

Overview:

This lesson is part of a 10th grade curriculum in “Jewish Philosophy-Maimonides’ 13 Principles of Faith”.

This lesson is for the 1st Principle of Faith-

“The Existence of a Creator Who is the Cause of all Existence”

The lesson examines the interface between science and religion.

Objective:

Examine scientific data regarding the early stages of the universe, and identify 7 recent scientific discoveries.

Show how these scientific discoveries are contained in the first 3 verses of the Torah, as interpreted by Ramban, Rambam, and Chazal.

Method:

Students receive a booklet with the first 3 verses of the Torah on the cover page.

The subsequent pages each have:

- ❖ A description of a recent scientific discovery regarding the early stages of the universe.
- ❖ An empty box on the upper right hand corner, where the students guess or predict which word or phrase from the first 3 verses of the Torah contains that discovery.
- ❖ The interpretation of that word or phrase according to classical or medieval sources expressing that particular scientific discovery centuries before science discovered it.

On the following pages, all Judaic sources are from Ramban’s commentary in the first 3 verses of Genesis, unless otherwise indicated. All scientific sources are from Prof. Gerald Schroeder’s works, unless otherwise indicated.

I have provided a summary and elucidation of the findings at the end.

בראשית פרק א - Genesis Chapter 1

(א) בְּרֵאשִׁית בָּרָא אֱלֹהִים אֶת הַשָּׁמַיִם וְאֶת הָאָרֶץ:

In the beginning God created heaven and earth

(ב) וְהָאָרֶץ הִיְתָה תֵהוֹ וּבֵהוּ

וְחָשֶׁךְ עַל פְּנֵי תְהוֹם

וְרוּחַ אֱלֹהִים מְרַחֶפֶת עַל פְּנֵי הַמָּיִם:

The earth was without form and empty
with darkness on the face of the depths
And God's spirit hovered on the face of the water

(ג) וַיֹּאמֶר אֱלֹהִים יְהִי אוֹר וַיְהִי אוֹר:

G-d said "There shall be light,"
and light came into existence

In 1959, a survey was taken of leading American scientists. Among the many questions asked was, "What is your concept of the age of the universe?"

In 1959, astronomy was popular, but a deep understanding the universe was just developing. The response to that survey was recently republished in *Scientific American* - the most widely read science journal in the world. Two-thirds of the scientists, that is the overwhelming majority, gave the same answer:

Beginning? There was no beginning.

Aristotle and Plato taught us 2400 years ago that the universe is eternal.

Oh, we know the Bible says 'In the beginning.' That's a nice story, it helps kids go to bed at night. But we sophisticates know better. There was no beginning.

That was 1959, about 50 years ago. Then came the discoveries, in 1965, by Arno Penzias and Robert Wilson. They revealed that the entire universe in all directions is bathed in a sea of very long wave of very 'cold,' radiation. They had discovered the echo of the big bang, the radiation left over from that intense vastly hot moment that marked the beginning. It was the one piece of information needed to nail down whether or not our universe had a beginning. For this they earned the Nobel Prize.

Over night the world paradigm changed from a universe that was eternal to a universe that had a creation. Understand the impact. Science said that our universe had a beginning, that the first words of the Bible are correct. I can't over emphasize the importance of this scientific "discovery."

(Dr. Gerald Schroeder)

The present universe, according to current cosmological understanding, is the result of a Big Bang, a massive expansion from a single point. While the conditions that existed prior to the appearance of energy and matter are not known, we can attempt to describe them at the briefest instant following the beginning, at about 10^{-43} seconds after the start. That time reads as one 10 millionth millionth millionth millionth millionth millionth millionth of a second. The universe was then the size of a speck of dust. It would have taken a microscope to study it. Now, 15 billion years later, even telescopes are not powerful enough to reach its limits.¹¹

רבי יונה בשם ר' לוי אמר למה נברא העולם בב' אלא מה ב' זה סתום מכל צדדיו ופתוח
מלפניו כך אין לך רשות לומר מה למטה מה למעלה מה לפניו מה לאחור אלא מיום שנברא
העולם ולהבא. בר קפרא אמר (דברים ד, לב): "כִּי שֶׁאֵל נָא לִימִים רִאשׁוֹנִים אֲשֶׁר הָיוּ לְפָנֶיךָ
[לִמֵּן הַיּוֹם אֲשֶׁר בָּרָא אֱלֹהִים]" למן היום שנבראו אתה דורש ואי אתה דורש לפניו מכאן

