Abstract for
Eyes on the Horizon: Theological and Halakhic Challenges for the First Jewish Settlers on the Moon, Mars, and Beyond by Adam Bellows, Rabbinical Student, Hebrew Union College – Jewish Institute of Religion:

This thesis is a conversation about the hypothetical theological and *halakhic* challenges the first Jewish settlers on the Moon, Mars, and beyond may face. It is split into two chapters, each with three subsections. The first chapter is entitled "Theological Challenges" and deals with the possible theological issues Jews would have with traveling into space and settling off-planet. The first subsection, entitled "Judaism and Science," demonstrates that the dichotomy has always been a positive one, and that one depends on the other. The second subsection, entitled "Astronomy and the Rabbis," discusses how the rabbis and other Biblical characters struggled to know and understand the cosmos. The third subsection, entitled "Humanity's Realm, God's Realm," questions whether it is theologically possible for Judaism to exist in space if our realm is on Earth. The second chapter is entitled "*Halakhic* Challenges" and confronts various challenges following Jewish law on other celestial bodies. The first subsection, entitled "Rabbinic Sources on the Lunar Calendar," demonstrates how crucial the Earthly lunar cycle has been to the Jewish calendar and questions if there could even be a Jewish calendar without it. The second subsection, entitled "Can *Halakhah* Exist Off-Planet?" hits on the fundamental question of whether Earth is needed to observe *halakhah*, and whether there is an "*halakhic* bubble" around the Earth. The third and final subsection, entitled "The Jewish Exo-Calendar," reviews *halakhah* written for travelers in polar regions, in low Earth orbit, and on the Moon, and applies it to the first settlers off-planet.

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Introduction

Throughout history, the Jewish people have struggled to keep our traditions and rituals alive. With each threat to our existence, we triumphed. When Pharaoh denied us to worship freely[1], God delivered us.[2] When Haman wished to exterminate us[3], Queen Esther saved us.[4] When the Romans destroyed the Second Temple, the rabbis reformed Jewish practice.[5] When the Nazis pictured a perfect world, devoid of Jews, countless nameless heroes preserved Judaism and its people for future generations.[6]

Today, the Jewish people, and indeed all of humanity, are faced with many existential threats. One of the direst threats to humanity's existence is Global Climate Change.[7] Most climate scientists believe we are past a point of no return, and humanity will experience drastic climate-related consequences. In response to this threat and countless others, visionary pioneers such as Elon Musk are catapulting humanity toward the heavens to ensure our survival.[8] In fact, Musk plans to have a million-person colony on Mars within the century.[9] It is likely Jews will be among the first off-planet settlers as many have been drawn to scientific endeavors.[10] There

[1] Cf. Ex. 5:1; 7:16; 8:1, 20; 9:1, 13; 10:3
[2] Cf. Ex. 8:8, 21; 13:15
[3] Esther 3:6
[4] Esther 7:1-6
[5] See Jacob Neusner, *Early Rabbinic Judaism: Historical Studies in Religion, Literature and Art* (Brill Archive, 1975), 50.
[6] See Sara Bender, *The Jews of Bialystok During World War II and the Holocaust* (UPNE, 2008), 84. Sara Bender is Fellow Professor at the United States Holocaust Memorial Museum.
[7] Trevor Nace, "15,000 Scientists From 184 Countries Just Issued A Dire 'Warning To Humanity,'" Forbes, accessed January 18, 2018, https://www.forbes.com/sites/trevornace/2017/11/15/15000-scientists-from-184-countries-just-issued-a-dire-warning-to-humanity/.
[8] See Ross Andersen, "Elon Musk Puts His Case for a Multi-Planet Civilisation – Ross Andersen | Aeon Essays," Aeon, accessed January 18, 2018, https://aeon.co/essays/elon-musk-puts-his-case-for-a-multi-planet-civilisation.
[9] ibid.
[10] See Noah J. Efron, *A Chosen Calling: Jews in Science in the Twentieth Century*, 1 edition (Baltimore: Cincinnati: Johns Hopkins University Press, 2014).

