

Lecture 9

The camel as a metaphor for wave-particle duality

We all remember the story of Isaac and Rebecca and how Abraham sent Eliezer, his servant, as a messenger (like we learnt before, regarding messenger particles) to find a wife for Isaac. The example of the *mishnah* we discussed earlier in respect to sanctifying a wife by messenger is in this story, which very often is explained in Kabbalah and Chassidut as the most essential *shiduch* in the entire Torah. Everything that we want to learn about *shiduchim*, about matchmaking comes from this story. When Eliezer had made the *shiduch* with Rebecca, even her father and brother, who were not very righteous individuals, had to admit that "from *Havayah* this thing came."

This phrase in Hebrew, **מי-הוה יצא הדבר**, has the numerical value of 378, which is also the value of the word **חשמל**, which is the name for electricity in Modern Hebrew. Parenthetically, if you reverse the numerals of 378, you get 873, which is the numerical value of "speed of light" (**מהירות האור**), the one essential constant of our physical reality according to modern physics. A similar example is that if you take the value of "Shabbat" (**שַׁבָּת**), 702, and write the numerals in reverse order, you get 207, which is the numerical value of "light" (**אור**).

Every word in the Torah has a particular place where it is especially concentrated, meaning, that the reality that this word represents is concentrated maximally in this place in the Torah. Surprisingly, the most ubiquitous word in the verses describing the *shiduch* of Isaac and Rebecca is "camel" (**גמל**), another of the images for a photon. A camel is both a particle and a wave, because if you look at its hunch, it is like a wave. But if you take in the whole camel at once, it itself is a big particle. We mentioned that it has been shown that all elementary particles exhibit wave-particle duality, so in essence they are all camels.

Meditation on the meanings of "camel"

All phenomena of the Hebrew language are amazing meditations. The usage of this root (**גמל**) in the sense of "weaning," appears in the Torah, specifically regarding Isaac. The Torah says: **ביום הגמל את יצחק**, which literally means that on the day that Isaac was weaned,

Abraham made a celebration. So this immediately connects Isaac specifically with "camels."

Besides meaning "camel" and "weaning," this same root (גמל) can also mean גמילות חסדים, "generosity," which is specifically related to Abraham. So what might be the meditation linking the three meanings of this root? The vast majority of the times that this root appears in the Torah is in the sense of "camel." Incidentally, the English word for camel clearly comes from the Hebrew word *gamal*. There are certain words in the English language which are a hundred percent from Hebrew.

$E=mc^2$

Now, this root is also the name of the third letter in Hebrew. The English alphabet in a certain sense simply mirrors the Hebrew alphabet. In English the third letter is c, which is the first letter of "camel." What about in physics? In physics c denotes the speed of light, as in $E = mc^2$. It is easy to understand that E stands for "energy" and m stands for "mass," but what does c stand for? Even physicists are divided on the reason for the usage of c in this convention. One opinion says that c stands for "constant." Another opinion says that it stands for the first letter for "speed" in Latin. [But we know what it really stands for: c stands for "camel"! So, $E=mc^2$ stands for energy is equal to the mass times a squared camel! It's hard to square a camel because he's round, but this is an important thing for women to know. A woman who wants to have a tranquil husband, which in Hebrew is a בעל רגוע, can use a technique of Abulafia, which involves rearranging the letters of a word or phrase to get something related. In this case, the letters of "tranquil husband" (בעל רגוע) can be rearranged to spell "circle the square" (עגל רבוע). A woman that wants to calm her husband down has to know how to make a square into a circle. This is not just cute. In Chassidut, it is explained in length that people are uptight and tense because they have too many corners, too many sharp edges. To calm them down, you have to help them round their edges and get them to change from a square into a circle.]

In the five books of Moses there are 34 instances of the root גמל. Not always do they mean "camel"; sometimes, they mean "wean" or "generous." The significance of 34 for us is that the choice word for "photon," egel (אגל) is equal to 34. The value of the word "egel" (אגל = 34) is twice the value of "good" (טוב = 17), reminding us of the verse: "God saw the light that it was good."⁷⁴

⁷⁴. Genesis 1:4.

Of all those 34 times, 18 are concentrated in the story of Abraham sending Eliezer with the camels, with gifts loaded on the camels. Every other verse mentions camels. And Eliezer, the messenger particle, says that he will test the woman to see if she is worthy of marrying the son of the most generous soul on Earth, i.e., Abraham. Will she give my camels water to drink? And that was the way that Rebecca proved herself worthy of entering Abraham's household, by watering the camels. 18 is the numerical value of "live" (חי). So this story is all about the "live camel."

