Netzach-Hod-Yesod*) of the "Higher" *Partzuf* (e.g. *Imma*) constitute the *Mochin* ("brains" or *Chochmah-Binah-Da'at*) of the Immediately "subjacent" *Partzuf* (i.e. *Z"A*). The *Mochin* animate the *Partzuf* (analogous

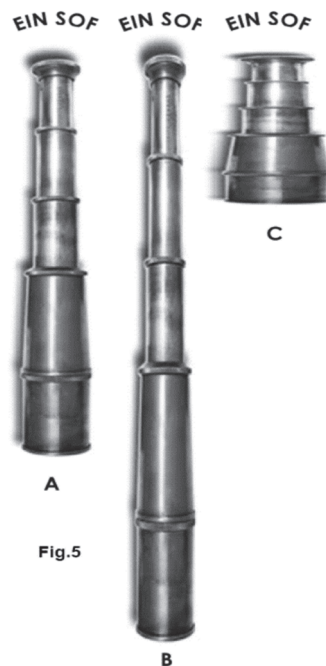
to the relationship of brain/mind to body) and transmit Divine Guidance from “higher” spiritual realms. (iii) *A”Y* can be construed as the “top” *Partzuf* of a given World (e.g. *Briah*) or the “bottom” *Partzuf* of the World immediately “above” (*Atzilut*). As such, it serves to “connect” Worlds akin to the bridging role of the *Mochin* between “adjacent” *Partzufim*. (iv) Physical reality (i.e. the entire observable universe with all its space, matter and energy) comes into being at the very “bottom” (*Malchut of Malchut*) of *Asiyah*. Everything in Creation “above” this level is represented by a complex hierarchy of purely spiritual domains that, via intricate chains of cause-and-effect (*Seder Hishtalshelut*), ultimately impact the affairs of material existence [8, 43-45].

## 5.2. *Hitlabshut, Hitkallelut and Hitkashrut*

*Hitlabshut, Hitkallelut* and *Hitkashrut* are three vital and inter-related principles at the heart of Kabbalistic doctrine. They are intrinsic to the mystical topography of the classical texts, such as the *Sefer Yetzirah, Sefer Ha’Bahir, the Zohar and the Etz Chaim*; the writings of more recent Kabbalistic masters, including *Rashash, Ramchal*, and the *Leshem* (R’ Shlomo Eliashiv, 1841-1926); and the prolific Chassidic literature (e.g. the compilation *B’shaa Shehikdimu* of the Rebbe Shalom DovBer (*Rashab*) of Lubavitch, 1860-1920). Familiarity with these basic concepts is paramount to appreciating the Kabbalah’s understanding of (i) the myriad relationships among all the particulars (*Pratim*) of the Creation and the Forces which gave rise to and govern them, and (ii) the critical nexus between the Cosmos as a unified whole and its individual parts.

***Hitlabshut*** (התלבשות), from the Hebrew root *L’vush* (“clothing”), denotes a system whereby the ‘bottom’ aspect of a World, *Partzuf* or *Sefirah* is ‘encloded by’ or ‘dressed within’ the superior aspects of its immediately subjacent counterpart. We have already encountered a prime example of *Hitlabshut* in the case of the *Mochin* (Section 5.1). One way to visualize this relationship is to imagine an incompletely extended telescope pointing downwards (Fig. 5a): The higher rungs, representing more refined levels of spiritual reality closer to the Godhead (*Ein Sof*), are interior to and partially overlapped by the lower, progressively more ‘mundane’ rungs. The region of overlap serves as a conduit by which Divine Guidance originating in the upper strata ‘descends’ to influence events within the lower realms. Note that each lower stratum, by virtue of the overlap, serves to conceal from our direct perception (*He’elam*) the higher, ‘inner’ domain, while revealing (*Gilui*) by inference the latter’s existence and functionality.

By analogy, the movements and touch of a gloved hand reveal much about the hand itself despite its ‘hidden’ nature. Note also that the degree of overlap among Worlds, *Partzufim* and *Sefirot*, indicating the propensity for Divine influence/blessing to flow from one level to the next, can vary with time and position within the Kabbalistic superstructure (*Etz Ha’chaim*, literally Tree of Life). Generally, the extent of overlap, i.e. flow of Divine Light, is least where divisiveness (*Pirud*) within the Creation is maximal. This occurs with increasing ‘distance’ from the Godhead, e.g. among the *Partzufim* of *Atzilut* relative to those of *A”K*; or whenever *Pirud* is exacerbated by the sins of Mankind.