Rabbi Yonah said in the name of Rabbi Levi: Why was the world created with a "bet"? Just as a bet is closed on all sides and open in the front, so you are not permitted to say, "What is beneath? What is above? What came before? What will come after?" Rather from the day the world was created and after. Bar Kappara said: "You have but to inquire about bygone ages that came before you [ever since G-d created humanity on earth]" (**Deuteronomy 4:32**). "Ever since G-d created them" you may speculate; however, you may not speculate on what was before that. ["From one end of Heaven to the other"] on this you may speculate and investigate, but you may not speculate and investigate on what was before.

(Bereshit Rabbah 1)

1

Physics and mathematics, as we know them today, cannot deal with times earlier than 10^{-43} seconds after the beginning. Prior to that time, the temperatures and densities of matter exceeded those that can be described by the laws of nature as we now understand them. Because of this, cosmological theory cannot handle the actual time-zero beginning of the universe in terms that relate to dimensions experienced by humans.

It is instructive to quote a few statements made by the cosmologists who stand at the very head of their profession.

Professor Stephen Hawking of the University of Cambridge writes,
"The actual point of creation lies outside the scope of presently known laws of physics."

Professor Francis Collins, director of the Human Genome Project and author of "The Language of God: A Scientist presents Evidence For Belief" writes:
"The Big Bang cries out for a Divine explanation. It forces the conclusion that nature had a beginning. I cannot see how nature could have created itself. Only a supernatural force that is outside of space and time could have done that."

Professor Alan Guth of the Massachusetts Institute of Technology and Professor Paul Steinhardt of the University of Pennsylvania write,
"The instant of creation remains unexplained."

Professors Guth and Steinhardt, comment that *"from a historical point of view, probably the most revolutionary aspect of the modern theory of cosmology is the claim that matter and energy were literally created.* These cosmologists emphasize *"this claim stands in marked contrast to centuries of scientific tradition in which it was believed that something cannot come from nothing."*

And finally, a recent scientific article published in one of the foremost international journals of physics carries the following title:
"Creation of the Universe from Nothing."

וְעַתָּה שְׁמַע פִּרְשׁ הַמִּקְרָא עַל פְּשׁוּטוֹ נְכוֹן וּבְרוּר – Now listen to the interpretation of the verse, according to its simple meaning, in a sound and clear manner: הַקָּדוֹשׁ בְּרוּךְ הוּא בָּרָא כָּל הַבְּרִיאִים – The Holy One, Blessed is He, created all creations from absolute nihility. מֵאַפְסֵיהֶם מְהֻלָּקָה – The Holy One, Blessed is He, created all creations from absolute nothingness. וְאֵין אֲפָלְנוּ בִּלְשׁוֹן הַקֹּדֶשׁ בְּהוֹצֵאת הַיֵּשׁ מֵאֵין אֵלָּא לְשׁוֹן "בָּרָא" – We do not have any word in the Holy Tongue (Hebrew) to express the idea of bringing forth something out of nothing except for the word בָּרָא, usually rendered, to create.

[Ramban now discusses the use of this particular Name of God (*Elohim*) in the context of the six days of Creation:]

וְאָמַר "אֱלֹהִים", בְּעַל הַכֹּחוֹת בְּלִמָּה – [Scripture] says the Name of God *Elohim*, which indicates "the Master of All Powers."³⁵ בִּי הַמְלָה עֲקָרָה "אֵל", שְׂהוּא בֶּן – For the root of [the word] is אֵל, which means "power." וְהוּא מְלָה מְרֻבֶּבֶת "אֵל הֵם" – [*Elohim*] is a compound word of the two elements אֵל and הֵם, Power and them, – as if אֵל, Power, were attached to the following word, הֵם, them, and means "the Power of them," וְ"הֵם" יָרְמוּ לְכָל שְׂאֵר הַכֹּחוֹת – with the pronoun them referring to all other powers.³⁶ בְּלִמָּה בְּלִמָּה – In other words, *Elohim* means "Power over all powers."