Sight and camels

At the end of the story, Eliezer takes Rebecca on the camels to the Land of Israel, where Isaac is waiting. The sages say that at the same time that Eliezer had gone to make him a *shiduch*, Isaac had gone to באר לחי ראי (*be'er lachai ro'ee*), where Hagar, Abraham's banished wife was living, in order to make a *shiduch* for his father, Abraham. באר לחי ראי, literally means "the well of the Living One that was seen," but it can also mean the "well of living sight," an allusion to photons of light coming out to give life (as in photosynthesis). The camels are coming over the desert. What more amazing image is there than seeing "camels"; like seeing photons? It is that Isaac is like a scientist who is watching the particle and wave effect. He was contemplating sight, and light, and the electromagnetic radiation, something that is hinted to in the place that he was coming from: "the well of sight..."

When Rebecca saw Isaac and saw how beautiful he was, the Torah says that she fell off the camel. It is like she fell off of her photon. She was "riding" the beam of light and fell off of it. There are many explanations of what it means that she fell off the camel. In order to get married, Isaac had to lift his eyes and see the camels coming.

Now let us return to the word "camel" itself. We saw that it is formed by adding the letter *mem* to גל, the Hebrew word for wave. The addition of a *mem* to גל gives the wave a particle reality, just as the addition of an *alef* to גל, which forms the Hebrew name for photon, אגל, gives the photon's wave reality, a particle reality. Now, why is the addition of a *mem* very good? Because, the meaning of the letter *mem* (when treated as a whole word) is "water" (*mayim*)! And clearly, the first image of waves that we have from the natural world is from the waves of water.

The sickle as a metaphor for wave-particle duality

In "camel" (גמל), the *mem* is added between the two letters גל. Now, what about the addition of the *mem* before these two letters, which then spells "sickle" (מגל)? The form of the sickle also resembles a wave. Moreover, the sickle is used in the field, which relates it to another important element of our topic: fields. Today, science is looking for a unified field theory.

What Eliezer was testing was Rebecca's loving-kindness, here ability to do kindness with the camels (as mentioned, גמל also means גמילות חסדים). 18 of the 34 instances of camel in the Torah appear in this story of Eliezer making the *shiduch* for Isaac.

When Isaac returns home, the Torah relates that he lifted his eyes and he saw camels coming. This is another beautiful allusion to the camels representing photons of light, coming at Isaac. When Rebecca saw Isaac, she fell off the camel.

Another root that comes from adding the *mem* to the end of גל is גלם, which literally is a golem, or an unformed substance. It can also mean an unformed mind. In the Ethics of the Fathers there is a description of the golem as an inverted wise man, who in reality is not a stupid person, but rather one who has not finished his training yet, he is mind is as yet unformed. Because he is on his way, everything for him is counter-intuitive. But once he finishes he will become a wise man.

Indeed, what is important about all three of these words is that their numerical value is 73 (גלם = גמל = מגל), which is also the numerical value of "wisdom" (חכמה). Wisdom is the origin of light. In Chassidic teachings it is called "the beginning of revelation" (ראשית הגילוי). The numerical value of the first verse of the Torah is 2701, which is the triangle of 73, the triangle of חכמה.⁷⁵ So the first verse of the Torah is like a giant triangular camel. The value of "camel" is thus very important. And, we should keep in mind that this is the biggest image of wave-particle duality possible.

The particle zoo

Camels are force particles, while the horses that we discussed earlier are matter particles. To recap, we said that the three types of particles (real matter, real force, and virtual particles) correspond to horses, living beings (animals), and fiery angels (*seraphim*), respectively. So now we are adding that

⁷⁵. As explained earlier, the triangle of n is the sum of integers from 1 to n . In this case, the sum of integers from 1 to 73 is 2701. In

function form $\Delta n = \frac{n(n+1)}{2}$.

the force particles are likened to camels, which act as messengers. We are translating all the particles into a zoo.⁷⁶ So what about the virtual particles? What animal should they be likened to? Answering this question requires that we expand our imagination. To do so, we need to have already rectified our power of imagination, an important subject in and of itself in Chassidic teachings.

We explained that there are both virtual matter particles and virtual force particles. In the world of Creation there are both virtual Formation (force) particles and virtual Action (matter) particles. So, actually we need to find two different animals as metaphors for both types.