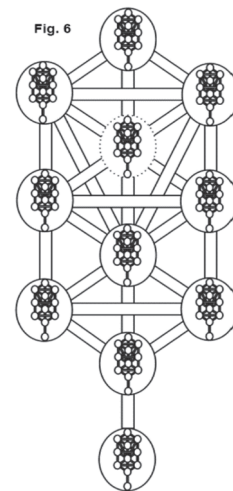
**Figure 5.** *Hitlabshut* (enclodment). Metaphorised by a set of extendable telescopes. A. Reference configuration of the Kabbalistic superstructure. Joints of the telescope symbolize degree of ‘overlap’ (enclodment) among *Sefirot, Partzufim* and Worlds. B. ‘Descent’ of Creation into *Orech* (increasing apparent disunity and ‘distance’ from *Ein Sof*). C. ‘Ascent’ into *Oivi* (progressive revelation of wholeness and the indivisible Light of *Ein Sof*), [http://www.gilai.com/images/items/1498\\_big.jpg](http://www.gilai.com/images/items/1498_big.jpg), (with modifications).

The *Rashash* [46] and others [47] refer to this telescopic extension downward into greater disunity as movement into *Orech* (‘vertical’ descent; depicted by the stretching of the telescope in Fig. 5b). This is the ‘top-down’ direction that the Creation naturally unfolds into to permit manifestations of apparent separateness, Evil and Free Will (*B’chira*). Contrariwise, the extent of

*Hitlabshut* ('overlap') is progressively augmented as one moves 'up' the *Etz Ha'chaim* or on account of the *Mitzvot/Tikkunim* (positive deeds or rectifications) performed by Man. This is tantamount to moving from *Orech* (*Pirud*) into states of increasing unification (*Shlaymut*) or *Oivi* ('horizontality'), as illustrated by retraction of the telescope in Fig. 5c. In extreme states of *Oivi*, in contradistinction to *Orech*, the hierarchical relationships among the created particulars dissolves and all things are perceived as spiritually equidistant from the Godhead (*Ein Sof*). Several examples may help flesh out this concept: (i) From the ladder-like perspective of *Orech*, we would ordinarily attribute greater value to humans than to gnats or pebbles. However, inasmuch as the three fulfil the mandates of the Creator, they are, when viewed from the perspective of *Oivi*, equally 'proximate' to the supernal *Sefirah* of *Keter*/Divine Will and thus equally vital to God's Plan. (ii) On *Orech*'s vertical scale, a seminary student who used to learn 12 hours a day but now only manages to put in 10 hours is still held in higher esteem than a peer who increased his daily learning from one to two hours. Not so in *Oivi* – by shifting the ladder 'horizontally', student A has lost ground and receded from God's Will (*Keter*) into increasing disunity/*Pirud*, whereas student B has entered a more profound state of wholeness/*Shlaymut* [47]. (iii) In times of despair, the common Hebrew expression *Gam Zu L'tovah* ("even this is for the good") is transformed from a hopeful utterance into a proclamation of truth when perceived through the lens of *Oivi*, for, according to the Kabbalah, all circumstances are ultimately decreed by the Benevolent One for the benefit of humanity. (iv) Using the symbolism of mathematics, we shift from *Orech* to *Oivi* (and from *Prat* to *Klal*) whenever we collapse a *Gematriyah* (sum of numerical values of the letters comprising a Hebrew word) to its numerical diminutive (*Mispar Katan*). Thus may the 613 *Mitzvot* (commandments/duties) be regarded as 'branches' of the more fundamental Ten Commandments ( $6+1+3=10$ ); and the latter as manifestations of the Will of the One God ( $1+0=1$ ). (v) According to Jewish tradition, the orbs of the sun and moon were initially created equal in stature (state of *Oivi*). God subsequently diminished the Moon (*Miyut Ha'yareach*) and rendered it a passive recipient (*Keli*) for the light of the Sun. This *Miyut Ha'yareach* is tantamount to a 'vertical' descent from *Oivi* into *Orech*. In the Messianic era, the Moon will regain its original position of prominence (*V'kayma Siharah B'ashlamutah* – 'the moon will be established in its completeness' [42]), a movement into *Oivi*, and function in harmony with the sun as *Shnay Malachim Mishtamshim B'Keter Echad* – 'two kings sharing a single crown' [48]. [This dynamic tension between the

Sun and Moon is but one special case of the pervasive Kabbalistic doctrine concerning the relationship of Masculine (*Mashpiah*-donor) and Feminine (*Keli*-recipient) which informs all aspects of the Creation [49]]. We contend that *Hitlabshut* and Bohm's 'Implicate Order' (Section 4.2) are identical theoretical constructs.

*Hitkallelut* (התכללות) stems from the root, *Klal* which connotes 'wholeness', 'cohesiveness' or 'generality', the antonym of *Prat* ('part' or 'specific'). *Hitkallelut* is commensurate with the notion that the Whole is recapitulated or contained within each of its parts (*Hakol Ma She'yesh Ba'klal Yesh Ba'prat*). This interinclusion is embodied in the mathematics of fractal geometry and in the perpetually-recurring images of the Mandelbrot set (<https://www.youtube.com/watch?v=0jGai087u3A>). By the same token, each *Sefirah* contains within it all 10 *Sefirot* (Fig. 6). This is exemplified in the Jewish liturgy by the 'Counting of the Omer' ritual between the festivals of Pesach (Passover) and Shavuot (Weeks): *Chesed of Chesed, Gevurah of Chesed, Tiferet of Chesed*, etc. until *Malchut of Malchut* on the 49<sup>th</sup> day. Similarly, every *Partzuf* and World contains within it all the *Partzufim* and Worlds. The concept is underscored by a homiletic indicating that the bush wherein God revealed Himself to Moses on Mt. Sinai (*Klal*) was also present, in miniature, within each stone (*Prat*) hewn from the mountain [50, 51].



