# Experiment Reveals an Understandable World

Unpublished work of August 8 2003, edited 1/2007, 3/2008, 9/2010, 3/2012, 7/2012 © Eric S. Reiter, Pacifica CA.

**Note:** This is a no-holds barred display of my assertions. It is written in first person, as if I were talking to you. This is not a formal physics essay.

Wave-particle duality is often dismissed as just something we need to accept as a fact of nature. Some physicists will admit that it is an unresolved paradox, or a problem. The question of light quantization has been argued since its treatment by Isaac Newton, but more hotly debated since the light quantum hypothesis of Einstein in 1905. Taking the view that it is a solvable problem, it is by far the most profound problem in all physics. We will describe here an old experiment and a unique implementation of that experiment that resolves the problem. There is a famous thought experiment by Einstein paraphrased by Bohr (see Figure 1):

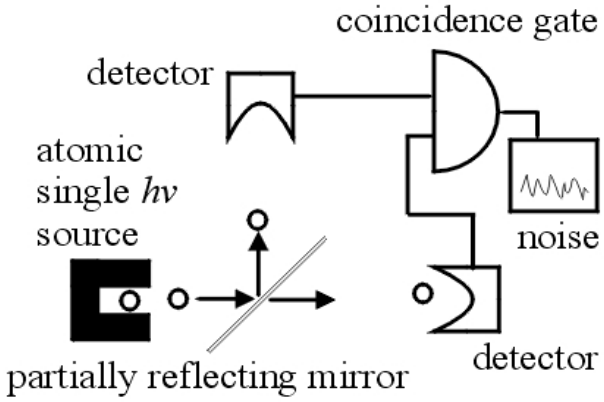


Figure 1. Beam splitter experiment. When no coincidences are detected the experiment indicated particle behavior, and they drew it this way. But light also acts like waves. Paradox!

> " If a semireflecting mirror is placed in the way of a photon, leaving two possibilities for its direction of propagation, the photon would be recorded on one, and only one, of the two photographic plates situated at great distances in the two directions in question, or else we may, by replacing the plates by mirrors, observe these effects exhibiting an interference between the two reflected wave-trains."(1)

This is the model of the photon. The first part of this quote constitutes a test of the particle-like property of light. At the lowest levels of light intensity, our photomultiplier tubes and solid-state detectors show pulses. Most physicist use the particle model and assume that a particle-like photon landed at the detector to cause this pulse. Physicists all agree light has wave properties. The problem is that some experiments are easily explained with the particle aspect of the photon model:

(1) At higher frequencies such as x-rays, pulses from our detectors are of an amplitude proportional to Planck's constant $h$ times the frequency of light $\nu$ ( $\nu$ = Greek letter nu). The currently accepted understanding is that a particle-like photon's worth of energy somehow assembles itself from space and deposits this energy at the detector with energy $E = h\nu$.

(2) In laboratory enactments of Einstein's beam-splitter thought experiment, atomic sources emitting a single $h\nu$ of light at a time, have in all past experiments measured

single detection pulses located in either one detector **or** the other detector past a beam-splitter, as predicted by the photon model (they did not use gamma-rays).

Notice I do not call an $h\nu$ of light a photon. I am showing the flaw in the photon model. Anyone who tries to explain the wave-particle duality paradox in the language of photons has completely missed the point. As soon as you describe an experiment about photons in terms of photons, you will find photons and remain in paradox. Amazingly, this simple and gross mistake is extremely common.

Both matter and light have these wave and particle-like properties. Physicists will often not admit that there is a problem here. In school we are taught that our experiments tell us that nature just has this strange property. Our literature abounds with attempts to deal with this strangeness. Some physicists might tell you that our experiments indicate a paradoxical world. Some physicists will explain that the micro-world is beyond the capacity of human common sense and we should just get used to it. Some will say that nature is fundamentally random or statistical, and that the wave properties are due to a *probability wave* that somehow guides particles.

Randomness is not the problem here. God may indeed *play dice;* Einstein is famous for saying the opposite, but that does not matter. The problem is that we have no reasonable understanding for how some localized particle of light (or matter) can generate a wave interference pattern. And conversely, there is no reasonable understanding behind the current dogma stating that a light wave of *probability* can spread over all space and somehow guide itself to collapse to create one particle-like electrical event in photoelectric absorption. Heisenberg called it "collapse of the wave function." I encourage you to put physicists to the test. They may agree that there is no physical understanding behind the particle/probability model. We do the equations and use the model because they work: "shut up and calculate". However, the prediction quantum mechanics offers does not work for my experiment; I designed it that way.

