PARTICLE VIOLATION SPECTROSCOPY

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ABSTRACT

A quantum mechanical particle should go one way or the other at a beam splitter. Using the 5.5 MeV alpha-ray (He++) emitted singly from Americium-241 in spontaneous decay, a thin gold foil beam-splitter, and two surface barrier detectors, we test this notion. Coincident detection should only occur by chance, at an easily calculated rate. However, the method at hand shows coincident pulse rates greatly exceeding chance. In most cases the pulse heights in the two detectors past the beam splitter will add to the full height of an un-split alpha-ray. One might think the alpha was split into components. However, kinetic energy is far below the binding energy threshold to perform any such split in either the helium or the gold. We conclude the alpha matter-wave was split like a wave, in violation of quantum mechanics. The degree above chance was found to be a function of the gold alloy. Therefore, the method is a measure useful in material science.

Background

Well known prior art experiments have revealed wave properties of so-called particle beams. C Davison and L H Germer published "Diffraction of electrons by a crystal of nickel," (1927) *Physical Review,* volume 30, No. 6, pages 705 to 740. Within two months G P Thompson published his electron diffraction experiment, as described in J J Thompson's book *Recollections and Reflections* (1937) page 347. G P Thomson's work is best described in his book *The Wave Mechanics of the Free Electron* (1930). Molecular wave diffraction was clearly demonstrated in the experiments of I Estermann, R Frisch and O Stern in "Monochromasierung der de Broglie-Wellen von Molekularstrahlen," *Zeitschrift für Physik A* (1932) volume 73 , pages 348 to 365. In modern physics, these experiments have been described in terms of quantum mechanical particles influenced by a purely mathematical wave function. Physicists realize that classical particles do not diffract, but somehow, they think a quantum mechanical particle can diffract. So-called particle diffraction experiments have always been a fundamental problem in physics. Attempts to understand how a particle can have wave properties have always resorted to a probability-wave that somehow guides the particle. It is well known that the model of classical particles cannot be adjusted in any way to explain wave cancellation or diffraction effects, when detection rates are adjusted to one at a time. Furthermore there is no reasonable way to understand how the energy of a wave could spread through macroscopic space, and then somehow collapse to cause a particle-like detection event to take place. This problem, often called a paradox, is known as wave-particle duality. The term "quantum mechanical particle" implies paradoxical wave-particle duality.

Predating wave-particle duality for matter was wave-particle duality for light, originating in Einstein's famous photoelectric effect paper of 1905, “On a Heuristic Point of View Concerning the Production and Transformation of Light.” It was a paradox. Experimental evidence for my method of solving the wave-particle duality paradox for light is described in detail, in *Photon Violation Spectroscopy,* PVS, (US patent pending US 2005/0139776 published June 30, 2006). In PVS I describe the method and theory of how the principle of the photon can be overturned. Light spreads classically, and is not held together in anything resembling a particle at all. I use the loading theory to reinterpret experiments that are famous for showing that light is particles. The loading theory and the theory of quantum mechanics make opposite predictions in a beam-splitter experiment. My theoretical work in PVS enabled me to predict these *unquantum* alpha-ray experiments. At the time of my writing PVS, there was no experimental evidence to demonstrate that matter likewise could split as a wave to cause detection coincidences beyond chance. The phenomenon is best described as a threshold reached in the loading theory. Both the classical and quantum mechanical understanding of the word "particle" presume that such a particle would hold itself together as an intact package incident upon a microscopic absorber.

My tests have recorded detector pulses in coincidence, at rates beyond the chance rate predicted by quantum mechanics. My test results indicate that a resonant precursor of the nuclear wave function, known as the atomic nucleus, must exist in a partially loaded state. The level of a partially loaded state determines the probability that an incident pulse of matter-wave energy can complete this partially loaded state to a threshold and trigger multiple detectable absorption events in coincidence. One measure of this threshold is Planck's action constant h understood here as a maximum. In the loading theory, action at or beyond h, could lose stability and a quantum of energy would be released, but this energy could thereafter spread like a wave. The energy released can be either electromagnetic, as tested with the gamma ray in PVS, or the energy released can be a matter wave, as tested with the alpha ray in this method of *Particle Violation Spectroscopy*.

In *Particle Violation Spectroscopy*, the source of matter-waves is radioactive spontaneous decay, but this does not necessarily limit my method to using spontaneous decay. My evidence employs alpha-rays, high speed helium nuclear matter-waves emitted in spontaneous nuclear decay. It would be misleading to explain my discovery with the usual term “alpha particle.” In mainstream physics, the treatment of conservation of energy is performed with particles emitted, processed, and absorbed, with no account of a pre-loaded state. Mainstream physics commonly assumes that even a quantum mechanical particle is just a shrunken down classical particle that is associated with a guiding wave function, and that the particle makes a crash landing to cause an absorption event. I warn that words like “atom” and “electron” should instead refer to their experimentally associated phenomena and not to tiny spheres that require a paradoxical world.

In this loading-theory physics substantiated by *Particle Violation Spectroscopy*, an aggregate of solid state matter may be faithfully modeled as atomic particles, and we may model standing waves to account for measured spectroscopic atomic structure. However, when an elemental wave function in its particle-like state is released to travel across space it loses this particle-like property and must spread longitudinally and transversely as a matter-wave to account for interference effects. In the solid state, a stable matter-wave may shape space with centers of its mass distribution described by particles, but such a mass can be released to convert its standing wave kinetic energy into a traveling spreading matter-wave. In these experiments I call it *heliumness*. The wave has a characteristic that can load up in a standing wave system to a threshold that can suddenly be released to give the illusion that a particle hit there.

Prior physics did consider the loading theory for light loading into the charge wave (electrons), but did not consider the loading theory for matter (atoms). The loading theory was first introduced in 1911 by Max Planck in his paper "Eine neue Strahlungshypothese," found in a collection of his works *Physikalische Abhandlungen und Vorträge.* Here Planck described continuous emission and explosive absorption, and theorized an energy E in the inequality $0 < E < h\nu$, where h is his action constant, and ν (Greek letter nu, not an italic v) is electromagnetic frequency. Planck also used ν for the same frequency of a material oscillator as I do. In this 1911 paper, Planck used the average energy $h\nu/2$ to derive his famous black body heat distribution equation. Planck's inequality algebraically implies action can be any value between 0 and h. The loading theory was described in T Kuhn's *Black Body Theory and the Quantum Discontinuity 1894-1912* (1978) as Planck's second theory. The only other works to be found on the loading theory are by P Debye and A Sommerfeld, one of which is "Theorie des Lichtelektrischen Effektes vom Standpunkt des Wirkungsquantums," *Annalen der Physik* (1913) volume 346, issue 10, pages 873-930. Planck's second theory with continuous absorption in black body radiation was well described in O W Richardson's book, *The Electron Theory of Matter* (1914) first edition, page 350. The research of E O Lawrence and J W Beams, "The Element of Time in the Photoelectric Effect," *Physical Review* 32, page 478 (1928), giving curves of current verses time clearly shows there are minimum, average, and maximum times to be considered. Early authors taught in their books to ignore or make implausible the idea of the pre-loaded state, examples of which are M Born, *Atomic Physics* (1935), and Hughes and DuBridge, *Photoelectric Phenomena* (1932), chapter 2-9, pages 32-33. The loading theory was considered in A H Compton and S K Allison's book *X-Rays in Theory and Experiment* (1935), page 47, and in R A Millikan's book *Electrons (+ and –)* (1947), page 253. To their credit, Compton and Millikan understood the loading theory include the existence of a pre-loaded state, but they did not embrace it. In all publications thereafter, in all my long search for it, writing on any form of loading theory, otherwise known as the accumulation hypotheses, was crippled by confusion over the issue of response time. Contrary to popular teachings there is indeed a lag in photoelectric current, as shown the data of Lawrence and Beams. Our textbooks will often show a calculation of the loading time. However, they unfairly compare a calculated <u>maximum</u> loading time to the experimentally observed <u>minimum</u> response time. The average loading time does change with intensity, but this is not acknowledged when only the minimum time is given to consider. These faulty arguments are the norm in physics and are still taught, most notably in Halliday and Resnick, *Physics*, sub-chapter on Photoelectric Effect.

I have found several errors of the sort described above and errors in other fundamental cases of historical physics resource. Another significant textbook error, also in cited Halliday and Resnick, sub-chapter The Compton Effect, is the common portrayal that " The presence of a scattered wave of wavelength λ' cannot be understood if the incident X-rays are an electromagnetic wave." It is very easy to go to Compton and Allison's book cited page 232 to find an electromagnetic wave explanation, similar to the one described by E Schrödinger, *Ann der Phys* (1927), 82, page 257.

