

## CLASS 2

### II. Introduction, continued

#### A. Astronomy (definition)

#### B. Why, from a Jewish perspective, should we study Astronomy?

1. To develop an awareness of, and appreciation for, Hashem by seeing His wisdom in the world.
2. To inspire and strengthen our commitment to the fulfillment of Hashem's word

##### a. Gemara Berachos 32b

נושא אשה על אשתו ראשונה זוכר מעשה הראשונה אתה עובתני ושכחתני אמר לה הקב"ה בתי י"ב מזלות בראתי ברקיע ועל כל מזל ומזל בראתי לו שלשים חיל ועל כל חיל וחיל בראתי לו שלשים לגיון ועל כל לגיון ולגיון בראתי לו שלשים רהטון ועל כל רהטון ורהטון בראתי לו שלשים קרטון ועל כל קרטון וקרטון בראתי לו שלשים גסטרא ועל כל גסטרא וגסטרא תליתי בו שלש מאות ושישים וחמשה אלפי רבוא כוכבים כנגד ימות החמה וכולן לא בראתי אלא בשבילך ואת אמרת עובתני ושכחתני <sup>17</sup>התשכח אשה עולה

[Hashem says to the Jewish people:] I created 12 constellations in the firmament, and on each and every constellation I have created for it 30 armies (*chayil*), and on each and every army I have created for it 30 legions (*ligyon*), and on each and every legion I have created for it 30 infantry heads (*rahaton*), and for each and every infantry head I have created for it 30 camp leaders (*karton*), and for each and every camp leader I have created 30 fort leaders (*gastera*), and on each and every fort leader I have hung 365,000 myriads (ten-thousands) of stars, corresponding to the days of the solar year. And all of them I have created only for your sake.

(See Appendix at end of this Source Sheet for the Gemara's calculation of the number of stars.)

##### b. Rav Shimshon Refael Hirsch, Tehillim 19 (see fuller text in Additional Resources)

... Indeed, heaven and earth demonstrate the existence of God to man in incontrovertible clarity, and no specific revelation of a word of God would be necessary for man to recognize the manner in which the ways of God are revealed in nature. Yet, were it not for the "word" revealed to him by God, man would be left quite helpless and perplexed with respect to his own role in this scheme of things. Without this Law, he would not know what his own relationship is to heaven and to earth, and to the Creator Who made him as well as the rest of the universe.

It is only the Law which can tell him how, as a human being in the midst of a world consecrated to the service of God, he must serve Him, his Lord and Maker, with his own life.

## Tehillim 19

### Verses 1-7 (text and translation from Chabad.org)

<b>1</b> For the conductor, a song of David.	<b>א</b> לַמְנַצֵּחַ מִזְמוֹר לְדָוִד:
<b>2</b> The heavens recite the glory of God, and the sky tells of the work of His hands.	<b>ב</b> הַשָּׁמַיִם מְסַפְּרִים כְּבוֹד־אֱלֹהִים וּמַעֲשֵׂה יָדָיו מְגִיד הַרְקִיעַ:
<b>3</b> Day to day utters speech, and night to night tells knowledge.	<b>ג</b> יוֹם לַיּוֹם יְבִיעַ אָמַר וּלְיָלֵה לַיְלָה יְחַהֲדַעַת:
<b>4</b> There is neither speech nor words; their voice is not heard.	<b>ד</b> אֵין אָמַר וְאֵין דְּבָרִים בְּלִי נִשְׁמָע קוֹלָם:
<b>5</b> Their line goes forth throughout the earth, and their words are at the end of the world; for the sun He made a tent therein.	<b>ה</b> בְּכָל־הָאָרֶץ   יֵצֵא קוֹם וּבִקְצֵה תֵּבֵל מְלִיהֶם לְשִׁמּוֹשׁ שָׁם   אֵהֶל בָּהֶם:
<b>6</b> And it is like a bridegroom emerging from his chamber; it rejoices like a mighty man running a course.	<b>ו</b> וְהוּא כְּחַתָּן יֵצֵא מִחַפְצּוֹ יוֹשֵׁשׁ כְּגִבּוֹר לְרוֹץ אֶרֶץ:
<b>7</b> From the end of the heavens is its source, and its circuit is to their ends, and none is hidden from its heat.	<b>ז</b> מִקְצֵה הַשָּׁמַיִם   מוֹצְאוֹ וּתְקוּפָתוֹ עַל־קְצוֹתָם וְאֵין נִסְתָּר מִחַמָּתוֹ:

