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Quantum Menace in Physics Education

Alion Alizoti

Department of Physics, Faculty of Natural Sciences, University of Tirana, Albania

alion.alizoti@fshn.edu.al

Abstract

This paper discusses the introduction of quantum ideas in general physics and education. Considering the fragile environment of physics education, the paper suggests three possible ways to help teaching and learning of quantum physics, (1) quantum metrics (2) simple experiments demonstrating quantum quantities (3) fractal and quantum analogies between worlds. From this perspective, this paper is also meant to be a test indicator of quantum popularity in physics and education.

Introduction

Quantum ideas have their roots deep inside antiquity of nature. The influence of quantum proportional elements in nature is as great as important.

Historically, distribution of common wealth, such as earnings, properties and anything else, is a meaningful aspect of the proportional quantization of the whole. From this perspective, scientific quantization is one of many subjective ways to systematize sharing and distribution of the whole [1].

Early conception of solid matter was based on powder atom, the smallest particle visible and indivisible. As such, early conception of liquid matter was based on liquid atom, the smallest droplet particle visible and indivisible. Although unclear,the early conception of gaseous matter. Physics and Chemistry conception of matter, of moles, granules and molecules, marks a modern beginning of quantum proportionality [2].

Despite endless treating, the separation of matter in quantum particles is still viewed with skeptical and also critics are not missing. In frontrow, researchers have it difficult to provide enough arguments tothe expansion of physical relations between quantum micro particles within macroscopic matter. On the other hand, micro relations based on physical fields within macroscopic matter contradicts clearly the idea of quantum particle restrictedly finite. For this reason, separation of matter into confined particles is considered more as a way of thinking rather than a pure accepted reality. Debates amongst Bohr's accuracies and Heisenberg's uncertainties are a clean reflection of such contradiction between united macro matter and micro matter fatherly undivided.To help solving out this conflict and preserve relations between quantized particles, modern theories suggest that the ratio of proportional quantization is to be led further to deeper levels. Another solution, more radical, proposes that all general models of matter are to be canceled and new diversifying models shouldbe advanced [3].

Newtonian conception of corpuscular light marks another remarkable step into the idea of quantization. Newtonian light is regarded as a specific matter, of particle structure, strictly separated and with no relations in between. However, the authority of Isaac Newton was never enough for others to fully acceptthe idea of corpuscular light. The contradiction between corpuscular light and wave light inspired Max Plank to follow an opportune unifying path. As a charming consequence, photon was summoned like the ideal physical object that was to bring balance to the corpuscular and wave properties [4][5].

To the social core, in education, the division of lessons to chapters, themes and paragraphs, mirrors the general tendency for a proportional systematic learning. Didactically, it is utopia to some kind to conceal that the smaller the amount of learning the greater the happiness of students; and also the opposite. In this case, it can be easily noticed the inverse dependence between space of learning and space of entertaining. Furthermore, class organizing is another example of social and physical quantization of educational activities. The bell ring determines the quantum divisions among class time and break time. The bell tingle itself is composed of physical quantized vibrations [6].

These are only but a few simple examples of scientific and social quantum system, that humankind has built throughout millenniums of evolving. Nonetheless, critics within the system urge to regard quantization as a menace in education and, hence, to take all necessary steps to prevent speculations on its behalf.

Quantum Treatings

Although classical physics and modern physics deal with different aspects of physical reality, scientific and didactic treatments establish successful bilateral relations between classical concepts and modern concepts in physics. Examples, suiting different levels of learning, can be introduced from exercises and experiments, to their best.

Theory – Exercise: Hooke's elastic spring of a spring constant ks = 100 N/m is stretched to X = 1 cm. Estimate potential energy of spring using the energy of red monochromatic photon of wavelength 650 nanometer [6].

Level: First,Second Third

Solution

Energy of red photon:

$$\mathrm{Eo} \ = \frac{\mathrm{hc}}{\lambda} \cong \frac{6.63 \cdot 10^{-34} \ \cdot 3 \cdot 10^{8}}{650 \cdot 10^{-9}} \cong 3.06 \cdot 10^{-19} \text{ Jaul}$$

Potential energy of spring:

$$\mathrm{Ep} \ = \frac{\mathrm{ksX}^2}{2} = \frac{100 \cdot 10^{-4}}{2} = 0.005 \text{ Jaul}$$

Number of photons:

$$\mathrm{N} = \frac{\mathrm{Ep}}{\mathrm{Eo}} \cong \frac{0.005}{3.06 \cdot 10^{-19}} \cong \frac{5}{3.06} 10^{16}$$

Experiment: Pingpong ball, or table tennis ball, is released to free falling from height Ho to the table. Observe the motion of the ball afterward. Measure all heights of ball bouncing.