**Figure 6.** *Hitkallelut* (interinclusion). Represented as a deca-Sefirotic fractal.

*Hitkallelut* subsumes the mind-bending idea that the entire physical universe is reconstituted within each atom; that each interval of time embodies the entire Past, Present and Future (see *Rashi* comment to *Va'yetzeh* [52]: "All things currently in existence have always

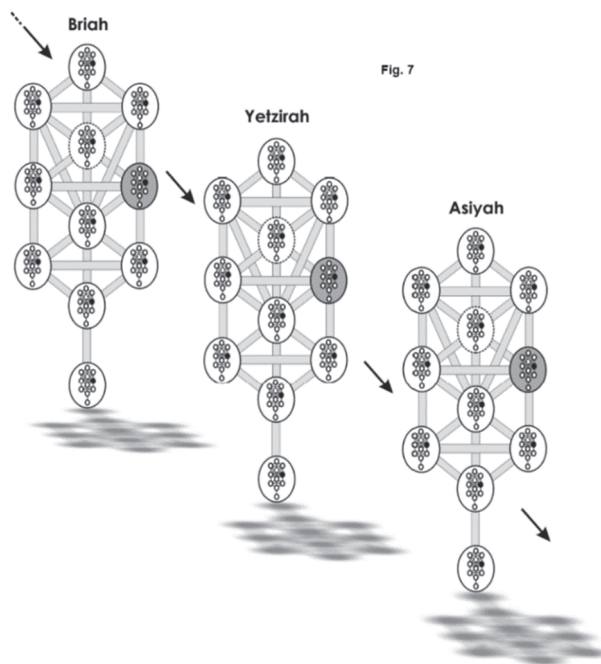


existed and will continue to exist in the future (*She'kol Davar Ha'hoveh Tamid K'var Hayah V'atid L'hiyot*)); and that each Soul is replete with *all* Souls extant and pending! Viewed from this vantage point, it is understandable why one who observes a single *Mitzvah* to full capacity is rewarded as if s/he fulfilled all 613 *Mitzvot* [53]; why the Sabbath and its concluding (*Havdalah*) blessings inadvertently uttered by a disoriented traveler on a weekday are, by dint of the mini-Sabbath enfolded within it, not pronounced in vain [54, 55]; why punishment of each and every transgression effects atonement for the singular sin of the Golden Calf [56, 57]; why "All of Israel are connected one to the other" (*Kol Yisrael Areivim Zeh La'zeh*) [58-60] is not merely a moral imperative but a metaphysical fact; and why the saving of a single life is tantamount to rescuing the entire world [61]. *Hitkallelut* is highly reminiscent of, if not synonymous with, Bohm's 'Holographic Universe'. Bohm conceptualized the property of interinclusion as being mandated by the relationship of the part to the indivisible Whole. In a similar vein, drawing on the Kabbalah, the Rebbe *Rashab* of Lubavitch wrote [42]: "And this is the concept of interinclusion (e.g. of *Chochmah* and *Binah*) which is contingent on the revelation of the Unlimited *Ein Sof*." (*V'hu Inion Hitkallelut [Chochmah U'binah] She'zehu Al Yadei Ha'gilui D'Ein Sof Ha'bilti Gvul*). Inasmuch as it reflects a deep, underlying Unity, the realization of *Hitkallelut* in Nature is, in the eyes of the Kabbalah, the quintessence of grace and fulfilment of the verse in Song of Songs: "Your entirety is beautiful...and you have no blemish [62, 63]"

***Hitkashrut*** (התקשרות) derives from the root, *Kesher* and connotes 'binding', 'connection' or 'amalgamation'. It is a mechanism of interpenetration which promotes a grand underlying unification of the Creation and operates in conjunction with the principles of *Hitlabshut* and *Hitkallelut*. By way of example, let's consider the four worlds, *ABY"A* arranged as a vertical stack of four blocks, with *Atzilut* on top 'nearest' to the Godhead. We can consider each World as a particular (*Prat*) composed of 10 *Sefirot*. Dynamic interactions among the latter are necessary for the establishment and proper governance of each World. Generally, for the *Ohr* of the *Sefirah Chesed* to 'radiate' in the 'bottom' World of *Asiyah*, a top-down 'chain of command' (*Seder Hishtalshelut*) is brought into play (Fig. 4): Influences 'descending' from the *Ein Sof* via *A"K* 'activate' in serial fashion the 10 *Sefirot* of *Atzilut*; *Malchut* of *Atzilut* serves as *Keter* of *Briah* to mobilize sequentially the 10 *Sefirot* of that World. This pattern of 'descending' influence continues through *Yetzirah* and *Asiyah* (and eventually extends to

us, if we're worthy, via the final *Sefirah* of *Malchut* of *Asiyah*).