### Verses 8-12 (text and translation from Chabad.org)

<b>8</b> The law of the Lord is perfect, restoring the soul; the testimony of the Lord is faithful, making the simple one wise.	<b>ח</b> תּוֹרַת יְהוָה תְּמִימָה מְשִׁיבַת נַפְשׁ עֲדוּת יְהוָה נֶאֱמָנָה מַחְקִימַת פִּתִּי:
<b>9</b> The orders of the Lord are upright, causing the heart to rejoice; the commandment of the Lord is clear, enlightening the eyes.	<b>ט</b> פְּקוּדֵי יְהוָה יְשָׁרִים מְשַׂמְחִי־לֵב מִצְוַת יְהוָה בָּרָה מְאִירַת עֵינָיִם:
<b>10</b> The fear of the Lord is pure, existing forever; the judgments of the Lord are true, altogether just.	<b>י</b> יִרְאַת יְהוָה   טְהוֹרָה עוֹמֶדֶת לְעַד מִשְׁפָּטֵי־יְהוָה אֱמֶת צְדִקּוֹ יַחֲדוּ:
<b>11</b> They are to be desired more than gold, yea more than much fine gold, and are sweeter than honey and drippings of honeycombs.	<b>יא</b> הַנְּחָמִידִם מְזוּהָב וּמִפָּז רַב וּמְתוֹקִים מִדְּבַשׁ וְנֹפֶת צוּפִים:
<b>12</b> Also Your servant was careful with them; for in observing them there is great reward.	<b>יב</b> גַּם־עַבְדְּךָ נִזְהָר בָּהֶם בְּשִׁמְרָם עֲקֵב רַב:

c. Alei Shur, vol. II, p. 271-272 (see original Hebrew and full text in Additional Resources)

The word “*hitbonen*” (to contemplate) is comprised of two roots: building (*binyan*) and understanding (*binah*). The person who contemplates (*mitbonen*) builds (*boneh*) himself through his understanding (*binah*) of everything around him.... We will now attempt to fulfill the verse, "Lift up your eyes on high and see, Who created these" (Yeshayah 40:26). King David contemplated them (the celestial

bodies) and he said, "When I see Your heavens, the work of Your fingers, the moon and stars that You have established, [I ask,] what is man that You should remember him, and the son of man that You should be mindful of him? Yet You have made him slightly less than the angels, and You have crowned him with glory and majesty. You give him dominion over the work of Your hands; You have placed everything beneath his feet" (Tehillim 8:4-7). We see that when a person contemplates the cosmos and their wonders, he discovers also his own place in the world, with all of his smallness together with his greatness. This is a paradigm for how the contemplative (*mitbonen*) person builds (*boneh*) himself!

### 3. To facilitate our understanding and practical fulfillment of Torah

#### a. Many Torah sages throughout the generations were expert in astronomy (examples:)

Tana'im (1<sup>st</sup> to 2<sup>nd</sup> centuries, CE)

Rabban Gamliel (Rosh Hashanah, ch. 2)

Rebbi Yehoshua

Rebbi Eliezer ben Hurkanus

Rebbi Elazar ben Arach

Rebbi Akiva

Amora'im (3<sup>rd</sup> to 6<sup>th</sup> centuries CE)

Rav

Shmuel

Abaye

Rava

Rav Adda bar Ahavah

Geonim (9<sup>th</sup> to 11<sup>th</sup> centuries CE)

Rav Saadyah Gaon (wrote *Sefer ha'Moadim*)

Rav Sherira Gaon

Rav Hai Gaon

Rishonim (12<sup>th</sup> to 15<sup>th</sup> centuries CE)

Rabbeinu Avraham ben Chiya (wrote *Sefer ha'Ibbur* and other books on astronomy and mathematics)

Rabbeinu Avraham ibn Ezra (wrote *Sefer ha'Te'amim*, *Sefer ha'Mispar*, and *Sefer ha'Olam*)

Rambam (Rabbeinu Moshe ben Maimon) (*Hilchos Kiddush ha'Chodesh*)

Ralbag (Rabbeinu Levi ben Gershon) (wrote *Maaseh Choshev*, invented "Jacob's staff" for measuring the angular distance between celestial objects)

