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QUANTUM MECHANICS AND CONSCIOUSNESS: NO EVIDENCE FOR IDEALISM[*]

Introduction

One popular claim made on behalf of quantum mechanics about the physical world is that there is no objective mind-independent physical world at all. At best, there is something we usually call «the physical world» that is mind-independent in some important respect but not in others. It somehow exists «outside» minds, usually reveals properties that do not depend on our desires and imagination, and is «shared» in that we experience it in ways that suggest the same spatiotemporal relations (structure and dynamics). However, historically it is, in a sense, a product of minds or, to be more precise, of inextricably mind-involving processes. If there was no mind, there would be nothing but the universal quantum mechanical wave. What we usually call «the physical world» of ordinary matter exists only owing to minds that somehow «collapse» the wave. On the more radical construal, which was stated and elaborated in a recent paper by Bernardo Kastrup [Kastrup, 2017b], quantum mechanics supports the view that there is no objective physical world (outside minds) at all; all there is are minds with their personal intra-mental «physical worlds» (appearances of the physical world), although they can have a large degree of similarity, or parallelism, which creates the illusion of the commonly accessible extra-mental world.

Among physicists, the interpretation of quantum mechanic processes that gives rise to such views was pretty respectable several decades ago; it was first explicitly advanced by Fritz London and Edmond Bauer [Bauer, 1939] and was favored by one of the founders of quantum mechanics, Eugene Wigner [Wigner, 1961; Wigner, 1964]. The most well-known contemporary adherent of this construal is the philosophizing physicist Henry Stapp [Stapp, 1993; Stapp, 2007; Stapp, 2017].

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However, the overwhelming majority of present-day professional physicists, especially those who specialize in quantum mechanics, do not favor this construal.

A layman would get quite a different impression: in popular scientific films, broadcasts, publications in press and Internet, we often meet sensational claims that quantum-mechanical experiments have proven that physical reality does not exist until we carry out the corresponding observations (measurements), or that past events are determined by future events-measurements. The typical headlines are like the following: «Reality doesn't exist until we measure it, quantum experiment confirms», «Scientists show future events decide what happens in the past». It is claimed that what we usually take for mind-independent objective reality is in fact determined by observations (measurements), that is, by mind. It is as though the mind creates what seems to be the physical world.

Whence such claims proceed from? Are they really supported by the results of scientific researches? If they were true, what would that mean for our picture of the world, and for science?

1. The hypothesis of the consciousness-caused-collapses, and how it is refuted rather than supported by the results of quantum-mechanical experiments

Contemporary theories about physical reality at the most fundamental level reached by science give a very strange and puzzling picture that is very different from our usual notions (formed on the basis of our daily experience) about physical objects-bodies. The picture is of something that manifests properties now of classical microparticles, now of waves, that does not have a single definite location but is somehow located simultaneously in several places, or is diffused, that can be described only by mathematical abstractions of mysterious complex numbers (numbers that can be described in the form $x+i*y$, where x and y are usual, real numbers, and *i* is the peculiar mathematical entity called *imaginary unit* and defined as the square root of -1).

Perhaps the most puzzling feature of quantum mechanics concerns the role of an observer, or an observation or measurement, in physical processes at the quantum-mechanical level. Quantum-mechanical observations (measurements) register «classical» microparticles at certain spatial areas, and it turns out that the regularities they display (in the frequencies of the corresponding microparticles being registered at various places) cannot be explained in terms of continuous movements of classical microparticles. However, they can be explained and mathematically described on the basis of the assumption that in the periods between the observations the corresponding classical microparticles do not exist; instead, there is something describable by the concept of electromagnetic wave, and at the moments of the observations, these waves «collapse» (or «get reduced») into classical microparticles. It is as if observation (measurement) breaks the normal development of quantum-mechanical processes as waves, and causes their collapse (reduction). Some (although not most of) physicists and philosophers believe(d) that this means that consciousness (of the observer) is involved into the collapses that transform quantum mechanical waves into «classical» matter (particles with definite spatial location).

