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Evidence for Forward Spin and Reverse Spin Radio Photons

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Abstract

We generated alternate spin radio frequency photons by accelerating metallic valence electrons in a wire with half portions of a sine wave. To avoid standing waves from sinusoidal movement, a non-resonating transmitter was built with a non-resonating antenna. An oscilloscope at a second non-resonant receiving antenna 3 wavelengths away from the transmitter detected positive going 180-degree voltage pulses. Reversing the direction of electron excitation in the transmitter antenna caused negative going 180-degree electric pulses in the receiver. The results confirm that photons produced by radio transmissions are of two types, forward +1 spin and reverse -1 spin. In the radio wave context, we may consider a zero spin 2-photon pair as a naturally occurring unit that forms waves. This research points the way to a much higher speed communication format based on photon pulses and not wave trains.

Keywords: Oscilloscope, Photons, Reverse Spin, Antenna, MOSFET.

INTRODUCTION

Photons are bosons, having -1 and +1 spin states. The 0-spin state of the photon is deemed imaginary because mathematically a massless boson cannot have 0 spin. [1] However, some conjecture that a 0-spin state may exist "as a superposition of two -1 and +1 circular states" [2]. The -1 and +1 spin states represent helical polarization of individual photons, and individual linear polarized photons exist [3]. These photon spin states are explored by separating photons of defined spin, using mirrors and beam splitters. But such manipulations interfere with photons and collapse of the wave function can limit such studies [4], Still, "weak measurements" of polarization behavior can characterize a quantum system before and after it interacts with a measurement apparatus [5]. But even weak measurements can cause photon decoherence from bouncing or passing through different media when separating entangled pairs. Unfortunately, photon studies are dominated by observations of single photons, which require destruction of the photon. "The interpretation of the uncertainty relation for photons is basically the same as in the case of the standard Heisenberg uncertainty relation" [6] and thus we are limited in the information that we can obtain. We do not always have to destroy photons to obtain information about their behavior. Unlike that of fermions, an infinite number of identical photons can exist at the same position and time. If one could synthesize many identical photons, then one could use sampling techniques to get more information about them and avoid the Heisenberg uncertainty for some investigations. By sampling (and collapsing the wave functions) of only a small portion of the identical photons, information could be obtained from the remaining photons without destroying them. This technique is very difficult to implement for light photons, the usual subject in photon experiments. Radio photons on the other hand are 100 million times longer and more slowly formed. For example, a 10 MHz photon has a 30-meter wavelength and consumes 100 ns of time to

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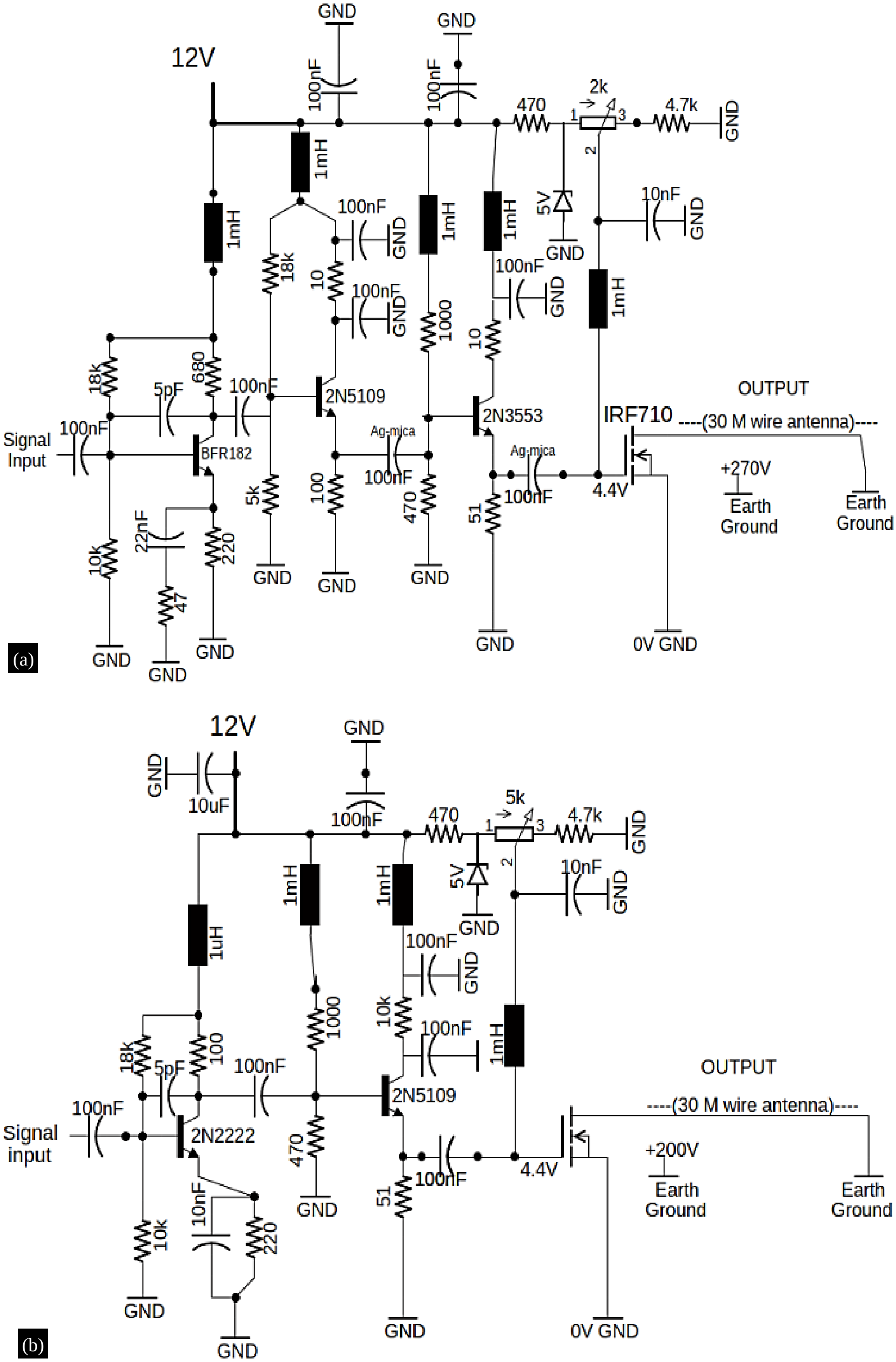
complete one vibration. And many radio photons can be made at virtually the same location and time using electronic circuits.