Rav Avraham Zakuto (official Royal Astronomer to the king of Portugal, invented the copper astrolabe for measuring latitude at sea, wrote *Ha'Chibbur ha'Gadol* and *Bi'ur Luchot*)

Acharonim (16<sup>th</sup> to 19<sup>th</sup> centuries CE)

Rav David Ganz (1541-1613) (wrote *Nechmad v'Na'im* and *Me'or ha'Katan* on astronomy and mathematics and halachah)

Rav Tuvyah Katz (1652-1729) (wrote *Maaseh Tuvyah*, an encyclopedia on science and medicine from a Torah perspective)

Rav Shlomo ben Moshe of Chelm (1717-1781) (wrote *Mirkeves ha'Mishneh* on the Rambam, and *Bereichos b'Cheshbon* on Talmudic arithmetic and geometry)

The Vilna Gaon (Rav Eliyahu ben Shlomo Zalman) (1720-1797) (wrote *Ayil Meshulash* (published by his students), and an unpublished manuscript on astronomy)

Rav Baruch ben Yaakov of Shklov (d. 1810), a student of the Vilna Gaon (wrote *Amudei ha'Shamayim* (on the laws of Kiddish ha'Chodesh), *Kenah ha'Midah* (on geometry and trigonometry), *Sefer Euclides* (a Hebrew translation of the first six books of Euclid's Elements)

## b. The Three Conditions for studying the sciences and astronomy

Introduction to Ayil Meshulash (of the Vilna Gaon) (introduction written by his grandson, Rav Yaakov Moshe of Slonim)

ואמר אין החכמה נקנית לאיש הישראלי אלא בשלשה דרכים :

הא', שלא לכנס בפתח החכמה עד שימלא כרסו בתורה ומצות. ואם אז תהיה לו אבן בוחן להבחין כל דבור ודבור מלמודי החכמות אם בא ללמד טעמי מצוה או נמצא למד טעמי התורה וכל שנוטה אליהם -- הרי דברים קיימים. ואם לאו -- אין חכמתו מתקיימת. והוא שאומר (משלי ב, א) "בני אדם תקח אמרי ומצותי תצפין אתך" -- הוא התנאי. בא התשובה אם אז תוכל לכנס בפתח פלטין החכמה. הוא שאמר אח"כ (משלי ב, ב) 'הקשיב לחכמה אזניך', כי תוכל לבחון בלבבך אם הדברים נוטים לבינה. ז"ש "תטה לבך לתבונה". ויבחנו דבריהם האמת אתם. ואומר (משלי כב, יז) "שמע דברי חכמים ולבך תשית לדעתי" -- היינו דעת התורה. אם הדבר מוסכם מדעת התורה -- והרי דבריו קיימים, ואם לאו -- שקר העד השכל. ואומר (משלי ד, ה) "קנה חכמה קנה בינה ואל תט מאמרי פי" -- היינו אמרי התורה. כל אשר נשאו לבו לדרוש בחכמה למלא בהם התורה והמצוה. קרנו תרום בכבוד. אשרי תמימי דרך ההולכים בתורת ה' וגו'. וכן ב"אשרי אדם מצא חכמה ואדם יפיק תבונה", כלומר אימתי הוא ב"אשרי אדם מצא חכמה"? כשישיג התועלת הנרצה בזה, והוא "ואדם יפיק תבונה" היינו טעמי התורה.

דרך השני, אמר (משלי ד, ז) "ראשית חכמה קנה חכמה ובכל קנייניך קנה בינה", כלומר החכמה לא תקנה קנין עולם אלא תקחנו לראשית אל הבינה, רק הבינה היא לך קנין עולם. אבל המשקיע עצמו בלימודי החכמות שלא על מנת להפיק תבונה -- הרי הוא אומר "כי גוי אוֹבֵד עצות המה ואין בהם תבונה" ואומר "כי לא עם בינות הוא על כן וגו'".

