Why EPR occurs:
An experimental proof of RePInULCoPaFil

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Abstract:

Discrepancies between theoretical and experimental results indicate flaws in the standard model. I proposed a simple hypothesis in the year 2003 [1] (hypothesis is an understatement. Readers would find that the proposal is an axiom). This simple hypothesis resolves all the paradoxes that plague the theory of quantum mechanics.

Current excitement over EPR paradox [4], following attainment of Schrödinger Cat-like State [5] with 6 beryllium atoms [6] gives me an opportunity to further probe into the chink in the armour of the standard model. I present an experiment, which, if conducted, would go on to simultaneously show (i) why EPR paradox (or Schrödinger Cat-like State) occurs, and (ii) make my hypothesis a theory.

Why EPR occurs: an experimental proof of RePInULCoPaFil

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Einstein, Podolsky and Rosen, in their original paper[4] proved that in QM that one can not get a complete description of a system (i.e., psi is incomplete). Their implicit assumption was that locality is valid, i.e., quantum mechanics must be local. Schrödinger, in his letters to Einstein, also dealt with the issue extensively. The phrase Schrodinger’s cat finds its origin to his paper regarding incompleteness of Quantum Mechanics, and its failure in a complete description of reality[5]. Bohm[6], [7],[8] showed a practical step to test EPR. John Bell [9] wrote a paper in 1964. It is known as Bell's Theorem. This is the paper that showed how to exclude an entire class of "hidden variable" theories from the realm of possibility via experiment. In a brilliant (and straight-forward) mathematical proof, he showed that there existed certain settings for physical experiments that contradicted "common sense" views of reality. The Bell test related to so-called "entangled" pairs of light particles (photons), and measurement of their polarity relative to an apparatus set at specified angles. The relative angles were picked to exaggerate and highlight the desired effect, leading to apparently impossible measurements. He showed mathematically that QM has to be non-local, using a system of coupled singlet electrons [experiment like Stern-Garlach] going in two different directions. Aspect, et al,[10] were the first to test Bell anomalies using entangled photons at a large enough distance –though to my belief, not convincingly. The actual results nevertheless confirmed the statistical predictions of Quantum Mechanics - as formulated in the late 1920's - and ruled out Einstein's view of a more complete specification of reality.

Later, in 2001, Julsgaard, et al,[11] experimentally proved entanglement in macroscopic entities. In 2005 such entanglement in macroscopic bodies were augmented with the creation of a six-atom Schrödinger Cat State. [12]

It is curious that Einstein, Podolsky and Rosen did not seek to find entanglement, rather they assumed that instantaneity was not possible, and quantum mechanics is essentially local and incomplete. The first assumption in EPR stands to be incorrect.

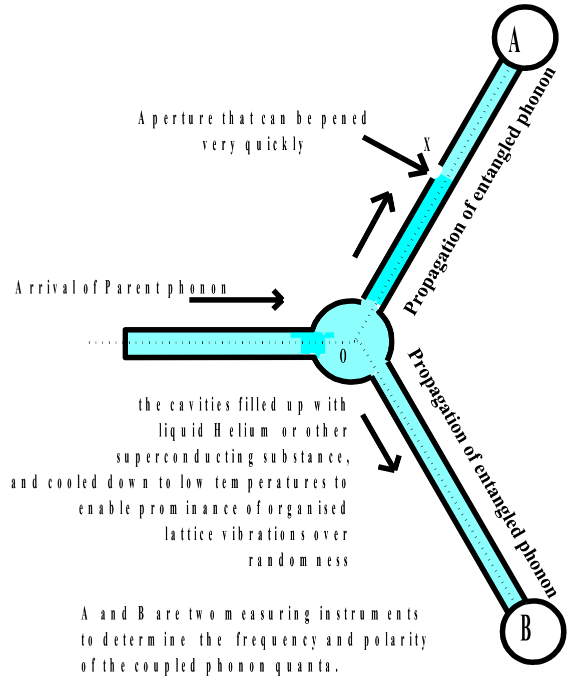
The physical world, of what we understand until now, is found to be made of Quarks, gluons and leptons. Theories indicate existence of gravitons- the quantum of gravity, anti-gravity and Higg's Boson- the quantum of mass. Observations indicate towards a grand unification of all forces. Mathematically, such unification has not been reached. Also, Quantum Gravity has not yet been experimentally observed.