The principle of *Hitkashrut* dictates that intimate bonds exist not merely among the *Sefirot* comprising any given *Prat*, but among 'like' *Sefirot*, e.g. *Chesed*, across *all* the *Pratim* (pl.) of Creation. *Hitkashrut* enables the *Chesed* (or any *Sefirah*) component of each and every part of the Creation to be "mobilized" concurrently (Fig. 7) when so decreed from Above, bypassing the 'domino effect' structure of the *Seder Hishtalshelut* (Fig. 4). The *Rashash* [46] would construe this shift from the sequential, 'series-like' actualization of *Chesed* within each branch and leaf of the *Etz Ha'chaim* (Kabbalistic superstructure) to the simultaneous 'parallel processing' of *Chesed* throughout the entire Creation as another instance of movement from *Orech* into *Oivi* and, hence, a greater expression of Wholeness (*Shlaymut*). Biblical literature is replete with examples of *Hitkashrut*. One famous instantiation of the principle, adduced from the inanimate domain, is the miraculous partition of all bodies of water concomitant with the splitting of the Red (Reed) Sea at the Exodus from Egypt [64].



**Figure 7.** *Hitkashrut* (interpenetration). Simultaneous co-actualization of like *Sefirot* (e.g. *Chesed*, dark ovals) within and among Worlds (e.g. *Briah*, *Yetzirah* and *Asiyah*). Such 'parallel processing' of homologous parts circumvents the linear, hierarchical flow of Divine influence illustrated in Fig. 4B and represents a greater manifestation of *Shlaymut* (wholeness).

A study of basic biology affords numerous examples of *Hitlabshut*, *Hitkallelut* and *Hitkashrut*. The human body is a hugely complex system of discrete organs and tissues, each discharging unique duties for the health and welfare of the organism as a unified whole. Brain cells express proteins indispensable for the regulation of diverse physiological functions, sensory perception, movement and cognition; liver cells synthesize very different sets of proteins for the maintenance of the body's energy requirements and detoxification of harmful substances. Yet, in accord with the principle of *Hitkallelut*, each brain cell contains within its nucleus all the DNA required to generate the full gamut of liver (and indeed all other human) proteins, and *vice versa* for liver cells: *Hakol Ma Sh'yesh Ba'klal* ('everything contained within the whole...' - in this case, the body) *Yesh Ba'prat* ('...is recapitulated in each of its parts' - brain, liver, etc.). Our ability to clone an entire organism from a single cell is a pragmatic realization of this principle. In the example invoked, neuronal genes (DNA) coding for liver and other non-brain proteins, albeit present in latent form (*Hitkallelut*), are repressed (*He'elam*/concealed or made implicate in Bohm-*sprache*) and only those proteins necessary for the maintenance of normal neurological function are actually produced (*Gilui*/revealed or rendered explicate).

In his *Sparks of the Hidden Light*, R' Moshe Schatz broadens the anatomical analogy further to implicate the principle of *Hitkashrut*. He intimates that achievement of absolute biological integrity and optimal component performance presupposes a functional 'bonding' (*Hitkashrut*) of, say, the right eye with some aspect of "right eyeness" inherent to every limb and tissue [65]. Along similar lines, but now operating inter-personally, *Hitkashrut* would explain the *Midrashic* (homiletic) account of sudden and widespread fecundity among hitherto childless women that coincided with the birth of a child to the previously barren matriarch, Sarah [66]. In the examples cited, *Hitkashrut* would imply, respectively, that the right eye *per se* is but the fullest expression of an attribute distributed throughout the organism as a whole, and that Sarah's abrupt fertility is microcosmic of a property permeating the community at large. Such top-down organization and regulation of biological systems is in harmony with an emerging anti-reductionist viewpoint which maintains that, to intuit deepest levels of 'meaning' (a concept dismissed *a priori* by most contemporary molecular biologists but gaining in respectability in quantum mechanics circles [67]), living and conscious processes are more profitably understood in their own right rather than in terms of any deconstructing physics or chemistry [68]. In essence, these natural examples of *Hitkashrut* are no different from the aforementioned ubiquitous surge of

Lovingkindness accruing from the simultaneous activation of *Chesed* within the innumerable deca-*Sefirotic* components of the Cosmos (*vide supra*). It is noteworthy that although Bohm's account of the holographic universe employed terms highly reminiscent of *Hitlabshut* and *Hitkallelut*, he did not explicitly enunciate a term homologous with the principle of *Hitkashrut*. Several possible explanations for this 'omission' are presented in Section 6.