To make pure pulses of isolated groups of photons, transmitting circuits were developed that periodically accelerate electrons in an antenna for selected sections of a wave form. This was impossible to do with existing circuits and all non-resonant circuits were developed and without frequency filters. The first section of results describes the resultant new transmitter operation. In the second section of results, the transmitter is used in combination with a non-resonant receiver to produce and record the generation of one-half wave and full wavelength photon signals separated by blank spaces of adjustable duration, and at two different frequencies.

MATERIALS AND METHODS

Data for this study was obtained with a unique photon pulse transmitter comprising (a.) a circuit for creating portions of a sine wave at a defined frequency; (b.) a non-resonating linear amplifier comprising 3 or 4 transistors biased for class A operation; and (c.) a non-resonating transmitting antenna directly connected to the output of the last transistor in the class A amplification chain. The receiver comprised a long antenna directly connected to an oscilloscope (Siglent Model SDS 1202X-E digital storage oscilloscope 200 MHz response and sampling 1 gigahertz/sec). The receiver absorbed photon energy created by accelerated electrons from the transmitting antenna and the connected oscilloscope displayed screen shots, which were recorded and shown as data for this study. A first transmitter used for the data was constructed according to the first two schematics shown in Figure 1. The circuit in the top panel of Figure 1 generated a partial sine wave signal, which was amplified by the circuit in the middle panel of Figure 1.

A frequency generator FeelTech FY3200S Dual Channel Signal Generator/Counter was adjusted to supply a sine wave input and a square wave input to the upper left connections shown in the schematic of the Figure 1 top panel. The data pin on the 74F74 D flip flop was set to ground. This data pin can be operated to select between 180-degree reversed sines and is intended for use in future experiments. The four JFET switches shown in the lower left of this schematic are in chip FST3125. The second circuit in the middle panel of Figure 1 takes the combined sine/square wave signal prepared by FST3125 of the first circuit and inputs to the base of 2N2222, a bipolar transistor which is biased for class A voltage amplification. The output from the 2N2222 transistor is input to the 2N5109 transistor, which is biased for class A current amplification. The output from the 2N5109 transistor drives the gate of high voltage MOSFET IRF710. High voltage energy electrons enter the source pin of the MOSFET and exit the drain pin, which is connected directly to the antenna wire, allowing the transistor output to accelerate the metallic bond electrons in that metal wire. The other end of the antenna wire is connected via a 390-to-470-ohm resistor to earth ground, and the earth ground connects to the positive pole of the 300-volt power supply, allowing return of the electrons in the output circuit. Electron accelerations were carried out in two directions. In the first direction, electron energy flowed from the transmitter into a transmitting antenna towards a receiver antenna. In the second direction, electron energy flowed from the transmitter into earth ground and then into the distal end of the transmitting antenna. The energy flowed back to the transmitter in a direction opposite from the receiver in this later case. In the experiment for the data it was felt that the transmitter was not linear enough, leading to some oscillations in the received signal. Therefore, the 2nd circuit was replaced with one having an extra stage of amplification to prepare a cleaner and stronger signal to the gate of IRF710. This demonstrates the need for careful attention to class A conditions in the circuit. A schematic of the improved amplifier with added stage is shown at the bottom panel of Figure 1. This shows an amplifier having a first voltage amplifier BFR182 followed by two current amplifiers 2N5109 and 2N3553. This extra amplification allowed a cleaner pulse to accelerate electrons in the transmitting antenna. It was unusual to add so many stages to an already strong input signal but was found necessary to produce a clean signal without filtering.