In the loading theory, the alternative to the concept of the particle is the threshold. Planck's second theory of 1911 introduced a threshold concept of energy: emission is quantized, and absorption is continuous up to a threshold. Prior art experiments, other than my own, have never shown quantized absorption to fail. In prior art physics, continuous absorption was not found necessary because a purely mathematical probability wave adequately described our measured wave properties, so the particle/probability model of quantum mechanics prevailed. After Max Born criticized Schrödinger's wave packet interpretation, as in Born's book *Atomic Physics*, formal mainstream physics and certainly our textbooks only published the particle/probability model.

The first coincidence experiment sensitive to ray characteristics was by W Bothe and H Geiger, "Uber das Wasen des Comptoneffekts," *Zeitschrift fur Physik* (1925) pages 639-663, vol. 32, where an x ray tube sourced x-rays to interact with hydrogen which was surrounded by an electron detector and a Geiger counter. Their coincidence rate was 11 times greater than chance, but that is what you would expect from two different kinds of detectors detecting two kinds of "particles." It seems foolish to attempt a split of the alpha if you think it acts like a quantum mechanical particle, but it is reasonable to attempt a test of the loading theory. It is not obvious to test the loading theory, especially since such a vast amount of prior art literature claims to have already tested and discredited it. The patent office will only grant patents on methods that support quantum mechanics, thinking it must be right. I have described in *Photon Violation Spectroscopy* major mistakes that were made in testing the loading theory. The loading theory and quantum mechanics cannot both be upheld; a major revision or replacement of quantum mechanics is in order. The form of experiment that has been repeated to strengthen the argument of quantum mechanics along the issues brought up by the Bothe Geiger experiment has only searched for how close together in time the coincidences have occurred. Prior art experiments like that of Bothe and Geiger, or with any "particle" have side-stepped the deeper question of a pre-loaded state.

In all prior art tests of the loading theory, beam splitter tests were employed using only electromagnetic light. Prior art beam splitter tests with light did not give coincident detection rates beyond chance, and that result would make a test to split a matter-wave in the view of quantum mechanics a waste of time. The idea behind the beam splitter tests I speak of seemed to originate in a thought experiment of Einstein's, recalled by N Bohr in his book *Atomic Physics and Human Knowledge* (1958):

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

It is the first half of this quote/definition that my experimental results conflict with. A beam splitter test has been performed in prior art using x-rays and visible light, and only chance coincidence rates were found, consistent with quantum mechanics; there was no *unquantum* effect. By these prior art tests, a physicist would predict that any quantum mechanical particle would behave similar to the photon: it would go one way or another at a beam splitter. I know of no prior art attempt to split what was thought of as a beam of material particles, into two beams of the same particle type, and to search for coincidences of pulse heights that are characteristic of that same particle type, employing a detector in each of the two beams. There are such things as particle telescopes that have similar detectors and electronics to sense coincidences, but they have never been used to test if what they thought was one particle, would become two. The only way to think about such a thing is to give up the idea of particle-like absorption, and embrace the loading theory.

An important component of my theory is to make the action constant *h*, the electronic charge constant *e*, and the electronic mass constant *m*, all be maximum thresholds, so that the ratio of any two of these three measures would stay unchanged as a wave thins out in space. Measurements will not show a lower action, charge, or mass because a ratio such as action/mass will be conserved and expressed in our measurements.

Of course, with matter, and particularly the alpha, there is a binding energy issue that must be addressed. In the case of alpha-rays, if a so-called alpha particle has a kinetic energy greater than its own binding energy, the alpha is known to split to display subatomic characteristics. Similarly, if an incident so-called alpha particle has kinetic energy exceeding the binding energy of a target atom, the target can be split into subatomics. See R D Evans' book *The Atomic Nucleus,* page 299. However, conventional physics will not understand a way for these splittings to occur if the incident kinetic energy is below its binding energy threshold. Therefore conventional physics will predict that a material particle with insufficient kinetic energy to cause a split, will go one way or another at a point of reflection. By prior art physics, such an experiment would predict coincident detection events only at the accidental chance rate. A prior art physicist would predict a low energy particle would go one way or another at a beam splitter; it would not go both ways at once, it would not violate binding energy calculation, and it would not cause coincident detections in two subsequent beams.

In the beam splitter test there must be a way to determine if a single so-called particle is emitted toward the beam splitter one at a time, and that multiple particles are not simultaneously emitted. The test for a singly emitted particle is called a true coincidence test and is well known in physics. A detection method specifying opposed detectors has been patented by Drukier US 5,866,907 to measure true coincidences. The detectors are usually arranged in an opposed orientation so that each detector receives a substantial flux of non-overlapping solid angle radiation. By non-overlapping solid angles, I mean there was no beam splitter and the radiation went in different directions. A true coincidence test is designed to see if a quantized emission sends energy in different directions at once. If the radiation obeys the equation for matter-wave wavelength, $h = m \, \text{v} \, \lambda$, or the equation for electromagnetic frequency, $\varepsilon = h \nu$, a conventional physicist will called it a quantum mechanical particle. Two of such quantum mechanical particles simultaneously emitted in different directions will create true coincidences. A true coincidence source is usually not used for *Particle Violation Spectroscopy*

It is important to point out how some experiments would support the probability-wave interpretation, in conflict with my method. There have been many attempts to confirm the probability-wave interpretation of quantum mechanics. Examples are experiments that report diffraction effects using molecules as large as carbon-60, so called “fullerene molecules.” Those “fullerene” experiments were performed in the laboratory of Anton Zeilinger, Universität Wien, Austria. None of their experiments report fringe shift data from the same apparatus as a function of different velocities. Such a comparison would have been very simple for them to do because their apparatus included a rotating wheel velocity selector, but such a fringe shift as a function of velocity has not been reported in any of their published papers. Velocity relates to de Broglie's wave equation h = (mass)(velocity)(wavelength) at the heart of quantum mechanics. A good example of the Austrian team's work is: O Nariz, M Arndt and A Zeilinger, "Quantum interference experiments with large molecules" (2003), *American Journal of Physics*, American Association of Physics Teachers, vol. 71 pages 319 to 325. Such a comparison of fringe shifts with velocity was indeed performed properly by Estermann, Frisch, and Stern in the reference previously cited on page 362. This 1932 work sets the obvious experimental standard that was not reached by the Austrian team. The theory used by the Austrian team was too complicated and contained many unnecessary assumptions. Furthermore, the flux rate was not reported, so at high flux rates there could have been in-flight interaction effects. For these reasons, reports by Zeilinger et-al claiming that large molecules interfere or diffract according to a probabilistic de Broglie wave cannot be held as evidence against the validity of my method. My work says particles, quantum mechanical or not, do not diffract. When dealing with low count rates, only mechanisms involving a load-up can display diffraction. Fullerenes are real particles and will not cancel out or constructively reinforce the way a theoretical quantum mechanical particle is thought to. Quantum mechanics assumes no size limit to its particle assumed to be guided by its probability wave. Publishers routinely deny any paradox and do not encourage its resolution. *Particle Violation Spectroscopy* and *Photon Violation Spectroscopy* are two distinct methods of demonstrating that all of modern physics has been in error by accepting probability-wave guided particles as the reality of nature.

A commercially viable utility of my method is a material science spectroscopy applied to gold, carbon, silicon and other materials. Another utility is to demonstrate the physics discovery with an apparatus to be sold to school labs. A low cost apparatus can be produced utilizing americium-241 as a low level alpha ray source, two semiconductor alpha ray detectors with their output pulses digitized by high speed analog to digital converters, and an interface to a personal computer. Pulse-amplitude windowing and time coincidence functions can be accomplished in digital signal processing software. For the alpha ray, if the source and detectors were placed close together in a miniature embodiment, a vacuum chamber would not be necessary.

The detailed description of the apparatus and method of this disclosure apply the actual apparatus used to obtain the data presented here. The drawings and description have been properly simplified, but are more than adequate for a physicist to understand how to readily build and operate the apparatus. Multiple repetition and supporting tests have been performed to insure against artifact, procedural error, and instrumentation error.

Description of Figures

Figure 1 describes an embodiment for splitting alpha rays with thin foils.

Figure 2 is a composite of data using 24 carat gold leaf as a beam splitter of alpha rays.

Figure 3a is a coincidence histogram for the same experiment as for fig. 2.

Figure 3b is a coincidence histogram using 23 carat gold leaf as a beam splitter of alpha rays.

Figure 3c is a coincidence histogram using a surface barrier detector to both detect and split alpha rays.

Figure 3d is a coincidence histogram with alpha rays and no beam splitter showing no true coincidences.

Figure 4 describes the arrangement for splitting alpha rays from a diamond powder coated surface.

Figure 5 is an annotated screen capture of a computer automated test of a diamond powder coated surface splitting alpha rays.

Figure 6a is a pulse amplitude histogram from a surface barrier detector receiving alpha rays.

Figure 6b is a pulse amplitude histogram of alpha rays reflecting from a surface of diamonds.

Figure 7a describes supporting physics evidence from *Photon Violation Spectroscopy*.

Figure 7b is a digital oscilloscope graphic for the experiment of fig. 7a.