הדרך השלישי, שהיא ממעט בלמודי החכמה ויעסוק בתורה. ז"ש (משלי כ"ד, י"ג-י"ד) "אכול בני דבש כי טוב וגו' כן דעה חכמה לנפשך", ר"ל הלא אכול דבש הרבות לא טוב, כן דעה חכמה לנפשך; מיעוט יפה ורובן קשה. וכן הוא אומר "כי ברוב חכמה רוב כעס", ובמדרש "כל זמן שאדם מרבה בחכמה מרבה בכעס". זה שחידש הדרש בלתי התאונן שלמה על לימוד עיקר החכמה כי אם על המרבה. והוא כי דברי חכמת עולם השפל שרשיו מועטין, והמרבה בשכלו ענפים מרובים -- הרוח באה ועוקרתו והופכתו על פניו. וכה"א (קהלת ב, טו) "ולמה חכמתי אני אז יותר" -- התאונן על המותר. וכן הוא אמר (קהלת ז, טז) "ואל תתחכם יותר". אבל מיעוטן יפה מאד להלל. ובלבד שיקדים הפקעת; כי בלתי ידיעות החכמות אי אפשר להגיע אל טעמי התורה וקיום המעשים הטובים כמ"ש במדרש משלי "לדעת חכמה ומוסר להבין אמרי בינה -- אם יש באדם חכמה ומוסר הרי ד"ת מסורין בידו ואם אין בידו חכמה ומוסר אין ד"ת מסורין בידו". וכן אמרו "אם אין חכמה אין יראה וכו'".

(Summary:)

- 1) He describes how Torah is the ultimate and highest form of Chochmah, wisdom, from which all other forms of wisdom flow.
- 2) - The great intellectual and spiritual value of studying mathematics and geometry. He says that these disciplines reflect Divine wisdom and are essential to understanding the physical world, the prophets, and Halachah.
- 3) - Early sources show that worldly wisdom, when studied properly, enhances our understanding and fulfillment of the Torah.
- 4) - No contradiction between Torah and true science. Our Sages themselves used scientific knowledge in areas like astronomy, navigation, timekeeping, and of course calculating the calendar.
- 5) - The value of mastering the skill of logic and deduction, saying that it's necessary for understanding astronomy and physical science.
- 6) - Justifies printing math and science books in Hebrew in order to make such wisdom available to students of the Torah.
- 7) - Encourages young scholars to study math and science as a form of Avodas Hashem.

(As part of point #6 and #7, he writes:)

The wisdom [of the sciences] is acquired by a Jew only with three conditions:

- 1) We should not engage in such wisdom until we have filled ourselves with Torah and mitzvos, for only then will we be able to discern whether it can enhance our understanding of the mitzvos or clarify matters of Torah.
- 2) We shall invest ourselves in the study of such wisdom solely for the sake of understanding the Torah and the mitzvos, and not for the purpose of an independent intellectual pursuit.
- 3) One should keep the primary focus of one's studies on the Torah.

(Title page of Ayil Meshulash, 1833 edition:)



### Appendix: The Calculation of the Number of Stars according to the Gemara

$$\begin{aligned} & 12 \text{ (mazalos)} \\ & \times 30 \text{ (ligyon)} \\ & \times 30 \text{ (rahaton)} \\ & \times 30 \text{ (karton)} \\ & \times 30 \text{ (gastera)} \\ & \times 365,000 \\ & \times 10,000 \\ = & 1,063,340,000,000,000,000 = 1.06334 \times 10^{18} \\ & \text{(One quintillion, sixty-three quadrillion, three hundred forty trillion)} \end{aligned}$$

(Although the Gemara has deeper, metaphorical meanings – see the Maharsha, and the Ben Yehoyada – at face value there is no other ancient text that provides such an accurate numerical estimate of the number of stars in the universe. Modern astronomers estimates that there are some  $1 \times 10^{22}$  stars in the universe. This number includes multiple types of stars, such black holes, neutron stars, pulsars, quasars, etc.)

## Additional resources for Class 2:

*Ayil Meshulash*. The mathematics textbook for Torah students, written by Rebbi Eliyahu ben Shlomo Zalman (the Vilna Gaon).

1833 edition: <https://hebrewbooks.org/20713>

2005 edition with commentary: <https://tinyurl.com/2rdd73tj>

*The Hirsch Tehillim*. Rav Samson Rafael Hirsch. New Edition, Feldheim Publishers, 2014.