12V
GND
100nF
1mH
470
2k
4.7k
5V
10nF
18k
10
2N5109
1000
2N3553
Ag-mica
OUTPUT
IRF710
----(30 M wire antenna)----
Signal Input
5pF
680
BFR182
5k
100
51
4.4V
+270V
Earth Ground
22nF
10k
220
47
0V GND
(a)
10uF
1uH
5k
2N2222
10nF
+200V
Signal input
(b)

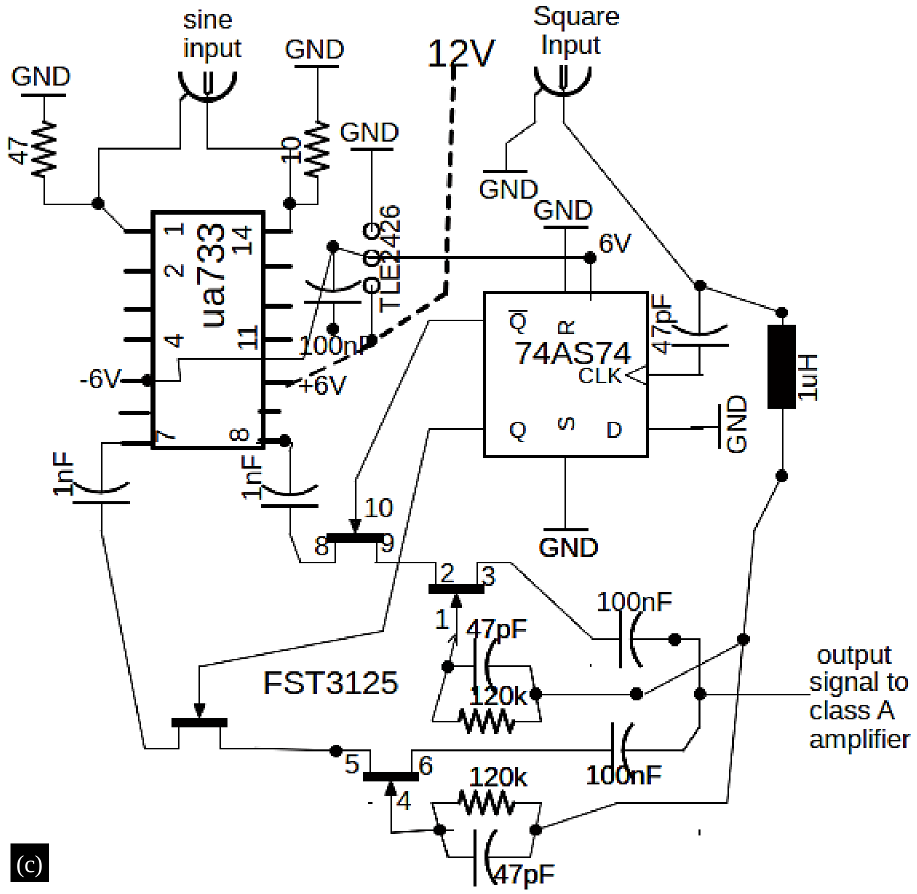


Figure 1. circuits used for the transmitter. *top:* circuit that produced partial sine wave pulses. middle and bottom: alternative class A amplifiers of increasing purity.

Despite this improvement the output (tested with a 10 MHz sine wave) was only about 99–99.9% pure, having 1% or less second and third harmonics. This was measured as a second harmonic on the scope at 20–30 db. voltage lower than the first harmonic. The earth ground was connected to the plus side of the high voltage. This was necessary because electron energy flow was from the negative power supply into the MOSFET source pin, and out from the MOSFET drain pin, into the antenna. The distal end of this transmitting antenna, being connected to ground, allowed flow of electrons back into the plus side of the supply located at the transmitter. Electron energy and electrons flow from negative to positive. Grounding the plus side of the circuit provides a return path for the electron energy. The two antennas were spaced 105 meters apart (total distance end-to-end of the two antennas 175 meters). The inner ends of the antennas were grounded with 50 cm deep ground rods. A 390–470-ohm resistor was attached between the left side of the transmitter antenna and the grounding rod there. A 390–470-ohm resister was attached between the right side of the receiver beverage antenna and the ground rod there, after some optimization. Briefly, resistor values were changed until resonance of test pulses were minimized. The transmitter was connected to the right side of the right antenna. An oscilloscope was connected to the left side of the left antenna and to a ground rod there. Power supplies for the transmitter, and the oscilloscope, respectively, were inverters connected to batteries. Neither power supply was grounded. Behind each beverage antenna, and within a few meters of each end was a rock wall about 5 meters high. The rock walls were expected to block outside radio signals along the receiving line and thus minimize background signals.

Transmission without Ground Connection

To evaluate the possibility that signals could be transmitted via a ground path, in an experiment the beverage antenna ground connection was removed, and the ground path replaced with an insulated wire that was placed near the ground. See Figure 2. This removal of the ground connection did not significantly alter the results.

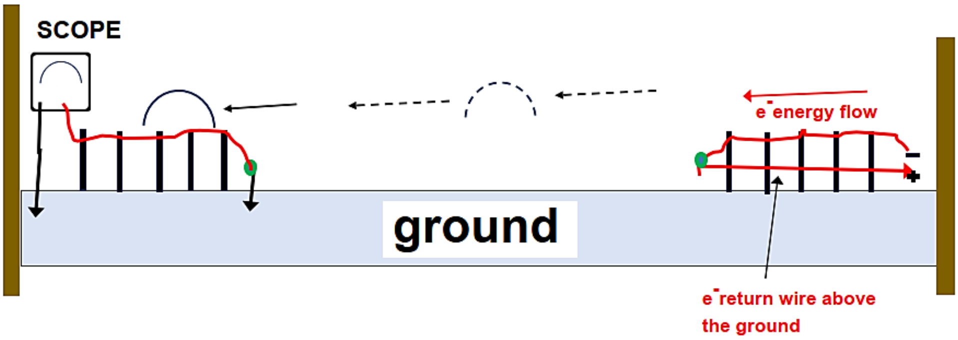


Figure 2. Same transmitter set up but without ground connection.