## 6. A Synthesis

The advent of quantum mechanics during the last century has heralded an unprecedented convergence of scientific and Jewish mystical interpretations of physical reality. In a previous article published in *The Torah u-Madda Journal* [8], we garnered evidence from the *Zohar*, the *Etz Chaim* and the 18<sup>th</sup> century writings of R' Moshe Chaim Luzzatto, that Heisenberg's Uncertainty Principle (1927) [69], a pillar of quantum mechanics, is strikingly similar to the Kabbalistic construct known as the *Raisha D'Lo Ityadah* (*Radla*; The Unknowable Head). Homologies were demonstrated as they relate to the fabric of reality, the intrinsic incomprehensibility and paradoxical nature of the universe, the translation of indeterminacy into experiential reality, worlds *in potentia*, and the grand scale unicity of the universe. Possible implications of these parallelisms for modern physics, epistemology and prophecy were discussed [8].

The present work builds on this theme by demonstrating a provocative dovetailing of insight between the Kabbalah and the scientific theories promulgated by a leading 20<sup>th</sup> century physicist, David Bohm. We have attempted to show in Sections 4-5 that there is no sacrifice of intended meaning when the lexicon invoked by Bohm to elaborate his innovations in quantum physics is interchanged with homologous Kabbalistic terminology. Where Bohm speaks of a 'holomovement' to describe Reality's absolute Wholeness from which all particulars spring and remain inextricably linked, the Kabbalah employs the corresponding concepts, *Ohr Ein Sof*, *Shlaymut*, *Klal* and *Oivi*. Bohm's 'implicate order' can be readily understood as all domains at and 'above' *Malchut* of *Malchut* (the 10<sup>th</sup> and lowest *Sefirah*) of *Asiah*, the World of Action situated at the 'bottom' of the *Seder Hishtalshelut* (Kabbalistic hierarchy). Similarly, Bohm's 'explicate order' is tantamount to the physical domain amenable to our perception 'below' and transduced by *Malchut* of *Malchut* of *Asiyah*. Bohmian mechanics mandate that each domain of the holomovement arises from, ensheaths, and is causally influenced by the layer immediately 'implicate' to it. Similarly, the concept of *Hitlabshut* dictates that each component (*Sefirah*, *Partzuf*, World, etc.) of the *Etz*



*Ha'chaim* (Tree of Life) 'dresses' and is controlled by the component immediately 'above/interior' to it. Were Bohm cognizant of the *Seder Hishtalshelut*, he might naturally have construed it as a cascading structure of interacting implicate and explicate orders. The Kabbalah teaches further that the elements comprising the *Seder Hishtalshelut* are in flux among various states of *He'elam* (concealment) and *Gilui* (revelation). We submit that Bohm invoked the terms 'enfoldment' and 'unfoldment' to capture precisely this dynamic, with enfoldment connoting the 'upward/inward' movement into *Oivi* (hidden unification) and unfoldment a 'descent' into *Orech* (apparent disunity). Perhaps the most revolutionary idea that Bohm injected into contemporary quantum theory – one that continues to impact scientific disciplines beyond physics and fire the public imagination - is the Universe's holographic design. The theoretical and practical implications of a Cosmos wherein each and every part enfolds (recapitulates) the entire Whole can only be dimly appreciated at this juncture. Yet, this singular concept, termed *Hitkallelut* in Hebrew, is a fundamental feature of the ancient Kabbalistic landscape and an essential aspect of the intrinsic interinclusiveness of God's Creation. Thus, according to both Jewish mystical tradition and Bohmian mechanics, each particle and wave contains enfolded within it all of the matter and energy in the Universe; within every present moment - the distant past and remote future; within each thought - the sum of all human cognition and consciousness. By linking the principle of *Hitkashrut* to *Hitkallelut*, the Kabbalah takes the indivisibility of the holographic universe a step further. *Hitkashrut* reinforces the unicity of the Creation by establishing a functional connection between a specific part of one deca-*Sefirotic* system (or mini-hologram) and its doppelgangers within the entire created network of fractal sub-structures. Examples of how *Hitkashrut* may operate metaphysically and within the human organism were provided in Section 5.2. Interestingly, as alluded to in Section 5.2, Bohm did not describe a construct equivalent to the principle of *Hitkashrut* in the elaboration of his physics. One possible explanation for this is that a process akin to *Hitkashrut* may have been implicit to Bohm's formulation of the holomovement and its seamless relationship to its myriad parts. He may have regarded as axiomatic the notion that any change in item *I* within a single mini-hologram would reverberate instantaneously to affect *all* item *I*'s throughout the universe's entire fractal architecture – for if not, how might holographic symmetry be preserved? If this indeed was Bohm's reasoning, qualifiers, examples and mathematical proofs to support the principle may have been superfluous. Perhaps he deemed statements such as

"each part is in a fundamental sense internally related in its basic activities...to all the other parts [17]" as sufficient to convey the gist of *Hitkashrut*-like phenomena. Alternatively, Bohm may have eschewed the idea of a holomovement-wide, concerted "co-activation" of replicate constituents or forces lest this might hint at the deliberate actions of a Supreme Consciousness, a position he exhibited some ambivalence towards (see Section 7). Finally, Bohmian mechanics, ostensibly uninformed by direct Kabbalistic influence (Section 7), may simply not have matured to the point of acknowledging the existence of the Universe's *Hitkashrut*-like properties.