Description of Preferred Embodiment

The radiation source for all of my matter-wave splitting experiments are 2 mm diameter foil disks plated with one microcurie of americium-241. An atom of Am-241 in spontaneous decay emits a 5.5 MeV alpha-ray and a 66 keV gamma-ray. Electron volts, eV, is a particle model energy unit, here relating to kinetic energy. I use this energy unit for convenient relation to commonly published measurements. This use is not to be construed as my embracing the particle picture. The alpha-ray is related in physics to the helium nucleus with chemical formula He^{++}.

My earliest strong evidence for splitting the alpha ray as a wave was on April 17, 2005 using a gold leaf beam splitter and two ORTEC brand DIAD (discriminating industrial alpha detector) surface barrier detectors, revealing characteristic coincidence detection events at 538 times chance. My detailed experimental description and evidence used different detectors and a more refined method. Many scattering material types, geometries, and detector types were tested. My most robust evidence employed beam splitter foils of gold and alloys of gold. Commercial surface barrier detectors are constructed two ways: (1) the front surface may be electrically isolated (non-grounded detector surface) from the casing such as those manufactured by CANBERRA, or (2) the front surface may be electrically bonded (grounded detector surface) to the casing such as those manufactured by ORTEC. It was found from careful measurement that the electrically isolated active surface of CANBERRA detectors were vulnerable to cosmic ray interference. Cosmic rays can cause artifact coincidences when two CANBERRA detectors are used. In control tests with the Am-241 source removed, it was found that the one inch detectors from ORTEC were the quietest. A no-source control test was arranged as in **fig.1** with one of the two detectors being a 1 inch ORTEC, and the second detector a CANBERRA detector. My best no-source control test ran continuously for 3 days with zero coincidences measured.

Referring to **fig. 1**, Am-241 source **10** is surrounded by cylindrical collimator **11** to prevent alpha-rays from directly encountering the surface of reflection-detector **13**. The source and collimator are typically supported on the outer edges of reflection-detector **13** by a thin bar **12** so as to shade the detector **13** as little as possible. A typical alpha-ray from spontaneous decay from the source will follow path **14** to encounter beam splitter **15** on mounting ring **16** that fits over transmission detector **18**. Beam splitter **15** is typically a thin foil of gold; two layers of artist's 24 carat gold leaf stacked together were found to work best. Most often the alpha-ray will continue with most of its kinetic energy intact along typical path **17** toward transmission-detector **18**. In some cases a component of the initial alpha-ray will be reflected along typical path **19** toward reflection-detector **13**. This reflection from a gold foil is the same phenomenon as observed in the famous experiment of Geiger and Marsden, and whose data was used by Rutherford to show evidence of a particle-like gold atom with a dense nucleus. The effects to be observed in the method of *Particle Violation Spectroscopy* occur when the alpha-ray splits and travels simultaneously along typical paths **17** and **19** to cause simultaneous pulses of current from both detectors **13 18**.

The bias and amplification of detectors **13 18** are performed by conventional methods in nuclear engineering. Briefly, the output terminals of detectors **13 18** are provided with a DC bias voltage via resistors **20 21,** typically 10 megaOhms, to bias the detectors with negative 40 volts from a DC power supply **22**. The detector's output current pulse is coupled via capacitors **23 25,** typically 1 microfarad, to preamplifiers **27 29**. The preamplifiers used were Linear Technology LT1222 op amps with a 155 kOhm resistor and 1 pf capacitor in parallel (not shown) for the inverting amplifier feedback network, and with the op amp positive input grounded via a 1 kOhm resistor (not shown). The detectors and amplifiers are housed in a vacuum chamber constructed from a cylinder **31** with removable end caps **33 35**. With detector **18** on support **36**, the end cap **35** can be rotated to orient detector **18** at different angles for reflection studies described in **fig. 4**. The chamber is evacuated of air with vacuum pump **37** to a modest vacuum of approximately 100 millitorr. Ultra high vacuum technique is not required for alpha work. I tested the alpha-split effect using both a roughing pump and, at a better vacuum, using a turbomolecular pump and gauges, and found no difference. The bias and detector signal wires connect by feedthrough **39** to the outside of the vacuum chamber. The pre-amplifiers require power wires, not shown, and use additional pins on feedthrough **39**.

Amplifiers **41 43** were commercial modules from ORTEC, designed to work with ORTEC single channel analyzer (SCA) modules **45 47**, the amplifier/SCA set being specified by ORTEC to minimize timing “walk” errors as a function of pulse amplitude. The amplifiers used were ORTEC model 460, and the SCA modules were ORTEC model 551. Although there are many ways to set up a coincidence circuit, the easiest and most convincing method is to use a full featured digital storage oscilloscope **DSO**. My data was obtained using a LECROY model LT344 DSO. Instruments of this class contain high speed analog to digital conversion electronics and digital signal processing features for obtaining coincidence histograms. Channels 1 and 2 of **DSO**, **Ch1 Ch2,** monitors the output of amplifiers **41 43**. Channels 3 and

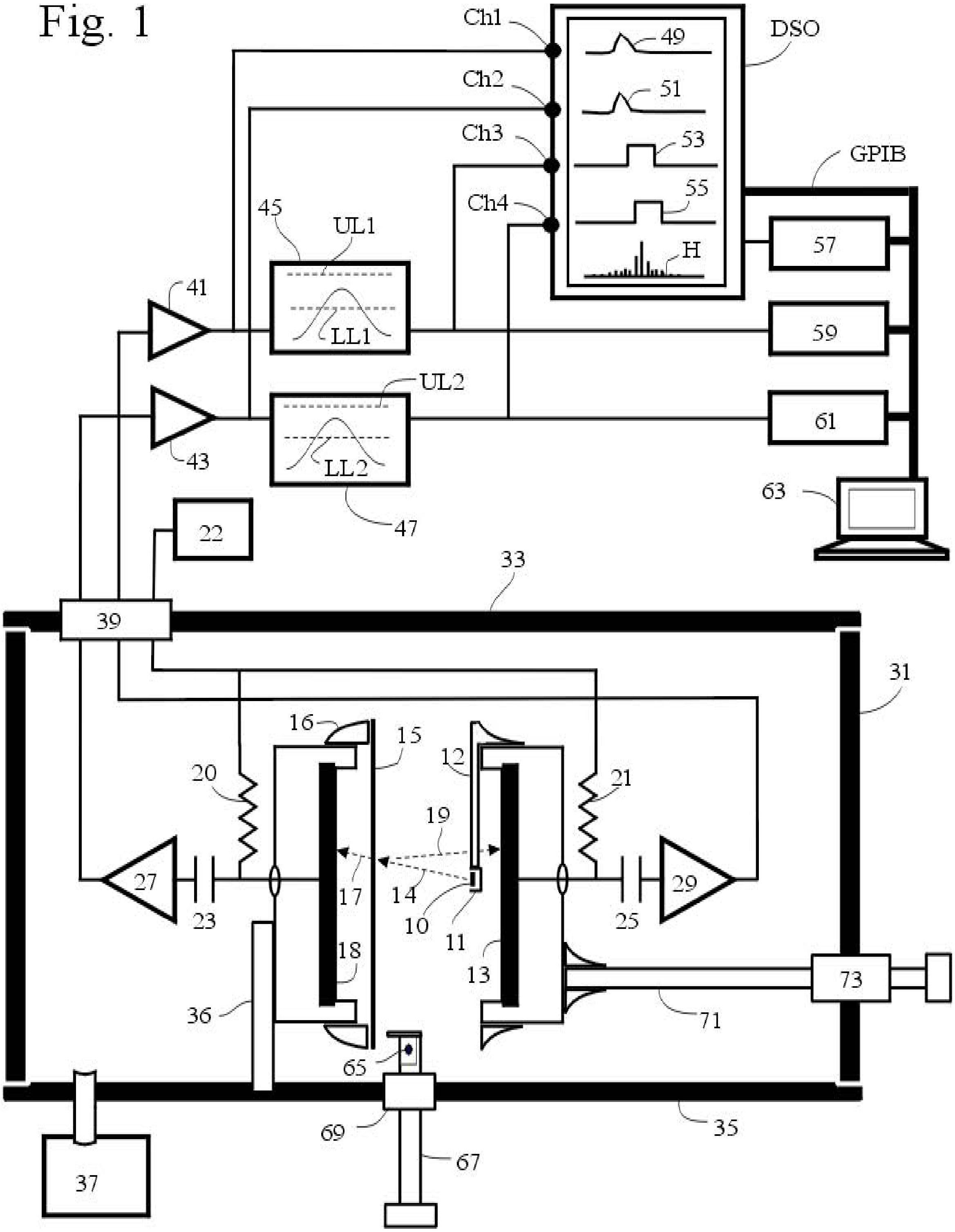
4 of **DSO**, **Ch3 Ch4,** monitor the square wave timing pulse output of SCAs **45 47**. **Ch1 Ch2** are useful for seeing that pulses **49 51** are not misshapen due to noise or pulse overlap. **Ch3 Ch4** are used by the LT344 smart trigger mode that triggers when SCA pulses **53 55** are within a preset time, typically 100 nanoseconds; this is the coincidence circuit. The lower level settings **LL1 LL2** of the SCAs must be set high enough to eliminate noise. Here I set these levels to 1/3 of the characteristic pulse amplitude of the 5.5 MeV alpha ray. The SCA upper levels **UL1 UL2** were set to its maximum. The range of pulse amplitudes between **LL1** and **UL1** is window number 1, and the range of pulse amplitudes between **LL2** and **UL2** is window number 2. The time between **Ch3 Ch4** timing pulses is plotted in coincidence histogram **H** by the **DSO**. A time delay feature in the SCA is used to make the channel 1 pulse record first so that histogram display **H** is centered on the screen. Coincidence histogram **H** is the most important output of the experiment. Quantum mechanics would predict a Poisson distribution with an imperceptible slope, essentially a flat band of noise like that of **fig. 3d**. Any peak in this distribution indicates there is a mechanism other than noise to be analyzed. **DSO** outputs a trigger pulse wired to counter **57** to count coincidences. Counters **59 61** record outputs of the SCAs for singles rate calculations. The time duration of the experiment is obtained from the **DSO** or a separate timer (not shown). The time duration and data from the counters provide for a calculation of singles rates from each detector. An enhancement to the data acquisition was employed in some of my tests employing computer **63** connected to **DSO**, and counters **57 59 61** through bus **GPIB.** GPIB is a popular instrument communication system. Computer **63** is optional to show the *unquantum* effect, but was found necessary to obtain ordered pairs of pulse amplitude data. Future implementations will likely employ a two channel high speed analog to digital converter with dual port ram interfaced to a host computer to digitize pulse shapes from each preamplifier **27 29**, and will perform windowing and coincidence operations in software.