RESULTS

All initial attempts to create isolated pulses of coherent (i.e., groups of identical photons made simultaneously in a common phase and direction) photons failed due to resonance. Radio electronics circuits generally add resonance or a frequency selective filter at each stage to maintain purity of a signal. It was quickly discovered that all phase changes ruined the integrity of a single wavelength-sized signal. The signal becomes degraded into a synchronous wave train. For this reason, circuit optimizations and experiments were carried out with a single repeating 10 MHz sine wave pulse driven by direct current and separated by blank spaces.

Generation of Individual Wavelets at 10 MHz Frequency

Isolated 10 MHz wavelets between 180 and 360 degrees (50 to 100 ns long) were generated at set intervals and used to find appropriate circuits for the transmitter. Figure 3 is an example of such a waveform applied to the output stage of the final amplifier after 2 stages of amplification.

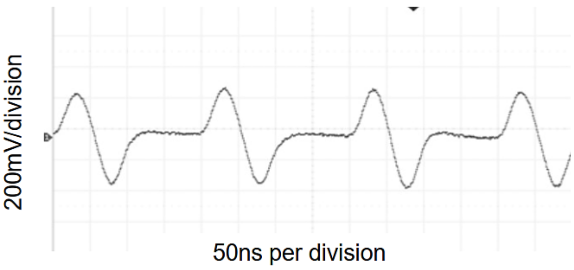


Figure 3. Isolated pulses applied to transmitter.

The electron pulse signal of Figure 3 was used to excite the last, high voltage stage in the transmitter to accelerate antenna electrons. All accelerations were direct current to avoid resonance and wave making. Even small deviations from this caused devolution of a single pulse into a repeating wave, usually of the same frequency as the original pulse. Thus. electrons were accelerated in a single direction using direct current excitation of an antenna. Frequency filtering was strictly avoided.

Figure 4 is a transmitter block diagram of the circuit that generated the wavelets by allowing selection of portions of a sine wave to be amplified in the transmitter. At the left side is two channel signal generator that outputs a 10 MHz sine wave and outputs a 5 MHz synchronized square wave, which were then combined. The square wave was used to block every other sine wavelet via a fast JFET switch [7]. The square wave duty cycle was typically adjusted to 50% but was increased in some experiments to 75% or 88%. The resulting intermittent signal was amplified to typically 60–70 volts direct current and connected to an antenna, for accelerating metallic bonding electrons as described in Materials and Methods.

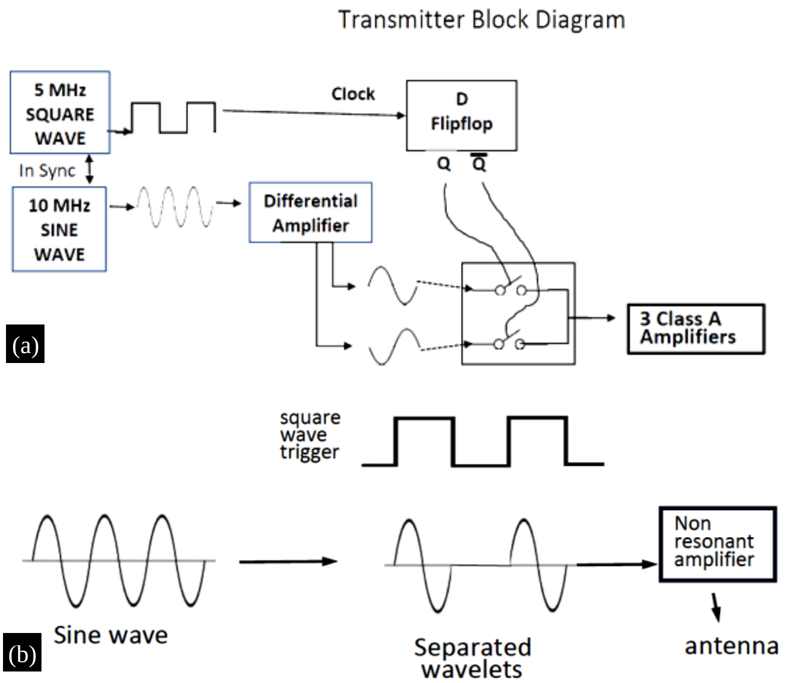


Figure 4. Transmitter block diagram.

Each wavelet was isolated from the others to avoid resonance and the formation of standing waves. Most traditional radio frequency amplifier circuits caused collapse of the signal into a continuous wave train, while acceptable "clean" circuits preserved the separate wavelets. See supplemental figures in Materials and Methods for circuit details on the transmitter build.

Detecting Wavelet Signals from the Transmitter

The receiver initially used was a non-resonant antenna 5 meters high, exposed to radio signals from all directions, and connected to an oscilloscope. All radio wave energies of all frequencies from far away were absorbed and displayed on the oscilloscope. This swamped out the oscilloscope signal and was abandoned.