## 7. Bohm on Religion

Is the conflation of Bohmian mechanics and the Kabbalah - one system based on reason and experimentation, the other a product of mystical thought and revelation - mere coincidence? Or was there something unique to Bohm's personality, intellect and environment that predisposed him to think about physics in the 'unorthodox' manner in which he did? Although it remains difficult to address this query with any degree of certitude, a modicum of conjecture may be warranted. Around the time of his Bar-Mitzvah (age 13), Bohm confessed to his community rabbi that science was his overarching passion and that he no longer felt connected to Judaism and its traditions [14]. As he expressed no overt statements to belie this sentiment throughout his professional life, it is unlikely that Bohm deliberately drew inspiration for his maturing scientific insights from the Kabbalah. He did, however, harbor certain views on theology and mysticism. In an interview conducted in 1986 by Renée Weber, a Harvard philosophy professor, Bohm opined, albeit somewhat evasively, on mysticism and the nature of God [70]. When asked whether the ultimate or super-implicate order is a euphemism for God, Bohm cryptically replied: "It's not a euphemism for God because [even] it [the super-implicate order] is limited". Weber reminded Bohm of a comment he had once made affirming the existence of a 'super-intelligence that is benevolent and compassionate, not neutral', to which Bohm tepidly responded: "We can propose that". Weber pressed on with the following: "What you have been saying sounds like mysticism – that we are grounded in something infinite. How does it differ from what the great mystics have said?" To this Bohm admitted: "I don't know that there's necessarily any difference" and, invoking Kierkegaard's definition of 'true religion', intimated that both legitimate physics and mystical insight must be 'grounded transparently in the power that constitutes one'.

So while denying traditional Judaism *per se* and falling short of actually declaring the existence of God, Bohm fathered a novel and compelling branch of physics which bears an astonishing resemblance to mainstream Kabbalistic philosophy. Referring specifically to Bohm's model, the physicist-philosopher, Bernard d'Espagnat stated that "present day physics forces us to take seriously conceptions lying so far apart from our usual experience – the scientific one included – that...the epithet 'meta-physical' naturally comes to mind" [71]. It remains possible that exposure in his youth to Chassidic lore and customs, a tradition steeped in Kabbalistic influence, may have unwittingly sensitized Bohm to formulate scientific theory along mystical lines. Moreover, as alluded to in section 4.1, Bohm enjoyed an intense and long-lasting intellectual discourse with Jiddu Krishnamurti. Krishnamurti, a master of Eastern philosophy and mysticism, may have consciously or subliminally channeled Bohm's nascent thought processes, already primed by latent religious indoctrination during childhood, along pathways ostensibly trodden by the ancient Kabbalists.

## 8. Concluding Remarks

Since its inception millennia ago, Jewish mystical thought has steadfastly attested to the absolute oneness of the Creator and His Creation in the face of apparent separateness and individuation. This perspective is at face value counterintuitive and outside the purview of classical (Newtonian) physics. The advent of quantum mechanics in the 20<sup>th</sup> century provided a novel conceptual framework for resolution of this great paradox, thereby breathing fresh life into the dialogue between Torah and science. That all particles and forces comprising the observable universe are blatantly interconnected ("entangled") was the inescapable conclusion which followed a series of intriguing '*gedanken*' (thought) experiments and the confirmatory bench work of Alain Aspect and colleagues at the University of Paris in 1982 [72, 73]. In the current article, we attempted to underscore further the growing reconciliation of Torah and contemporary science by juxtaposing several fundamental Kabbalistic principles with David Bohm's unique approach to quantum mechanics. Specifically, we adduced evidence from the respective literatures that Bohm's implicate and explicate orders, enfoldment/unfoldment and holographic universe are mathematically-valid descriptions of Reality long intuited by the Kabbalists as *Hitlabshut*, *Hitkallehut* and *Hitkashrut*. Indeed, the following statement by Talbot [19] is an accurate

rendition of the world-view professed by both Bohm and the ancient mystics: "Everything interpenetrates everything...all apportionments are necessarily artificial and all of nature is ultimately a seamless web...the universe is at heart a phantasm, a gigantic and splendidly detailed hologram". To the extent that quantum physics and the Kabbalah address the self-same characteristics of natural law, ongoing exchange between these disparate disciplines could prove mutually reinforcing. Science may arm mystical traditions such as the Kabbalah with compelling analogies and vocabulary to open the wellsprings of the latter's (hitherto arcane) wisdom to modern societies. Reciprocally, the richly imaginative Kabbalistic doctrine could potentially demarcate novel directions and enlighten the enterprise of scientific inquiry. Along these lines, Cambridge's 1973 Nobel laureate, Brian Josephson suggested that Bohm's implicate order may one day allow for the assimilation of Mind or God within the framework of science [74]. The following comments by physicist Joel Primack and the historian of science Nancy Ellen Abrams were cited in our earlier work describing other parallels between quantum mechanics and the Kabbalah [8] but are worth repeating here: "We will turn to Kabbalah, medieval Jewish mysticism, as a possible source of language and metaphor, because certain Kabbalistic concepts fit our picture amazingly well. Moreover, Kabbalah's cosmology gave meaning and purpose to the everyday lives of its adherents, which we hope may become possible with the scientific cosmology emerging today [3]". While these words may pertain to many aspects of contemporary quantum mechanics and cosmology, nowhere do they resonate more cogently than with the physics of David Bohm.

