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Is quantum physics really strange?

Demystifying the quantum realm by comparison of macroscopic scenarios providing similar outcomes

The conclusions from investigations of physics at the quantum realm, and theoretical models fitting the results, have presented that scale of reality as a realm utterly unlike macroscopic material reality, as we 'know' it.
The aim of this paper is to show that some the difference between the scales is due to the way in which the quantum scale is considered and portrayed, not actually a difference in the way phenomena are happening.

Fire into white doves transformation illusion: **Double slit and half silvered mirror** experiments

Illusion relies upon some information being concealed or otherwise unavailable, thus not forming part of the perception of how the event happened. For example the highly replicate-able fire into white doves transformation illusion.
Paper is put into a metal pan and ignited. The lid is put on the pan. When lifted again live doves fly out.

This works because the information that the doves are inside a pan liner attached to the lid is concealed from the audience. Thus it is the lack of information that prevents drawing of a justified true belief from a reliable cognitive process IE to know or have knowledge of what has occurred.

That is why illusion needs to be suspected in the double slit and half silvered mirror experiments. If something is happening that is imperceptible except though its effect, it (the cause) may not be built into the perception of how the events is happening. Imperceptible is not the same as nonexistent. That is to say that there can be disturbances that are sufficient to disturb a single particle but not provide a quantum of information that our senses or devices can detect. The alternative is to discard what we trust about objective reality and believe in magic.

The double slit experiment might be understood as the wave effect of the vibration of an electron passing through both slits and then interfering and affecting the particle path rather than the particle passing through both. It can then be seen as an interaction with the environment that feeds-back rather than just an independent behaviour. It is, when viewed that way, a concrete interaction (rather than an abstract effect) that can work with the mathematics. The suggested medium does not provide electromagnetic information whereby the interference pattern could be seen and identified. It is proposed that nevertheless it can interact with electron entities and guide their paths.

Such a medium is not a necessary part of Einstein's space-time and, as it

2 provides no direct visual evidence of itself. It is not a part of the seen "Image reality product" formed by observers. Yet the behaviour of the electron giving the results that are seen provides evidence of the interaction. The *effect* of an electron on the environment can be separated from the electron entity rather than considering the effect as the thing. (It seems that quantum field theory would have all effects and no causal thing.)

A flash of light from detection of a photon is not a photon itself but product of processing the received information. Likewise the click of a photo-multiplier. An undetected photon might be regarded as a potential quantum of information. (From the viewpoint of a detector.) Indivisible by the barriers in experiments such as double slits and half silver mirrors. An accompanying disturbance of the electromagnetic medium that is less than a potential quantum of information would be undetectable. The quantum of information, not being broken up by the barrier/s, has to take one path or the other but the accompanying undetectable disturbance will take both and can be reunited giving an (undetectable) interference pattern affecting the path of the quantum of information that will be detected as the photon.

The explanation provided is simple and does not require endowing photons with ability to know what an experimenter has done and the ability to adjust what it is in response. Nor does it require going against the principle of causality, becoming what it needs to have been, as some experiments have seemed to require.

The suggestion is that only a part of the whole photon phenomenon is detectable, and that part is identified as the photon. The other undetectable part of the phenomenon is responsible for the seemingly odd findings of evidence for interference.

Rabbit from an 'empty' hat: **Quantum decoherence** or wave function collapse
The difference between perception of reality, IE. meaning put on observations, and the "source" reality (Object reality), is very important.
There are two places in physics where that difference, unappreciated, causes difficulty. One is Einstein's relativity in which seen things (products of the processing of sensory information, produced from electromagnetic signal input) are regarded as Object things. Another place is in QM where observation (especially by a conscious agent) is regarded, by some at least, to be responsible for production of the external 'objective' reality. However it will be argued that the sequence of causality flows from external source, to EM radiation signal or sound wave signal, to stimuli, to impulses, to construction of internal model. Not from internal model to construction of external reality. The latter is magical thinking.