(German edition (1924) available (see p. 106 and on) at: <https://tinyurl.com/y23wwenw> )

*Tzeva ha'Shamayim: Machshevet ha'Astronomiyah b'Mekoroteha ha'Yehudiyim (The Legions of the Heavens: The Study of Astronomy in its Jewish Sources*. Rabbi Professor Nissim Vidal. Jerusalem: Memtran, 2003–2021. 13 vols. Hebrew. (A comprehensive series on astronomy and Jewish tradition, exploring halachic, philosophical, and scientific perspectives on the phenomena of the cosmos.) Part of the volumes are available online at: <https://tinyurl.com/4u9vdx8n>

## Additional readings:

### 1) Rav Shimshon Refael Hirsch, Tehillim 19

(Verse 1) David states that the revelation at Sinai was not essential for the recognition of the fact that there must be someone Who is the omnipotent Creator, regulator and ruler of all the world. The realization that there must be a God could come to anyone who thoughtfully contemplates nature and the heavens in particular (verses 2–7). The study of the heavens and earth alone, however, does not provide man with the answer to the question *why* he should praise God or recognize Him as his Master. The heavens and the world around us cannot answer the question of what man should do with his freedom of will and action in a world which is dominated by God's omnipotence and ruled by His Law. The mere contemplation of the wonders of nature will not teach man how he must employ his free will and liberty of action in the service of God. By merely looking at the heavens and earth, man will never discover the Divine Law which governs his task in this world. Whatever answer he would derive from this kind of study would only enmesh him in hopeless confusion. It is only the word of God, the Divine Law, the Torah which was handed down to Yisrael and the rest of mankind on Mount Sinai, which gives him that exalting doctrine which is in harmonious accord with man's nature and which will shape man's individual and communal life in accordance with God's will (verses 8–10). The Torah therefore should be his sole desire. This goal may first seem to stand in the way of the fulfillment of our lusts, but when attained it will yield an ever-increasing abundance of wholesome fruit (verses 11–12)....

(Verse 6-7) ... Whoever beholds the sun in its constant brilliance and strength will think it is a power that is self-sufficient and dependent upon no other force. Yet this bright ball cannot even choose its own point of origin or its orbit — both of these have been set in pre-ordained points in the heavens. It is this immutable regularity, which limits the diurnal and annual paths of this mightiest of heavenly bodies, that indicates the existence of a Being that is mightier still. This supreme force can call even this most powerful source of light and heat “His,” חממו — His sun whose orbit He has set. Because the sun is “His,” He cannot be eclipsed or obscured even by this most radiant power that shines over all the earth....



(Verse 6: “[The sun] exits its chamber... to run its course.”) ... David, as do all the Holy Scriptures, talks in the language of men. דברה תורה כלשון בני אדם He speaks the speech of men to men. His language is the same as that of Copernicus, Keppler and Newton, and as that which we use today and which will most likely be employed by every human tongue as long as men shall be capable of speech. This language will remain the same even when the assumption that the sun is static and that the earth revolves around it — and not the sun around the earth — will have been proven to be irrefutable certainty. For it is not the aim of the Holy Scriptures to teach us astronomy, cosmogony or physics, but only to guide man to the fulfillment of his life’s task within the framework of the constellation of his existence. For this purpose it is quite irrelevant whether the course of the days and years is determined by the earth’s revolution around the sun, or by the latter’s orbit around the former.

The Scriptures will have achieved their purpose if only man’s spiritual ear will remain attuned for the understanding of the “speech of heaven and of earth.” This language speaks to the thinking man through the conformity of all these phenomena to a fixed set of laws which control all of nature, from the paths of the infinite galaxies down to the microscopic development of the most minute, one-celled animal. The Scriptures will have attained their end if man will refuse to listen to any attempts to explain away the equally irrefutable certainty that there can be no thought without a Thinker, no law without a Lawgiver. The more he comes to understand the ideas demonstrated by the course of nature and the laws that govern the world, the clearer will he see with his mind’s eye the One God, Who has always been the source of all the thoughts that are realized and find their realization in nature, and Who has ordained and maintained the laws that control the universe.

(Verse 8: “The Torah of Hashem is perfect...” ) If man keeps his spiritual eye and ear attuned to these thoughts, he will gain greater understanding of the language of heaven and earth, of his own place in a world ruled by God, and of the Divine Law which controls all things great and small. He will come to attain understanding of that Law which is universal, to which all living things are subject. Only by subordinating themselves to the will of God will His creatures on earth become that which they should be and fulfill the purpose that gives meaning to their existence. However, as man’s ability to perceive these things grows, he will become aware of a question for which he will find no answer in the mere contemplation of heaven and earth. He will face the question of what that Law is to which he must subordinate himself in all that he is and may achieve, so that he too may become what he should be in accordance with the will of his Creator....