So the claim at issue is that it is consciousness (of a human observer) that makes quantum mechanic waves collapse into classical particles. As far as I can judge, this claim is rash, and by far not the best way to understand the results of quantum-mechanical experiments; it contradicts much of what science, and physics in particular, (not just quantum mechanics) tells about the world. Moreover, taken as a scientific hypothesis (further on, I will refer to it as the consciousness-caused-collapse hypothesis, or the CCC hypothesis), it was repeatedly refuted.

First, contemporary physics tells about the existence and development of physical reality throughout several billion years before the emergence of the first conscious observer, and describes this development, starting with the first seconds after the Big Bang, mainly in terms of classical physics (such microparticles as protons, neutrons, electrons, atoms, etc.; later — the formation of stars and planets) rather than of wave functions. (See, for example, [Weinberg, 1993].) We learn about the emergence of stars, planets, life on one of them, and the evolution of this life from primitive unicells to *homo sapiens*. From archeology and history, we learn about many millennia of the cultural evolution of humankind preceding the moment when (in the last century) scientists had carried out the first observation-measurement at the quantum-mechanical level. At least, physical events at the macroscopical level occur as a development from preceding states according to physical laws that proceeds independently of observation, except in the area of human activity. If we have not found a way to fit this harmoniously with the results of quantum-mechanical experiments, this testifies the poorness of our understanding of these results rather than the non-existence of objective mind-independent physical reality.

The CCC hypothesis entails that for the largest part of this scientific story (all that «as if happened» before there were conscious observers), nothing even remotely along its lines did really happen. In this part, the scientific story is entirely false, with no approximation to the truth. And even with respect to what happened when there were conscious (human or animal) observers, we have nothing like workable idea as to how individual animal and human minds' experiences can coalesce to constitute the shared world (or «as-if-world»), of which history natural and human sciences inform us. Generally, so far as the explanation of regularities of human experiences and their intersubjective correlations is concerned, physical realism[1] is *by far the best*

[1] In this article, I use the term «physical realism» to designate the view that there is something usually called «the physical world» that satisfies the following specification:

1) it contains, among other its constituents, such things as stones, trees, tables, human and animal bodies;
2) it is the world I share with other people and animals;
3) its and its constituent's existence and properties are objective in the sense that they are not part of our (of any human being or animal) mentation, and do not directly depend on our mentation (except in so far as our mentation affects our behavior and so produces physical changes).

This definition leaves open the question about the ultimate «intrinsic nature» of physical objects. Physical realism so defined is consistent with some forms of idealism (such as cosmopsychism); however, its by far the most usual form (I will refer to it as «common physical realism») is non-idealistic.

metaphysical hypothesis, — in fact, the only one at our disposal that *allows us to make sense of these regularities and correlations in satisfactorily rich details*.

Secondly, even at the microscopic level, the popular statement that consciousness of the observer influences quantum-mechanical processes is very problematic. To begin with, note that these processes cannot be observed with naked eyes. In fact, the «observations» (measurements) are carried out by devices, and conscious observers (people) see readings of the devices. And the readings of measuring devices are not micro-processes at the quantum-mechanical level but perfectly macroscopic physical states. Now imagine the following situation: at the moment t_0 such a measuring device registers something and writes it down, and the person (consciousness) looks at it after a day or a week, at the moment t_1. We need to answer the question: When did the quantum-mechanical «collapse» registered by the device (the reduction of the quantum-mechanical wave) occur — at the moment t_0 or at the moment t_1? If this happened at t_0, then consciousness has nothing to do with it, and quantum-mechanical collapse (reduction) is a purely physical event of a special kind, a result of the interaction of a quantum-mechanical wave with a physical system of a certain kind. (The problem is just that scientists have not, as yet, succeeded to devise a satisfactory theory that reveals the physical conditions responsible for quantum-mechanical collapses.) Otherwise, if the collapse happened at t_1, this means that in the period between t_0 and t_1, such macroscopic objects and states as measuring devices and their readings were in quantum-mechanical superposition (something like neither here nor there, or both here and there), and at the moment t_1 consciousness had «collapsed» them to normal physical states. (In a bit different way, this problem is illuminated by the famous thought experiment with Schrödinger's cat.)[2]