[REDACTED]

At this early time, all matter was concentrated into the one minuscule core location. The temperature was 10^{32} K (100 million million million million million degrees Kelvin). For comparison, the temperature at the center of the Sun is about 15 million degrees Kelvin. The surface of the Sun is a mere 5,800°K.

ואין כל ה"נעשה מִתַּחַת הַשֶּׁמֶשׁ", או למעלה, הוֹנָה מִן הָאֵין הַתְּחִלָּה] וְאֵין כֵּל הַנִּשְׁעָשֶׂה מִתַּחַת הַשֶּׁמֶשׁ, או למעלה, הוֹנָה מִן הָאֵין הַתְּחִלָּה] Now, nothing that is "made under the sun,"²⁷ or above it, initially comes into existence from nothingness; rather, אָבֵל הוּצִיא מִן הָאֵפֶס הַגָּמוּר הַמְּחֻלָּט וְיִסוּד דֶּק מְאֹד, אֵין בּוֹ מִמַּשׁ – [God] brought into being from complete, absolute nihility an exceedingly fine primary essence with practically no substance. – אָבֵל הוּא בֶּחַ מִמַּצִּיא, מוּכָן לְקַבֵּל הַצּוּרָה, וְלַצָּאת מִן הַבֶּחַ אֶל הַפּוֹעַל – But this essence is the potential for bringing forth other things, ready to receive form and to emerge from the potential to the actual. – וְהוּא הַחֲמֹר הָרִאשׁוֹן, נִקְרָא לְיוֹנִים "הוּיֹלִי" – This is the primary substance called by the Greeks ulh (*hule*). – וְאַחֲרֵי הַהוּיֹלִי לֹא בָּרָא דְבָר – And after this *hule*, [God] did not create anything out of nothing; rather, He "formed" and "made" things,²⁸ – אָבֵל יָצַר וַעֲשָׂה – for He brought all things into being from [the *hule*], endowed them with forms and perfected them.]

[The Sages] expounded this word, asserting that it always is meant to include something extra not mentioned in the verse explicitly.⁴³ כִּי הוּא – וְדָרְשׁוּ בָּהּ שֶׁהוּא לְעוֹלָם לְרִבּוּת – [The Sages] expounded this word, asserting that it always is meant to include something extra not mentioned in the verse explicitly.⁴³ כִּי הוּא – וְדָרְשׁוּ בָּהּ שֶׁהוּא לְעוֹלָם לְרִבּוּת – For it is related to the word אָתָּא, *has come*, in the verse, *morning has come, and also night* (Isaiah 21:12).⁴⁴ – וְכֵן אָמְרוּ רַבּוֹתֵינוּ – And so too in explaining our verse, our Sages said: – אֶת הַשָּׁמַיִם לְרִבּוּת חֲמָה וּלְבִנָּה כּוֹכָבִים וּמִקְלוֹת – The term אֶת is used with reference to the heavens to include the sun, moon, stars and constellations of the heavens; "אֶת הָאָרֶץ",

– and the term אֶת is used with reference to the earth to include the trees, vegetation, and the Garden of Eden, all of which are located on the earth (*Bereishis Rabbah* 1:14). – וְאֵלֵּי כָּל הַנִּבְרָאִים בְּעֲלֵי הַגּוֹף – These things enumerated by the Sages include all the creations that have a physical form.⁴⁵

Our present world is composed of 'matter' (in the form of atoms and molecules), which is the basic constituent of everything we see, ranging from stars and galaxies to oceans and trees and animals. From where did all this matter come? The answer is given by the famous formula of Einstein's theory of relativity,

$$E = Mc^2$$

where E denotes energy, M denotes matter and c denotes the speed of light.

This formula states that matter can be converted into energy. Moreover, because of the large value of the 'exchange rate' c^2 , a little bit of matter suffices to produce an enormous amount of energy. This matter-to-energy conversion is not merely a hypothetical possibility, but forms the basis for nuclear energy, whose powerful bombs devastated Hiroshima and Nagasaki but whose peaceful use provides electric power for tens of millions of families.

The big-bang theory utilizes the fact that Einstein's formula can work both ways: not only can matter be converted into energy, but energy can also be converted into matter. Although it requires a vast amount of energy to produce only a little matter, the amount of energy present in the primeval fireball was so enormous that it was the source of all the matter that now exists in the entire universe.