Man, just like all other living things, is subject to higher laws that are independent of the development of his body and mind. He knows, however, that, unlike other forms of life, he has the power to determine for himself what use he will make of his physical and mental faculties. If he is to make proper use of his power of self-determination in accordance with the will of his Creator, he is in need of specific guidance.

The will of God is fulfilled automatically by all other things in Creation, from the golden orb of the sun down to the smallest of plants nourished by its rays, from the lowliest creature up to the greatest beasts — all except man. For all of them — save man — His will is the Law which they are all compelled to follow unswervingly, לא יסבו בלכתן איש אל עבר פניו ילכו; they cannot deviate from their paths.

Each creature except man moves in the direction in which the will of God has turned it. There is no conflict between good and evil in its development. The satisfaction of any of its desires is good in the eyes of its Maker, because it was He Who instilled this desire into it so that

it may be fulfilled. Man is not so. He has been ennobled by the will of God, for He has implanted in man a spark of His own free personal Being. He has suspended the force of His own power in order to let man enjoy the free use of his faculties and abilities. It is God's wish that man should be able to recognize the law and will of his Maker, but man should also have the ability to act contrary to it. For man there does exist a conflict between good and evil. For him, that which is good cannot always be what is sweet to his senses, nor will evil always taste bitter to him. If he were not confronted with such free choice, then he would stand under the iron rule of his sensual nature, as do all other creatures. He would then no longer be the free servant of his Creator or the voluntary executor of His Law.

Accordingly, we have, in the very beginning of the history of mankind as described in the Book of books (see Commentary to Bereishis 3), the basic teaching concerning the recognition of good and evil. Indeed, heaven and earth demonstrate the existence of God to man in incontrovertible clarity, and no specific revelation of a word of God would be necessary for man to recognize the manner in which the ways of God are revealed in nature. Yet, were it not for the "word" revealed to him by God, man would be left quite helpless and perplexed with respect to his own role in this scheme of things. Without this Law, he would not know what his own relationship is to heaven and to earth, and to the Creator Who made him as well as the rest of the universe.

It is only the Law which can tell him how, as a human being in the midst of a world consecrated to the service of God, he must serve Him, his Lord and Maker, with his own life.

The rest of creation, individually and collectively, lacks the ability to act in a manner contrary to the will of God. Therefore, resolve, unwavering clarity, joy of living, the undeceived recognition of things as they are, an unfettered fulfillment of individual destiny, and collective harmony automatically reign supreme with all creatures except man. Man must have the word of God which explains to him the unity underlying his dual nature and which reveals to him the Law that is to define his purpose in life. But for this Law which shows him the way, man would succumb to disconsolate doubt, constant vacillation, empty, joyless existence, frustrated hopes and lost individuality. Without the Law, society would be in a perpetual state of war.

The word of God, תורת ה' תמימה, however, gives man a Divine teaching which encompasses every aspect of his existence. This doctrine implants in his heart and spirit the seeds of the knowledge of what is good and true, and the ability to perceive such qualities in the physical, moral, earthly and heavenly facets of his life. (The word תורה is derived from ירה, which means, "to implant within someone a seed which is in the process of steady growth.") This Law of God, Who "leads mankind to its goal," is תמימה; it tells him in an all-encompassing manner the significance of his entire physical and spiritual being, with its physical dependence and moral freedom of will in the kingdom of God, for the sake of the Divine kingdom of the Law which shapes and rules the world. Therefore the Torah is משיבת נפש; it leads him out of all doubt that torments his soul.

## ועד שני

שני שרשים מרכיבים מלת "התבונן": בנין ובינה. המתבונן בונה את עצמו על ידי בינתו בכל הסובב אותו. הרגלנו עצמנו להתבונן בעלה, בפרח ופרי. עכשו ננסה לקיים "שאו מרום עיניכם וראו מי ברא אלה" (ישעיה מ, כו). הנה דוד המע"ה התבונן בהם ואמר: "כי אראה שמך מעשה אצבעותיך, ירח וכוכבים אשר כוננת — מה אנוש כי תזכרנו ובן אדם כי תפקדנו, ותחסרהו מעט מאלקים, כבוד והדר תעטרהו! תמשילוהו במעשי ידיך, כל שתה תחת רגליו" (תהלים ח).