[2] An important point about quantum mechanics is that although its experiments are in fact limited to microscopic particles and the corresponding waves, this is due only to practical but not principal limitations. Modern physics knows of no principal distinction between the microlevel, to which quantum-mechanical equations and models apply, and the macrolevel, to which they do not. On the accepted physical theories, quantum mechanical apparatus is, in principle, applicable to cats, or elephants, as well as to photons and electrons. You can think of elephants as if they, when not

However, such considerations of intuitive implausibility can be judged as indecisive, and the important question arises: can the hypothesis of an observer's consciousness necessary involvement into quantum mechanical collapses be experimentally tested (supported or refuted) by scientific experiments? Two reported kinds of testing seem worth mentioning.

First, there is the claim by the team headed by a parapsychologist Dean Radin from the Institute of Noetic Sciences (an American non-profit parapsychological research institute) that their experiments, which are varieties of the classical two-slit experiment, demonstrate considerable statistical dependence (in the direction expected if the CCC hypothesis is true) of the results on the Buddhist meditator's directed meditative attention to the slits (just imagining and keeping them before one's «mind's eye»). The results were published in a series of articles in the journal *Physics Essays* and a book [Radin, 2006], and they are considerably advertised. However, «Physics Essays» is not a reputed scientific journal but rather a free forum where extravagant views on physics (in particular, those involving parapsychology) are welcome; as for «mainstream» physicists, they do not seem to take Radin's claim seriously. At least, there was no discussion in reputed scientific journals, and no reported attempt to reproduce the results of Radin's experiments. (However, the relevant criticisms can be found at Internet sites of skeptics and in the paper by Erich Goode in the collection dedicated to philosophy of pseudoscience [Goode, 2013].) It

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measured (observed), exist not in the way we usually presume, but as sort of quantum-mechanical elephant-waves (like photon-waves or electron-waves), and then these waves get collapsed into usual elephants when measurements (observations) are made. For all the distances where elephants can really be moved, quantum mechanics give the prediction that with the probability extremely near to 100%, elephants will be observed almost exactly (with possible deviation so small that it is indistinguishable) where they should be according to the calculations of classical physics (one that does not involve quantum-mechanics). However, contemporary physics allows for the possibility of quantum-mechanical effects with elephants as well as with photons or electrons (for example, imagine the huge two-slit experiment in which not electrons but elephants are emitted, and elephant-wave interferential patterns observed on the screen), only that the distances that should be involved for such effects to be observable are of the galactic scale.

is no wonder: scientific laboratories and journals do not bother with discussing, checking and refuting claims that do not look scientifically respectable; besides, quantum mechanical experiments are not cheap. Probably, the main reason why «mainstream» physicists do not take Radin's experiments seriously (besides quite a few more specific methodological faults) is that these experiments are out of touch with the character and origin of the problem. Quantum-mechanical data that gave rise to the CCC hypothesis has nothing to do with such specific states of consciousness as Buddhist meditative attention; it arose from perfectly ordinary observations, such as seeing a reading of a measuring device. So it seems clear that if some experiments can decide between the CCC hypothesis and its negation, they should have to do with the same kind of ordinary observations.

The second reported kind of testing fits this demand. An illuminating way to approach it is to consider the description and explanation of the famous double-slit experiment by Richard Feynman.[3] It suggests a simple reflection to the point that quantum-mechanical collapses do not depend on the conscious observer, and that the «observation» or «measurement» at issue is a specific kind of purely physical processes. Moreover, this reflection easily converts into the idea of a decisive experiment.