[Ramban continues to discuss the nature of the primary substance *hule*:]

וְיָדַע בִּי הַשָּׁמַיִם וְכָל אֲשֶׁר בָּהֶם חֶמֶד אֶחָד – You should know that the heavens and all that is in them are of one primary substance, וְהָאָרֶץ וְכָל אֲשֶׁר בָּהּ חֶמֶד אֶחָד – and the land and all that is in it are of one different primary substance. וְהַקְדוֹשׁ בְּרוּךְ הוּא בָּרָא אֵלֹהֵי שְׁמֵיהֶם מֵאֵין – The Holy One, Blessed is He, created both of these from nothing. וְשְׁנֵיהֶם לְבָדִים נִבְרָאוּ – These two things alone were created from nothing, וְהַכֹּל נַעֲשִׂים מֵהֶם – and everything else in the universe is made from them. הַיּוֹמָר הַזֶּה, שֶׁקִּרְאוּ הַיּוֹגִלִּי, נִקְרָא בְּלָשׁוֹן הַקָּדֵשׁ "תוהו" – Now, this substance, which [the Greeks] called *hule*, is called *tohu* in the Holy Tongue (Hebrew). "בְּתוֹכָהּ עַל הָרָאשׁוֹנוֹת" – The word *tohu* is related to the word תוהו, *regrets*, found in [the Sages'] expression, "when he regrets his first deeds" (*Kiddushin* 40b). מִפְּנֵי שֶׁאִם בָּא אָדָם לְגַזֵּר בּוֹ שֵׁם, תוֹכָהּ וְנִמְלָךְ לְקוֹרְאוֹ בְּשֵׁם אֶחָד – It is called this because if a person tries to coin a word for [this *hule*], he regrets his choice and changes his mind to call it by another name, כִּי לֹא לִבֵּשׁ צוּרָה שְׁיִתְפַּשׁ בָּהּ הַשֵּׁם כָּלֵל – for it has not taken on any form that a name should be applicable to it at all.²⁹ וְהַצּוּרָה הַזֹּאת לְבִשָּׁת לְחֶמֶד – And the form that is taken on by this *hule* substance is called in the Holy Tongue *bohu*. הַיּוֹמָר הַזֶּה, שֶׁקִּרְאוּ הַיּוֹגִלִּי, נִקְרָא בְּלָשׁוֹן הַקָּדֵשׁ "בוהו" – The word is a con-tracted compound word; as if it said, בּוֹ הוּא, *it is in it*, that is, "there is form in this *hule*."

In that first spot of time following creation, all the mass of the universal energy-matter continuum was concentrated in a single point. When a vast amount of mass is in a small volume, the gravity generated by this mass can be so great that nothing can escape. Not even light. It's what cosmologists call a black hole. Black holes were discovered two decades ago, notwithstanding the 3,400-year-old statement of Genesis 1:2. Matter, light, whatever comes near, is drawn into a black hole. They are formed today when a star with a mass about ten times greater than that of the Sun has used up most of its nuclear fuel. The cooling process that ensues allows the core mass to collapse toward the central point of the star. The concentration of matter becomes so great that its gravity pulls all the mass, photons included, into the center. Nothing escapes. It is black.

Based on our understanding of the conditions just after the Big Bang, the laws of physics would predict either a universe composed predominantly of heavy elements, or a universe filled with matter so widely dispersed that stars and galaxies might never have formed. Forces are required that are not observed today. We find them only as characters written on a theoretical physicist's blackboard! To arrive at our universe from the conditions and substance that existed in the first millionth billionth billionth

billionth of a second after the Big Bang required a one-time homogenization, which would direct the course of the universe's expansion. The first theoretical statement of this unique homogenization was formulated in 1979 by Alan Guth at M.I.T. He referred to the concept as inflation.⁴

At 10^{-35} seconds after the beginning, the universe had a diameter of 10^{-24} centimeters. At that instant, a unique, one-time force—a sort of antigravity—developed. This force, acting for a minuscule fraction of a second, caused an expansion of the universe at a rate far in excess of any rate prior to, or after, this episode. In this brief epoch, the universe inflated to the size of a grapefruit.

Astrophysicists also have no conventional explanation for what could have started the outward flow of matter. But very early in the life of our universe, they call for a one-time, new type of force, an "inflationary epoch."