Additional features of the apparatus are required for calibration or various studies. Test source **65** mounted on rod **67** can be manipulated through linear-rotary seal **69** to illuminate each detector with alpha rays, or to illuminate both detectors simultaneously. Detector **13** is mounted on rod **71** supported by linear seal **73** so the optimum spacing between the two facing detectors **18 13** can be adjusted. A spacing of 4 mm between source **10** and gold foil beam splitter **15** was found to be optimal.

In a pulse amplitude histogram, for example **fig. 2 RE** for the alpha ray, a characteristic pulse amplitude is revealed as a peak in the histogram at 5.5 MeV. The alpha-ray can cause pulses over a wide amplitude range. It is known from nuclear physics books and my own tests that an Am-241 source only emits one alpha in an atomic spontaneous decay, and that this source does not cause detector pulses in a surface barrier detector from anything but the alpha-ray. The pulse amplitudes are known to be smeared over the histogram by two dominant mechanisms: there are different velocity alphas produced in escaping the solid of the source, and the detector can distort the pulse amplitude. The SCA window for each detector was set to include a wide range of pulse amplitudes, the smallest being 1/3 of its 5.5 MeV characteristic, set by **LL1** and **LL2**, and ranging to an upper limit set beyond what the monitoring oscilloscope **DSO** was able to acquire without clipping.

Figure 2 is data from an experiment performed November 13, 2006 that used essentially the same hardware as described in **fig. 1**. The data of **fig. 2** is from **fig. 1** coincidence histogram **H**. The source was one Am-241 disk **10** which emits approximately 1 microcurie of alpha rays.

Fig. 1



Ch1
Ch2
Ch3
Ch4
DSO
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GPIB
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The surfaces of the two surface barrier detectors **13 18** were approximately 9 mm apart from each other, and the detector's working diameter was approximately 2 cm. The beam splitter consisted of two layers of 24 carat gold leaf imported from Thailand and held to aluminum ring **16** with a thin layer of vacuum grease. The histograms of **fig. 2** labeled **RE** and **TR** are the reflected and transmitted singles spectra respectively. Data of **RE TR** was collected with the gold in place and no coincidence gating applied. Pulse amplitude histograms **RE TR** were collected by a Δt feature in the LT344 **DSO.** The reflected pulse amplitude histogram **RE** was taken using test source **65** pushed up and swung in place to aim at detector **13**. The positioning and scaling of the **fig. 2** composite was determined from test pulses and by noting the voltages on **DSO**. The peak of each **RE TR** histogram is assumed to correspond to 5.5 MeV and is designated 1 on pulse amplitude scales **Ch1 Ch2** of **fig. 2**. Position 0.33 for each pulse amplitude histogram was determined by SCA settings **LL1** and **LL2**. The points in the **Ch1 Ch2** plane are from coincidences within τ = 100 ns as measured from detector pulses **49 51**, digitized by **DSO**, and transmitted to computer **63** for analysis and plotting.

This **Ch1 Ch2** way of plotting was accomplished by interfacing between **DSO** and host computer **63** running a QUICKBASIC program of my own development. It was necessary to develop this xy plot of pulse pairs to see the pair relationships for testing if particle-energy conservation was broken. It is easy to visualize from **fig. 2** that the average pulse pairs occur at about half the 5.5 MeV point. This is what would be expected if an alpha-particle were to split into two particles, each of half its initial kinetic energy. However in R D Evans' book he clearly describes that it takes over 7 MeV to split a helium nucleus, and even more to split off a component of gold. The kinetic energy spectrum of Am-241 is published in *Radiation Detection and Measurement* by Knoll page 398 first edition, and shows the maximum initial kinetic energy at 5.545 MeV. Therefore, there is not enough kinetic energy to split the alpha by conventional theory. The detectors and count rates are responding to alpha waves.

It is important to understand that the coincidence xy points plotted in **fig. 2** do not occur below about 0.45 of the characteristic average pulse amplitude. This was not due to the SCA settings which were set at 0.33, it is due to the phenomenon. If there were some phenomenon at play other than what I describe, smaller pulse amplitude pairs would be detected in coincidence.

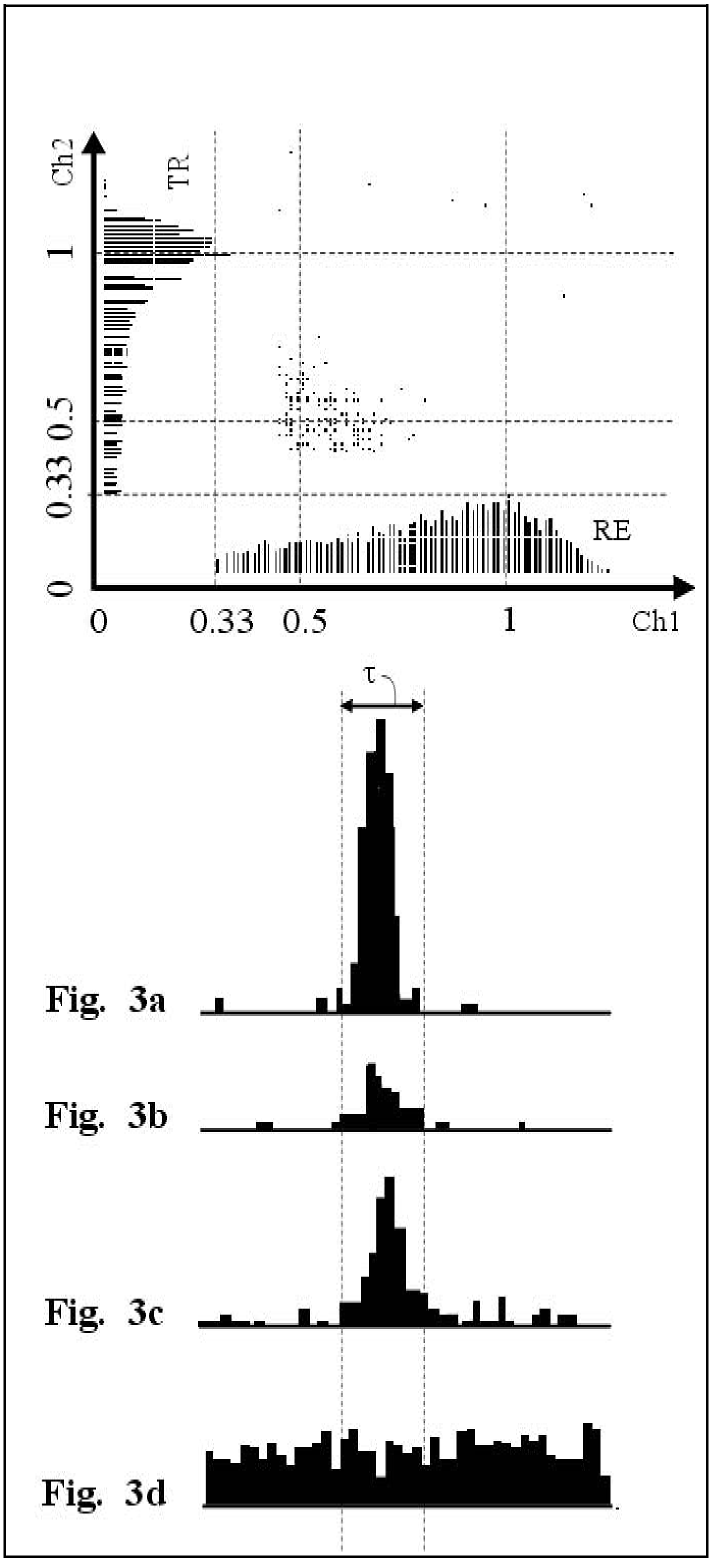
The experiment of **fig. 2** of November 13, 2006 had a reflected singles rate R_{re} = 0.042/sec from the 24 carat gold and a transmitted singles rate R_{tr} = 2314/sec through the gold. For each coincidence histogram in **fig. 3** the window of times between plotted coincidences was set at τ = 100 ns. The chance rate of coincidences is calculated $R_c = R_{re} R_{tr} \tau$ = (0.042)(2314)(100ns) = 9.8×10^{-6}/sec. The experimentally measured rate was R_e = (159 coincidences)/(154ks) = 1.04×10^{-3}/sec, making the ratio R_e / R_c = 105 times chance. Any ratio greater than 1 and surpassing error margins is significant, because quantum mechanics would only predict ratio R_e / R_c equal to unity.