would also probably be new economic opportunities for settlers, and Jews have always found ways to find economic niches in new economies.[11]

The problem is how these "ExoJews", the term I will use in this thesis to refer to Jews who settle off-planet, will live Jewishly. How will living on another celestial body affect Jewish theology and *halakhah*[12]? In the chapter on theological challenges for the first ExoJews, this thesis will explore Judaism's ancient and contemporary relationship with science. It will then focus on the rabbis' relationship with astronomy. Finally, it will explore Ps. 115:16 which assigns the Earth to humans and the heavens to God and asks whether humans can pass into the divine

[11] See Hasia R. Diner, *Roads Taken: The Great Jewish Migrations to the New World and the Peddlers Who Forged the Way* (Yale University Press, 2015).

[12] From The Editors of Encyclopedia Britannica, “Halakhah | Jewish Law | Britannica.Com,” Encyclopedia Britannica, September 29, 2008, https://www.britannica.com/topic/Halakhah: “Halakhah, also spelled Halakha, Halakah, or Halachah (Hebrew: “the Way”), plural Halakhahs, Halakhot, Halakhoth, or Halachot, in Judaism, the totality of laws and ordinances that have evolved since biblical times to regulate religious observances and the daily life and conduct of the Jewish people. Quite distinct from the Law of the Pentateuch (the first five books of the Bible), Halakhah purports to preserve and represent oral traditions stemming from the revelation on Mount Sinai or evolved on the basis of it. The legalistic nature of Halakhah also sets it apart from those parts of rabbinic, or Talmudic, literature that include history, fables, and ethical teachings (Haggadah). That Halakhah existed from ancient times is confirmed from non-pentateuchal passages of the Bible, where, for example, servitude is mentioned as a legitimate penalty for unpaid debts (2 Kings 4:1).

Oral traditions concerning Jewish law passed from generation to generation, and eventually it became apparent that they required organization. The work of gathering opinions and interpretations was begun by Rabbi Akiba in the 1st–2nd century AD and carried on by his disciples, such as Rabbi Meïr. Early in the 3rd century, this new compilation, the Mishnah, was complete, arranged in its final form by Judah ha-Nasi. Though the Mishnah contained the most comprehensive collection of Jewish laws up to that time, it was not meant to settle issues involving contradictory interpretations. Almost immediately, however, Jewish scholars in Palestine and Babylonia began to elaborate extensive interpretations of the Mishnah that were called Gemara. When the work was completed several centuries later, the Mishnah and the Gemara, taken together, were called the Talmud.

Centuries later, social and economic changes presented new problems of interpretation and required new applications of the law. This gave rise to new compilations of Halakhah by such outstanding scholars as Moses Maimonides in the 12th century, Jacob ben Asher in the 12th and 13th centuries, and Joseph Karo in the 16th century.

Though Judaism acknowledges a continuous development of Halakhah, the law is always viewed as an explication or extension of the original Law given on Mount Sinai. Conservative rabbis tend to adapt certain *halakhot* to fit conditions in the modern world, as, for instance, the Halakhah regarding observance of the sabbath. Reform Jews tend to disregard Halakhah, though some of them adhere to certain of its precepts.

Interpretations and discussions of law directly related to Old Testament texts are referred to as Midrash Halakhah.”

realm. In the chapter on *halakhahic* challenges for the first ExoJews, this thesis will review rabbinic sources tied to the Lunar calendar. It will then explore a fundamental problem for ExoJews: can *halakhah* itself exist off-planet? Finally, this thesis will map out the *halakhic* challenges for creating a calendar off-planet. It will utilize *halakhah* written for Jewish travelers to the Terran[13] polar regions, as well as *halakhah* written when humans first landed on the Moon and when astronaut Ilan Ramon[14] first visited space.

[13] From or on Earth. Someone from Earth, for instance, would also be called a Terran. Lunar will be used in this thesis to denote anything having to do with Earth's Moon, and Martian will denote anything having to do with Mars.
[14] (b. 1956-2003) See Tanya Lee Stone, *Ilan Ramon: Israel's First Astronaut* (Millbrook Press, 2003).