Now, about this beam-splitter experiment. The hard part of performing it is to insure that only a single $h\nu$ of electromagnetic energy is emitted, one at a time. This was first accomplished using visible light in 1974, and repeated in 1986. These experiments[(2)] all showed that light acted like a photon. There were no coincident pulses in detectors located beyond the beam-splitter at rates beyond accidental chance. These results led physicists to conclude that light acted like a particle that went one way or the other at the beam-splitter, consistent with quantum mechanical predictions. They were happy to see this, published it, and refer to these experiments very frequently.

Why has no one tried to do the beam-splitter experiment with gamma rays? Because gamma rays are thought to be the most particle-like light. Our entire literature will describe that it is a fact that a gamma-ray, or any so called photon, will deposit its entire energy in a particle-like manner upon an absorption event. No one did the beam-splitter experiment with gamma rays to see if this was true. Surprise! With gamma rays this experiment shows a single emitted $h\nu$ *does* split its energy in two paths. This changes our understanding of the physical world, in a big way.

Furthermore, my other writings will show how previous experiments that tried to find this one-way-or another effect using x-rays and optical light were flawed in obvious ways. Furthermore, we were warned against the photon idea by the greatest names in physics: Planck,

Lorentz, Schroedinger, and Einstein. Einstein was a complicated character. Although he started quantum mechanics with his 1905 "photon" paper,[3] he also argued against quantum mechanics in a famous paper of 1935 with co-authors Pedolsky and Rosen, often called the EPR paper.

The effects in my home laboratory experiments are robust, repeatable, and work in many ways. Proper control experiments were performed to eliminate artifacts. A singly emitted $h\nu$ can split to trigger two simultaneous detector events, at a rate substantially beyond the chance rate. Chance is calculated by a simple, well accepted, equation and technique.

How can all this be? Answer: $E = h\nu$ is a property of matter, not light. My coincident detection-pulses are of the same amplitude that are characteristic of the original gamma-ray. The single emitted $h\nu$ is split into two partial classical pulses in a way that preserves the original frequency $\nu$. *Action* is taught to have a minimum at $h$, but when when we consider that *action* is in multiples of $h$ we can also see that *action* has a maximum of $h$. This *action* can be initially lower in the detection mechanism to reveal my two-for-one effect. The obvious way to interpret the result of these new experiments is to understand that a classical light pulse is resonantly absorbed to complete a loading to a threshold of action at $h$. The electromagnetic frequency remains unchanged in the beam split experiments. We are not witnessing a violation of the principle of energy conservation. The experiment reveals a violation of the principle of the photon, light quantization, embraced by quantum mechanics. Physicists have argued against this *loading theory* by explaining our experiments by the photon model. However, I have re-interpreted those same experiments with the *loading theory*. The *loading theory* lets us remove the duality paradox.

Quantum mechanics is the most dominant paradigm of modern physics. Physicists are trained to ignore philosophical and common sense considerations. However, their arguments are based on interpretation of past experiments. Physicists should argue from the data, not interpretation of others. The physical science community and their publishers are very heavily invested in maintaining their grants and subscribers. They are trained to think that there is nothing wrong with the way science has progressed, that there were no mistakes, and that the wave-particle duality issue is a done deal. My new experiments force a reinterpretation of our most famous physics writings all the way back to 1905. Those who argue against me stand on a platform embracing paradox.

Prior physics has never found an experiment to explain the wave-particle illusion. It was obvious to me that the famous double-slit experiment must involve a loading theory. The new *unquantum* experiments will let you see past this illusion and guide you toward understanding this most fundamental aspect of our world. Contrary to the message in all of our science books: light has nothing to do with particles, there is no particle property of light, there are no photons. Quantized-absorption is an illusion of a quantized-emission-only system. Light is only quantized at an instant of emission. It is explained by the *loading theory*, which you will see has been unfairly treated.

In my following papers the *loading theory* is used to derive the photoelectric effect equation from a slightly modified version of deBroglie's wavelength equation. This is very important because the *unquantum effect* is closely related to the photoelectric effect, and the photoelectric equation is one of the most important in all physics. I am not an Einstein basher; he was obviously great. History took up the photon model because Einstein's photoelectric effect equation was right.

The loading theory explains particle-like effects without particles. It was logical from my wave oriented derivation of photoelectric, and other key equations, that my gamma-ray experiments would give the opposite result from prior beam-split tests. At least 20 versions of *unquantum* gamma-ray experiments, and many related tests, were performed in search of flaws since year 2001. Later, I contradicted the probabilistic understanding of quantum-mechanical particles in experiments that split the alpha-ray (the helium nucleus) the same way. The physical science community offered little assistance, and mostly skepticism. My message is too astounding for most physicists, and they automatically dismiss my work as somehow flawed.