In the version discussed by Feynman, there is a stream of electrons that comes from a source, passes through two parallel slits, and reaches a screen E, where the electrons get registered with a distribution that is determined by the interference of the waves from the two slits. Then we modify the experiment. We direct a stream of light at the slits, and this enables us (with help of some additional measuring arrangement) to detect the electrons passing through each slit. One of the mysterious facts of quantum mechanics is that if we do this, the distribution of electrons registered on the screen E changes. When the light is turned off, we have one result; when it is turned on, we have a different result. This can be explained, in full accordance with the quantum theory, by the reduction of electronic waves at the slits

[3] Feymnan characterized the double-slit experiment as one that «has in it the heart of quantum mechanics. In reality, it contains the *only* mystery.» [Feynman et al., 1965: p. 1-1]

as a result of «observation» [Feynman, 1965: pp. 130-48]. However, what is that «observation»? Is it a matter of a conscious observer's awareness of electrons passing through one slit or the other, or of light being directed at the slits? Unfortunately, Feynman does not consider this question; however, I expect that the result depends only on whether light is turned on, not on whether a conscious person observes (by means of this light and some devices) the electrons at the slits.

This suggests an experiment that can serve as crucial on this issue. Suppose there are two observers, the first watches the indications of the device that registers electrons at the screen E, and the second watches the indications of the devices that register electrons passing through the slits. The second observer shuts her eyes from time to time for a minute, and so interrupts the observation, and then she resumes the observation by opening the eyes. If quantum mechanical collapses depend on *conscious observation* (rather than on the physical conditions that make the observation possible, or on the devices), then the first observer should observe that the interferential pictures (the distributions of the intensity of light on the screen E) switch whenever the second observer closes or opens her eyes. However, no such effects were reported in the literature on quantum-mechanical experiments.

Moreover, several experiments of this kind (not exactly as described, but on the same principle) were carried out (reported in [Zou, Wang, and Mandel, 1991], [Mandel, 1999], [Eichmann et al., 1993], [Dürr, Nonn, and Rempe, 1998], [Zeilinger, 1999]), and the results were as follows: whenever the arrangement of the experiment is such that it makes possible the measurement that would detect the passing of the emitted particles (electrons, or photons) through one slit or the other, the interference pattern disappears, *even if there was no one to observe* the «which-path» measurement, and even if the measurement was not in fact made (the terminal measuring device turned off or absent at all). (See [Yu and Nicolić, 2011] for a survey.) This amounts to unambiguous empirical refutation of the CCC hypothesis. However, for a non-physicist, it is very unlikely to meet information about this refutation. It is not the right stuff for hype. (Imagine publications in press and Internet with headlines like: «Reality does exist before we observe it, quantum experiment confirms», «Scientists show future events do not decide what happens in the past».)

Admittedly, physical reality at the quantum-mechanic level and the transition from quantum-mechanical entities and processes to those physical entities and processes that are describable in terms of classical physics are very mysterious and hard to comprehend. They cannot be understood in the terms we are used to, which are adapted for our everyday experiences; to a certain extent, they are understandable in complicated abstract mathematical terms for those who have mastered these abstractions. However, this does not contradict at all the point that physical reality is objective, exists independently of the mind, and involves objective, mind-independent properties and relations. Quantum mechanics gives grounds for a big measure of agnosticism about physical reality at the fundamental level, but this agnosticism well agrees with realism about the physical (matter).

In may be worth noting that the results of the experiments that refute the CCC hypothesis leave open the possibility for some other important connections between quantum mechanics and consciousness. The general point is that quantum mechanics, with its indeterminism and mystery, makes the physical picture of the world a bit looser than the older Newtonian picture, and this is favorable for non-materialist or non-deterministic metaphysical views. A philosophical libertarian is likely to think that quantum mechanics, by making physical picture of the world indeterministic to a degree, makes it easier to make sense of the idea of human freedom of will. An emergentist can hypothesize that in the systems that have consciousness (unlike those that quantum mechanics explored so far), its emergence has something to do with quantum mechanical processes. An interactionist dualist can speculate on the possibility that quantum mechanical indeterminism leaves a causal gap in the physical processes in the brain, and that the mind may perhaps interact with the brain by filling the gap. A panpsychist (or Cosmopsychist) can take the fact that the probability of a microparticle (or frequency of microparticles) being detected in an area during a time depends on distinct paths open to the «pilot wave» as an indication that microparticles, or the Universe as a whole, somehow (instantly, with no usual physical limitation by the speed of light) *know(s)* which ways are open, and knowledge means sort of mind. However, although quantum mechanics may make some of these and other possibilities more plausible (or less implausible) than they would be without it, it provides no stronger, positive support for any of them. And it is important that all these possibilities, unlike the CCC hypothesis, fit with physical realism: they retain the physical world as (human-and-animal-)mind-independent reality and leaves the objectivity of scientific history (as given by natural and human historical sciences) unimpaired.