To overcome this problem, two beverage antennas 30 meters long and 2 meters high above the ground were constructed facing each other and pointing along the same radial line as shown in Figure 5 and further detailed in Materials and Methods. The beverage antenna is very directional, does not significantly absorb radio energy except from the direction to where it points, and is very quiet [8].

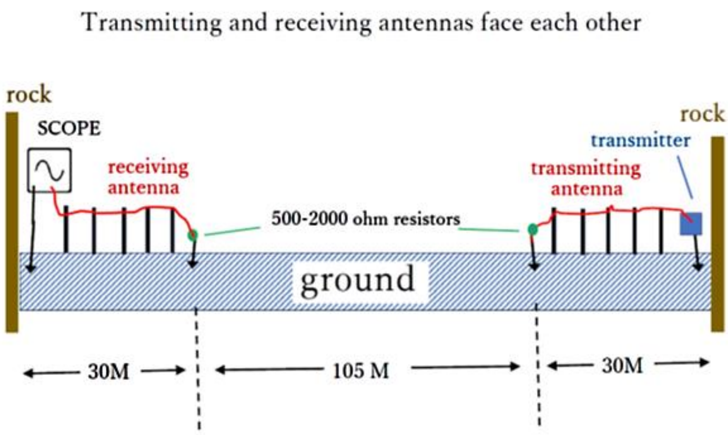


Figure 5. Transmitting and receiving antennas face each other.

Electrons in the transmitter antenna were excited by direct current separately applied in one or the other direction at a time using repeated 180 degrees (half wave) 50 ns pulses separated by 150 ns between each, from a 10 MHz sine wave source. The transmitter was adjusted to accelerate antenna circuit electrons only during the first 180 degrees half of every four 10 MHz sine waves by setting the sine wave to 10 MHz and setting the square wave to 5 MHz with a 75% blanking duty cycle. This created 50 ns pulse accelerations in the wire followed by 150 ns of blanking (no force) applied to the antenna.

Photon emission results were obtained by accelerating the antenna electrons first in one direction from the transmitter direct current output. Then the antenna connections were reversed, and the antenna electrons were accelerated in the opposite direction. Connections are described more specifically in Materials and Methods

Acceleration of 180 Degrees (1 pi radian) every two 10 MHz Cycles.

The top plot of Figure 6 shows that positive going pulses of excitation to the metallic bond electrons in the wire caused similar shaped positive pulses in the receiver antenna as indicated by the scope output reproduced here. After the transmitter antenna connections were reversed the receiver sensed photons that made opposite pulses in the receiver wire, as shown by the scope recording at the bottom of Figure 6 [9–14]. The lower plot of Figure 4 shows the response of the receiver to this reversed electron energy acceleration. The electron flow pulses in the receiver antenna have been reversed (changed polarity). The upper and lower traces were obtained at different times with different trigger levels and therefore their peaks do not overlap. Importantly, the received signals are pulses, not complete sine waves. Each 50 ns pulse is followed by a small amount of resonance during a 150 ns pause as 3 smaller voltage peaks possibly due to non-linearities in the last transmitter stage.

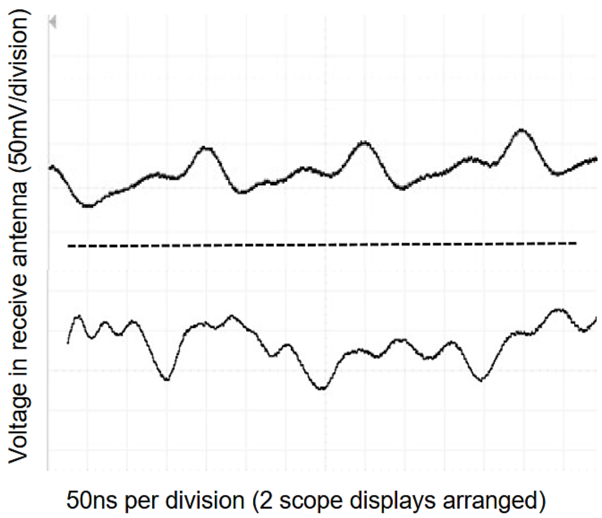


Figure 6. Induced electric pulses in receiver antenna.

Vary Electron Acceleration Periodicity and Wavelength

Acceleration of electrons in the antenna was varied by adding longer spacing between accelerations. The square wave generator was adjusted to 2.5 MHz and 82% duty cycle to blank out a 10 MHz sine wave train. This forced the transmitter to apply a direct current acceleration voltage measured at 0–70 maximum volts to the antenna over a time of 50 ns every 400 ns. These accelerations produced 50 ns wide single direction pulses in the receiver antenna at 400 ns apart, as shown by the scope recording in the top of Figure 7.

The electron output from the transmitter MOSFET was directly connected to the antenna and the plus side of the 300 V power supply was connected to earth ground. The electron pulses in the antenna thus were one directional from the transmitter end to the distal end of the antenna pointing to the receiver. Next, the transmitter output connection to the antenna was reversed. That is, the electron flow from the MOSFET drain was connected to earth ground and the plus side of the 300 V power supply was connected to the transmitter end of the antenna. The distal end of the antenna away from the transmitter was connected to ground. Thus, electric force traveled through ground and traveled back to the transmitter via the antenna. This caused an opposite polarity pulse in the receiver antenna as shown in the bottom plot of Figure 7.