Chapter One:
Theological Challenges

1.1: Judaism and Science

Some would say that today there is a growing gap between faith and science, or at least people of faith and people of science. Many Americans distrust science and would rather practice alternative medicine or pseudoscience. This gap is exacerbated by religious fundamentalists whose religious beliefs compel them to be anti-science. There are those who say great scientific topics such as evolution or global climate change contradict their religious beliefs and the teachings in the Bible. This thesis is meant to address Christians, Muslims and Jews who hold such an opinion. My goal in this thesis is to speak to all Jews about the relationship between Judaism and science.

There are a great many *halachically*-minded Jews who take issue with some scientific fields and theories. Usually these theories contradict processes described in the Torah. For instance, Jews who do not subscribe to the scientific theory of evolution usually cite that Darwinism does not need God to intervene or participate in creation to occur. Rabbi Tzvi Freeman, a contributor to the Chabad website, writes, "Evolution and Genesis both agree that human intelligence began as a hunk of mud. Evolution says that if you leave enough mud alone for long enough, it will eventually—through chance events and natural selection—become a human being who will build computers and spaceships. Genesis says that intelligence arises from

a greater intelligence."[15] In other words, there is the Jewish notion that science and the scientific process is devoid of Divine intervention.

I fear there may be Jews who will claim that we have no business in space for various theological and *halakhic* reasons. For example, issues of *tzniyut*, or modesty could be an issue, as well as questions of *kashrut*, and the calendar.[16] If that happens, if cannot reconcile our traditions with space travel, then our people will find ourselves left behind in the spaceward expansion of humanity.

Rabbi David Lister, an Orthodox rabbi with Edgware Synagogue in North West London, writes in his book Intergalactic Judaism that there should be no conflict between studying science and Judaism. Lister points out that science is about the accumulation of knowledge. If Judaism states God is omniscient, then according to Judaism, God is "the ultimate scientist" with infinite knowledge. It would stand to reason that scientific innovation and discovery cannot and does not contradict or conflict with anything in our ancient texts because "facts that would only be discovered by humans thirty or forty centuries later were known to God when [God] vouchsafed prophetic insight to those worthy to receive it, and it would be reasonable to suppose that [God] included these insights as part of [God's] message."[17]

It should be considered sacrilegious to say we humans can do anything that harms God or God's message. Who are we to think or propose we know how God creates? Who are we to think that Darwin can discover the three billion-year-old notion of "survival of the fittest" without God having already been aware of it aeons ago?[18]

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[15] "Does the Theory of Evolution Jibe with Judaism?", accessed January 7, 2018, http://www.chabad.org/library/article_cdo/aid/755394/jewish/Does-the-Theory-of-Evolution-Jibe-with-Judaism.htm.
[16] "Jews in Space," Ohr Somayach, accessed January 7, 2018, https://ohr.edu/ask_db/ask_main.php/78/Q1/.
[17] David Lister, *Intergalactic Judaism: An Analysis of Torah Concepts Based on Discoveries in Space Exploration, Physics and Biology* (Urim Publications, 2011). P. 15
[18] Herbert Spencer, *The Principles of Biology* (William and Norgate, 1864). p. 444

Rather than viewing science and faith as at odds with each other, we should see them as complementary. On this, Rabbi Samson Raphael Hirsch states, "Consider how much more profound our children's understanding of the rest of the Biblical text will be if, by the time they read it, their knowledge of natural sciences and learning of Genesis will have made them aware that the whole world, down to the minutest form of matter, down to each fiber of every living thing and every component of that fiber, represents realization of one single thought."[19]

To expand on Rabbi Hirsch's thought, consider the lists of plants and animals in the Bible, such as in Leviticus 11:

