Schrodinger's cat and gravitational waves

Eran Sinbar

Abstract

Schrodinger's cat [1] describes a paradox in which a cat is located in a sealed black box with a poison sealed capsule inside it. Radioactive source decays and emits radiation, which activates a Geiger counter, The Geiger counter generates a signal to release poison from the capsule and kill the cat. Since the decay of a radioactive source is a random sub atomic event, based on quantum mechanics we can only derive a probability-based assumption on the exact time that the decay of the radioactive atom will occur. The Copenhagen interpretation says that until an observer opens the box, the entire system is in superposition and the cat is both dead and alive. In this paper, I will show that we can extrapolate this superposition of the wave function to entropy level, to the fabric of space – time, to the information paradox of black holes, new dimensions and to the multiverse theory.

Schrodinger's cat in the time domain

Let us reconstruct the same thought experiment (figure 1) where a newly born kitten is located in a rocket, orbiting far away from the black hole gravitational influence (orbit A). As the radioactive atom (which is located in the sealed rocket) decays randomly, it radiates, and the Geiger counter detects the radiation and generates an electric signal that activates the rocket engine, which sends the rocket with the cat inside it to circle near the black hole's event horizon (orbit B). Assuming that near the event horizon time nearly stops due to the strong gravitational time dilation, the age of the cat (or the entropy of the system), becomes a function of a random quantum effect due to the radioactive atom decay.

There seems to be a dependency between the cat's age (the entire systems entropy) and the quantum mechanical random effect of the radioactive atom decay.

If the entire macro system (rocket, orbit A, orbit B and the cat) are in a sealed unmeasurable region ,based on the Copenhagen interpretation , until the observation (the collapse of the Schrodinger's wave function) ,the age of the cat is a superposition of all the possible ages, from a newly born kitten to an old or even deceased cat. The location of the rocket is a superposition of orbit A, orbit B and the space between them. This Copenhagen interpretation leads to a conclusion, which requires that the macro system, Schrodinger wave function, will collapse when measured, in both the space and the time domain.

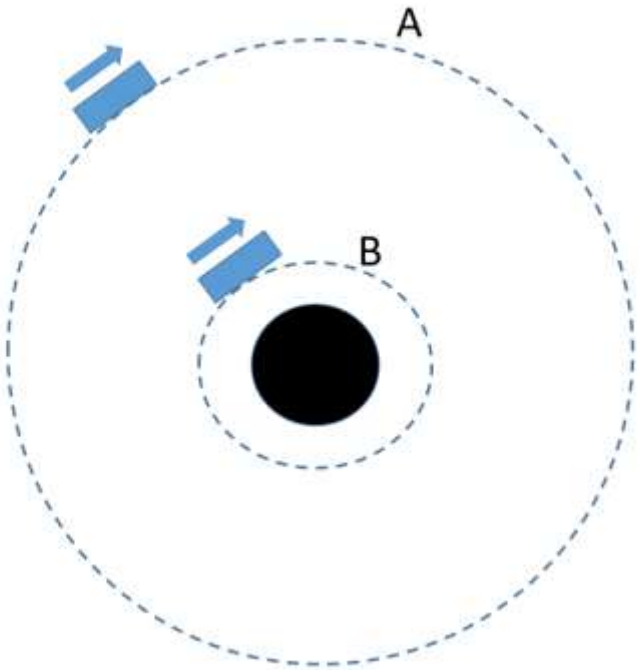

Figure 1: The blue rectangle illustrates the rocket with the cat and the radioactive atom inside. The blue arrow above indicates the direction in which the rocket is orbiting around the black hole. The black circle in the center illustrates the black hole. The dashed circle with the letter A is the orbit far away from the gravitational influence of the black hole .The dashed circle with the letter B is the orbit near the black holes event horizon where time slows down due to gravitational time dilation. The random decay of the atom will cause the rocket to move from orbit A to orbit B, which will slow the aging process of the cat, and will influence the entropy level of the entire system. The Schrodinger's wave function will collapse when the measurements are applied in the space (orbit A or B), time (gravitational time dilation of orbit A or B) and entropy (the age of the cat).