A time difference (Δdly) coincidence histogram for the experiment of **fig. 2** is plotted at **fig. 3a** by means of the LT344 **DSO** Δdly histogram and smart qualified trigger features, depicted in **fig. 1 H**.

From an earlier experiment of November 10, 2006 comes the Δdly histogram of **fig. 3b**. Everything except for the beam splitter material was kept unchanged for a good comparison to the experiment of November 13, 2006. Beam splitter **15** was two layers of an Italian brand of 23 carat gold leaf. The transmitted singles rate here was R_{tr} = 2434/sec, nearly identical to the test of November 13. Singles rates are calculated by the total singles counts per experiment duration, 895 minutes. The similar transmitted singles rates indicate the gold leaves were very similar in their ability to attenuate alpha, indicating the thickness by the stopping power of the 23 carat gold of **fig. 3b** was similar to the 24 carat gold of **fig. 3a**. The reflected singles rate was markedly different at R_{re} = 0.0793/sec. Nearly twice as often, alphas were reflected from this less pure 23 carat gold. One might expect the alpha-split effect to work better with the 23 carat gold given these singles rates. The chance rate was R_c = (0.0793)(2434)(100ns) = 1.95 x10^{-5}/sec and R_e = (40 coincidences)/(53.7ks) = 7.45 x10^{-4}/sec, R_e/R_c = 38 times chance, 2.7 times worse than with the 24 carat gold, defying expectation. The 1/24 difference in gold purity could not account for this. The ratio above chance is therefore an interesting measure indicating something in the metallurgy of the 24 carat gold that could not be measured by prior art alpha interaction physics.

Gold is not necessary as a beam splitter. **Figure 3c** shows a Δdly histogram using only the transmission detector surface itself as a beam splitter. This experiment of November 8, 2006 used the same SCA settings and detectors, but with a stronger Am-241 source than in the previously described experiments. There were 10 disks of Am-241: 9 at the periphery of the reflection detector, and one suspended at the center. The strength of the source only changes the length of time to obtain a Δdly histogram that bears a shape discernible from randomness. It has been found that the strength of the source does not affect the degree above chance. The experimental duration was 6.64 hours, R_{re} = 0.15/sec, R_{tr} = 8527/sec, R_c = 4.8 x 10^{-4}/sec, R_e = 0.0044/sec, R_e/R_c = 9.3 times chance. The detector surface has a thin layer of aluminum vacuum deposited over silicon, designed for the alpha ray to pass through. Copper leaf as a beam splitter material under study also revealed a small positive *unquantum* effect, but tests with palladium and silver leaf foils, plastic, and mica did not surpass chance. The method of *Particle Violation Spectroscopy* will undoubtedly be useful in measuring properties of atomic structure of silicon and other materials in the semiconductor industry. The fact that not any beam splitter material is capable of revealing an *unquantum* effect is evidence of its material specificity. The tests mentioned with palladium and silver leaf foils produced a coincidence histogram of noise resembling **fig. 3d**. Gasses were also tested as a beam splitter in March of 2005 using butane (2.3 x chance), propane (chance), and oxygen (chance).

Many control tests were performed. A test for true coincidences (simultaneously emitted quanta) of December 7, 2006, shown in **Fig. 3d**, was performed for 2 hours with a single Am-241 source disk present, using detectors at right angles to each other with no beam splitter so that the detectors received non-overlapping solid angles of radiation from the relatively small pointlike source. The SCA window settings were the same for all the experiments of **fig. 2** and **fig. 3**. If there were true coincidences there would be a peak within section τ of **fig. 3**, the center of which is 0 ns between timing pulses. However, the relatively flat coincidence histogram shows my Am-241 source disk contained no impurity source of true coincidences. The detectors, window SCA settings, and detector positioning within the vacuum chamber for the non-beam splitter (true coincidence) control test, were also the same as used for testing



reflection of alpha-rays on diamonds described for **fig. 4**. Equivalent to performing a true coincidence test would be to read published data describing emitted energies in nuclear decay, and to understand that the published data proves the chemically known source is not able to create true coincidences. The true coincidence test applies for both matter and energy rays.

It is still valid to perform my method using a source that does produce true coincidences, if a third detector is placed outside the beam heading for the beam splitter, and to use the pulse from this third detector in a triple coincidence test. Detection schemes employing greater numbers of detectors or arrays of detectors are obvious, so long as a set of coincident detections are utilized to defy quantum mechanical chance prediction. The photon-violating triple coincidence test described for **fig. 7** are easily adapted to particle violation.

A no-source background coincidence test was performed for 48 hours with everything else unchanged, to accompany experiments testing a diamond-split effect of **fig. 4.** This background test used a 1 inch diameter ORTEC and a 1.5 inch diameter CANBERRA PIPS detector at right angles to each other with an Am-241 disk centrally located. This kind of background test was repeated several times with different geometries. In none of these background tests was a single coincidence found, even by chance. This indicates that cosmic rays were not interfering with the experiments. Cosmic rays were indeed found to interfere and cause coincidences when two CANBERRA PIPS detectors were employed, and coincidences occurred at an average rate of about 3/day, with the amplitudes of pulses being irregular. The fully shielded ORTEC detector was therefore shown to protect from recordting artifact coincidences of cosmic origin.

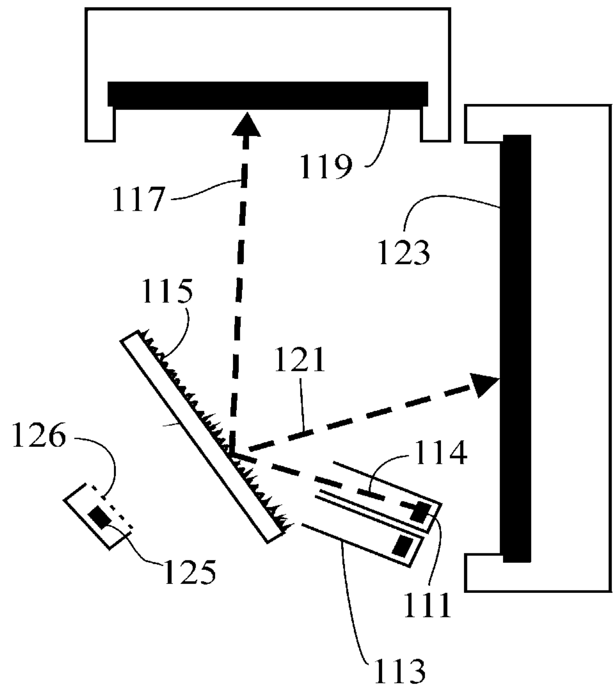
Figure 4 describes the arrangement used for splitting alpha-rays from diamonds. I suspected an unquantum effect with diamond because a resonant reflection of alpha rays at 5.5 MeV was found by Ferguson and Walker, "The Scattering of Alpha-Particles by Carbon and Oxygen," *Physical Review* (1940), vol. 58, page 666. In this resonant reflection helium (alpha) joins carbon to make oxygen in an unstable form that quickly decays to return the helium in a retro reflection. It was fortunate that Am-241 ejects an alpha ray at just the right kinetic energy to stimulate this resonant reaction. Ferguson and Walker found that the alpha retro-reflects from carbon at a greater rate than calculated by Rutherford's method; this inspired me to experiment with diamonds as a beam splitter to see if different orders of reflected components of the alpha ray could be detected in coincidence. The experiment of **fig. 4** of November 28, 2006 used 10 Am-241 source disks **111** in two rows of 5, mounted in collimator tubes **113**, to aim alpha rays **114** toward a set of diamond powder coated files **115**. Beam splitter **115** is a 1 inch square surface of a commercial diamond machinist's file. Alpha rays that were predominantly specular reflected **117** were captured by a 1 inch ORTEC surface barrier detector **119**, and alpha rays predominantly retro reflected **121** were captured by a 1.5 inch CANBERRA PIPS surface barrier detector **123**. I discovered that to make the effect work, a low level alpha-ray ambient source **125** of Am-241 was needed to leak a low level to both detectors without reflecting from the diamonds. Shutter **126** adjusts the flux of matter-wave. I assume this is necessary to enhance the pre-loaded state of resonant atomic He++ domains in the detector; but I'm not sure. The *unquantum* effect in this diamond reflection test was found to disappear without source **125**, and ambient source **125** alone does not cause coincidences. No correction in the chance calculation was needed because the singles rate measurements read from diamond-reflection and from ambient source **125**. The duration of the experiment was 6.56 days. The singles rates were calculated in computer **63** by taking the ratio of singles counts and the sum of all time durations between each coincidence event.