Level: Second, Third; First

Experimental observations show that ball bounces up and down loosing height, so loosing initial potential energy at each drop down. Experimental data are listed in the tables and, also, plotted in the graphs next to.

Table 1

N	H (cm)
1	100
2	69
3	47
4	36
5	28
6	23
7	19
8	16
9	11
10	8
11	5
12	3
13	1
14	0

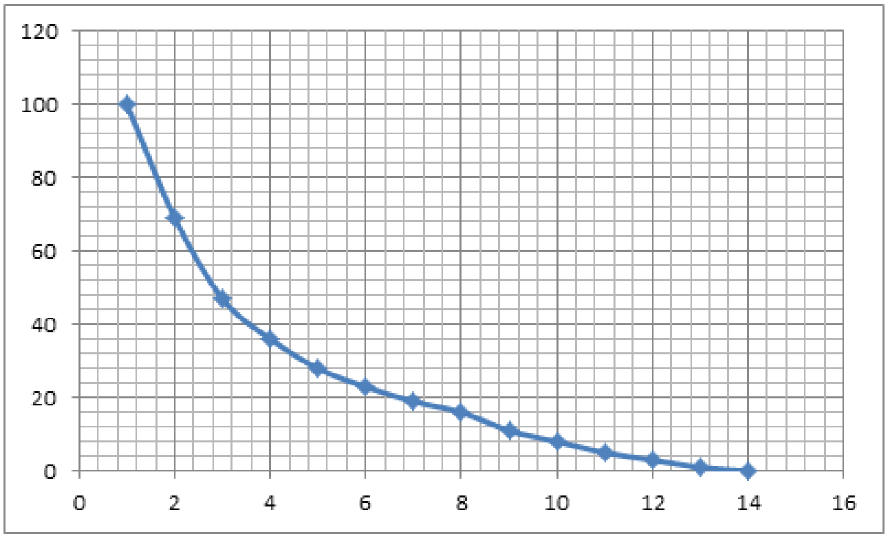
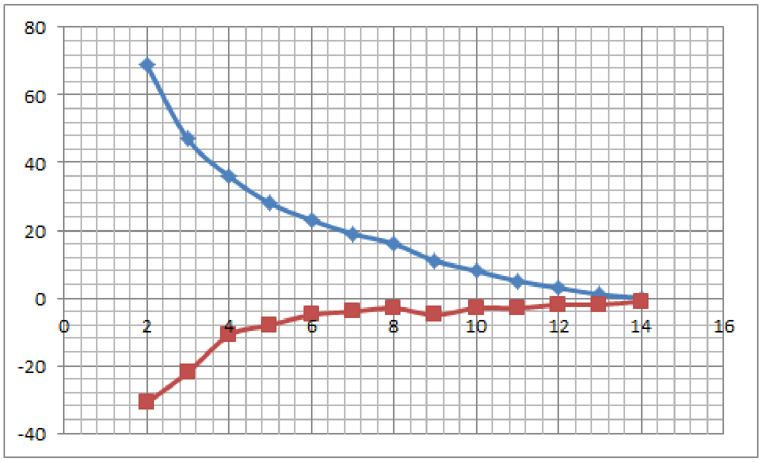


Table 2

N	H (cm)	ΔH (cm)
1	100	
2	69	-31
3	47	-22
4	36	-11
5	28	-8
6	23	-5
7	19	-4
8	16	-3
9	11	-5
10	8	-3
11	5	-3
12	3	-2
13	1	-2
14	0	-1



Motion Detector Sensor – Interface – Computer is also used to shoot at the ball, collect and analyze data on – line, figure 1 [7].