The term RePInULCoPaFil[1] is an acronym, standing for Residual Potential and infinite Upper and Lower Continuum of Particles and Fields. In the physical Universe no material particle can ever attain zero potential energy and similarly, no group of particles can. A system of particles interact with each other trying to attain the minimum possible potential energy configuration, leaving behind a residual potential energy to enable interaction on a different level. This potential energy creates a field. Quantisation of field creates particles, which in turn create another system of particle-field entity, and the process goes on infinitely. So indirectly, there is always present an amount of coupling between two adjacent field-particle system.

This simple axiom resolves all the paradoxes that plague the theory of quantum mechanics. It is an attempt to add details to the Standard Model. The analysis in my earlier paper goes one order below the scale we deal with for the standard model, and subsequently, for all scale of observations in the actual physical Cosmos. In it I then explain why the hypothesis is needed, using a flaw in the interpretation of probability current density[2] and antimatter[3]. Subsequently, I then analyse the experimental observations, physical phenomena and present a complete, continuous picture of the Universe rather than the piece-meal picture that is now prevalent. I also show that the String theory is a special case of my hypothesis. My hypothesis is essentially a system of infinite string-levels, one on top of the other so that we can form a scale of smallness with indefinite no. of terms.

I will now construct an experimental set up to show why EPR paradox occurs. This experiment will also prove my hypothesis. Phonon is the quantum of lattice vibration. It travels in matter with a speed equal to the speed of sound. We will frame an experimental set up similar to Joulsgaard, et al, for observing entanglement in phonons, and see whether there is an instantaneous reduction of state of the second entangled phonon if the first phonon is measured, or is there a lapse of finite time.

According to present assumption, the reduction of state must be instantaneous – however large be the distance, as is assumed in Julsgaard's experiment. Quantum mechanics does not explain why such instantaneity in signal propagation occurs. But according to the hypothesis of RePInULCoPaFil there will be a finite lapse of time, equal to the distance one of the entangled phonon traverses before being measured by an instrument, divided by speed with which a photon [not phonon] traverses in that medium.



According to the hypothesis, the entire cosmos is built up by infinite continuum of particle and fields. At the scale just below the scale of observation a particle is composed of a field-particle cluster, so is a system of particles. Any change in the particle will affect the system immediately below. The particles in the scale just below the scale of observation move much faster, are much smaller and denser, so that the relativistic limit in the scale of observation can only be well within the classical limit of the scale below.

Here, the parent field of the phonon (sound) field is the strong field modulated by electromagnetic field traversing with a speed c. Hence, the information about measurement must proceed at the speed c.

But in case of entangled photons or atoms, the scale immediately below the scale of observation is sustained by hypothetical newtons that are enormously denser (~ $\hbar^3 V_p$), stronger (~ $\hbar^{-1} E_s$) and faster (~ $\hbar^{-1}$ c). Here $\hbar^{-1}$ is dimensionally equal to the Plank's constant without the units; V_p, the volume of a proton; E_s,, the field strength of strong field; and c, the speed of light. No wonder that the entanglement in electromagnetic or strong field appear instantaneous.

We look at schematic diagram of the experimental set-up that would help us to probe why entanglement occurs. When the aperture at X is closed, the A arm and the B arm are equidistant. The aperture must be engineered to switch open faster than the time it takes for the phonons to propagate significantly. The arms A and B should be made as long as possible to ensure accurate data and reduce error margin. The distance OX must not be a multiple of the principle wavelength of the phonon within the filled cavity.

The incident phonon is made to give rise to two phonons at 'O' by a procedure analogous to that of Julsgaard's for photons. Each of the two phonons thus created, must be entangled, one will travel to measuring instrument A, and the other to B. If we measure the phonon at A we automatically know the state of the other phonon, and vice versa.

We are then to open the aperture at X, and note whether any change is registered in the instrument B, and by carefully synchronising the clock at X and the clock at B, we can find out how quickly the instrument B registers the change in state of the phonon arriving at B owing to opening up of aperture at X. We then determine whether or not the two events – opening of aperture and change of state of photon at B – is instantaneous.

According to the hypothesis, entanglement occurs because the wave functions of the parent field particle system are coupled, and it is the coupling that shows up in these cases, and this is prominently observable for the first order term in the scale of smallness immediately below it.

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