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## References

- [1] Aviezer, N. (2004/5765) Kabbalah, Science and the Creation of the Universe in: Jewish Action, FALL.
- [2] McLean, A. (1988) Kabbalistic Cosmology and its Parallels to the Big Bang of Modern Physics, *Hermetic Jour.*, 39 11.
- [3] Primack, J.R. (1995) Quantum Cosmology and Kabbalah, in: *Tikkun*, 66-73.

- [4] Schreiber, A.M. (2009) *Quantum Physics, Jewish Law, & Kabbalah: Astonishing Parallels*, J Levine/Millennium, New York.
- [5] Schroeder, G. (1991) *Genesis and the Big Bang: The Discovery Of Harmony Between Modern Science And The Bible*, Bantam, New York.
- [6] Smith, H. (2006) *Let There Be Light: Modern Cosmology and Kabbalah: A New Conversation Between Science and Religion*, New World Library, Novato CA.
- [7] Matt, D. (1996) *God and the Big Bang: Discovering Harmony between Spirituality and Kabbalah*, Jewish Lights Publishing, Woodstock, Vt.
- [8] Afilalo, R. Schipper H.M., (2012-2013) *The Kabbalistic Radla and quantum physics: Analogies and differences*, Torah u-Madda, 16 134-152.
- [9] Albert, D.Z. (1992) *Quantum Mechanics and Experience*, Harvard University Press, Cambridge.
- [10] Weinberg, S. (1992) *Dreams of a Final Theory*, Pantheon Books, New York.
- [11] Gribbin, J. (1984) *In Search of Schrödinger's Cat*, Bantam Books, Toronto.
- [12] Gribbin, J. (1984) *In Search of Schrödinger's Cat*, Bantam Books, Toronto, 154-157.
- [13] Mitchell, E. (2014) *Nature's Mind: The Quantum Hologram*, in: National Institute for Discovery Science.
- [14] Peat, F.D. (1997) *Infinite Potential: The Life and Times of David Bohm*, Basic Books, New York.
- [15] Falk, D. (2016) *New support for alternative quantum view*. *Quanta Magazine*, May 16, 2016, <https://www.quantamagazine.org/20160517-pilot-wave-theory-gains-experimental-support/>
- [16] Talbot, M. (2011) *The Holographic Universe*, HarperCollins New York, 38-40.
- [17] Bohm, D. (1980) *Wholeness and the Implicate Order*, Routledge, London.
- [18] Nichol, L. (2003) *The Essential David Bohm*, Routledge, London.
- [19] M. Talbot, (2011) *The Holographic Universe*, HarperCollins, New York, xiv-xvi.
- [20] Gabor, D. (1948) *A new microscopic principle*, *Nature*, 161, 777.
- [21] Gabor, D. (1949) *Microscopy by Reconstructed Wave-Fronts*, *Proceedings of the Royal Society of London A: Mathematical, Physical and Engineering Sciences*, 197, 454-487.
- [22] Merriam-Webster Dictionary.
- [23] Schrodinger, E. (1975) cited in Capra Fritjof, *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism*, in: S. Publications (Ed.), Berkeley.
- [24] Peat, F.D. (1997) *Infinite Potential: The Life and Times of David Bohm*, Basic Books, New York, 106.
- [25] Bohm, D. (1975) *On the Intuitive Understanding of Nonlocality as Implied by Quantum Theory*, *Foundations of Physics*, 5 93-109.
- [26] Peat, F.D. (1997) *Infinite Potential: The Life and Times of David Bohm*, Basic Books, New York, 260.
- [27] Marcer P.J., Schempp, W. (1998 ) *The brain as a conscious system*, *International Journal of General Systems* 27, 131-248.
- [28] Marcer P.J., Schempp, W. (1997) *Model of the neuron working by quantum holography*, *Informatica*, 21 519-534.
- [29] Penrose, R. (1999) *The Emperor's New Mind*, Oxford University Press, Oxford.
- [30] Bekenstein, J.D. (2003) *Information in the holographic universe*, *Scientific American*, 289 58-65.
- [31] De Valois, K.K., De Valois, R.L., Yund, E.W. (1979) *Responses of striate cortex cells to grating and checkerboard patterns*, *The Journal of Physiology*, 291, 483-505.
- [32] Pribram, K.H. (1982) Ch. 13. *Localization and Distribution of Function in the Brain*, J. Orbach (Ed.) *Neuropsychology after Lashley: Fifty Years since the Publication of Brain Mechanisms and Intelligence*, Lawrence Erlbaum, New York, 450.
- [33] Jibu, M., Hagan, S., Hameroff, S.R., Pribram, K.H., Yasue, K. (1994) *Quantum optical coherence in cytoskeletal microtubules: implications for brain function*, *Bio Systems*, 32, 195-209.
- [34] Amoroso, R.L. (1999) *An introduction to noetic field theory: The quantization of mind*, *The Noetic Journal*, 2, 28-37.
- [35] Di Biase, F. (2009) *Quantum-holographic informational consciousness*, *NeuroQuantology* 7, 657-664.
- [36] Hameroff, S., Penrose, R. (2003) *Conscious events as orchestrated space-time selections*, *NeuroQuantology*, 1, 10-35.
- [37] Jibu, M., Yasue, K. (1995) *Quantum Brain Dynamics and Consciousness*, John Benjamins, Amsterdam.
- [38] Globus, G. (2010) *Toward a quantum psychiatry: Hallucination, thought insertion and DSM*, *NeuroQuantology* 8, 1-12.
- [39] Pykkänen, P. (2010) *Implications of Bohmian quantum ontology for psychopathology*, *NeuroQuantology* 8, 37-48.
- [40] Woolf, N.J., Craddock, T.J.A., Friesen, D.E., Tuszyński, J.A. (2010) *Neuropsychiatric illness: A case for impaired neuroplasticity and possible quantum processing derailment in microtubules*, *NeuroQuantology*, 8 13-28.
- [41] Afilalo, R. (2006) *Kabbalah Concepts*, Kabbalah Editions, Montreal.

