Rejecting the Use of Thought Experiment Results in Physics

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In physics, whenever we cannot do an experiment in the real world for physical, technological, financial or ethical reasons, we use "thought experiment" [1]. In this letter, we prove that sometimes a thought experiment may lead us to the wrong results; and so, to achieve the definitive and reliable results, all experiments must be done in the real world. This means rejecting the use of the results of intellectual analysis of an experiment, namely thought experiment.

There are several thought experiments in physics. Schrodinger's cat experiment [2], EPR paradox [3] and Einstein's light box [4],[5],[6] are some of the most famous of them. It is clear, all experiments are initially a thought experiment (As Ernest Mach said a thought experiment is any experiment that has not been performed yet [7]). Some of them become real physical experiments and some of them remain thought experiment, due to the human inability to perform them in the real world (because of physical, technological, financial or ethical reasons). For example, due to the restrictions of today's technology**,** we cannot perform the Einstein's light box experiment in the real world. Because, by today's tools, we cannot measure the change in mass of the box after emission of a photon.

There is a very important point about thought experiments that seems to have been ignored so far: Sometimes a thought experiment may lead us to a wrong result. A thought experiment is an experiment which it is designed and performed in the brain of a scientist, by using the knowledge and science of that time [1], and since human knowledge has never been complete, a thought experiment can sometimes lead us to wrong results. Let me explain this with an example. In Photoelectric effect, which was discovered by Philip Lenard in the 1990s, there is a threshold frequency that scientists of that time could not predict existence of it, based on the main theory of that time about light i.e. electromagnetic (EM) theory [8]. The existence of a threshold frequency for a given metal, a frequency below which no photoemission occurs, however great the light intensity, is completely inexplicable in electromagnetic terms [8]. From the electromagnetic point of view the primary circumstance that determines whether or not photoemission will occur is the energy reaching the surface per unit time (or the intensity), but not the frequency [8]. If a person in the 1990s (namely in the years before the discovery of quantum aspect of light) wanted to predict the result of photoelectric experiment, could he predict the existence of threshold frequency? The existence of threshold frequency was discovered via perform the photoelectric experiment in the real world, not by intellectual analysis. The photoelectric experiment shows well that sometimes a thought experiment can lead us to a wrong result (which in this case is prediction of nonexistence of threshold frequency).

Another example is the experiment of subatomic particles diffraction from double-slit. If we do this experiment for macroscopic particles (such as sand particles or salt grains), the pattern of diffraction will be random [9][10]. If we do this experiment with subatomic particles, like electrons, we expect to achieve the same result (namely a random pattern); but performing of the experiment in the real world leads us to an interference pattern, i.e. dark and light bands

[9][10], (Fig. 1), which is contrary to expectation. Therefore, in this case, too, the prediction of thought experiment is untrue.

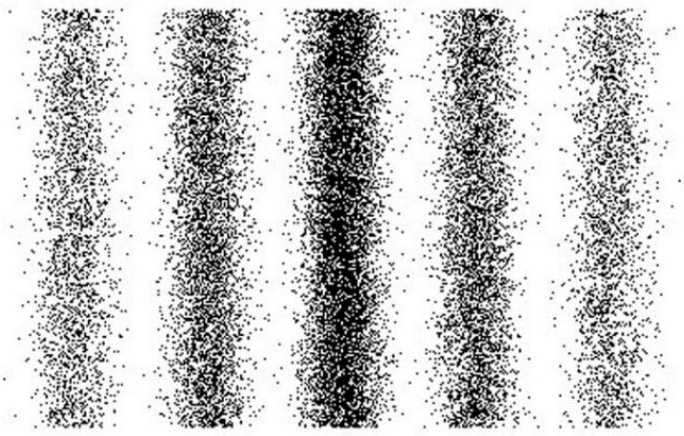

Fig. 1. Diffraction pattern of electrons from double-slit.

Numerous other examples can be mentioned that show that the results of thought experiments are not reliable. As another example, most of us know the famous phenomenon of Chain Fountain (Fig. 2). In this experiment, we expect the chain to fall from the edge of the glass; but the result of the experiment is different from our prediction, and the chain falls with a distance from the edge of the glass (Fig. 2).

Fig. 2. Chain Fountain phenomenon

Based on these three examples, the conclusion of this letter is as follows: *In physics, using the results of intellectual analysis of an experiment before performing in the real world, namely thought experiment, is completely wrong.* Because, as we proved in this article, the result of the intellectual analysis of an experiment (thought experiment) may be wrong, like the result of the intellectual analysis of the photoelectric effect, which predicted the absence of a threshold frequency. Therefore, *all experiments must be performed in the real world so that we can accept their results.* This means, for example we cannot design a thought experiment near a black hole and discuss its results and modify or develop our theories based on these results.

Because, with performing this experiment in the real world, some results may be observed that are not in our predictions and conclusions.

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