Schrodinger's cat and the fabric of space – time

As the rocket ship with the cat changes its orbit around the black hole it will generate gravitational waves. Assuming that the Schrodinger's cat experiment detailed in figure 1 is done by measuring gravitational waves, based on the Copenhagen interpretation, the fabric of space time is in a super position of all the optional gravitational waves configuration and it will collapse to a specific configuration instantaneously during the act of measurement. The super position of states is a unique behavior of quantum mechanics and that is an indication that the fabric of space time is also (like matter and energy), quantized into discrete local units of space and time (probably in the size of Planck's length and Planck's time). In order for space time to be quantized it must float in another non local grid like space time dimension which is located everywhere between these discrete space time units (figure 2). This extra non local grid dimension is responsible for the non-local behavior of quantum mechanics like the quantum entanglement.

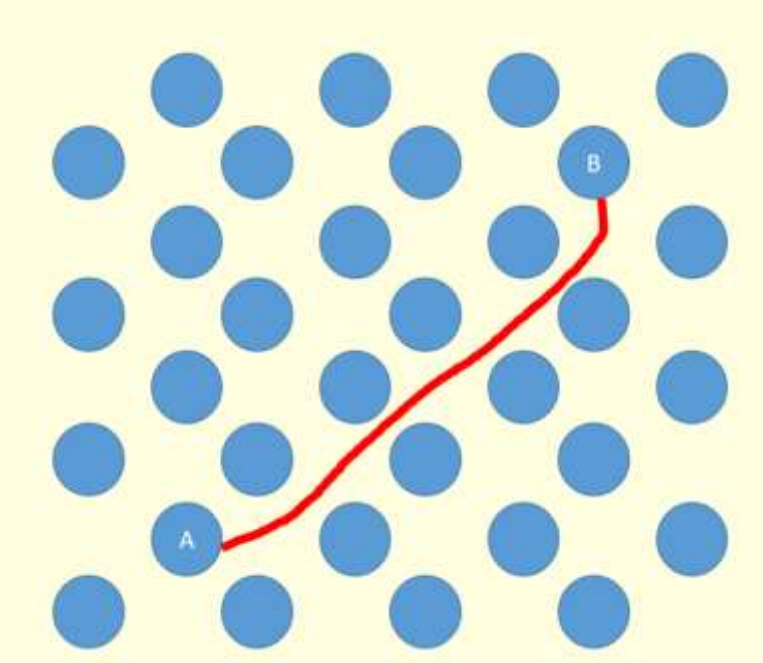

Figure 2: small region of space is quantized into local units in the size of Planck's length, illustrated as the blue round circles. Between the space units lays an extra non local grid dimension illustrated by the yellow background between the quantized units. The non-local grid dimension is responsible for the non-local behavior of quantum mechanics like quantum entanglement which is illustrated by the red line connecting instantaneously two space-time units A and B ("spooky action at a distance " – Albert Einstein). The real image should be a quantized three dimensional space which is evolving every quantized pulse dimension of time ,and between these four space time quantized dimension lays the non-local (in space and time), grid dimension (or dimensions).

Schrodinger's cat and the many worlds interpretation

The classic Schrodinger's cat experiment rises a conflict. Since the cat has a deterministic point of view regarding his situation (dead or alive) while the outside observer describes the cat's situation as a superposition of both dead and alive, we must consider the many worlds interpretation [2] in order to overcome the conflict. The quantization of space time and the grid dimension enables to introduce multiple worlds staggered next to each other (figure 3) without any conflict between them.

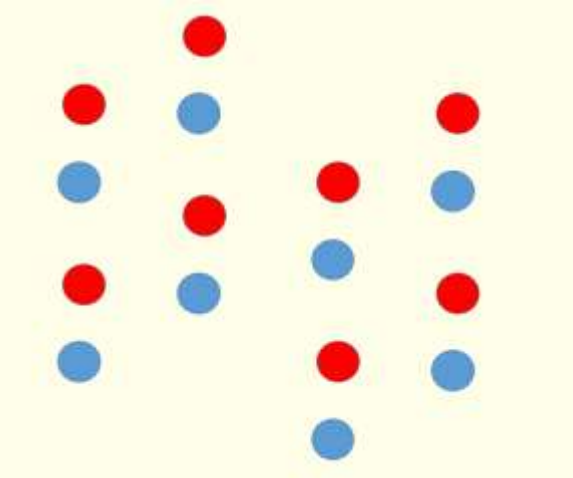

Figure 3: a small region of space in which the quantized world of the cat (blue circles) are staggered next to the quantized world of the observer (red circles), and they both float in the non-local grid dimension (yellow background). This new structure enables to introduce as many parallel worlds (multiverse) as required by quantum mechanics.