הרי כאשר התבונן בשמים ופלאותיהם, נתגלה לו גם מקומו של האדם בעולם עם כל קטנותו וגדולתו — דוגמה היא איך האדם המתבונן "בונה" את עצמו! "כל המברך על החודש בזמנו כאילו מקבל פני שכינה, כתיב הכא החדש הזה וכתוב התם זה אלי ואנוהו, תנא דבי ר"י אלמלא לא זכו ישראל אלא להקביל פני אביהן שבשמים פעם אחת בחדש דים" (סנהדרין מב, ע"א). מהי הקבלת פני השכינה בקידוש החודש? הר"י על הרי"ף סופ"ד דברכות מבאר זאת: "הקב"ה אע"פ שאינו נראה לעין, נראה הוא ע"י גבורותיו ונפלאותיו, כעגין שנא' אכן אתה א' מסתתר, אלקי ישראל מושיע: אע"פ שאתה מסתתר — על ידי תשועתך אתה מתגלה ומכירים אותך, וכן בכאן ע"י שמחדש חדשים הוא מתגלה לבני אדם, והוא כאילו מקבילין פניו". מהו ההבדל בין זריחת השמש כל בוקר מחדש מהתחדשות הלבנה? הרי הלבנה נעלמה בסוף החודש בערך יומיים, ופעמים באה בקצרה ופעמים באה בארוכה, וזה מעורר את האדם יותר להתבוננות, ובוה הוא בא להכיר את הבורא, והכרה זו היא היא "הקבלת פני השכינה"! וכבר כתב מרן הרש"ז מקלם, "כי לא כמו שאנו חושבים שבברכת הלבנה מקבל פני שכינה, אבל כך הוא: בהתבוננות החדשות שרואה בחידוש הלבנה ומבין מי ברא אלה — בזה מקבל פני שכינה. והברכה — על החסד שקבלנו פניו" (חכמה ומוסר ח"א מא' סא). הן, הכרה כזאת פעם אחת בחודש — דיה לכלל ישראל!

נתלמד מעתה "להתבונן במעשיו וברואיו הנפלאים הגדולים" (כלשון הרמב"ם). אולי נסתכל בזריחת החמה או בשקיעתה, או בלילה בשמי הכוכבים, וזאת כל יום פעם אחת בהסתכלות ושימת לב רבה במשך זמן מספיק. בלי ספק המתלמד בזה עומד גבוך במשך ימים רבים מה יש לו להפיק מהסתכלות זאת. המראה הזה אינו אומר לו כלום, הוא ינסה לחזור על המלים שבועד זה, או על הפסוקים בישעיה "שאו מרום עיניכם וראו מי ברא אלה" ועוד, אבל הדברים נשארים יבשים. ואין דבר — ימשיך כל יום להתבונן, וינסה רק להתרשם ממה שעינו רואה, לאט לאט יפתח לבו.

The word "hitbonen" (to contemplate) is comprised of two roots: building (*binyan*) and understanding (*binah*). The person who contemplates (*mitbonen*) builds (*boneh*) himself through his understanding (*binah*) of everything around him.... We will now attempt to fulfill the verse, "Lift up your eyes on high and see, Who created these" (Yeshayah 40:26). King David contemplated them (the celestial bodies) and he said, "When I see Your heavens, the work of Your fingers, the moon and stars that You have established, [I ask,] what is man that

You should remember him, and the son of man that You should be mindful of him? Yet You have made him slightly less than the angels, and You have crowned him with glory and majesty. You give him dominion over the work of Your hands; You have placed everything beneath his feet" (Tehillim 8:4-7). We see that when a person contemplates the cosmos and their wonders, he discovers also his own place in the world, with all of his smallness together with his greatness. This is a paradigm for how the contemplative (*mitbonen*) person builds (*boneh*) himself!

"Whoever recites a blessing over the new moon in its time is considered as if he greets the Divine presence"... "It was taught by a Tana in the study-house of Rabbi Yishmael: If the Jewish people had not merited [to have any mitzvah] except to greet their Father in heaven one time each month, it would have been enough" (Sanhedrin 42a).