This is what makes the comparison between theology and cosmology so interesting in this breaking of light out of darkness. One-time phenomena are almost never called on by physicists.

Maimonides, Guide to the Preplexed (I:40)

The meaning of "intention, will," is likewise contained in the word ruah. Comp. "A fool uttereth all his spirit" (ruah) (Prov. xxix. 11), i.e., his intention and will: "And the spirit (ruah) of Egypt shall fail in the midst thereof, and I will destroy the counsel thereof" (Isa. xix. 3), i.e., her intentions will be frustrated, and her plans will be obscured; "Who has comprehended the spirit (ruah) of the Lord, or who is familiar with his counsel that he may tell us?" (Isa. xl. 13), i.e., Who knows the order fixed by His will, or perceives the system of His Providence in the existing world, that he may tell us? as we shall explain in the chapters in which we shall speak on Providence.

Thus the Hebrew ruah when used in reference to God, has generally the fifth signification: sometimes, however, as explained above, the last signification, viz., "will." The meaning of the word in each individual case is therefore to be determined by the context.

The "wind of God" or "God's wind" of verse 2 is not like the "strong east wind" that opened the Sea of Reeds for the Israelites leaving Egypt (Exod. 14:21). "And Moses stretched out his hand over the sea and God caused the sea to go back by a strong east wind all the night, and made the sea dry land, and the water was divided." At the exodus, the description is of a distinct physical, albeit God-inspired, phenomenon. It was a wind composed of moving air. Here in Genesis, Maimonides explains that had a true wind been meant, the action attributed to this wind (merahefet in Hebrew) would be illogical.⁵ The Hebrew word merahefet means "to hover above," as a bird hovers above its nested young (see Deut. 32:11). It does not mean to blow. The wind of the "wind of God" has the meaning of spirit (Eccles. 12:7), or Divine inspiration (Num. 11:17), or God's will (Isa. 19:3). It is of great significance that this term wind of God is used only once in Genesis. It is a one-time phenomenon.

The most familiar form of matter is an atom, or a group of atoms called a molecule. However, when matter was initially formed, immediately after time zero, it did not exist in the form of atoms. The

enormous temperature of the primeval fireball would have instantly disintegrated any atom. At first, matter existed in a different form called a 'plasma.' The important distinction between these two forms of matter is that an atom is electrically neutral, whereas a plasma consists of positively and negatively charged particles. The properties of charged particles cause a plasma to 'trap' light and to prevent its free passage. Since the universe initially contained a plasma, the light of the fireball was trapped and could not 'escape' from the plasma to be 'seen.' Therefore, the universe would have appeared dark to an outside observer even though it was filled with the light of the fireball.

The very hot primeval fireball cooled extremely rapidly. By the time 0.001 (see the Table), it had cooled sufficiently to permit the charged particles of the plasma to form atoms. The formation of atoms from the plasma was a vitally important event, being crucial for the universe to develop into its present form.

In contrast to a plasma, any region of space filled with free atoms and molecules is completely transparent. One need only think of the transparent atmosphere which is composed of molecules of air (mainly nitrogen and oxygen). Light shines freely through the atmosphere: from the surface of the Earth, one clearly sees the sun, the moon, and the distant stars and galaxies. Therefore, when the plasma was suddenly transformed into atoms and molecules 15 billion years ago, the light of the fireball was no longer trapped by the plasma. Instead, the light began to 'shine' visibly and it soon filled the entire universe, as it still does to this very day.

After this, [Scripture] elaborates further that this form included the form of four elements, *אש, מים, ארץ, ואוויר* - which are fire, water, earth and air. *והארץ תהיה תהום* - The word *הארץ*, *the earth*, in the earth was "tohu" and "bohu," encompasses these four elements,⁴⁸ as indicated by the subsequent phrase: *with "darkness" upon the surface of the "tehom," and a "wind" from God hovered upon the surface of the waters*, as will be explained presently.⁴⁹ *אש* - Fire is called *darkness* in this verse because the essential fire is dark;⁵⁰ *ואלו היתה ארץ היתה מאדירה* - if [fire] were red inherently it would redden the night for us.⁵¹

Summary of Scientific Discoveries and Corresponding Jewish Sources:

1st Box: בראשית - In the Beginning

Discovery:

“Singularity” or “Moment of Firstness”

Based on discoveries made by Penzias and Wilson, with the aid of information received from the Hubble telescope, the world had a definite beginning, known as Singularity, in contrast to the accepted Platonic and Aristotelian model that the world was eternal.