The magician shows the audience an empty hat. It then seems that he reaches into the empty hat and pulls out a rabbit
For this illusion to be performed the magician must put a rabbit into the hat or

3 allow a trained rabbit to enter the hat unseen. The rabbit is concealed nearby, such as in a black pocket hanging from the rear of the magician's table. Making it easy for the transition into the hat to be accomplished with ease. Careful positioning of hat and use of distraction prevents attention being paid to the maneuver. There is a pocket in the, most usually black, lining in which the rabbit can be concealed preventing it being glimpsed once inside the hat. (The black colour of the lining being absorbing rather than reflective minimizes transmission of light (potential visual stimuli). So not attracting attention.

It isn't possible to withdraw, from the hat, a rabbit that is not in the hat.
Similarly, a detected state (a relation between the measured object/phenomenon and the measuring device that the variable is measured relative to) has to exist prior to the observation of the result.
The conscious observer becomes aware of the result (usually) via a 'visual (EMr)' or 'auditory' (sound wave) signal or display. Which means that the sound wave or em radiation encoding that signal or display must travel *from apparatus to observer,* then stimulating the sensory system of the observer and after a sensory signal has been sent to the CNS and processed cognition of the result of the experiment occurs. The cognition is therefore happening *after* a causal sequence of earlier events necessary for its coming to be.

This means that consciousness causes collapse models must be incorrect. They require cognition of events that have not happened. Retroactively causing the necessary events to match the prior untrue (not matching physical reality)'cognition'; after the *unfounded* 'cognition' has occurred. This is very magical thinking. Akin to I have just seen a rabbit and therefore a rabbit has now come into existence. Rather than I have just seen a rabbit appear and therefore my knowledge must be incomplete, some information that would complete it (how it got into the hat) has been withheld.

Not to say that the measured state exists all along; It is not suggested here that it is within space-time just awaiting an observers acknowledgment. The measured state can not come into being until the relation with the apparatus that enables the measurement to be is established. The heads or tails measurement of a coin is not in existence until the coins orientation relative to a chosen surface is established. The spin up or spin down result of an electron that has passed through a Stern Gerlach apparatus does not exist until the electron has been exposed to the environment of the apparatus.

The relation that determines the outcome exists prior to collection/receipt of the result. One might say that, establishment of the relation (that gives the measurement outcome) *is* where/when the fixed state of the variable comes to be, in the object-apparatus system, unobserved, like the rabbit entering the hat unseen.
Conscious awareness of the result is a product of information receipt, an 'internal' reality that didn't previously exist. It is not the external reality coming into

 being. The wave-function collapse or decoherence associated with knowledge of the result, rather than corresponding to a change in external reality,
is a mental *switching* from thinking about the unknown state represented by the superposition model to the known representation of reality built form received information.

Uncertainty and scale

The Heisenberg uncertainty principle[1] was brought to attention by Werner Heisenberg in 1927. It points out that even theoretically, the position *and* the velocity of an object cannot be measured exactly, at the same time. There can be no exact position and exact velocity together, of a singular object in nature. Though this might at first sound surprising, it is intuitive if one thinks that velocity requires a change in position with time and so can not be fixed and exact and position requires a fixed state so can not be changing simultaneously. This is not a condition that applies to only quantum objects.

Uncertainty at the quantum scale:The accuracy of measurement of the position of an electron is limited by the wave length of the illuminating electromagnetic radiation. Very short wave length light can be used to increase accuracy of position measurement, however the shorter the wavelength the more the electron's momentum is changed, due to recoil from at least one photon impact. It follows, Heisenberg reasoned that simultaneously with the position measurement momentum is being altered and so can not be accurately known.

Comparison with the macroscopic scale: It is worth thinking about how measurements are conducted at macroscopic and quantum scales. For the macroscopic object a course grained scale is used that is appropriate for the scale of the object. A football for example would not have its position measured in nanometers. So tiny variations in position, such as thermal vibration or changes in shape due to air pressure variation are lost in the generalized course grained measurement.

Macroscopic measurements can be made without touching the object itself, such as using a camera. The position relates to position at emission of the em radiation not receipt; Inconsequential at everyday distances and speeds because of the extremely small difference(as light speed is so fast)- but again this is a matter of the scale to which attention is being paid. The position of the macroscopic object isn't exactly known but what is known by measurement is considered good enough; scale appropriate.