Experimental results of November 28, 2006 are from the arrangement of **fig. 4** and are shown in **fig. 5**, which is an annotated screen capture of the QUICKBASIC program I wrote for automating the experiment. There is nothing in my QUICKBASIC program that could not be reproduced from the information in the disclosure at hand by a programmer skilled in BASIC and GPIB interfacing. The appendix QUICKBASIC program is titled alpha19.txt. The chance rate R_c, experimental coincidence rate R_e, and degree above chance $R_e / R_c = 8.84$, are displayed at the bottom of **fig. 5,** and are calculated using only the valid pulse pairs that were within 160 ns of each other, as set in the program by adjustable vertical line cursors **141 143**. There are 16 pulse pairs bracketed in the 160 ns window. The analog shapes of these chosen pulse pairs **PULSES** are in the computer display. It is readily seen that **PULSES** are all undistorted, and in coincidence. On the same time scale and to the right of the analog **PULSES** are timing pulses number 1 and timing pulses number 2 from SCA **45** and SCA **47** respectively. The timing pulses are digitized in **DSO** in **fig. 1** as **53 55**, and re-displayed in computer **63**. These timing pulses are 500 ns wide, and their vertical offset in **fig. 5** is artificial. Analog and digital pulses that were from pulse pairs beyond cursors **141 143** were eliminated from the calculation and the x-y display. A base line **151** of the analog pulse for one channel is positioned at the keyboard, and is done similarly for the other channel, not shown. These base lines determine the zero of the **Ch1 Ch2** coordinate system. The software creating the **fig. 5** display is the same software used for the **Ch1 Ch2** plot in the **fig. 2** composite. There were 16 pulse pairs plotted in **fig. 5.** The spectacular discovery from this test is that the pulses were big. Diagonal line **153** was calibrated from separate tests and inserted in **fig. 5**; this is the line upon which two pulses would add to twice the characteristic 5.5 MeV alpha ray. If a point were plotted on the center of this line it would be from pulses that each had the full characteristic pulse amplitude of 5.5 MeV, as described for **Fig. 2**. Such a point on line **153** would have broken particle-energy conservation by a factor of 2; only one such point is displayed here. Breaking particle-energy conservation is not breaking the law of energy conservation, it breaks the particle model. I uphold energy conservation. Line **155** is where particle-energy is conserved; a point plotted on the center of this line would be from two (5.5 MeV)/2 detector pulses. Points to the right of line **155** break what I call particle-energy conservation. This is different from energy conservation in general. It shows violation of the principle of the particle, the same way I have shown breaking particle energy conservation in *Photon Violation Spectroscopy*. *Particle Violation Spectroscopy* reveals this two-for-one effect, and is a reasonable prediction of the loading theory.

I performed several tests with the apparatus and method describing **fig. 4**, but substituted for beam splitter **115** surfaces of graphite, quartz, gold, and cubic zirconium. None of these beam splitter materials revealed an *unquantum* beam split effect in this geometry. The fact that the *unquantum* effect was revealed analyzing carbon in the diamond chemical state but not in the graphite chemical state, is evidence that the method of *Particle Violation Spectroscopy* is sensitive to the chemical state of the beam splitter, at least for carbon. There are several well developed forms of alpha spectroscopy employed for material analysis, but they are not coincidence tests.

There is yet another mode of *particle violation spectroscopy* that I have discovered. My earliest success with finding an *unquantum* splitting the alpha with diamond were obtained as early as October 12, 2005, and those tests did not require a second source, a tickler field so to speak. The test of November 28 did require a tickler field. In a 6.6 ksec test with two Am-241 disks and two jewel diamonds, with singles rates of 1/155 sec and 1/76/sec there were 5 coincident detections within 75 ns and no others, to give $R_e / R_c = 6$ million times chance. This test used two of the shielded DIAD ORTEC detectors found to be immune to cosmic caused coincident events. The function of the tickler field may have been expressed by an unknown ambient source of the chamber's metal. The chamber was built from parts from a discarded coating machine from Stanford University, and was undoubtedly contaminated. However, control tests in the Stanford machine revealed no background coincident detections that would have confounded the measurement. The data of **figs. 2**, **3**, **5**, **6**, and **7** were not obtained from the Stanford machine. It is an important discovery in itself that the *unquantum* effect can be modulated by an ambient or a controlled source, as verified by the data of **fig. 5**. My alpha ray *unquantum* effect was tested in three different vacuum chambers. My series of tests also employed different detectors and amplifiers as well. Tests searching for electronic cross talk were also carefully undertaken. It took me two years of rebuilding and testing to convince me the alpha-split effects for diamond and gold were real and were in contradiction to prior art

Fig. 4



119
117
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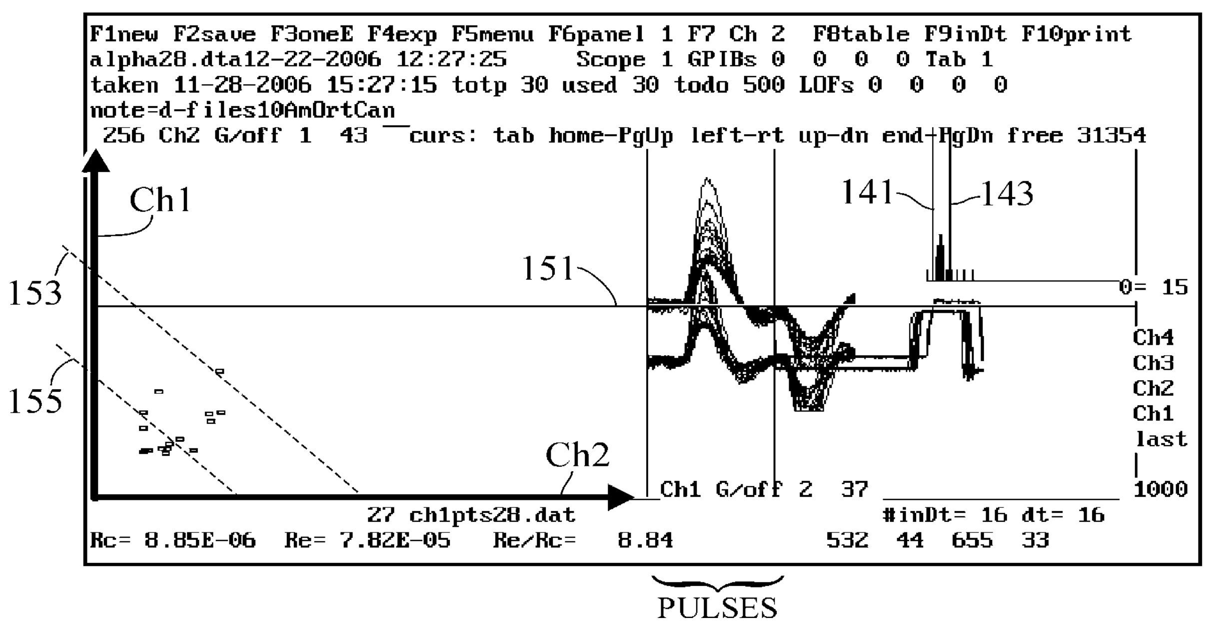
Fig. 5



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alpha28.dta12-22-2006 12:27:25 Scope 1 GPIBs 0 0 0 0 Tab 1
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Rc= 8.85E-06 Re= 7.82E-05 Re/Rc= 8.84
532 44 655 33
PULSES

particle physics. Prior art physics does not recognize the pre-loaded state. Therefore the discovery of an ambient field modulating the *unquantum* effect from the data of **fig. 5** is additional evidence of a pre-loaded state.