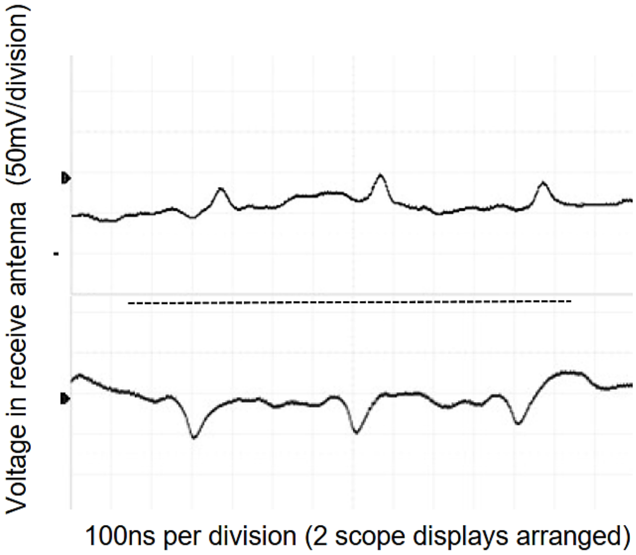


Figure 7. Induced electric pulses in receiver antenna.

Single 16 MHz accelerations compared to sine wave.

Shorter pulses of higher frequency half sine accelerations were examined. The first half sine of every four sine waves was accelerated at 16 MHz. The transmitter was adjusted to accelerate antenna circuit electrons only during the first 180 degrees half of every four 16 MHz sine waves by adjusting the sine wave output to 16 MHz and adjusting the blanking square wave pulse to 4 MHz with 88% blanking duty cycle. This created 32 ns half sine shaped pulses every 250 nanoseconds. For control, the square wave blanking signal was turned off and the 16 MHz sine wave (in direct current) energy was applied to the antenna. Figure 6 shows the receiver antenna scope recordings for these 3 accelerations. The top scope display is the control 16 MHz sine wave with no blanking. The middle scope display from the receiver antenna wire shows approximately 32 ns unidirectional peaks of electron movement every 250 ns in the receiver wire. The bottom scope tracing shows the same peaks and 250 ns periodicities in the receiver wire after reversal of the antenna connections of the transmitter.

Figure 8 Induced electron movement in the receiver wire from sine wave, reverse accelerated pulses, and forward accelerated pulses. The x-axis time and y-axis voltage ranges are roughly the same for the three signals. The forward and reverse transmitted 32 ns pulses (lower two traces) are each similar in size and shape to one half cycle segments from the received sine wave signal (top trace). Details of the wave forms applied to the transmitter last stage amplifier for these three conditions are found in Materials and Methods. An example of an oscilloscope display of acceleration voltage applied to the transmitter antenna, which caused the receiver recordings for the middle scope display of Figure 6, is shown in Figure 9

Figure 9 is a plot of the high voltage applied to the antenna, with arrows that point out acceleration times. This figure shows that a strong 32 ns acceleration of 37 volts occurred every 250 ns.

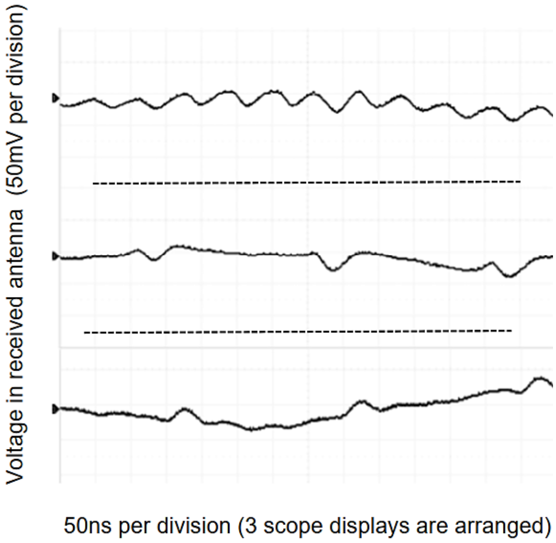


Figure 8. sine wave and each half wave compared.

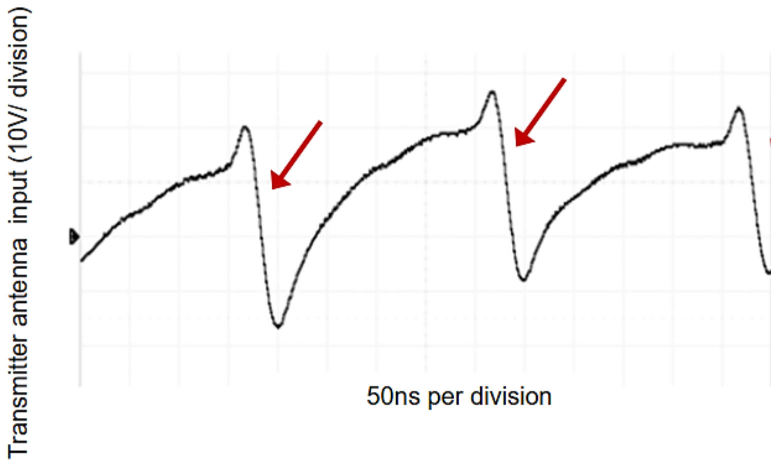


Figure 9. Transmitter antenna input voltage vs time showing accelerations.