If the macroscopic object itself was measured the situation would potentially be the same as for quantum experiments, as interaction with the measuring apparatus would affect the object. Even though it would be possible to use a very small delicate senor that would make very little difference, some energy would have to lost in the interaction if the smallest scales are thought about. However because the measurement is scale appropriate such considerations are excluded.

5 The cut off in know-ability of position and momentum, velocity or energy applies to objects of all scales. However because it is so small in comparison to a large object the accuracy of the measurement is never taken to that extreme of measure-ability. What we know for macroscopic objects is approximations, they can be really good approximation but still not absolute to the smallest possible resolution of measurement. The idea that in classical physics 'we can know these values with certainty" is based on the certain values being acceptable scale appropriate approximations.

Testing spin with the Stern Gerlach apparatus[3]
Is the Stern Gerlach apparatus sorting pre-existent differences or creating them? It will be shown that experimental results are indicating that the device is not a device measuring existing reality, an inherent property, but measure-er of the created response it has produced. Imposing orientation and relative reference frame. It gives a limited fixed state output, that pertains to the physical reality input from the environment (particle)that has been affected in some other way because of the effect of the environment of the apparatus on it.

If y axis spin is produced then x axis spin is potentially lost. Fitting the evidence from experiments where x axis spin is tested first and then one output (let's say up) is y axis tested, and then x axis tested again. Former x axis spin 'supposed identity' has been lost by half of the particles undergoing the test (the spin measurement outcome has become 50:50 chance). But, if only half have changed, it would be necessary to explain why only half the particles lose their x axis spin; and why them in particular, rather than all being affected the same way?
A better proposition is: If y axis spin is produced then x axis spin is probably lost, as the particles re-tested along the x axis behave as if they have never been previously tested in that way. This means spin isn't an identity or inherent property (prior to exposure to the environment of the apparatus but a response to what a particle has 'experienced'. Therefore, the output of a provocation of one partner particle, not carried out on the other, cannot be used to know about the one not tested in that way.

It isn't possible to know for example both x and y spin for one member of a pair of entangled particles; y from 'measurement' and x from knowing the spin of the entangled partner. The possibility of an x measurement does not come into existence until the necessary environment- particle relation is applied.
Investigating spins with Stern Gerlach type apparatus: The response to a test not carried out does not exist. Each different test with the apparatus is a different environment- particle relation producing a new response and there is no correlation between the responses for each axis.

The above premise suggests that the Bell's inequalities argument is a red herring, as Bell's argument requires the assumption that all *measurements* are of pre-existing intrinsic properties. The explanatory framework (providing the

