

ATPEW-Superposition

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1 Reminder

Following on from my two previous posts:

- https://www.reddit.com/r/LLMPhysics/comments/1pf18q2/speculative_hypothesis_the_universe_as_a_single/
- <https://www.reddit.com/user/Scared-Resolution465/>

2 Quantum Superposition in this Hypothesis

I propose a hypothesis for a new interpretation of Quantum Superposition, a phenomenon where a particle can exist in several states simultaneously. The hypothesis is that this phenomenon arises from the synchronization of local phase velocities \tilde{C}_{local} between particles (see the post on entanglement). This approach offers testable predictions (see below).

As a hypothesis proposed in my response to the comment on the initial post, the local phase velocity of the primordial energy wave determines the flow of time for a particle. There is a critical de-synchronization threshold beyond which superposition (and entanglement) is broken (decoherence):

$$\frac{\Delta\tilde{C}_{\text{local}}}{\tilde{C}_{\text{local}}} > \varepsilon_c$$

Conversely, synchronization persists as long as the particles have:

$$\frac{\Delta\tilde{C}_{\text{local}}}{\tilde{C}_{\text{local}}} < \varepsilon_c$$

As seen in the post on entanglement, the local phase velocity is given by:

$$\tilde{C}_{\text{local}} = \tilde{C}_0 \cdot \sqrt{\frac{h\nu}{m\tilde{C}_0^2}} \cdot \sqrt{1 - \frac{2GM}{r\tilde{C}_0^2}}$$

with:

- $h\nu$: Energy of the particle,

- m : Mass of the particle,
- M : Mass of the object creating the gravitational field (e.g., Earth, black hole),
- r : Radial distance from M .

The three variables in the equation for a particle are (m, ν, r) . We can imagine variations for m in nuclear reactions, so that the most significant variations should occur in intense gravitational fields (black holes, etc.), and the variable that seems easiest to vary is ν , for example, an electron that absorbs or emits a photon.

We can think of \tilde{C}_{local} as a "local clock" for each particle.

2.1 First Hypothesis: Electrons in an Atom

Two electrons in an atom have identical \tilde{C}_{local} (same m , same ν , same r). Their superposition is preserved as long as $\Delta\tilde{C}_{\text{local}} = 0$.

But if one of the two emits a photon (change in ν), its \tilde{C}_{local} changes:

$$\tilde{C}_{\text{local}} = \tilde{C}_0 \cdot \left(\sqrt{\frac{h\nu_1}{m\tilde{C}_0^2}} - \sqrt{\frac{h\nu_2}{m\tilde{C}_0^2}} \right) \cdot \sqrt{1 - \frac{2GM}{r\tilde{C}_0^2}}$$

If the $\frac{\Delta\tilde{C}_{\text{local}}}{\tilde{C}_{\text{local}}}$ ratio exceeds a threshold, the superposition is broken (decoherence).

2.2 Second Hypothesis: Photon in Young's Double-Slit Experiment

A photon in Young's double-slit experiment has a stable \tilde{C}_{local} ratio. Its superposition state is maintained ($\Delta\tilde{C}_{\text{local}} = 0$). But there is decoherence if the photon interacts with a detector (change of ν , $\frac{\Delta\tilde{C}_{\text{local}}}{\tilde{C}_{\text{local}}} > \varepsilon_c$) and the photon is localized.

2.3 Third Hypothesis: Macroscopic Object

In this case, decoherence is instantaneous because a macroscopic object (e.g., a cat) has an extremely variable local density due to its interactions with the environment (temperature, pressure, gravity). The superposition is immediately broken (the cat is either dead or alive, but not both).

3 Testability

Regarding testability, tests have been considered to verify whether these hypotheses hold. But I would appreciate your suggestions for varying the variables m , r , or ν .

3.1 Variable r

$\Delta\tilde{C}_{\text{local}}$ increases near a mass (e.g., Earth vs. Space). Could we measure $\Delta\tilde{C}_{\text{local}}$ for different isotopes (e.g., cesium, ytterbium) in microgravity? On Earth and then in near space?

3.2 Variable m

Could we use a particle accelerator to vary m ?

3.3 Variable ν

Young's slits are one example, but could we vary the particle frequency finely enough to determine the decoherence threshold? If you have any experimental ideas, they are welcome.

The equation predicts that, near a mass M , \tilde{C}_{local} decreases:

$$\tilde{C}_{\text{local}} = \tilde{C}_0 \cdot \sqrt{1 - \frac{2GM}{r\tilde{C}_0^2}}$$

So the superposition should be weaker near massive objects (e.g., black holes). Could we observe the breaking of the superposition near the event horizon of a black hole (e.g., Sagittarius A*)?