DISCUSSION

+spin photons, -spin photons each occupy a half-wavelength.

The data show that a half sine wave pulse applied to conducting electrons of an antenna wire caused emission of a pulse of energy (putatively "photons"), which were detected by a receiving wire. Assuming that a "photon" is the smallest indivisible unit of energy transfer, this transfer of energy from accelerated electrons in the transmitter wire to induced voltage pulses in the receiving wire must have been carried out by a photon. The time duration of the excitation measured as an accelerated voltage to the transmitting antenna was half the wavelength of the original frequency. The received pulse also had the same time duration.

By reversing connections to the transmission antenna, single direction electric acceleration was asserted on the metallic valence electrons in the opposite direction. These reversed direction pulses in the transmission antenna produced opposite polarity electric pulses in the receiver as summarized in Figures 5 and 7.

These complementary results suggest that two kinds of photons exist to link an energy transmitter such as an electron in the transmission wire, to an energy receiver, such as an electron in the receiver wire. A one direction acceleration of energy in the virtual one-dimension space of a wire causes emission of a photon with assumed forward spin. An opposite direction acceleration of energy in the virtual one-dimension space of the wire causes emission of a photon with assumed reverse spin. Reversing the polarity of the transmitter connection to the antenna caused reversal of the acceleration. However, reversed acceleration would be expected by selection of the second 180-degree half of the sine wave signal instead of the first 180-degree half. Figure 10 is a diagram of the energy flow, showing the putative photon coupling energy created from the accelerated electrons in the transmitting wire, to electron energy in the receiver wire. The top half of Figure 10 shows electron activation in the transmitting antenna by an increase in voltage from the right side. The bottom half shows electron activation with reversed energy flow.

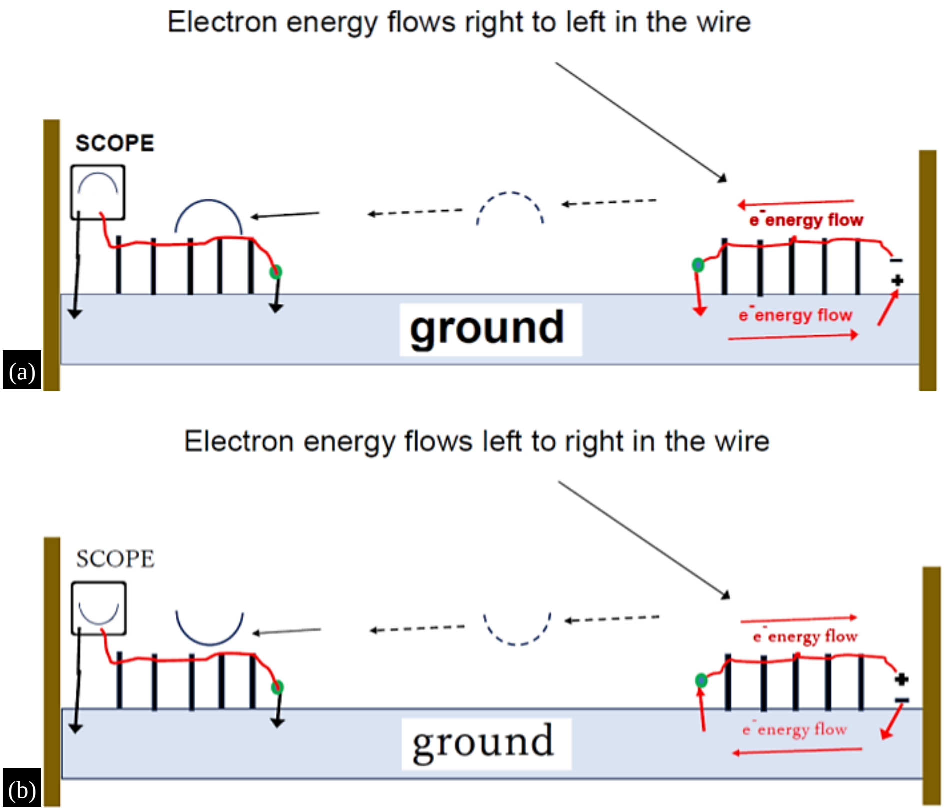


Figure 10. Electron acceleration direction in the transmitting antenna.

These relationships between the direction of acceleration electric force applied to the transmitting wire and the direction of induced electric field in the receiver wire were not affected by length of time between accelerations or by frequency. The data shows that changes in the electric field sensed by the receiver in each case corresponded in duration and in periodicity with the accelerations in the transmitter wire, despite differences in intervals and change in frequency from 10 MHz to 16 MHz.