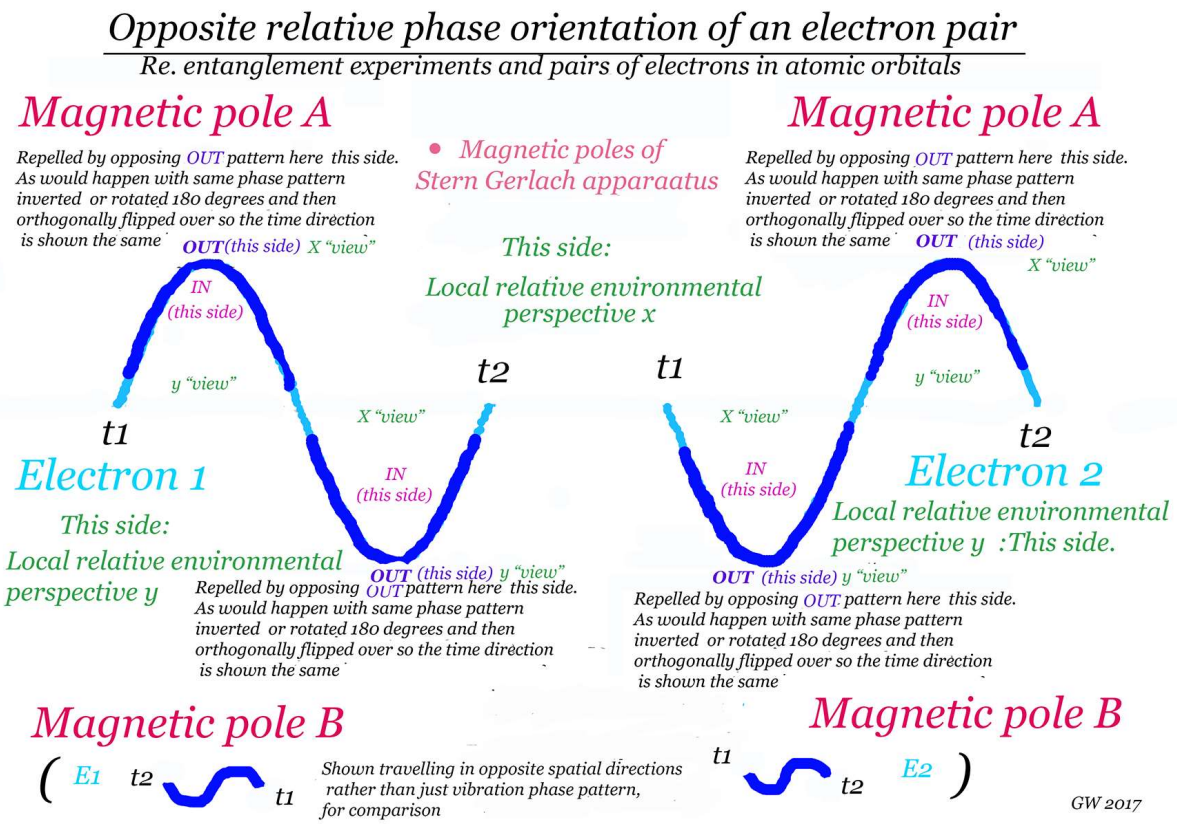
6 necessary ontology for dispelling the paradoxes or relativity and allowing QM and relativity to exist without contradiction) places the particles in uni-temporal foundational space and not the space-time continuum.

This is a categorically different kind of local realism from the kind Albert Einstein supported.
1. There is only what and where an electron beable is, what it was and what it will be are not a part of the (Object universe).
2. At any chosen moment the variables that are relations with other beable objects that give the references necessary for relative qualitative or quantitative characterization of the particle form a unique profile set.
3. There is no communication of required spin between the separated entangled particle pair.
Vibration of an electron has been suggested as a source of waves that can pass through double slits and interfere.

Evidence favour of quantum vibration rather than spinning producing the effect called quantum spin.

Physicists are aware that the notion of the spinning of charged subatomic particles producing the magnetic moment can be ruled out as, because of their known extremely small size, the surface would have to be moving faster than the speed of light.
Hund's rule[2]: Electrons are repulsive to one another and only pair after all the orbitals have been singly filled.
The vibration model allows the electrons within the proximity of the same orbital to be continually moving, at the same rate, and the electrons to be maximally separated over a complete phase of movement. Spinning does not give the same intuitive separation /avoidance picture of what is happening. Spinning doesn't really provide a comparable 'mechanism' of avoidance and has the speed problem.

If magnetic attraction or repulsion is due to compatible or incompatible vibration



phase with electrons of the magnet, then a pair of entangled electrons with opposite phase will maintain that difference what ever same test is done on them both.

A thought: Maybe on larger than than single electron scales spin can produce a magnetic moment because the vibration of the free electrons align perpendicular to the orientation of spin and thus the magnetic moment is produced, but for a single electron there is no other electron vibration to align its orientation with so causal spin is not needed to account for the magnetic moment. Overcoming the impossibly high intrinsic spin requirement issue.