Schrodinger's cat and the black hole information paradox

Imagine Alice falling into a black hole with the Schrodinger's cat experimental setup (Figure 4). After Alice passes the event horizon towards the singularity she opens the box to see if the cat is dead or alive. Since she opened the box after passing the event horizon this information (dead or alive) is not imprinted on the event horizon and this information will be lost once the black hole evaporates through the Hawking radiation [3]. In order to overcome this information paradox [4] we can suggest that when Alice opens the box, the cat's final state (dead or alive) will have an impact on the gravitational waves generated by the black hole. If the interior entropy (information) of the black hole has an impact on the gravitational waves generated by the black hole, and these gravitational waves can escape out into space, this can solve the information paradox. Information can escape the black hole through gravitational waves, and these gravitational waves can influence the Hawking radiation or the gravitational waves measurements, done by an observer outside of the event horizon.

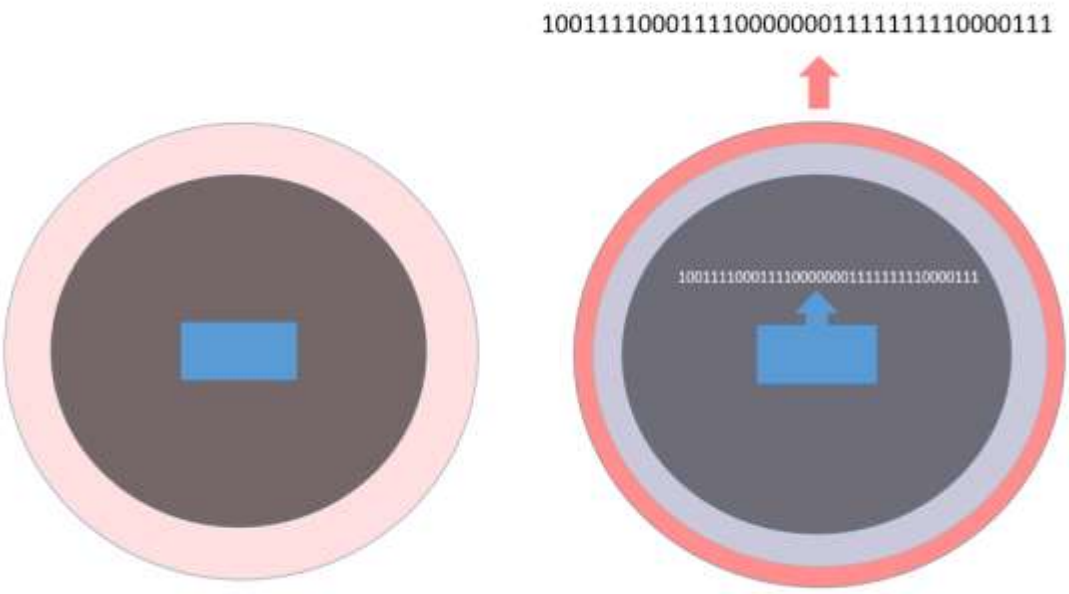

Figure 4: On the left side there is the black hole, illustrated by a black circle, with the Schrodinger's closed box inside, illustrated by the blue rectangle, passed the event horizon towards the singularity. The bright red colored ring illustrates the Hawking radiation. On the right hand side the Schrodinger's box opens up and the cat wave function collapses to its dead or alive final position and this generates information illustrated by the 0 and 1 string of characters. The new information generates gravitational waves, illustrated by a gray ring, which can escape the black hole gravitational pull. These gravitational waves pass on the information beyond the event horizon to the Hawking radiation, illustrated by the red colored disc .This mechanism solves the information paradox.

Reference:

1 https://en.wikipedia.org/wiki/Schr%C3%B6dinger's_cat

2 https://en.wikipedia.org/wiki/Many-worlds_interpretation

3 https://en.wikipedia.org/wiki/Hawking_radiation

4 https://en.wikipedia.org/wiki/Black_hole_information_paradox