What is the "greeting of the Divine presence" that is happening when one recites Kiddush ha'Chodesh (the blessing over the new moon)? Rabbeinu Yonah on the Rif (end of chapter 4 of Berachos) explains as follows:

"This is because the Holy One, blessed is He, even though He is not seen by the eye, He is seen through His mighty acts and wonders, as it is said: 'Indeed, You are G-d Who conceals Himself, the G-d of Israel, the Savior' (Yeshayah 45:15). That is to say, even though You conceal Yourself, through Your salvation people perceive You, and You reveal Yourself to them, and they come to recognize You. So, too, here – through the renewal of the months, He reveals Himself to humankind, and it is as though they are encountering His presence."

What is the difference between the shining of the sun each morning anew and the renewal of the moon? [Why is the monthly renewal of the moon cause for people to recognize Hashem, and not the daily rising of the sun?] The moon disappears at the end of each month for approximately two days, sometimes reappearing sooner, sometimes later. This is a much stronger cause to arouse a person to contemplation, through which he comes to recognize the Creator. This recognition itself is the "greeting of the Divine presence"!

Our master, Rav Simcha Zissel of Kelm, has already expressed, "It is not like we think, that through the blessing of the new moon one greets the Divine presence; rather it is through the *contemplation* of the newness that a person sees in the renewal of the moon and understands Who created these, through this one greets the Divine presence. The blessing is [merely] on the kindness that [Hashem gave us the opportunity that] we were able to greet His presence" (*Chochmah u'Mussar* 1:61). Indeed, such a recognition just once a month -- that would suffice for the Jewish people!

Let us practice now "contemplating His great, wonderful works and creations" (in the words of the Rambam). Perhaps we will watch the sunrise or the sunset, or we will gaze at night at the stars. We will do this each day, one time, with great mindfulness and attention, for a sufficient duration of time. Undoubtedly, a person beginning this exercise will be confused after a few days, wondering what is there to gain from this exercise. "This scene [of the sunrise, etc.] doesn't speak to me at all." He might try going over the words of this essay, or reviewing the verse in Yeshayah, "Lift up your eyes on high and see, Who created these," and other verses, but it all still remains very dry. That is not a problem – he should continue each day to contemplate, allowing himself to be influenced by what his eye sees. Slowly, his heart will open up.

3) Sample of Talmudic expertise in astronomy (statements of the Amora, Shmuel, circa 165-254 CE)

Berachos 58b

אומר ברוך שככה לו בעולמו: על הזיקין: "מאי זיקין אמר שמואל  
כוכבא דשביט ואמר שמואל נהירין לי שבילי דשמיא כשבילי דנהרדעא  
לבר מכוכבא דשביט דלא ידענא מאי ניהו וגמירי דלא עבר כסלא ואי

*Shmuel said: "The paths of the sky are as clear to me as the paths of [my city] Nehardea."*

Eruvin 56a

מערבית דרומית אמר שמואל אין תקופת  
ניסן נופלת אלא בארבעה רבעי היום או  
בתחלת היום או בתחלת הלילה או בחצי  
היום או בחצי הלילה ואין תקופת תמוז  
נופלת אלא או באחת ומחצה או בשבע  
ומחצה בין ביום ובין בלילה ואין תקופת תשרי  
נופלת אלא או בשלש שעות או בתשע שעות בין ביום ובין בלילה ואין תקופת  
טבת נופלת אלא או בארבע ומחצה או בעשר ומחצה בין ביום ובין בלילה  
ואין בין תקופה לתקופה אלא תשעים ואחד יום ושבע שעות ומחצה ואין  
תקופה מושכת מחברתה אלא חצי שעה ואמר שמואל אין לך תקופת ניסן  
שנופלת בצדק שאינה משברת את האילנות ואין לך תקופת טבת שנופלת  
בצדק שאינה מייבשת את הזרעים והוא דאיתליד לבנה או בלבנה או בצדק:

*Shmuel said: The vernal equinox occurs only at [the beginning of one of] the four quarters of a day: either at the beginning of the day, or at the beginning of the night, or at the midpoint of the day, or at the midpoint of the night. The summer solstice occurs only at either the end of 1 1/2 one and a half hours or 7 1/2 hours of the day or night. The autumnal equinox occurs only at either the end of 3 hours or 9 hours of the day or night. The winter solstice occurs only at either the end of 4 1/2 hours or 10 1/2 hours of the day or night. And there are only 91 days and 7 1/2 between the beginning of one season and the next. And each season begins exactly 1/2 hour past the beginning of the previous season....*