Without explaining this too deeply, the virtual matter particles would be likened to elephants (פילים). The Talmud says that if you dream of elephants, you should expect wonders of wonders to happen to you (wonders, פלאים, are actually greater than miracles, ניסים). The most wondrous experience is to see an elephant pass through an eye of a needle (פילה בקופא דמחטא). This reminds us of the double slit experiment, which ascertained the wave-matter duality of real photons. Here we are talking about virtual particles. We saw that according to string theory, size does not matter, so there is no difference between imagining photons passing through a microscopic slit, and imagining elephants passing through the eye of a needle. The elephant is considered to be the biggest animal. In the Song of Creation (which relates the song that every part of creation sings in praise of the Creator—the song reveals the essence of each part of creation), it is written that the elephant sings the verse: "How big are your actions, God,"⁷⁷ alluding to itself as the biggest of God's creations. So a virtual electron, which is a virtual matter particle, would be likened to an elephant. This is what comes to mind in regard to the virtual matter particles.

Now, what about the virtual force particles, like a virtual photon? These we say are symbolized by a butterfly. In Hebrew a butterfly is a *parpar* (פַּרְפַּר). Virtual particles come in pairs, and the word *parpar* is like "pair pair." They also spontaneously appear and disappear, which is also "appear disappear." These are two linguistic puns on the Hebrew word *parpar*. In any event, now we have all this imagery of horses, camels, elephants, and butterflies in our quantum zoo.

⁷⁶. Physicists today are fond of likening the abundance of elementary particles discovered to a particle zoo.

⁷⁷. Psalms 92:6.

Camels in the Bible

We mentioned already that in the Five Books of Moses there are 34 instances of the root גמל. In the entire Bible there are 112 instances of camel in the Bible. Now, since the numerical value of גמל is 73, looking at the 73rd instance of this root in the Bible is most significant (as the 73rd instance of a root that equals 73 is an example of self-reference). The 73rd instance is in the verse: "God is the God of payments, he will surely repay" (כִּי אֵל גַּמְלוֹת יְהוָה שְׁלֵם יְשַׁלֵּם).⁷⁸

There is a famous saying of the sages in the Talmud, "'Knowledge' is great, for it appears between two Names [of God]." There is a verse: "God of knowledge is God."⁷⁹ In the original Hebrew, the word "two types of knowledge" (דעות) appears between two Names of God, *Kel* and *Havayah*. The sages then mention that the word "Temple" also appears between two different Names, *Adni* and *Havayah*, which they also explain. The Talmud then goes on to ask about the word "revenge." Since it too appears between the same two Names as "knowledge," it too should be great. As we have discussed in the past, the teaching about "knowledge" can indeed be extended to "revenge." Very significantly, when one checks the entire Bible, one finds that there is one more example of a word that appears between two Names of the Almighty. This is our word here: "payments." Surprisingly, though the sages do not mention this.

Now this word גמלות, even though it stems from the same root, does not mean "camel" here. It means "payment," a meaning that is closer to the meaning of "acts of kindness." But payment can be positive or negative. You can get a reward and you can get punishment as payment. Though it does not mean "camel," "payment" is still etymologically related to camel, since they stem from the same root. It is in the *Zohar* that we find that the camel can be a negative image. Sometimes it is so negative that it is a symbol for the angel of death (that should be written on Camel cigarettes). Nonetheless, camels were part of the positive image of the patriarchs and matriarchs, especially Isaac and Rebecca. The camel is also a symbol of acts of loving-kindness. The unified view of a camel is therefore that it is a symbol of just payment: reward and punishment.

The essential message of the letter *gimel* (ג) is that of reward and punishment, as explained in length in our book *The Hebrew Letters*. To believe in reward and punishment, the 11th of the 13 principles of faith enumerated by Maimonides, is camel-consciousness. That is what the camel represents: reward and

⁷⁸. Jeremiah 51:56.

⁷⁹. *Berachot* 33a.

punishment. Punishment is also reward, because it too has a positive intent to it—it purifies. This is what this phrase mean: “...God is a God of payments.”

So, now we have that the three words that in a verse appear between the two names *Kel* and *Havayah* (this excludes “Temple,” which appears between *Adni* and *Havayah*) correspond to the three axes of left, right, and middle.

א-ל גמלות הויי - right (loving-kindness)

א-ל דעות הויי - middle (knowledge)

א-ל נקמות הויי - left (might).

The simplest reason to say that the sages do not note our phrase is because it is so similar to the verse on “revenge,” except that revenge is pure might while payments alludes to loving-kindness as well. So now we have the simple understanding that all the forces of natures are camels.

