

Lecture 4

We can certainly say that the driving force of science since Einstein has been the quest for unity. As we said before, in his theory of Special Relativity, Einstein unified energy and matter with space and time, by bringing space-time into the context of events that happen with energy and matter, all with $E=mc^2$. But then, for the rest of his life, Einstein tried to unify gravity, as he described it in the General Theory of Relativity with electromagnetism. But, he was unsuccessful. After his death, two more forces were found that work at the sub-atomic level, the strong and the weak forces. So once more, a grand unified field theory is what everyone is looking for.

The fact that science is seeking unity is a very Jewish thing. Even though we said before that scientists are wrong in seeking a totally encompassing theory, because it can never fully be found, nonetheless the quest for unity is the real reason that scientists continue to do so. Nonetheless, every step is a step forward. God makes it so that the scientists believe that they might find the ultimate theory, all in order to get them to progress and move higher and higher in their understanding.

As we said, the quest for unity is a very Jewish thing, as we are really into unity. As in the verse: **שמע ישראל הו"י אלקינו הו"י אחד**, "Hear O' Israel, Havayah is our God, Havayah is one."³⁷ There are actually three different ways to achieve unity. They too correspond to the mind, heart, and action of the individual (i.e., the intellectual, the emotional, and the habitual faculties of the soul).

The first way to achieve unity is that two elements that seem to be opposite nullify themselves to something that is above them. The classic example for this is two opposing officers of a king will bow down before their king. But, as soon as they rise up and go home, they are still at odds. But, in the presence of the king they are null, and because of their nullification they become one. This is called *hitbatlut* (התבטלות), or nullification.

There is a second way to achieve unity, and this is very appropriate to our lives. Take for example a couple that wants to

³⁷. See Rambam, *Sefer Hamitzvot*, 2, where this verse is defined as the Torah source for the commandment of unifying God. See also in length in *Derech Mitzvotecha, mitzvat ha'amanat elokut*.

achieve greater unity. One way is to have common nullification to someone, for instance the Rebbe. But, then you have to be with the Rebbe all the time, otherwise you fall back into disparity. The second approach is thus by inter-inclusion, or *hitkalelut* (התכללות). In inter-inclusion each one has to reveal in himself an aspect of the other. This is something like charge symmetry—that each has the other in him.

The third approach is to undertake a project together. Even if we are different, a common objective that we are working on together will unite us.

Let's try to think about these three types of unity.

Nullification is what can be achieved by the mind. But if you do not remain in a very high level of consciousness, you can readily fall from this type of unity, meaning that the mind is not everything. Its important to realize that the mind, chabad, is not everything, as far as unity is concerned. To this end, the Mittler Rebbe explained in *Kuntras Hahitpa'alut* (*An Essay on Excitation*) that the heart is the real essence of our service, and a person should not think that to pursue the Divine is solely an intellectual endeavor. Our purpose on Earth is to rectify the heart by means of the intellect. So the mind is important, but it is not the whole objective.

To have maximum unity, one has to have all three types of unity. We have to have nullification, and inter-inclusion, and cooperation (*shituf pe'ulah*). Cooperation means that by having a common objective we will be unified. Inter-inclusion means realizing that you are in me and I am in you. Inter inclusion allows us to exchange roles in a sense, allowing me to become you and you to become me. It's just a question of which side of my personality I manifest.

Of all the approaches to achieve a unified field theory, before String Theory the only approach was through nullification. The model for this was extremely high temperatures at which the different forces become one. At very high temperatures, it is as if the different forces melt away and they just become the same thing. This was demonstrated for the weak force and the electromagnetic force, which at very high temperatures are the same. Raising the temperature to such a great degree is like nullifying each until they can combine. It is a little like melting things together. So this is just nullification. At very high temperatures, even the forces of nature melt into one plasma. But, at lower temperatures, which are like leaving the presence of the king, they split.

So the theory went that at even earlier times, at the very first instance of creation, at extremely higher temperatures, the strong nuclear force would also combine with the weak force and

electromagnetism, giving one unified force. Nonetheless, it is clear that even at higher temperatures, the gravitational force cannot be united as well. So this method is only good for the non-gravitational forces. Regardless of the height of the temperature, gravity could not be “melted” into the other three forces.

How did String theory help in this respect. String Theory posits that by adding spatial dimensions, in actuality the forces merge together. Merging is like working together, like cooperation, they work together. This is what we described before as unity that corresponds to *nehi*,³⁸ to the habitual, the action-oriented *sefirot*. Science has not yet discovered at all the intermediate level of unity through inter-inclusion. There is no theory that tries to surmise that perhaps within gravity there is some inter-inclusion of the strong or weak or the electromagnetic forces. Meaning, that there is some trace of these forces within gravity.