I know from experience with physicists, mainstream publishers, and the US patent office, that methodology not embraced by the current paradigm of quantum mechanics is automatically rejected. Their rejections persist, even in the face of obvious paradox and a torrential flow of "quantum weirdness."

My position is firm: there has been much silly physics reported lately. They will claim that a pair of "particles" are entangled to communicate their respective states instantaneously across the universe. A continuous flow of reports claim validity to quantum weirdness in the form of quantum teleportation, quantum signaling, and quantum cryptography. Evidence for quantum weirdness is: (1) beam-splitter experiments with no coincident detections is taken as evidence that a "photon" goes only one way or another at the beam splitter, and (2) reactions that emit two “photons” that are detected in coincidence in perpendicularly polarized states. For (2) they call upon the probability wave that had to travel from one detector to another instantaneously. I have studied patents granted on quantum cryptography and found that they have no supporting data, just references to famous yet poorly conceived experiments. Those photon physicists are full of cheap tricks. If you look past all their hype and look carefully at their technical papers, you will see that quantum cryptography never worked by the photon principle they hold so dearly. If quantum cryptography really did work, it would be my experimental results that were working by some illusion. My experiments are easy to understand and there is no illusion at play. The *unquantum* experiments are the ones that work. Quantum cryptography will never work.

How can it be that something as fundamental as my gamma-ray coincidence tests has not been done before? There were serious obstacles:

**1** The *unquantum effect* required choosing a radioactive isotope that emits a single low frequency (what they call low energy) gamma-ray. More than one gamma-ray emitted in a spontaneous decay would void the measurement. Also, if the gamma-ray “energy” is not low enough, the photoelectric effect efficiency of the detector will not be high enough to reveal the effect. There were only two such radioisotopes readily available.

**2** If a single $h\nu$ could trigger two events, we should see sum-peaks in our pulse height spectrums at twice the energy. Gamma-ray spectrums gave little hint of this effect because our highest resolution detectors have a lower photoelectric efficiency. A high photoelectric efficiency is necessary for the *unquantum* effect, but not for making good spectrums. So in this situation, where we use instruments that make us think we see better, we see the *unquantum effect* worse.

**3** The radioactive isotope first explored was Cadmium-109. Many samples of Cd109 are

contaminated with Cd-113, which emits a coincident second gamma-ray that obscures detecting the *unquantum effect*. With this contamination, the *unquantum effect* will be obscured in a simple pulse height spectrum when using any type of detector.

**4** The *unquantum effect* I measured in the sum-peak of a Cobalt-57 pulse height spectrum is not large enough challenge quantum mechanics if it was noticed by others.

**5** There are mistakes in our textbooks. See *Exposure of Physics Misconceptions*.

**6** The way to understand the wave-particle paradox for light required an understanding of the particle-like properties of matter first.

**7** In the electromagnetic spectrum, gamma-rays are thought to be the most like particles. One would need to understand how a wave effect can be expressed with a pulse of classical gamma-ray energy, and why an *unquantum effect* cannot be detected using visible light.

**8** In a beam-split experiment that tests if light acts like photons that go one way or another at a beam-splitter, one must see through the conceptual and experimental flaws of previous workers, and ignore their conclusions.

**9** Concerning most experiments in modern physics, one would need to see through the dominant paradigm, ignore the models used by our most famous experimentalist's, and freshly analyze their experimental setup and data in order to see what *nature* is saying, not *people*. Then one would need to solve the theoretical riddle, predict the beam-splitter effect, and understand how to look for it.

There is a metaphorical way to understand the loading theory. Picture instead of atoms, identical cups that can hold any level of water. The cups are balanced so that when a cup is full, it can tip and dump the whole cup. There can be partially filled levels of water. If water is added to the cups in an unquantized manner like a spray, the cups can become full and the cups will dump at random times: no coincident dumps. If one full source-cup of water is dumped to split its contents onto two receiver-cups that were previously only half full, these receiver cups will become full and can dump at the same time: coincident dumps. This way a single source cup-dump can cause two coincident receiver-dumps. A single quantized emission can cause two coincident loadings-to-threshold. It depends how the energy is sprayed. A gamma-ray is sufficiently pulse-like to see through the illusion.

## References


1 Atomic Physics and Human Knowledge, Niels Bohr, page 50 (1958).

2 "Demonstrating single photon interference," Science 231, page 671, Feb 14, 1986.

3 "On a heuristic point of view concerning the production and transformation of light," Albert Einstein, Ann Phys 17, 144 (1905).