Name: Asish Bharadwaj Chodavarapu

Batch: UG 1

Email id: [asish.chodavarapu@students.iiit.ac.in](mailto:asish.chodavarapu@students.iiit.ac.in)

Hypothesis:

Classical vector superposition is different from quantum vector superposition

Reasoning:

In classical terms, we define superposition as adding together two physical quantities to get an entirely new physical quantity. Whereas in quantum mechanics, a particle exists as a combination of different states at the same time. According to laws of quantum mechanics, we cannot precisely tell which state the particle is in at that moment, but we can express it in terms of probability. Each possible state has a probability of being observed, but the measurement/ observation destroys the principle of superposition as only a definite state is seen/ observed.

Both vector superpositions have similar syntax. Just by looking/writing the vectors, we cannot find a difference between the two.

The major difference between classical and quantum vector superposition is in the ‘interpretation’. In classical logic, we use superposition to combine multiple physical quantities and find the ‘resultant’ physical quantity. For example, two waves superimpose to give a new wave, having different amplitude. Two force vectors superimpose to give the resultant force acting on a particle. In classical logic, we define vector as a physical quantity having magnitude and acting in a particular direction.

In quantum logic, we define (or interpret) vector as having an amplitude (the coefficient of the state in superposition) for a particular state. It clearly differs in the interpretation.

Conclusion:

The concept of superposition is studied in both classical and quantum physics. Both have their roots in the abstract vector spaces used. Quantum superposition is less intuitive and a more fundamental phenomenon.

Comment:

Understanding the essence of quantum mechanics takes time. For context, the discovery of quantum mechanics was not a single event. It took about quarter of a century, from 1900’s to 1925. The idea of describing a simple quantum system using a complex vector in two dimensions summarizes much of what was learnt over that period. When some of the greatest minds in the world struggled for that long to develop the theory, it is not an obvious theory.