"כָּל ו מַפְרֶסֶת פַּרְסָה וְשֹׁסַעַת שֶׁסַע פְּרָסֹת מַעֲלַת גֵּרָה בַּבְּהֵמָה אֹתָהּ תֹּאכֵֽלוּ ׃ז אַךְ־זֶה לֹא תֹאכְלוּ מִמַּעֲלֵי הַגֵּרָה וּמִמַּפְרִיסֵי הַפַּרְסָה אֶת־הַגָּמָל כִּי־מַעֲלֵה גֵרָה הוּא וּפַרְסָה אֵינֶנּוּ מַפְרִיס טָמֵא הוּא לָכֶם׃ח וְאֶת־הַשָּׁפָן כִּי־מַעֲלֵה גֵרָה הוּא וּפַרְסָה לֹא יַפְרִיס טָמֵא הוּא לָכֶם׃ ט וְאֶת־הָאַרְנֶבֶת כִּי־מַעֲלַת גֵּרָה הִוא וּפַרְסָה לֹא הִפְרִיסָה טְמֵאָה הִוא לָכֶם׃ י וְאֶת־הַחֲזִיר כִּי־מַפְרִיס פַּרְסָה הוּא וְשֹׁסַע שֶׁסַע פַּרְסָה וְהוּא גֵּרָה לֹא־יֵגֶר טָמֵא הוּא לָכֶם׃מִבְּשָׂרָם לֹא תֹאכֵלוּ וּבְנִבְלָתָם לֹא תִגָּעוּ טְמֵאִים הֵם לָכֶם׃"

"You may eat any animal that has a divided hoof and that chews the cud. There are some that only chew the cud or only have a divided hoof, but you must not eat them. The camel, though it chews the cud, does not have a divided hoof; it is ceremonially unclean for you. The hyrax, though it chews the cud, does not have a divided hoof; it is unclean for you. The rabbit, though it chews the cud, does not have a divided hoof; it is unclean for you. And the pig, though it has a divided hoof, does not chew the cud; it is unclean for you. You must not eat their meat or touch their carcasses; they are unclean for you."[20]

Without a deep appreciation for the difference in these various species, this is just a list. If a child were to read this list with a deeper knowledge of each animal, then that child's appreciation for the text would be that much more significant. Similarly, if a child were to learn basic astronomy, then that child could more keenly imagine the beauty of God's creation of the universe.

[19] Samson Raphael Hirsch, "The Relevance of Secular Studies to Jewish Education," *Jeschurun*, no. 1867 (n.d.).
[20] Lev. 11:3-8

Herein lies the counterintuitive reality of science and scientific knowledge: Judaism makes us want to know the universe, and science is how Jews get to know it. God's paintbrush is science. God creates through science. God destroys through science. God uses the laws of nature and the universe to enact miracles.

Cyril Domb, an Orthodox Jew and a physicist[21], however, points out that Jewish tradition stipulates God does, indeed, suspend the laws of nature every now and then for the people of Israel. He writes:

> "The fundamental assumption of all science that there is a regular pattern in nature so that experiments performed under identical conditions will lead to identical results in very much accord with religious tradition. But for the religious person this regularity is divinely controlled and is the pattern in which God created the Universe. God who is responsible for these 'natural' laws can revoke them on any particular occasion . . . Under normal circumstances the laws of nature have overriding priority [unless God suspends them and creates a miracle]."[22]

Domb mentions a *midrash* which explains such instances in Jewish history during which the laws of nature were suspended:

