Cycle One

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Abstract – Cycle One identifies the spectrum position of an electromagnetic wave where the velocity has the same numeric value as the frequency. The interest in a Cycle One concept started when a geometric relationship was identified between wavelength and frequency. The frequency value is not arbitrary. The frequency value was mathematically predicted in 1944 and in 1951 it was detected coming from space. The triangle pair wavelength-frequency relationship would not have been recognized until after the 1951 radio astronomy discovery. The triangle pair relationship establishes a universal unit of length, a time duration, and allows a unit of energy to be defined.

I. INTRODUCTION

The concept of a Cycle One had its start in 2001 when a geometric relationship between wavelength and frequency was identified.[1] The geometric relationship is established using a pair of right triangles with one having the dimension of wavelength and the other the dimension of frequency, Fig. (1). The triangles are linked by a common dimensional element, the vertical element, to assure any change in the angle preserves the relationships between the triangles. The geometric relationship does not require the units of measure to be predefined. To identify the actual wavelength and frequency values produced by the wavelength-frequency geometric relationship requires a culture that has developed a system of units of measure and has identified a reasonably accurate value for the speed of light (SOL).

The classical algebraic relationship between wavelength and frequency is identified by the formula $\mathbf{c}=f\lambda$, where **c** is the SOL, f is frequency and λ is wavelength. Frequency is defined by 1/T where T is a time duration. For frequency measurements, the time duration used is the second. An algebraic equation requires that all the dimensions of the variables to be predefined in a common measurement system. Most are now taught to use the metric measurement system, which is based upon man-defined or man-selected units of measure.[2] The SI second is the official unit for a time duration that is based upon the duration of an Ephemeris second, which has been updated in 1979 using the term Terrestrial Dynamical Time.[3] The SI second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom. The count periods fit within the Ephemeris second duration.

A history of how we established units of time is provided in a Scientific American article.[4]

II. THE METHODOLOGY

A description of the wavelength and frequency geometric relationship was published in a paper titled, "A methodology to define physical constants using mathematical constants", ref. (1) The title identifies what is accomplished by the geometric relationship and the content of the paper was presented to be understood by electrical engineers. The published paper will be referred to as the *methodology* in later text.

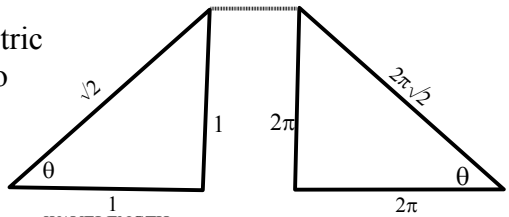

Figure 1

Fig. 1 illustrates the triangle pair with the basic units assigned to their legs. The geometric relationship has two basic units of measure, a unit of frequency, which is expressed in radians, 2π specifically, and a wavelength equal to 1. The vertical legs are held as constants, which is noted by the

connecting bar. This allows the angle θ to be changed and retain the dimensional relationships between the two right triangles. The size of these units can be extracted using any contemporary units of measure as long as you know the value for the SOL. It was found that the angle of the triangle was directly related to a unit of time and it has a value of 1 at 45°, but it has a different duration than the SI second. The basic units of measure are described as *intrinsic units*. From the *methodololgy:*

> "When the numeric value of the leg of one triangle is multiplied by the hypotenuse of the second triangle, the resultant is the constant of proportionality between the triangles. When each of the products are equal the two triangles are inversely related."
>
> "The speed of light is defined by a product of the geometric relationship, which allowed an iteration process to be performed to identify the frequency value and the related unit of length and unit of time duration in SI units."

The *methodology* also allows an unit of energy to be defined; see Fig. 4 of ref.(1). E=*hv* could be considered as a starting point, but the science community needs to recognize the problem using the Planck constant. For more than a century, everyone has been taught that higher frequency EM waves have more energy than lower frequency waves because of the formula *E=hf,* where *h* is Planck's constant and *f* is frequency. In the real world, where there are always more than one unit of energy (*h*) involved in creating an EM wave, a multiplier has to be applied, such as ***m***, *E=h***m***f*, to accommodate the number of charged particles that were responsible for producing a particular EM wave. The value of **m** will be related to the mass of the charged particles that produced the EM wave. When charged particles are involved there will be action-at-a-distance, which complicates how mass is defined in relationship to the production of EM waves.

A right triangle with a 45° angle represents the mid-point of the angle between 0° and 90°. It also represents the point where the SOL and its frequency have the same numeric value. Once the angle is greater than 45° the wavelength becomes smaller and the frequency numeric value becomes greater than the SOL. The wavelength frequency relationship is reversed when the angle is less than 45°.

The presently used frequency scale was developed when nothing was known about the EM spectrum and light was not recognized as a EM phenomenon. Merriam-Webster states that the use of the term electromagnetic was first used in 1821, which reveals we have less than a century of experience with electromagnetic concepts. Our experience with mechanical waves extends back many centuries and their frequency range is a fraction of the EM spectrum.