Conditions prior to 10^{-43} seconds after the Big Bang are *unknown and cannot be described*.

Jewish Sources

There is a beginning.

Conditions prior to the moment of appearance of energy and matter are not known.

This is encapsulated by the word “Bereshit” and in particular with the dot in

the first letter , which represents the Big Bang after which the world was the size of “a speck of dust” (Schroeder) or, the size of a “mustard seed” (Ramban), conditions prior to which are unknown and impenetrable- as evidenced by the 3 walls of the letter ב. Only conditions from that point forward are observable as evidenced by the opening on the left side of the letter ב.

2nd Box: ברא אלוקים -- Elokim Created

Discovery:

The Big Bang!

Creation ex Nihilo

The modern theory of cosmology states that matter and energy were created from nothing, *creation ex nihilo*, by a supernatural Creator outside of time and space.

Jewish Sources

Ramban's interpretation of ברא- creation from nothing

Ramban's interpretation of אל הם = אלוקים

The name of the chosen appellation of G-d here as Elokim, is a conjunction of two words meaning Master of all forces, Master of all powers.

3rd Box: את השמים ואת הארץ - The Heavens and The Earth

Discovery:

All matter was concentrated into one miniscule core location. This matter was actually intangible and had no real substance. It was energy, which had the potential to gain real substance.

Jewish Sources

Ramban explains that את השמים ואת הארץ - The Heavens and The Earth refers not to actual matter of the heavens and earth, but rather to a fine primary essence with practically no substance.

4th Box: תוהו ובוהו -- Tohu and Bohu (formless and void)

Discovery:

Einstein's Theory of Relativity: $E=MC^2$

Students learn the theory of relativity, and the energy-to-matter conversion (and vice versa: matter-to-energy). They supply commonly observable examples of these conversions.

Jewish Sources

Ramban's interpretation of תוהו - Tohu:

From תוהא - to regret. You can't give tohu a name, and if you do you will regret it because it is not limited to that name because it is an all-encompassing thing, namely E = Energy.

Ramban's interpretation of בוהו - Bohu:

It is a conjunction of two words בו & הוא, "it is & in it"

This word signifies M =Matter (i.e. the form which energy/ Tohu can take.)

In other words- it too is in it, because all potential matter/Bohu is contained in it, the Tohu/Energy)

As a pedagogical tool, I first teach the terms Tohu and Bohu in conjunction to the previous term את השמים ואת הארץ- without mention of Einstein's theory, and then teach the theory of Relativity. I ask them to then look in the verses and find $E=MC^2$. Students are very surprised, excited, and pleased, to discover that Einstein's Theory of relativity $E=MC^2$ is contained in the biblical words Tohu & Bohu.

5th Box: וַחֲשֹׁךְ עַל פְּנֵי תְהוֹמֹת – And darkness on the face of the depths

Discovery:

Black holes!

Black holes are the result of the gravity generated by vast amount of mass in a small volume, from which nothing can escape including light.

Jewish Sources:

Students are asked to find the black hole in the verses.

They are super excited to discover the וַחֲשֹׁךְ – darkness על פְּנֵי תְהוֹמֹת – upon the great abyss!

6th Box: רוּחַ אֱלֹהִים מְרַחֶפֶת – G-d's *spirit* hovered

Discovery:

Inflationary epoch

To direct the course of the universe's expansion there was a need for a one time phenomenon- an anti gravity which would inflate the universe and set the expansion into motion. The major problem is that physicists almost never call for one-time phenomena, yet this precisely is what occurred. A one time anti gravitational inflation occurred, causing the expansion of the universe at a rate far greater than any rate prior to or after this inflationary epoch.

Jewish Sources:

Maimonides interpretation of רוּחַ אֱלֹהִים מְרַחֶפֶת – is G-d's *spirit* or G-d's *will* hovered. Ruach cannot be interpreted as wind here since the verse says that G-d's Ruach hovered and wind does not hover. Rather Ruach Elokim is the will of G-d, the spirit of G-d, which willed an inflationary epoch to occur.