Spiritually and psychologically these are three essential types of unity. Until science discovers a form of unity based on inter-inclusion the picture will not be complete. All the GUTs (Grand Unifying Theories) before String Theory were based on melting the forces together. But, this does not work for gravity, and has even not been proven for the strong force. It has only been proven in regard to the weak and the electromagnetic forces. What remains open is inter-inclusion. On the spiritual level, inter-inclusion is the most important. By seeing that I am in you and you are in me, we can go on to do things together (as in cooperation).

Going back to our couple, they first need a common commitment to one authority, like the Rebbe, then they have to find themselves in one another, and finally they have to work together. Because science does not have all three types of unity, the quest for unity is still incomplete.

Before we conclude let us say one more thing. The problem with 20th century science is that General Relativity does not get along with Quantum Mechanics. At very small scales, the foam, or claustrophobia of the subatomic particles does not work with the laws of gravity which are relatively very gentle and not frantic.

General Relativity says that space is curved, but it is a relatively gentle curve. There are no extreme and frantic events that affect spacetime. But, Quantum Mechanics claims that the smaller things get the more frantic they become. That wildness of the extremely small is caused by putting a particle, which is

³⁸. Netzach (victory), Hod (thanksgiving), Yesod (foundation).

like a soul, into a small box, and then it goes mad. The more you try to confine an elementary particle to a determined space, the more crazy it becomes and because of that strange things happen, like spacetime begins to tear apart, as well as other strange topological changes.

Relatively, GR is the world of (*tikun*) rectification while QM is an example of the world of (*tohu*) chaos. The two do not get along. GR is excellent in describing the cosmos, the very large, the macro. But, it cannot explain the very small. While QM is the opposite. They especially do not agree in the micro level.

This disagreement comes to the fore in special cases like a black hole, which occupies a very small space (on the scale of a particle), but has a huge mass (on the scale of many, many stars). Another place is in cosmology, at the moment of the Big Bang, when all the mass of the universe was confined to a single point. We will speak more about this later on.

But, what we now see is that the ultimate quest for unity revolves around getting rectification (*tikun*) and chaos (*tohu*) to unify. This is why inter-inclusion is the missing link. Because *tohu* and *tikun* will not cooperate together without inter-inclusion. They will not become good partners doing the same thing without inter-inclusion. Even at the level of nullification, which we likened to their being melted together, they will not work together on a common project.

The example of chaos and rectification in the Torah is that of Jacob, who is like General Relativity and Esau, who is like Quantum Mechanics (as we mentioned earlier, Noah discovered Special Relativity). Then came Jacob and Esau. And they are not going to jive unless some inter-inclusion will be found to connect them. This is something that the Rashash teaches, that even extreme opposites like *tohu* and *tikun* do possess some inter-inclusion and that is the only way to unify them.

One last topic that we need to address is that of determinism. It is well known that Einstein preferred determinism, he did not like to think that God was playing dice with the universe. Again, Einstein did not like Quantum Mechanics' seeming allowance of free-will due to probability. But we know that the Torah tells us that the most basic, fundamental tenet of the Torah is free will. Quantum Mechanics allows a lot more freedom. General Relativity, on the other hand, follows Einstein's preference for determinism. So deep down, unifying General Relativity and Quantum Mechanics also depends on our ability to solve the paradox of God's omniscience (determinism) versus man's free will. General Relativity is like God's omniscience. Quantum Mechanics is like our freedom of choice.

Ultimately this goes back to the right and the left. Right is omniscience, while the left represents the free will. The angel of Esau is called the samech mem (alef lamed), which is a variant spelling of the Hebrew word for "left." In the weak interaction (force) the left remains the left, it does not interchange with the right. In other words, because the weak force does not preserve parity, the samech mem, the left there, remains the samech mem, Esau's angel. Nonetheless, he too has to do teshuvah, meaning he has to change. Until, as the prophet says, finally, "Death will be swallowed up, forever,"³⁹ meaning that Esau's angel, the samech mem, will eventually be swallowed up in a black hole.

We will discuss more about black holes and how they swallow up things later. We will then also further understand how to achieve unity between Quantum Mechanics and General Relativity.

³⁹. Isaiah 25:8. Death is one of the seven names given to Esau's angel, see *Sukah* 52a.