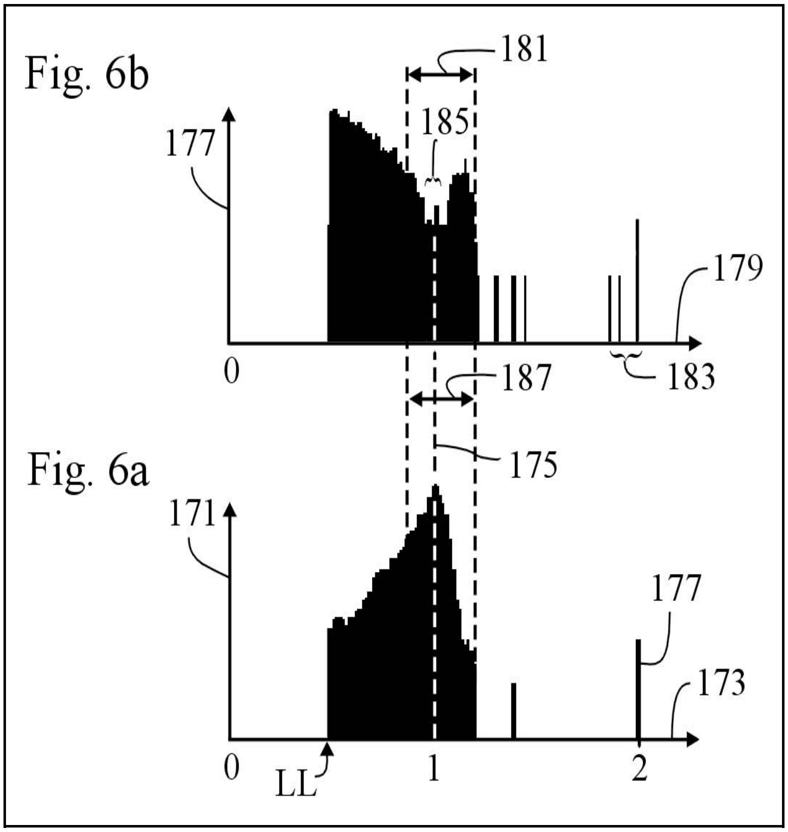
Figure 6a is a conventional pulse amplitude spectrum of alphas aimed straight toward a single ORTEC detector, of 2 cm diameter active surface. The source was ten Am-241 disks (1 microcurie per disk) mounted in brass collimator tubes similar to **114** of **fig. 4**. Vertical scale **171** is logarithmic and horizontal scale **173** is pulse amplitude with "1" marked at the characteristic pulse amplitude and "2" marked at the expected sum-peak position. The lower level **LL** cut-off in these histograms is from the SCA setting. A characteristic peak section **187,** had a detection rate of 23.3k/253 sec = 92 pulses/sec. From observing the analog pulses on the **DSO,** an estimate can be made of the time that two pulses would need to overlap to create a sum-peak, and this estimate was made to err in favor of quantum mechanics. This estimate is τ_s = 200ns. Sum-peak **177** has 2 pulses/253sec= 1/126sec. Calculation of the expected chance rate for the sum-peak region would be $R_c = (92/sec)^2(200ns)$ = 1/589sec. The ratio R_e / R_c is approximately 4, which for such a low count rate in the sum peak can be taken as a good match between theory and experiment for what is expected for sum peak **177**. We defy chance, but not by much.

Figure 6b is a pulse amplitude spectrum of alphas now reflecting from a set of diamonds. These diamonds were a pair of diamond earrings and a mosaic of 1 mm triangular diamond macles that added up to a surface of approximately 1 cm^2. The detector was the same as used for **fig. 6a**. The alpha source and detector were both placed approximately 45 degrees above the diamond reflecting surface. Vertical scale **177** and horizontal scale **179** are the same as for **fig. 6a**. The range of pulse heights **181** was the same as used for **fig. 6a** and had 668 pulses/41 ksec = 1.63×10^{-2}/sec = R_1. Region **183** on scale **179** at 2 times the characteristic, had 8 pulses/41 ksec = 195×10^{-6}/sec = R_e. The chance rate R_c for this region would be $R_c = R_1^2 \tau_s = 5.3 \times 10^{-11}$/sec. R_e / R_c = 3.6 million times chance, reflected from the diamonds indicating a substantially enhanced sum-peak. This is strong evidence for an *unquantum* effect enhanced by reflecting alphas from diamonds as measured with a single detector. The unusual dip **185** in reflected spectrum **179** implies that a large fraction of the alpha matter wave was not reflected in any omnidirectional sense, but instead implies that a large fraction was either retro-reflected or sent in two directions at once, and was not picked up by the single detector because the source/ detector arrangement was not adjusted to receive retro-reflection. Dip **185** sits exactly in the center of the 5.5 MeV characteristic peak **187** of the non-reflected spectrum of **fig. 6a**. Here we see consistency between the two-detector beam split test of **fig. 5** and the single detector reflection test of **fig. 6b**, which both used diamonds and broke chance. Either the released alpha waves from the diamond reaction were more coherent so as to more readily trigger detection, or energy was released from the diamond; either case is an *unquantum* effect. I conclude that these alpha diamond *unquantum* effects are enhanced by the 5.5 MeV alpha resonance with carbon discovered by Ferguson and Walker. Coincidence data of **fig. 5** are due to a retro reflection of the single alpha ray from diamond that took place simultaneously with an omnidirectional reflection of the same single alpha ray. Such a simultaneous splitting of the alpha ray has never been reported in prior art and is clear evidence of the usefulness of *Particle Violation Spectroscopy*.

Recent Support from Photon Violation Spectroscopy

Useful results from the method of *Photon Violation Spectroscopy* are additional evidence for the importance and usefulness of *Particle Violation Spectroscopy*. The physics behind the method of *Photon Violation Spectroscopy* must be valid for the method of *Particle Violation Spectroscopy* to be valid. Newly tested evidence refuting the photon model, similar to my evidence given in US 2005/0139776, is emphasized here to show due diligence in developing the physics underlying both *Particle Violation Spectroscopy* and *Photon Violation Spectroscopy*. I have discovered in September 2007 that annihilation radiation, a well studied form of gamma radiation from electron-positron collisions, produces a notably strong *unquantum* effect. Three detectors were used to remove a possible artifact produced by a third gamma ray produced in true coincidence upon decay from **Na22**. Here the coincident detection rate approaches 1000 times the rate predicted by chance and quantum mechanics. The third detector acts as a trigger to record the splitting of one of the two annihilation-radiation gammas.

Referring to **fig. 7a**, source **Na22** of gamma rays are sodium-22 (Na-22) atoms in spontaneous decay. Na-22 can suddenly emit a unit of positive charge, an anti-electron. The anti-electron meets an ambient negative electron. The two charge-waves cancel, and two oppositely directed gamma rays **γ1** and **γ2** are produced. A higher frequency gamma ray **γ3** is also produced in the radioisotope decay. Sodium iodide scintillator crystal **NaI**, is incorporated to respond to gamma ray **γ3**. Labels **γ1 γ2 γ3** represent a typical set of rays. The gamma detectors are scintillator crystals that emit a classical pulse of visible light energy proportional to a captured gamma-ray's electromagnetic frequency. Detector **NaI** responds with typical scintillator pulse **PNaI**. Two bismuth germinate scintillator crystals **BGO1 BGO2** are incorporated to respond to **γ1**. Detector **BGO3** responds with typical scintillator pulse **P3**, and detector **BGO4** responds with typical scintillator pulse **P4**. The scintillator light is converted to an electrical pulse by photomultiplier tubes **PMT2 PMT3 PMT4**. The single channel analyzer circuits **SCA2 SCA3 SCA4** are set to allow electrical pulse amplitudes that are characteristic of their respective scintillation-captured gamma-ray, and generate timing pulses delivered to counters **ctr2 ctr3 ctr4** and digital oscilloscope **DSO2** channels **2 3 4**. The time interval between timing pulses is measured and plotted in typical histograms **Dt23**, **Dt34**, the real data of which are plotted in **fig. 7b**. Any peak in these histograms indicates coincident gamma-ray events surpassing what can be caused by chance overlap; this is the *unquantum* effect. The signals from **SCA2 SCA3 SCA4** are used in triple coincidence to remove any possible artifact. The rate of overlapping pulses **2 3 4**, after subtracting a background coincidence rate, was measured at coincidence histogram **Dt23** to be a rate 963 times the chance rate, from my experiment of September 27, 2007. For the **BGO3 BGO4** pair, the rate of overlapping pulses **3 4**, after subtracting a background coincidence rate, was measured at coincidence histogram **Dt34** to be a rate 29 times the chance rate, from my experiment of September 27, 2007. The chance equation used was $R_c = R_2 R_3 R_4 \tau_{23} \tau_{34}$. Mechanism **DC** of producing the double coincidence histogram **Dt34** was the smart trigger feature in the LT344 scope. Mechanism **TC** of producing the triple coincidence histogram **Dt23** was accomplished in the LT344 using its Δdly parameter feature. **Figure 7b** is a screen capture of the LT344, graphing the most convincing picture on



September 27,2007. The counter rates were calculated at ctr2 = 60 /sec for the NaI, ctr3 = 193 /sec for the first BGO, and ctr4 = 129 /sec for the second BGO, respectively. The background coincidence rate was 2.075 x 10^{-5} /sec. Channel B is the first BGO spectrum vertical logarithmic, and channel D is the NaI spectrum vertical linear, with different pre-amplifier gains. Channel A is **Dt34** and channel C is **Dt23**.