> "אָמַר רַבי יוֹחָנָן תְּנָאין הִתְנָה הַקָּדוֹשׁ בָּרוּךְ הוּא עִם הַיָּם שֶׁיְּהֵא נִקְרָע לִפְנֵי יִשְׂרָאֵל, הֲדָא הוּא דִכְתִיב)שמות יד ,כז(: וַיָּשָׁב הַיָּם לְאֵיתָנוֹ, לִתְנָאוֹ שֶׁהִתְנָה עִמּוֹ. אָמַר רַבי יִרְמְיָה בֶּן אֶלְעָזָר לֹא עִם הַיָּם בִּלְבָד הִתְנָה הַקָּדוֹשׁ בָּרוּךְ הוּא, אֶלָּא עִם כָּל מַה שֶׁנִּבְרָא בְּשֵׁשֶׁת יְמֵי בְרֵאשִׁית, הֲדָא הוּא דִכְתִיב)ישעיה מה ,יב(: אֲנִי יָדַי נָטוּ שָׁמַיִם וְכָל צְבָאָם צִוִּיתִי, מִידַי נָטוּ שָׁמַיִם וְכָל צְבָאָם צִוִּיתִי, צִוִּיתִי אֶת הַיָּם שֶׁיְּהֵא נִקְרָע לִפְנֵי יִשְׂרָאֵל, צִוִּיתִי אֶת הַשָּׁמַיִם וְאֶת הָאָרֶץ שֶׁיִּשְׁתְּקוּ לִפְנֵי מֹשֶׁה, שֶׁנֶּאֱמַר)דברים לב ,א(: הַאֲזִינוּ הַשָּׁמַיִם וַאֲדַבֵּרָה וְתִשְׁמַע הָאָרֶץ אִמְרֵי פִי, צִוִּיתִי אֶת הַשֶּׁמֶשׁ וְאֶת הַיָּרֵחַ שֶׁיַּעַמְדוּ לִפְנֵי יְהוֹשֻׁעַ, שֶׁנֶּאֱמַר)יהושע י ,יב(: שֶׁמֶשׁ בְּגִבְעוֹן דּוֹם, צִוִּיתִי אֶת הָרִים שֶׁיְּכַלְכְּלוּ אֶת אֵלְיָהוּ, שֶׁנֶּאֱמַר)מלכים א יז ,ו(: וְהָעֹרְבִים מְבִיאִים לוֹ לֶחֶם וּבָשָׂר וגו', צִוִּיתִי אֶת הָרוּחַ לַחֲנַנְיָה מִישָׁאֵל וַעֲזַרְיָה, צִוִּיתִי אֶת הָאָרוֹת שֶׁלֹּא יַזִּיקוּ אֶת דָּנִיֵּאל, צִוִּיתִי אֶת הַשָּׁמַיִם שֶׁיִּפָּתְחוּ לְקוֹל יְחֶזְקֵאל, שֶׁנֶּאֱמַר)יחזקאל א ,א(: נִפְתְּחוּ הַשָּׁמַיִם וגו', צִוִּיתִי אֶת הַדָּג שֶׁיָּקִיא אֶת יוֹנָה, שֶׁנֶּאֱמַר)יונה ב ,יא(: וַיֹּאמֶר ה' לַדָּג וַיָּקֵא אֶת יוֹנָה."
>
> "R' Yochanan says: God stipulated with the sea that it should split before Israel; thus it is written (Shemos 14:27), "And the sea returned... to its strength (l'eitano)" - to the stipulation (l'tano) that [God] made with it. R' Yirmiyah ben Elazar says: not only with the sea did God stipulate, but with all that He created during the six days of Creation; thus it is written, "From my hand I [God] have stretched the heavens, and all their legions I have commanded" - I

[21] "Cyril Domb Interview," accessed November 29, 2017, https://authors.library.caltech.edu/5456/1/hrst.mit.edu/hrs/renormalization/Domb/index.htm.
[22] Cyril Domb, "The Orthodox Jewish Scientist" in *Challenge: Torah Views on Science and Its Problems*, 2nd edition (Feldheim Pub, 1988). pp. 21-22

> commanded the sea to split before Israel; I commanded the heavens and the Earth to be silent before Moshe, as it is stated, "Give ear, O heavens etc."; I commanded the sun and the moon to stand still before Yehoshua, as it is stated, "Sun, stand thou still upon Gibeon"; I commanded the ravens to sustain Eliyahu, as it is stated, "And the ravens were bringing him etc."; I commanded the fire not to harm Chanania, Mishael, and Azarya; I commanded the lions not to harm Daniel; I commanded the heavens to open to the voice of Yechezkel, as it is stated, "The heavens opened etc."; [and] I commanded the fish to spit out Yonah, as it is states, "Hashem spoke to the fish and it spat out Yonah."[23]