Space as a desert

To complete our meditation on this image of the camel as a force, let us ask what medium the camel travels through? The camel is known as the ship of the desert. Its medium of travel is the desert. For a camel the space-time continuum is the desert. So the desert represents the medium through which the forces travel, which is space-time. Thus the camel, which represents the photon, the force particles, traverses the desert, which represents the space-time. Just like space, the desert has curvature. The desert is in a sense full of waves. We might ask: Why do camels have humps? Because they are born of the desert! If you are born out of something, you resemble it, you represent it. The camel, which is born out of the curvature of the desert, resembles its origin in that it has a hump.

Another example of this principle that we have already seen is the drop of dew. We said that it seemingly comes out of the nothingness. So the drop itself resembles nothingness. Seeing a drop of dew is like seeing (as much as can be seen) the nothingness from where it originates.

The Dirac Sea

The famous physicist Dirac, symbolized space-time by a sea—even called the Dirac Sea. He called the medium in which the universe exists: a sea. A sea is also full of waves.

What is the connection between the desert and the sea? Based on Psalm 107, the sages learn that four individuals should thank

God for delivering them from a dangerous situation.⁸⁰ One is a person who has successfully made a journey through the desert and another one who has made a journey by sea. Dirac envisioned the medium of the universe as a sea. Likewise, one can imagine the entire world as a gigantic desert, part of which we inhabit. Just as a sea has islands in it, so a desert has its own islands: oasis. The universe also has islands, which are stars, planets, moons, etc.

Space as a field

There is another concept that is very similar and actually appears more commonly in science: the image of a field. Every force establishes a field. A field also has a wave-like property to it. Like grass growing in a field and then you have to take the sickle to cut down the grass.

How do you say "space" in Hebrew?

You can imagine space-time in modern physics symbolized as a desert, or a sea, or a field. There is one more word that is used by the sages to connote "outer space," in Hebrew. That word is חלל (*chalal*). The first step of creation is the contraction of the infinite light which results in the creation of the חלל הפנוי, the empty space within which the entire universe was created. Let us give all these images a sign.⁸¹ The particular sign in this case is made up of the initial letters of these four symbols for space-time: מדבר שדה ים חלל, which spells משיח, *Mashiach*. *Mashiach* has now become the image for us for the four symbols of space-time in Torah.

Space is not empty!

Let us return to Dirac's sea. What was he thinking of when he chose this symbol. He was imagining fish jumping up and down. These symbolize virtual particles that are continuously being created and annihilated. According to quantum mechanics there is no such thing as a vacuum, because everywhere there are eruptions of virtual particles, which are named so because they are short-lived, not because they do not exist. So every little piece of space-time is constantly creating and annihilating virtual

⁸⁰. *Berachot* 54b. Note that the Talmud changes the order of the four states from its order in the Bible and places travelers through the sea...

⁸¹. The sages say that the Torah cannot be remembered or sustained without using signs to condense one's learning.

particles. This is a sea of particles. This is like how the Torah describes the creation from water, from the sea, "Let the waters teem with crawling, living creatures..."

The Hebrew word for "space," *chalal* is usually translated as "vacuum." But, quantum mechanics says that there is no real vacuum. What does Torah have to say about the existence of a vacuum?

Rachav, who had an inn in Jericho, before converting completely said to the spies that I know that your God, the God of Israel, is the God of the heavens above and the earth below." But Moshe Rabbeinu added another two words: "there is no other," which Rachav did not say. The sages explain that Rachav did not know that there is no real vacuum, for the Almighty is even in the vacuum, or in Hebrew אפילו בחלל של עולם. There is no other, even in the apparent vacuum of the universe. Meaning, that God is equally present even in what seems to be a vacuum. Meaning that in essence there is no real vacuum. She did not have this understanding until she became a complete convert. This also teaches us about the difference between a full fledged convert and a non-complete convert. The full fledged convert receives a Jewish soul in his or her internal consciousness and therefore can understand this concept.

The word used for "vacuum" in Hebrew, *chalal*, is also root of the word "event," as in מְתְחוּלָל, some activity is going on. So it is very significant that in Hebrew, the language of creation, the very word for "vacuum" implies that activity is going on; something is happening in the vacuum. This is exactly the mindset of quantum mechanics. Space looks at first as if nothing is there, but there is an infinite amount of activity going on inside. This is a beautiful example of insight into nature using the Hebrew language itself.

So we have four words in Hebrew that can be used to describe the space-time medium. Because the acronym designating these four words spells "Mashiach," we may conclude that our becoming conscious of the nature of the medium of the universe is an indication of having Messianic consciousness.

According to many modern physicists, space-time itself is in essence gravitons, it is gravity itself (gravitons are the as yet undiscovered force particles of gravity). From these gravitons erupt all of the other particles, spontaneously, as virtual particles do.