In another similar test of August 23, 2007, using the same **BGO3 BGO4** detectors and electronics, Cs-137 with its single gamma ray, is used as a source. The Cs-137 660 keV gamma ray is close in frequency to that of 551 keV annihilation radiation, but no coincidences were detected beyond chance, in a 1.6 hour test. In yet another similar test of August 29, 2007, Mn-54 with its single gamma ray, is used as a source. The Mn-54 700 keV gamma ray gave 3.75 times chance in a test spanning 1.9 days and a background test spanning 25 hours. The data from tests with Cs-137 and Mn-54 as compared with data from the test with Na-22 indicate an extra factor other than electromagnetic frequency, such as resonance or coherence, is at play to cause the *unquantum* effect. These extra factors are yet another discovery made using the method of *Photon Violation Spectroscopy*. Discoveries made with *Photon Violation Spectroscopy* reinforce the validity of *Particle Violation Spectroscopy*. In prior art, light was thought to be a particle because the electron was thought to be a particle in the photoelectric effect. I show light is not a particle in the same class of test that famous prior art tests have used to favor light being a particle. If light is not a particle it implies the electron is not a particle.

Conclusions, Ramifications, and Scope

Experimental evidence from *Particle Violation Spectroscopy* have been described showing its distinction from prior art. My experimental evidence utilizes what prior art would term particles with rest mass, and more particularly what prior art would term the alpha-particle. In the nomenclature of *Particle Violation Spectroscopy*, the helium nucleus would be termed the helium nuclear matter wave. In my previous disclosure of *Photon Violation Spectroscopy*, the underlying mechanism implies electrons do not act like quantum mechanical particles. Therefore the electron should be able to split in a similar way to that performed here for the alpha-ray. This could be accomplished by using a radioisotope that decays to emit a single electron. Beta decay would not be an appropriate source because the pulse amplitude is lowered by a distribution of neutrino energy shared in the process. On the other hand, when a gamma is emitted in spontaneous decay it will often generate an internal photoelectric conversion electron with its full kinetic energy preserved. A bare source of conversion electron events such as Cd-109 in a vacuum chamber may produce double high pulses in a single surface barrier detector. In other words, the physics behind the method predicts that two electrons can be loaded to threshold by one incident electron, to show itself in an anomalously high sum-peak.

It is obvious to apply the method of *Particle Violation Spectroscopy* to charge waves, neutron waves, proton waves, atomic waves, and to any particle-like micro-phenomenon that also displays wave properties. The object of the disclosure at hand is to provide evidence, methodology, and apparatus concerning the violation of quantum mechanics for rays associated with a rest mass, such as alpha-rays and electronic rays. If a phenomenon displays diffraction, the phenomenon is not due to particles, and the probability interpretation can be shown to fail in a beam splitter test of the particle. I have provided evidence in this disclosure that my method provides ways to defy the principle of the particle and to gain useful information. A particle is something that holds itself together and should go one way or another at a beam splitter, unless it reacts and splits into sub-particles. My evidence for splitting the alpha could not be due to breaking an incident particle into sub-particles, because the binding energy of the incident ray and the target element exceeds the kinetic energy of the incident matter wave.

Spectroscopic and material science probe applications of my method in many forms are obvious. A tested commercially viable application for future manufacture is a miniature gold and diamond purity analyzer. It is obvious to apply *Particle Violation Spectroscopy* to more complicated sources of radiation that are known to coincidently emit multiple quanta, by employing a third detector and appropriate electronics to certify a coincident pair, in addition to the usual two detectors described in *Particle Violation Spectroscopy*. More elaborate schemes with arrays of detectors are obvious. It is also obvious to perform *Particle Violation Spectroscopy* with only one detector to measure sum-peaks occurring at rates surpassing a chance calculation. The method of *Particle Violation Spectroscopy*, by measuring energy at such a fundamental level, will undoubtedly be further applied to material science, matter-energy conversion, and event control. My method measures a characteristic of the incident ray that is already present in the detector as the pre-loaded state. Such a new fundamental measurement will undoubtedly be useful in monitoring the flow of electric charge within a material under study in superconductivity research. The sensitivity of my method of measurement to crystalline silicon, and its ability to reveal crystalline states of matter, implies that my method will undoubtedly find use in semiconductor applications such as developing solar cells.

I am often challenged on the issue of usefulness applied to a method or apparatus that displays a discovery in physics. Why would something as crude as gold leaf have the optics to split a matter wave of such short wavelength? The answer is that data from *Particle Violation Spectroscopy* relates to the workings of the microscopic world. These first successful tests with diamond and gold for measuring the matter-wave pre-loaded state make the means of performing such a measure valuable in itself. These first successful tests were successful in discriminating between different levels of gold purity and different crystalline states of carbon thereby making my method a useful tool in analysis of these materials. Such a unique test to be

Fig. 7a

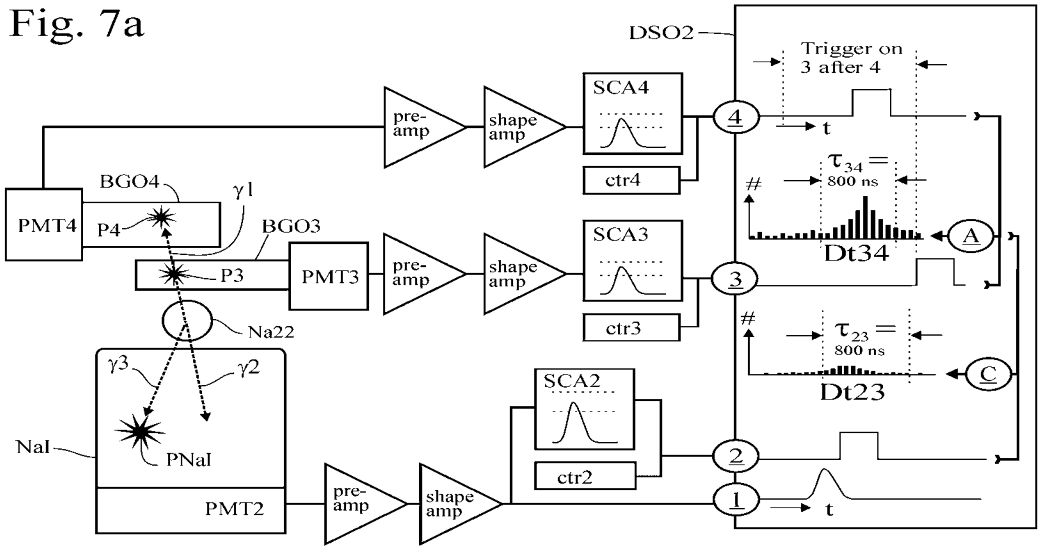
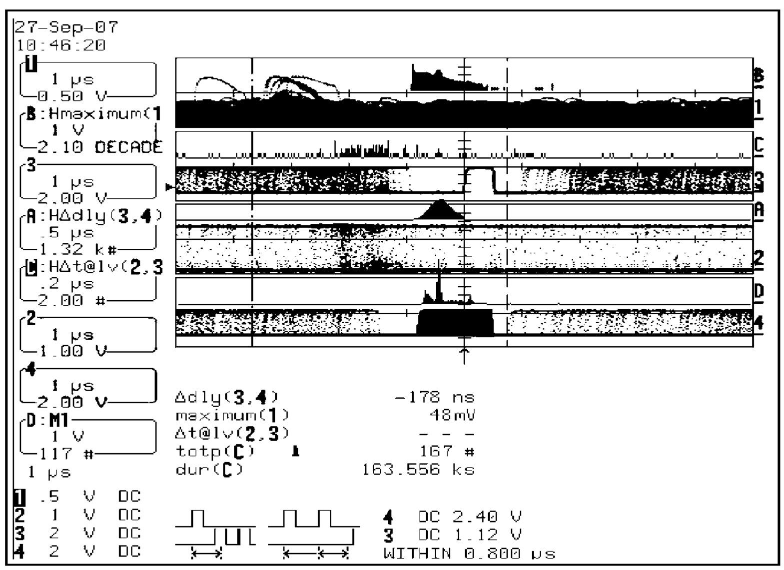


Fig. 7b



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performed upon gold and diamonds makes those materials even more valuable. The relative ease of performing these measurements upon other materials, other matter wave sources, and as part of another physical process, makes my method a widely applicable spectroscopy. A good example of a fundamental measurement in physics becoming even more useful is the invention of the measurement of nuclear magnetic resonance; this measurement has found great use in medical imaging. Expansion of my method to imaging applications is technically feasible.

New experiments are under construction in my laboratory extending my method to other physical variables besides chemical purity and structure. The method of *Particle Violation Spectroscopy* changes modern physics altogether; it is an entirely new and useful method of measuring the way matter can be divided. Methods of measuring physical properties are every bit as useful as methods of measuring chemical or biological properties. Indeed my new form of measurement introduces a new branch of physics. My method is a direct confrontation to the formal scientific community: absorption is not quantized; it is thresholded.

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