Thus, beside the very few exceptions in Jewish history when God arranged for nature to turn upside-down, natural laws take precedence and govern the universe. So how does one synthesize scientific predictability and supernatural miracles? Personally, I do not need a supernatural miracle to believe and trust in God. Scientific discoveries are enough for me. There are new and amazing scientific discoveries that remind me that I really do know nothing about this universe. For example, as Lister points out, the Ptolemaic view that the universe is “a system of spheres one inside the other” remained for centuries until Copernicus proposed a solar-centric model. Similarly, as Lister says, “Newtonian physics was sacrosanct in scientific circles for centuries until Einstein and his peers showed that Newton’s theories are not universally applicable, and that they break down over very large or very small scales.”[24] Surely, one can believe these scientific advances were governed by the hand of God.

Lister’s point is that scientific discovery is, indeed, access to the Divine. As to my earlier point, Judaism inspires me to want to know the universe, and science is how I do so. I can meditate on the heavens, or, as I will speak much more to later on, I can actually go there. No amount of faith in God will get me to the moon or to Mars without the scientific method, and as we will see later, no amount of faith in God will determine the Jewish calendar without mathematics and astronomy. Jews have reached toward the moon for millennia while reciting

[23] *Breishit Rabbah 5:5*
[24] Lister, *Intergalactic Judaism*. P. 21

Birkat Ha-Levana, the blessing recited each month upon seeing the moon for the first time, but have never actually reached it.[25] It was only through the scientific method that humanity set foot on the moon in 1969.

The book Challenge: Torah Views on Science and its Problems is a collection of essays written by members of the Association for Orthodox Jewish Scientists, edited by Rabbis Aryeh Carmell and Cyril Domb**.** In it, William Etkin, a prominent zoologist who taught at City University of NY, Columbia, Chicago and Yeshiva Universities, who writes on "the philosophic confrontation of science and religion,"[26] stresses the beauty of scientific discovery. He writes, "When we learn to comprehend a new geometry, a new chemical concept of gene structures, a new statistical analysis of the evolutionary process, a new theory of instinct, or any other of the great theoretic triumphs of contemporary science, we recognize that somehow we are in tune with the Creator and His Creation."[27]

In fact, Etkin reiterates that scientific exploration is not contradictory to one's faith. On this he writes, "To many contemporary thinkers, science seems to be knowledge wrested by man from a recalcitrant world by the sheer power of his own intellect . . . I wish here to develop the contrary theme, that contemporary science can only be understood in terms of a basic harmony between man's mind and the creation, a harmony by which an communicates with the Creator and shares in His creation."[28]

Thus, to access the secrets of the Divine, one needs to access the secrets of the universe using the scientific method. One could go so far as to argue that the method of scientific analysis

[25] For more on *Birkat Ha-Levana*, see BT Sanhedrin 42a; *Beiur Halacha* 426:2
[26] Carmell and Domb, *Challenge*. 30
[27] Carmell and Domb, 38
[28] Carmell and Domb, *Challenge*, 31.

and discovery was given to humanity as a tool to discover more Torah and more truth. One's intellect can act as an avenue through which one can gain intimate knowledge of the Creator.

The great twelfth-century Jewish philosopher, Moshe b. Maimon, also referred to as Maimonides or the Rambam, wrestled with the balance between science and faith. As an Aristotelian philosopher, he believed revelation was a tool to improve one's own intellect.[29] Only by increasing one's own intellect could someone access the Divine. In one of his two greatest works, the *Mishneh Torah*, Maimonides details the importance of the intellect:

