ISAQC Screening round

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Problem:

> The superposition principal states that a state function can be expressed as a linear combination of it's normalized eigenstates. When a measurement is performed, the statefunction collapses to one of these eigenstates

The measurement performed above is a quantum measurement, however, humans can only observe classical information. How would you "see/observe" the result of the above collapse?

Hypothesis:

I believe this problem is similar to the measurement problem and there have been various attempts to solve the measurement problem that has been futile. Thus an approach has still not been found but the quantum decoherence offers hope.

Reasoning:

The problem can be reduced into the form of a Schrodinger equation

The Schrodinger equation is as follows:

$$i\hbar\frac{\partial}{\partial t}\Psi(\mathbf{r},t) = \hat{H}\Psi(\mathbf{r},t)$$

One of the most important properties of Schrodinger equation is that it is linear, that is if the there are two solutions A,B to a wave function then any linear combination of these two is also a solution. From this equation it is clear that from all the wave functions of each atom of a large body like a screen or a detector we can determine the wave function of a large body.

All shit I talk is good until you realise that I have tricked you because if it is true then you can predict the future right? because the wave function is linear with time. So where is the problem? Let's look at the Born's rule.

The Born rule is another key postulate of quantum mechanics which states that the probability density of finding a system in a given state, when measured is proportional to the square of the amplitude of the wave function.

Hence it is obvious that after we measure some quantity like momentum or velocity, the probability of the measured event becomes one. But this can't be shown by the Schrodinger equation as it doesn't take into account that a measurement is taken or not. Hence the wave function needs to be updated and this is where the problem starts. How do we observe this change of quantum probabilities from classical probabilities during a collapse from a superposition to an event? How does the Schrodinger equation gets updated? This problem is believed to be solved by taking into account "Quantum Decoherence"

The idea of this theory is that environment has an effect on the quantum coherence of a system and and it is lost with time. It further claims that decoherence makes it possible to identify the fuzzy boundary between the quantum micro-world and the world where the classical intuition is applicable. The superposition state in the quantum micro-world becomes a mixed state which consists of pure states with classical statistical probabilities. But we still not know when does the distortion occurs and the distinction between a quantum world and the classical world where the natural intuition applies. Hence this is still I believe still an as they say an NP problem but soon to be P. (*I may have gone horribly wrong with all I have written and I have studied this shit for fun and no reason at all, so my apologies if this is horribly out of place*)

Sources:

Wikipedia and random youtube videos, (and sorry for the language if it is offensive)