2. Bernardo Kastrup's idealism, and how it misappeals to quantum mechanics

In contrast with the preceding analysis, Bernardo Kastrup recently argued that quantum mechanics supports the view that there is no objective physical world (outside minds) at all; all there is are minds with their personal intra-mental «physical worlds» (appearances of the physical world), although they can have a large degree of similarity, or parallelism, which creates the illusion of the commonly accessible extra-mental world [Kastrup, 2017b]. He appealed to three main considerations:

(1) «The recent loophole-free verification of Bell's inequalities … has shown that no theory based on the joint assumptions of realism and locality is tenable» [Kastrup, 2017b: p. 33];

(2) «other recent experiments have shown that the physical world is *contextual*: its measurable physical properties do not exist before being observed» [Kastrup, 2017b: p. 33];

(3) although idealism faces some challenges, Kastrup, in another recent article [Kastrup 2017a], has «addressed and hopefully refuted common objections to it» [Kastrup, 2017b: p. 37].

In what follows, I

– concede (3), if only for argument's sake;
– explain that (2) is a huge overstatement;

– explain that if (2) were true and if (1) and (2) clash with physical realism, then they clash just as well with the (Cosmopsychist) kind of idealism that Kastrup defended according to (3);
– argue that if what stands behind (1) and (2) is correctly understood, quantum mechanics do not support Cosmopsychist idealism in any way, except for the (very weak, to my judgment) one mentioned at the end of the preceding section.

Let us begin with (3). Admittedly, [Kastrup 2017a] is a pretty good defense of idealism against the most common objections. But we should be careful to keep in mind what was the kind of idealism so defended. It was Cosmopsychist idealism, according to which what we take for the physical world is in fact sort of Cosmic Mind, to which we (finite mental subjects, or «alters», in Kastrup's terms) are somehow «plugged in».

In fact, Kastrup formulates it as if we, individual (human and animal) mental subjects, are parts of that Cosmic Mind; however, we are its *isolated* parts, which are *not integrated with the rest* of the Cosmic Mind in the way it is integrated within itself, or we are integrated within ourselves. For me, this makes it more sensible and convenient to describe the integrated part of the Cosmic Mind and integrated individual mental subjects, like me and you, as distinct mental subjects (finite subjects, or selves, and the Cosmic Subject), or distinct minds. I will follow this way of putting things, but nothing essential for my argument depends on it. I could just as well talk in Kastrup's terms of *integrated alters* and *the integrated rest of the Cosmic Mind*, or *mind-at-large*.

With the idealism defended by Kastrup, although we are, in a sense, isolated from the Cosmic Mind, we are *not absolutely isolated* — we interact with it in some way; just that this way is different from the one in which mental states interact within integrated mental subjects, like ourselves.

Now note that on this cosmopsychist idealistic view, the physical world is as real and human-and-animal-mind-independent as on the usual view of physical realism. I would classify it as a peculiar sort of physical realism, idealistic physical realism. The physical world is over there, outside my or your or any animal's mind; it has properties independent of my or your or any animal's mind; it existed and developed long before there was any human and animal mind. The difference from the more common kind of physical realism is just that cosmopsychist idealism takes the intrinsic nature of the physical world to be mentation, or experiences (qualia) of the Cosmic Mind. Physical properties and events and relations are in fact properties and events and relations within this cosmic mentation. The difference from common physical realism is pretty considerable, but not with respect to quantum mechanics and the issue of observers' (of usual, human or animal kind) causing collapses and so «producing» ordinary (macroscopic) physical events and measurable physical properties.