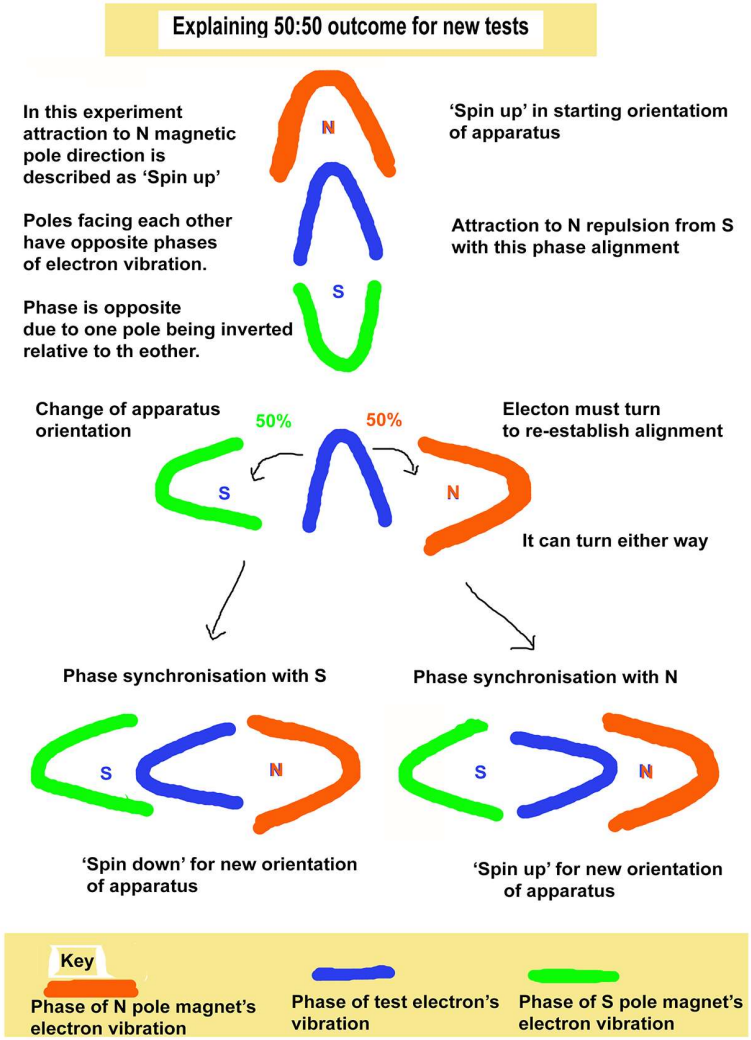
From the above discussion, the magnetic moment can be regarded as the axis of vibration. The anti correlated symmetry of the magnetic moment orientations of entangled particles is measurable when same tests are done is not due to pre-existing spin orientations but the way in which the *anti correlation symmetry is preserved* and gives anti correlated outcomes whatever of the 20 degree separated field orientation of apparatus' environmental field is chosen for same tests of the two partners.

It has been demonstrated, from 'entanglement' experiment results, that the 'wild/untested' magnetic moment orientation must have a bearing on spin outcome but in a wild population of particles the random orientations will result in

8 a 50:50 split in outcomes for the population. The entangled particles are not just random electrons (which *as a population* show no pre-existing preference for up or down.)

<u>Explaining the 50:50 ratio of outcomes for new tests</u>
A tested particle develops an affinity for one of the poles with which its phase of vibration is synchronized meaning its axis of vibration has become aligned increasing compatibility with that pole and incompatibility with the opposite. That affinity remains when retested with same orientation.

When orientation of apparatus is altered to regain alignment the particle must rotate either one way or the other, becoming a magnetic moment axis orientation that will result in either spin up or spin down result. Both directions of change in orientation are equally likely which is manifest in the aggregated results of may tests showing the 50% of each up and down spin outcomes.



9 Macroscopic analogue of the Stern Gerlach test: Allan's Invitations[3]
Allan is going to be invited to a number of social events. There are 3 different changing rooms, called X, Y and Z. In each room he will receive an invitation and must dress appropriately for the occasion.

If he goes into X he will find an invitation to a formal dinner and the dress code. He has the choice of a dinner jacket and cravat or a smoking jacket and bow tie. He makes a choice. If after leaving he re-enters the same room X, or another room X, he does not have to choose how to dress because he is already wearing appropriate attire.
Though if he goes into Y he will find an invitation to a causal house party. He is given the choice of track pants and hoodie or blue jeans and sweater. Now he will have to get changed because he can't attend in formal wear.
Likewise, if he enters Z, where he gets an invitation to a pool party. Here he must choose between board shorts and multi-coloured beach towel or swimming trunks and plain bath towel.