- [42] Schneersohn, S.D. (2011) B'Shaa Shehikdimu, Kehot Publishing Society, New York, [1911].
- [43] Zohar, (1999) Margoliot R. (ed.), Mossad Harav Kook, Jerusalem.
- [44] Luria, Y. (1782) Etz Chaim.
- [45] Luzzatto, M.C. [1785] (1992) Klach Pitchei Chochmah, Friedlander, Bnei Brak.
- [46] Sharabi, S. (1806) Nahar Shalom [River of Peace], Yeshivat Hamekubalim, Salonica [Jerusalem].
- [47] Goldstein, E. (2006) Etz Chaim, Kol HaLoshen, <http://www.kolhalashon.com>.
- [48] Afilalo, R. (2005) The Kabbalah of the Ari Z'al according to the Ramhal (Klalot Ha'Ilan HaKadosh), Kabbalah Editions, Montreal.
- [49] Schneider, S. (2001) Kabbalistic Writings on the Nature of Masculine and Feminine, Jason Aronson, New York.
- [50] Eibeschutz, S. (1871) Parshat Sh'mot, Arvei Nachal.
- [51] Ben Moses I. (Efodi), Commentary to Maimonides' Guide for the Perplexed, in, c. 1400.
- [52] Genesis 29:3.
- [53] Babylonian Talmud Sanhedrin 111a.
- [54] Babylonian Talmud. Shabbat 59.
- [55] Shulchan Aruch : 344.
- [56] Babylonian Talmud Sanhedrin 102a.
- [57] S. Yitzchaki [Rashi] Commentary to Exodus 32:34.
- [58] Babylonian Talmud Sanhedrin 27b.
- [59] Babylonian Talmud Shavuot 39a.
- [60] Babylonian Talmud Sotah 37a.
- [61] Babylonian Talmud Sanhedrin 37a.
- [62] Song of Songs 4.
- [63] Genesis Rabba Vayechi.
- [64] Yitzchaki S. [Rashi] Commentary to Exodus 14:21.
- [65] Schatz, M. (1996) Sparks of the Hidden Light, Ateret Tiferet Institute, Jerusalem.
- [66] Genesis Rabba 53:8.
- [67] Henry, R.C. (2005) The mental Universe, Nature, 436, 29.
- [68] Talbot, S. (2011) What do organisms mean?, The New Atlantis, Winter, 24-49.
- [69] Heisenberg, W. (1927) Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik, in: Zeitschrift für Physik, 172–198.
- [70] Nichol, L. (2003) The Essential David Bohm, in, Routledge, London, 139-157.
- [71] d'Espagnat, B. (2013) On Physics and Philosophy, Princeton University Press, Princeton, NJ, 206.
- [72] Aspect, A., Grangier, P., Roger, G., (1982) Experimental realization of Einstein-Podolsky-Rosen-Bohm Gedankenexperiment: A new violation of Bell's inequalities, Phys. Rev. Lett. , 49, 91-94.
- [73] d'Espagnat, B. (2013) On Physics and Philosophy, Princeton University Press, Princeton, NJ, 51-88.
- [74] Talbot, M. (2011) The Holographic Universe, HarperCollins, New York, 54.