

The Unification of Torah and Science: Basic Principles and a Case Study on Electromagnetism

Part 22--A New Name for the Photon

One of the beauties of electromagnetism lies in the dual physical properties of light. Although Maxwell initially treated electromagnetism exclusively as a wave, Einstein proposed the quantum mechanics processes, which initiated the understanding of the particle property of electromagnetism. One unique word in the Tanach that expresses such a dual character is the word *aleph-gimel-lamed, egel*, found in the expression in Job, *eglei tal*. This is the one and only time in the whole Tanach that this word appears. Almost all of the commentaries on this phrase understand it to mean "drops of dew." Rashi, however, understands that its root is from the word *gal*, meaning wave, thus, in this context meaning "a wave of dew," referring to dew as a wave that passes across the face of the earth each morning, settling upon the ground. Elsewhere in the Tanach, we find that *tal*, dew is directly identified with light in the verse, "Your dew is a dew of lights." Thus the idealized concept of dew is water, light and magnetism combined into a single drop. Just as we have seen in these two interpretations of the different commentaries, so we know that whether light appears as a wave phenomenon or a particle phenomenon depends entirely upon the perspective of the observer.

The complete verse in which the expression *eglei tal* appears reads, "Does rain have a father, and who gave birth to the dewdrops?" The reference here to birth suggests other idioms throughout the Tanach that combine both children and dew. There is a phrase in Psalms that refers to the dew of youth. Another word for "drop" in Hebrew is *tipah*, which also relates to *taf*, meaning children, thus *tal* and *taf* both imply infants. Another word that is related to this is the Aramaic *talya*, which means "child's play." Chasidut teaches us that a child is called *taf* or even *tal*, because he still reflects the original drop of semen, to a certain extent. This is the reason why parents hug their small children so much and express their love for them, because either consciously or unconsciously the little child still reflects the drop of the parents' seed in the union itself. As the child develops, the parent remains living and connected to him, but his experience of the reflection of the original drop of semen gradually disappears.

So we see that the word *egel* has both the wave and particle phenomenon captured within it.

Although the word *egel* does not actually appear in the verse in the singular (but rather in the plural, with an additional *yud*), we find that it does appear in a special way within the five word phrase, for if one takes all fifteen letters of the

phrase *o mi holid eglei tal* and writes them in the form of a triangle, the letters at the corners of the triangle are the letters of *egel*.

א
 מ ו
 ו ה י
 א ד י ל
 ל ט י ל ג

A New Hebrew Name for the Electron, Too

Above, we already discussed two words that have been accepted in Hebrew, *chashmal*, the modern Hebrew word for electricity and *magnet*, a Hebrew transliteration of the original word "magnet," which was used even by Torah sages of the past. We will now continue to discover new words in Hebrew for the electron and the photon.

The electron spins around the nucleus of an atom, creating an energy field. It is the electron's circular spin that suggests a wheel; *ofan* in Biblical Hebrew. Just like *chashmal*, the word *ofan* is also one of the words that Ezekiel used to describe his fantastic vision, in reference to the revolving wheels of the Divine chariot. If we further examine the word *ofan*, we will discover that this word is particularly appropriate for the electron, as it has a numerical value of 137 (exactly equaling the numerical value of the Hebrew word, *Kabbalah*), which, as anyone who has studied physics may know, is the closest whole number to the inverse of the fine structure constant. To date, the inverse of the fine structure constant has been

calculated to approximately 10 or 20 decimal places and closely approaches 137.0. Yet through the most recent experiments based on cosmic ray analysis that discovers the behavior of stars that are billions of light years old by radiation, scientists are beginning to support the idea that it is even closer to 137 than before. The fine structure constant is the first instance of which scientists are willing consider the possibility that nature may have changed. Our own uneducated guess is that the fine structure constant has a finite limit to it and will stop once it reaches $1/137$, although this is something that physicists cannot yet research.

Until the idea that the fine structure constant is changing was proposed, scientists believed that this number was a transcendental number like π or e . However, whereas π and e are better for the fact that they are transcendental (meaning that there is no algebraic, fractional or decimal method for expressing the number, which has an infinite number of integers after the decimal point), it would be much more elegant for the fine structure constant to be exactly $1/137$.

The significance of 137 in physics refers to the relationship between electrons and photons. This number primarily expresses itself in electromagnetism and is explained in two very simple ways.

- a) the ratio of the speed of light to the maximal speed of an electron revolving around a hydrogen nucleus.
- b) The probability that an electron bombarded at a screen will emit a photon.

So we see that the number 137 is directly connected to the electron, which is why it is particularly fitting that the name we have chosen for the electron in Hebrew, *ofan*, has a numerical value of 137.

There are also some very special mathematical phenomena which further uphold our choice of the word *egel* as the Hebrew word for photon. We would expect this word too to have some relationship with 137 and indeed it does, for 137 is the 34th prime number and *egel* has a numerical value of 34! So, just as the numerical value of *barzel* (239) is the 53rd prime number, 53 being the value of the word *even*, stone, so we have a similar phenomenon here; the electron (137) is the *egel* (=34) prime number. However, the relationship to 137 does not end there, for if we take the first ten letters of the phrase *o mi holid eglei tal*, until the *lamed* that completes the word *egel*, we find that the numerical value also equals 137.

The total numerical value of the five words equals 195, meaning that the average value of each word is 39, the value of *tal*, "dew" which is also the last

word of the verse. In other words, the phrase equals five times *tal*, which also equals *Havayah echad*, "God is one."

[*Chelkik*=248=*Avraham*=number of limbs in male human body=number of negative commandments. There is a new theory that there are exactly 248 elementary particles in the universe]