Any changing room of the same letter, entered directly after a room of that letter, will give the same attire outcome. It is understandable that there is no motivation to change if already suited to the circumstances presented. It makes sense that there is no change unless it is *required* by the circumstances presented.
For any different letter room for the following test there is an even chance of either outcome. A 50:50 result if a different letter retest is done many times. The analogy works with the assumption that Allan has no inherent preference for any particular clothing type. (Cf. Having a prior affinity for up or down does not give a correlated outcome for another orientation of test.) Because of that Allan can be imagined tossing a coin inside the changing rooms to choose.

To clearly demonstrate the change from certain outcome for same rooms, one after another, to probabilistic 50:50 outcomes, for rooms that are different (and when the same one is entered once again after a different one in between), it would be necessary to send many Allan clones through (or at least people similar enough to be considered as equivalent to an Allan). Another group can watch the outcomes from the sequence of changing rooms entered and marvel at the similarity of their apparel choices to electron spin measurement outcomes, for different orientations of measurement.

Unknowability at different scales.
The QM model applied the double slit experiment has the electron modeled in a superposition of states in mathematical Hilbert space. In that model the electron doesn't have an either or location in (Object reality) space while somehow it is passing through the apparatus. So which slit it has gone through can't be known because the question just doesn't apply in the way in which the scenario is modeled and described.
This is often presented as something uniquely quantum mechanical in nature without a macroscopic equivalent. However at the macroscopic scale there is a

10 similar situation with the pea and shell trick.
Which shell the pea is under is not knowable even though that goes against common sense regarding material reality. The pea is not necessarily under a shell while the choice is being made, so the which shell question doesn't apply. The trickster decides which location of pea will be found using slight of hand, its location is not the independent variable it is presumed to be. Variations of performance of the trick can be used to build up the idea that the location is knowable - but it isn't. A mathematical model of many games would give an even distribution of shell locations. Which could be modeled as a 'superposition' of all three locations prior to a selection.
So the unknowability isn't because of scale but the kind of scenario being considered.

Demystifying the quantum realm
The above considerations have shown that there are macroscopic scenarios that produce similar results or can be compared with the results of quantum experiments. The main ideas are: 1. being incompletely informed about how something has happened. That can result in an illusion; Justified misinformed belief (JMB) from a reliable cognitive process, rather than justified true belief (JTB). IE the illusion of knowledge, a mistaken belief, rather than knowledge. 2. Uncertainty and unknowability are not confined to the quantum scale but apply to both. The difference between quantum and macroscopic measurement uncertainty is in the relative size of uncertainty to object size. 3. It is not possible to know something that doesn't exist to be known. There can be no justified true belief (JTB) because there needs to be some correspondence with objective reality for the designation of true to apply. This is not dependent on scale. 4. Allan's invitations, though an unusual scenario, shows that what is occurring at the quantum scale, giving the surprising results, is not a pattern that is inexplicable at the macroscopic scale.

Resources and Thanks
Information about the uncertainty principle
1. Hilgevoord, Jan and Uffink, Jos, "The Uncertainty Principle", *The Stanford Encyclopedia of Philosophy* (Winter 2016 Edition), Edward N. Zalta (ed.), URL = https://plato.stanford.edu/archives/win2016/entries/qt-uncertainty/

2. Hund's rule "Rules for filling orbitals"
URL= http://chemphys.armstrong.edu/P1/3rules.htm

Inspiration for Allan's Invitations and explanation of Stern Gerlach experiment results Thanks to Allan Adams for his excellent teaching
3. Video: "Introduction to Superposition MIT 8.04 Quantum Physics I"
MIT OpenCourseWare (Published on Jun 18, 2014)
URL= https://www.youtube.com/watch?v=lZ3bPUKo5zc&t=1603s

4. FQXi.org Thanks for inspiring content and helpful discussion platform