7th Box: עַל פְּנֵי הַמַּיִם – On the face of the water

8th Box: וַיֹּאמֶר אֱלֹהִים יְהִי אוֹר וַיְהִי אוֹר -- G-d said, "There shall be light"
and light came into existence

Discovery:

Pre-matter called Plasma

Initial matter did not exist in the form of atoms, but rather in a form called plasma. Plasma consists of charged particles, which trap light. Thus the universe would have appeared dark even though it was filled with the light of the fireball.

Jewish Sources:

Students are asked to find the pre-matter called *Plasma*.

They quickly point to על פני המים – On the face of the water.

Ramban explains that the essential initial fire (pre- matter) was dark.

Once the “fireball” cooled enough to allow the charged particles to form atoms, the light was no longer trapped by plasma, and ויאמר אלוקים יהי אור-- and G-d said “There shall be light” and light came into existence.

References and Recommended Reading

Immortality, Resurrection and the Age of the Universe: A Kabbalistic View

by: Aryeh Kaplan

The Science of God: The Convergence of Scientific and Biblical Wisdom

by Gerald L. Schroeder Ph.D.

Genesis and the Big Bang: The Discovery Of Harmony Between Modern Science And The Bible

by Gerald Schroeder

In the Beginning: Biblical Creation and Science

by Nathan Aviezer

Fossils and Faith: Understanding Torah and Science

by Nathan Aviezer

**STUDENT
REACTIONS
And
FEEDBACK:**

In class we learned how the first 3 pesukim of Bereshit contained many scientific discoveries of the creation of the world. As a Jewish girl in the modern world I found this very interesting. This is because I am constantly being told that the science of creation and the Torah belief of creation do not go hand in hand. But, as a Jew in the modern world both Torah and science are sources that I trust and stand by. Thus, I found much relief in knowing that they could. I found such relief that for a good week I was telling everyone I knew about what I learned. Like the Rambam says that if science and Torah does not meet eye to eye, then you either did not learn the Torah well enough or you did not learn science well enough. I guess in this case I did not know the Torah well enough and scientist did not know science well enough. Also, to think that Torah has information that Science could not even prove until 1960s which wasn't even long ago is pretty unbelievable.

Nevertheless, I believe this is one lesson that I will never forget.

Taliah Soleymani

Sophomore

ICJA

Before this lesson, I was confused with the material which made me angry that I did not get satisfactory answers. However, this confusion and anger came before I was given the packet. This packet made my anger go away and actually made me happier. I was able to see a crystal clear connection between the actual pasuk from the Torah, and the science that has been discovered over the years. I connected, using the packet, word for word from the pasuk to science today. I learned that not only do science and Torah match up, but the Torah presented these ideas even before they were scientifically discovered. I may have not been completely convinced by what I was presented with, but the information was shocking and inspiring. I went home the next Shabbat after learning this and started telling my parents about what I learned that started from a five minute discussion and turned into a twenty minute lecture of me talking about this one packet. I was completely amazed, and we had a non-Jewish guest over who was visiting houses taking part in different religions. After I explained what I had learned she too was amazed and wanted to know more. This packet was a great way to learn what we learned and truly changed my mind about the Torah.

Abigail Brasch

Sophomore

ICJA

This class on the interface between science and religion is necessary for anyone who desires to strengthen their Torah and science understanding. In addition, this unit is intensely captivating and overall I am enriched with this once misunderstood concept that has been rejected in my career as a student.

Before studying this topic, I personally had many simple questions on instances where science contradicted religious beliefs. In many cases, basic misconceptions concerning science and Torah are neglected and I am pleased I gained an opportunity to strengthen my belief in our religion.

Sarah Richter

Sophomore

ICJA

Student reactions:

Students are open mouthed, and duly impressed in their reaction to learning this material.

Students feel empowered, relieved, and vindicated that their faith does not contradict science.

I had one student, E.B., who was so fascinated, that she asked to record the review we did in class on this material. I happily agreed.

Two years later, as a senior in HS, in one of her other classes, she was learning something in one of her Tanach classes on science and religion, and she asked her teacher if she could play the recording of the review session I held in class two years ago, which she still had saved on her phone because it was so precious to her!

Her teacher agreed, and E.B., replayed the review and excitedly explained the connections to her entire class.

Kochava Yitzhak

Teacher

ICJA