With respect to quantum mechanics, common physical realism and cosmopsychist idealism are in the same boat. If the boat is overturned by quantum mechanics, both founder. (But then, with the kind of idealism that remains — one that holds that there is no mind-independent physical world and no Cosmic Mind containing what we are used to call «the physical world» — Kastrup's defense does not apply; this sort of idealism falls victim to the objections that Kastrup so diligently deflected in the earlier paper [Kastrup, 2017a] on the assumption of cosmopsychism.) Happily, it is not. The boat of physical realism (common or idealistic) is afloat with quantum mechanics, as it was explained in the first section of this article.

As far as quantum mechanics is concerned, it does not matter whether the reality that we usually call «the physical world» «really consists in patterns of excitation of a universal mind», as Kastrup suggests [Kastrup, 2017b: 39], or in something non-mentational — all that matters is the structure (relations) and dynamics of whatever it is.

Kastrup equivocates with the word «physical world», and his delusion that quantum mechanics supports idealism very much depends on this equivocation and the confusion it produces. He begins with the claim (which falsity is explained in the section 1 of this paper) that quantum mechanics supports the view that there is no common physical; instead, there are *individual physical worlds of different observers*

[Kastrup, 2017b: p. 35], and he describes these *worlds as sort of interface* between an individual (finite) mind and the Cosmic Mind [Kastrup, 2017b: pp. 43-45]. However, in fact, in the metaphysical system he promotes, the relevant counterpart of the common realist physical world is not any, or multitude, of these «physical worlds» but the Cosmic Mind (or mind-at-large, in his terms). Kastrup explains that «the inanimate universe is the extrinsic appearance of mind-at-large in relation to us» [Kastrup, 2017b: p. 47]. This description is not quite felicitous, because the word «appearance» applies better to what he describes as individual physical worlds of different observers: we all have individual appearances of the physical world that differ from person to person and change with time. The Cosmic Mind — structures and dynamics within its mentation — is *what accounts for these appearances*, both in their variety and commonality, *in the same way as for a common physical realist the non-mentational physical reality does*. And it (either the Cosmic Mind or the non-mentational physical reality) can account for of our *personal appearances of the common physical world* only insofar as it has some properties, structures, relations and dynamics that do not depend on personal point of view (i. e., are objective) and we have shared cognitive access to them, that is — only insofar as it *is our common world* (even if its nature is in fact mentational).

A few explanatory points remain to be made with respect to (1) and (2).

1) If no theory based on the joint assumptions of realism and locality is tenable, then this equally touches both common and idealistic realism. Both would do well to hold to non-locality. As far as I understand, there are at least two alternative construals of quantum mechanics that retain ordinary mind-independent physical reality — one (roughly along the orthodox Copenhagen lines objectivistically construed) on which parts of physical reality take alternately two forms, of waves and of classical particles, with quantum mechanical collapses as specific *objective* physical processes, and another (that of Bohm) on which these two forms coexist and correlate, so that waves determine probabilities of (continuously existing) particles being located in different spatial areas at different moments of time.

2) Other recent experiments to which Kastrup refers have not shown that the physical world is contextual and that its measurable physical properties do not exist before being *observed* [Kastrup, 2017b: p. 33], — if by «observed» we mean *conscious observations by experimenters*. At worst, they showed that with respect to some measurable physical properties, quantum-mechanical systems do not have these properties until their measurement takes place. (In fact, they did not show even that, because their results are also consistent with the Bohmian interpretation.) However, (as was explained in the section 1) the «measurement» at issue need not involve conscious observers at all; it is an objective human-and-animal-mind-independent physical process out there in the world — the process of specific interaction of quantum mechanical waves with the experimental setup. Modern physics has no satisfactory physical account of necessary and sufficient physical conditions that produce quantum mechanical collapses and so qualify as *measurement* (and make conscious observation of the results of the measurement *possible*), but quantum mechanical experiments referred to in the section 1 unequivocally testify that quantum mechanical collapses are matter of some objective physical conditions rather than of conscious observation.

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