Data shown in Figure 8 is a comparison of sine wave acceleration with separated negative and separated positive accelerations of the metallic bond electrons in the receiver wire. The received sine wave signal plot at the top of Figure 8 has both positive and negative portions and presumably was made by a combination of forward and reverse spin photons. But the transmitter created these by accelerating electric force in one direction of the wire. This indicates that the spin variable of the photon wave energy was not determined by the direction of electric force in the transmitter antenna wire. Instead, the plus and minus spins correspond to the derivative of the acceleration of electrons in the transmitting wire. A positive derivative presumably creates a + spin photon and a negative derivative (as shown in Figure 6) creates a - spin photon. Metallic valence electrons in the transmitting wire were accelerated for half a sine wave (31.25 ns) via a quick 37 V decrease in voltage over this time as shown in Figure 7. The middle panel of 6 Figure 7 shows the consequence of that 32 ns acceleration on the receiver wire. The received pulse in the wire was 32 ns long, separated by the same 250 ns spacings and showed up as a negative dip. When the electric force changed direction via reversing connections to the transmitting antenna, an inverse polarity of the derivative occurred. The receiver recorded opposite going pulses of the same size and spacings as shown in the lower panel of Figure 6. The results imply that regardless of frequency or timing, the putative + spin photons and -spin photons were separately created according to the sign of the derivative of the force applied to the transmitting electrons. This suggests that a full wavelength "photon" created by a resonating antenna and recognized as a unit of a wave train may be a combination of contiguous plus and minus spin photons. Dirac stated that a "photon has two possible polarization states, which we may denote by |R> and |L>, corresponding to right-handed and left-handed circular polarization respectively. Any other state of polarization of a photon can be expressed as a superposition of these two states."[9] However, the two spin state photons studied here are not co-existing in time but instead contiguous. Two types of complete plus/minus spin unit wavelength photon pairs may exist.

CONCLUSION

The first type of zero-spin like unit is the plus-minus pair wherein the plus spin photon leads (but is contiguous to) the minus spin photon. The second type is the minus-plus pair wherein the minus spin photon leads the plus spin photon. Perhaps these are opposite spin circularly polarized photon pairs and have the energy defined by the equation E=hf. Radio photons may be superior as test subjects compared to light photons for some experiments that require time measurements. Events such as conversion of standing wave energy from an electron mass into a traveling wave photon occur 100 million times more slowly for radio photons compared to light photons. For example, creation of a 10 MHz 100 ns long radio photon should consume 100 ns of time during transformation of an electron standing wave vibration into the photon traveling wave. This process can be interrupted by collapsing the wave function at any time by, for example removing energy by switching on a low impedance to the orbit (antenna conductor). Laboratory equipment capable of carrying out these relatively slow events is readily available.

This photon spin detail has not been described before, possibly for two reasons. One, photons created by resonating transmitters exist as wave trains that are not easily separable. Two, when a photon enters a new medium, is reflected or refracted (as in commonly done in experiments), the photon is destroyed and most of the energy re-emerges as a later emitted photon, and contributes to wave formation at the same or similar frequency. This leads to conclusions based on wave behavior that glosses over the true nature of the photons.

Individual photon behavior is often conflated with that of groups of photons acting as waves. For example, photons arranged in a wave train are slowed in a denser medium and it is often said that light travels slower in a medium. But at the photon level this may occur by destruction of individual photons and emission of new photons at the same speed along the original pathway, at later times as a consequence of the denser medium.[10] Photons do not change their velocities when passing through different media but it is easy to mistakenly infer such photon character from group wavelike behavior.

Thus, the wave properties of groups of photons can be easily conflated with individual photon behavior because photons are commonly studied in groups.

Individual photons are assumedly shot "through" a slit in slit experiments but then wave effects from single photons traveling to the slit are inferred after collecting group behavior from many single photon measurements. The group behavior prompts conclusions of individual photons in the slit experiments but are particularly inapposite because the photons collected on the surface behind a slit are likely not even the same photons that entered the slit. Every time a photon reflects, a similar one is created later intime, which is easy to confuse with the original photon. Multiple integer wavelength spacings of later created photons would be expected, and would create diffraction patterns.

This explanation for the double slit experiment could be tested by measuring the elapsed time from departure of the original single photon and the sensed reception on the 2-dimensional scatter plate downstream of the slit. Repeating this experiment with 10 nanosecond long photons (3.3 meter long, 100 MHz) could allow such measurements because each bounce of the photon at or within the slit (causing its destruction and creation of a new photon) should consume at least 10 nanoseconds. We cannot easily examine such timing detail using light photons but could detect bounce-delayed time of arrival information from the much longer radio photons.

Quantum Studies can Benefit From Using the Much Lower Frequencies and Bigger Apparent Photon Sizes of Radio Photons

Application of the Schrodinger equation to electrons in large molecules is extremely difficult if not impossible. However, wave equations for valence electrons in very long wires might be simplified by assuming one dimension wave functions. The study of radio photons from essentially one-dimensional electron orbits may shed light on their orbit size, electron speed and frequency relationship. The conducting electron path over nuclei in a typical wire antenna has a length that is much longer than it is wide. For example, a 10 meter long antenna wire typically has a metallic diameter of 2mm (5000 fold difference). However, only a very thin layer on the antenna surface actually contains the excited electrons. This is known as the "skin effect" in radio and is only about 12 microns for that 10 meter long (30MHz) signal.[11] In other words, the length to width ratio for a physical i.e. "electron cloud" representation of an electron wave function involved in creating 10 meter long photons from a wire should be on the order of about a million to one.

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