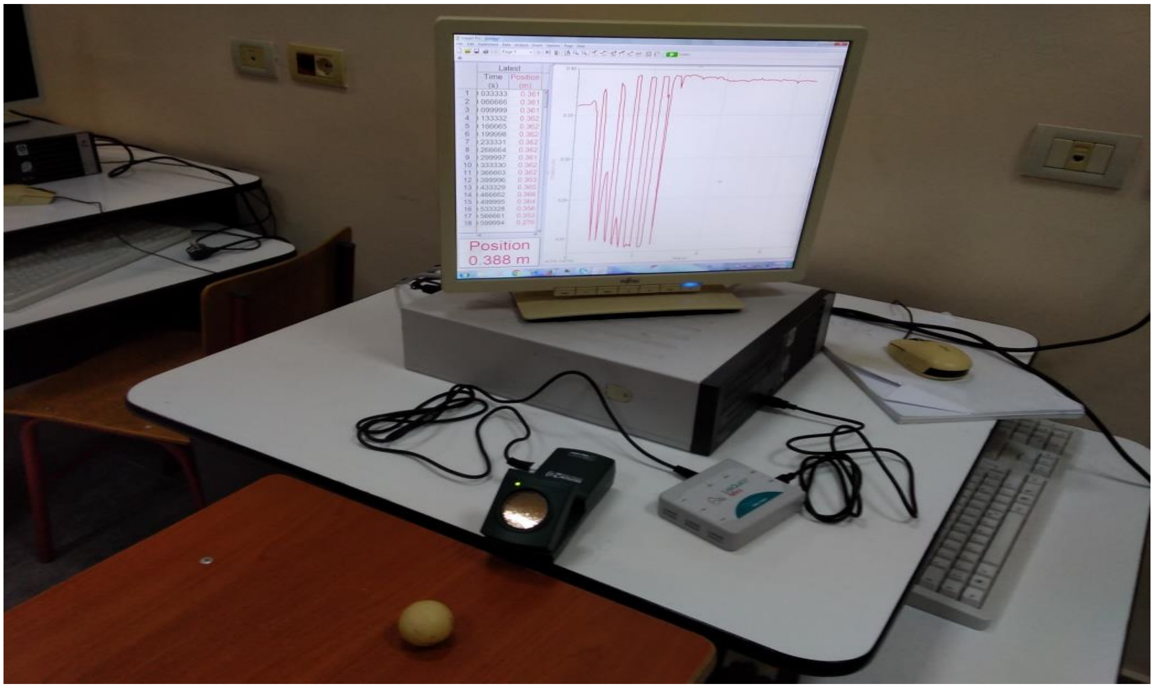


Figure 1

Observations show that, the ball bounces periodically relative to the table.

First, we can't say that bouncing is proportionally harmonious in time. Apparently, bouncing heights decrease in a quantum variety relative to each other, also spotted irregularly. In room space, the ball executes vertical oscillating motion to cease then gradually.

Secondly, the intriguing idea is to study the relation between heights of jumps and counting numbers of jumps, according to the table method, graph method and analytic method.

Table 1 and blue graph show an inverse relationship between Heights and Numbers of Bouncing Measurements H ~ 1 / N. Several analytical functions can be used to refer, such as: H = 111.8 / N or H = (111 / N) + (0.3617)

Table 2 and red graph show another relationship between Differential Changes in Heights and Numbers of Bouncing Measurements H = f(N). Several analytical functions can be used to refer, such as:

H = –52.92 / N or H = –141.3 / (NN) or H = (–126.8 / (NN)) + (2.076)

After each bounce, potential energy is diminished in proportion to a specific quantum pattern.Therefore, the energy, absorbed by the given table, is estimated to be:

$$\Delta E = E(i+1) - E(i)$$

Or

$$\Delta E = mg\,\Delta H = mg\,[H(i+1) - H(i)]$$

Third, what a wonder situation will it be in the ideal case of heights increasing, wow!?

Experiment – Theory: Bohr – Galileo's Fractal

Level: Third; Second, First

Solution

According to Bohr model, orbital radius obeys to law: $r = n^2 r_0$ ratio (1, 4, 9, 16, …, n^2) relative to ground orbit radius. Slide falling, or rising, the electron jumps in between [8].

On the inclined plane, when the physical body slides down with constant acceleration, displacements obey to law: $s = n^2 s_0$ratio (1, 4, 9, 16, …, n^2) relative to initial position.

Now, isn'tthat an example of similarities in physics and, also, repetitions of physical laws in the micro – macro world [9][10].

Conclusions

Mix treatment of concepts from micro world and macro world enables simultaneous developments of classical and modern ideas in physics. In this fashion, at the foundations of macro world phenomena are stated causes of micro world dimensions, i.e. energy. On the contrary, at the foundations of micro world phenomena are stated causes of macro world dimensions. For instance, irregular bouncing of a given ball, or Bohr – Galileo fractal, provide some excellent basis for the non – linear quantum mechanics [11][12].

It must be recognized that, such strategy in education, is not always efficient. Lessons to study are increasingly too much and extremely extended. Consequently, macro and micro treatments in physics education recommended to cover simple issues, classified according to different levels of learning, usually named to distinguish the first, the second and third level of either oriented or free will learning. Theoretical and experimental implementations of modeling and analogies are assumed to be a good strategy to help both teachers and students to better understand the diversifying physical reality [13].

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