When scientists in the 1600s used the second to define frequency, they were unknowingly establishing a starting point of 1 Hz for the EM spectrum without knowing that EM waves existed. There are EM waves with frequencies below 1 Hz and they have to be identified by a number of leading zeros or by appending negative powers of 10 to the number, such as 1.0 (10^{-3}).

The true mid-point of the EM spectrum is where the SOL and its frequency have the same numeric value.

III. CYCLE ONE

The term Cycle One refers to the position of its frequency within the EM spectrum. The frequency revealed in the *methodology* identifies it as the mid-point of all possible frequencies from the lowest to the highest possible. In the *methodology*, a 10^6 factor was assigned to keep the frequencies within the concepts currently accepted. The frequency and SOL value expressed as $2\pi\sqrt{2}$ is a mathematical equation friendly form, obviating the need to make artificial numeric assignments to make the numeric value of **c** easy to manipulate in mathematical formulas. However, to use the new basic value for the SOL requires that the other units of measure used in physical law formulas conform to those identified

in the *methodology*.

Cycle One should not be confused with a Primal Cycle, where its wavelength would be defined by the largest straight line dimension of the universe times two. In a cavity, that has a conducting surface, the longest wavelength EM wave that can exist in that structure is defined by the largest straight line distance between the conducting surfaces times two. Using the concepts identified in the *methodology*, there will exist a Max Cycle, which will be the same numeric distance from the Primal Cycle to Cycle One. Currently, insufficient information is available to identify the dimensions for the Primal and Max Cycle wavelengths.

IV. Units of Measure

The current units of measure were developed before it was known that EM waves existed. Even after it was known EM waves existed, and that they could be artificially produced, no attempt was made to alter the basic units of measure to mathematically accommodate the SOL in mathematical formulas. No one knew in the 1700s how important the SOL was to physical law and its related formulas. The French surveyed a Dunkirk to Barcelona length to establish a basis for a meter length, but it had to be adjusted by the least squares smoothing process to produce a straight line.

The French could have altered the meter size slightly so that the speed of light would have been precisely 314,159,265 meters per second, a pi value, instead of 299,792,458 meters per second. The pi value would not match the value revealed by the *methodology* but it would have been closer than what is currently being used. No one considered that mathematical constants could be the basis for physical law constants and this is still taught. The *methodology* reveals that the SOL can be expressed as the product of a transcendental and irrational number and both of these numbers individually are considered mathematical constants.

Optical astronomers were responsible for establishing the Ephemeris second and that unit is based upon the Earth's rotation relative to the Sun. The duration of the Ephemeris second was used to establish the SI second duration and linking that to 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom.

The French had considered changing the duration of the second such that it could be decimalized as are metric measurements, but that did not acquire general acceptance. We have the same duration second that has been used for many centuries, but it is now being defined using new terms in order to give it a higher precision. It is still based upon 86,400 seconds (60sec x 60min x 24hr) in one daily revolution of our planet (Ephemeris time), which makes it suitable for domestic use by the residents.

Using the concepts identified in the *methodology*, it is now possible to have a basic time unit that is mathematically defined mutually in relationship to a mathematically defined SOL. There is no need for the populace to change their local planetary time unit, but those that deal with physical law should consider using the time duration and SOL value identified in the *methodology*.

The EM triangle pair concept suggests that the frequency expressed at $2\pi\sqrt{2}$ is the mid-point of the EM spectrum and there will be lower and higher frequencies. Nothing changes when referring to a frequency by a specific wavelength or a particular band, such as 10 meter band, 2 meter band, C-band, L-band, etc. We will know whether the band is above, below or encompasses Cycle One.

IV. FREQUENCY

According to Merriam-Webster, the first known use of the term frequency is stated to be the year 1600 and the term oscillation the year 1658. Before the term frequency was applied to a cyclic event, wave periods had been counted using a time period wherein some method of providing a consistent

repeating time duration could be applied. The manner in which frequency ranges were established varied between the type of wave and the medium in which it can propagate and the method used to count waves in a medium. The second has been around a few thousand years but it was not until the 1700s a reliable mechanical method was developed to measure a time unit to that small of a time duration.

The current process used to describe EM frequencies is based upon the characteristics of mechanical waves. Mechanical waves have different propagation velocities depending upon the molecular materials in which they can propagate. EM waves can propagate in many molecular materials, but they propagate unhindered in a vacuum at a specific velocity. Until it was established that EM waves existed there was little reason to question how a frequency was established for a wave type oscillation. Basically, our current method of identifying frequency is arbitrary. This is not significant in describing mechanical waves, but it has physical law consequences when applied to EM waves.

It was suggested in 1865 by James Clerk Maxwell that light and EM waves were related. In 1888, Heinrich Hertz revealed his research, by letters to Hermann von Helmholtz, that demonstrated that man-made EM radiation propagated in the same manner as light. Hertz's receiving apparatus was a loop antenna with a spark gap that required a dark area and a magnifying glass to see the spark.

After his EM wave propagation results were finished, Hertz determined that the EM waves he was producing had transverse polarization. It is not known how he eliminated other types of polarization since nothing was or is currently known about what produces EM wave polarization. The electron had not been identified and it was not known they were one of the charged particles responsible for producing EM waves and detecting them. The electron was identified in 1897 and it wasn't until 1925 it was determined that it had a magnetic moment.

It is not surprising that the same method of applying frequency to mechanical waves was applied to EM waves. Mechanical waves do not have a velocity that is fundamental to physical law as do EM waves with their SOL propagation velocity. Even though mechanical waves are fundamentally different from EM waves, the contemporary scientific community insists on using Hz to note their frequency rather than the previous propagation medium neutral designation cycles per second (cps).

Technically, the lowest EM frequency should be 1 without any multipliers or divisors, but 1 Hz is known not to be the lowest frequency using the present method of calculating EM frequencies. Contemporary magnetotelluric machines are functioning at 0.001 Hz or $1.0(10^{-3})$ Hz. The wavelength of a 1 Hz EM wave would be 299,792,458 meters. A slight change in the value for the duration of a SI second, to increase its precision, will slightly change the wavelength and frequency for every EM wave. Just because we have no direct method of detecting the presence of very long wavelength EM waves does not mean they do not exist. Visual observations suggest there are very, very long cyclic EM processes; the most obvious being the sunspot and solar cycles. One of the challenges in capturing and examining the characteristics of sub-Hz frequencies is having recording equipment that can accommodate the very long time periods required to acquire the data and then convert it for display in a compressed manner without losing the detail of shorter period amplitude excursions that may occur.

Before the *methodology* was published, we did not know that the EM spectrum could be mathematically defined geometrically and has a mid-point. It is understandable why the current method of defining frequency for EM waves has not been challenged. It is now possible to define the EM spectrum mid-point as Cycle One with an absolute value of 1. Since the frequency is produced by the neutral hydrogen atom, which is noted as H1 in the literature, the frequency could be symbolized as H1z, with the z being extracted from the z in Hz to note it as a special frequency. It is not about how many cycles an EM wave has in reference to a specific time duration, it is about its position in the EM spectrum.

It would seem strange to most users to express frequency starting at a center point and then going both directions, but this would mesh with using the Planck constant to express an energy level where the energy level is defined at the frequency of Cycle One, H1z. There is no need to change the

frequency calculation method for domestic use, but this should be considered when using frequency in physical law equations. One issue is whether the scientific community decides to establish a unit of energy at H1z.

To denote the frequency of *Cycle One* all one needs is to enter is H1z with no + or – sign. Since contemporary frequencies are determined by digital frequency devices, the instrument can readily note if a frequency is above or below H1z by adding a + or – sign or convert it to the present method. For physical law equations, the difference in actual frequency from H1z is a relationship issue.

Currently, large frequencies in the spectrum above 1 Hz are decimalized and noted with a positive 10s multiplier, the + is usually omitted, such as 10^3, and all frequencies below 1 Hz noted with a negative 10s multiplier, such as 10^{-3}. There may be a better way to present EM frequency that is not currently recognized. The current manner in which we define EM frequencies is easy to understand, but it may not be the best way. H1z has harmonic relationships above and below that frequency, as do other frequencies, and this has to be considered.

V. ELECTROMAGNETIC POLARITY AND ACTION-AT-A-DISTANCE

Our understanding of the characteristics of EM wave polarization and action-at-a-distance are not fully understood. It is generally accepted that EM waves have transverse polarity, but optical researchers are now producing EM waves that have pure longitudinal polarity. James Clerk Maxwell accepted the conclusions of early optical researchers that found that the light they were viewing or creating from various sources had transverse polarization. It has to be considered what types of devices were available a century ago that could identify whether longitudinal EM waves were present?

Heinrich Hertz, who demonstrated in 1887 that EM waves could be produced artificially, proved that the EM waves he produced with an electric arc source had transverse polarization. He did not identify why they had polarization, nor can any references be found that address that issue. To assist in identifying why most EM waves have a specific polarity and its possible cause, a question was asked to a senior Los Alamos National Laboratories nuclear physicist, “Does the magnetic moment of electrons and ions influence the polarity of propagating EM waves?” The response, “I'm afraid I am unaware of any publications that address your question.”[5]

For a given type of EM source, the scientific community does not have a symbol to represent the EM wave polarity. It is premature to consider that all artificial and natural EM radiation sources are transverse only. Once the scientific community decides to investigate what actually causes the polarity of an EM wave, it may find that producing longitudinal polarization and different polarization mixtures could be quite simple. Then, additional symbols sets will be needed to denote other polarization combinations.

One of the issues recognized in Maxwell's time was action-at-a-distance. Maxwell recognized the difficulty in accommodating action-at-a-distance, thus he excluded it from his electromagnetic equations. His 1864 paper, “A Dynamical Theory of the Electromagnetic Field,” Maxwell mentioned the possibility of particles acting at a distance. He stated, “The mechanical difficulties, however, which are involved in the assumption of particles acting at a distance with forces which depend on their velocities are such as to prevent me from considering this theory as an ultimate one, though it may have been, and may yet be useful in leading to the coordination of phenomena.”

References

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