> "וְהֵיאַךְ הִיא הַדֶּרֶךְ לְאַהֲבָה וְיִרְאָה. בְּשָׁעָה שֶׁיִּתְבּוֹנֵן הָאָדָם בְּמַעֲשָׂיו וּבְרִיאָיו הַנִּפְלָאִים הַגְּדוֹלִים וְיִרְאֶה מֵהֶן חָכְמָתוֹ שֶׁאֵין לָהּ עֵרֶךְ וְלֹא קֵץ מִיָּד הוּא אוֹהֵב וּמְשַׁבֵּחַ וּמְפָאֵר וּמִתְאַוֶּה תַּאֲוָה גְּדוֹלָה לֵידַע הַשֵּׁם הַגָּדוֹל..וּכְשֶׁמְּחַשֵּׁב בַּדְּבָרִים הָאֵלּוּ עַצְמָן מִיָּד הוּא נִרְתָּע לַאֲחוֹרָיו וְיִפָּחֵד וְיֵדַע שֶׁהוּא בְּרִיָּה קְטַנָּה שְׁפָלָה אֲפֵלָה וּמְדֻעַת קַלָּה מְטֻפֶּלֶת לִפְנֵי תְּמִימֵי דֵּעוֹת."
>
> "How can one come to feel love and reverence for God? When one considers [God's] great and wondrous deeds and creatures, and understands through them His infinite and incomparable wisdom, immediately one is moved to love and praise God, and one yearns to know Him better . . . When one thinks about the [elements of creation] themselves, one is immediately brought up short, one is seized with awe, and one knows that one is a small, lowly and obscure creature with a limited and wayward understanding before the One who is all knowing."[30]

Maimonides discusses the insignificance of humanity in his other major work, *Moreh Nevuchim*, or the Guide for the Perplexed. A more esoteric work, the Guide delves into the secrets of the Divine while leaving the reader with more questions than answers. Regarding humanity's insignificance, Maimonides writes, "Know that the major source of confusion in the search for the purpose of the universe as a whole, or even of its parts, is rooted in one's error about oneself and one's supposing that all of existence is for one's own sake. . . but if one

[29] Sarah Pessin, "The Influence of Islamic Thought on Maimonides," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, Spring 2016 (Metaphysics Research Lab, Stanford University, 2016), https://plato.stanford.edu/archives/spr2016/entries/maimonides-islamic/.
[30] MT *Hilchot Yesodei HaTorah* 2:2

examines the universe and understands it, one knows how small a part of it one is."[31] He adds, "The truth is that all humankind and certainly all other species of living things are naught in comparison with all of continuing existence."[32]

Maimonides' argument is reminiscent of the great scientific thinker and communicator, Carl Sagan. In his book, Pale Blue Dot: A Vision of the Human Future in Space, he writes:

> "Look again at that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every "superstar," every "supreme leader," every saint and sinner in the history of our species lived there-on a mote of dust suspended in a sunbeam.
> ...
> Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.
> ...
> It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we've ever known."[33]

Both Maimonides and Sagan would say one can only observe the universe in awe. Doing so reminds us of our own finitude and insignificance. Space exploration reminds us that we are from dust, and dust is our end. After all, as Sagan says, "We are made of star stuff."[34] Sagan, however, would certainly not claim to be a man of faith in any way. His awe does not stem from

[31] *Moreh Nevuchim* 3:25
[32] Ibid. 3:12
[33] Carl Sagan and Ann Druyan, *Pale Blue Dot: A Vision of the Human Future in Space* (Random House Publishing Group, 2011).
[34] Carl Sagan, *Cosmos* (Ballantine, 2013), 244.

the humility of standing before one’s own Creator. Rather, his awe is similar, in part, to Rabbi Joseph Soloveitchik’s description of the Adam of Genesis Chapter 2:

> “Adam the second is, like Adam the first, also intrigued by the cosmos. Intellectual curiosity drives them both to confront courageously the *mjuterium magnum* of Being. However, while the cosmos provokes Adam the first to quest for power and control, thus making him ask the functional "how"-question, Adam the second responds to the call of the cosmos by engaging in a different kind of cognitive gesture. He does not ask a single functional question. Instead his inquiry is of a metaphysical nature and a threefold one. He wants to know: "Why is it?" "What is it?" "Who is it?" (1) He wonders: "Why did the world in its totality come into existence? Why is man confronted by this stupendous and indifferent order of things and events?' (2) He asks: "What is the purpose of all this? What is the message that is embedded in organic and inorganic matter, and what does the great challenge reaching me from beyond the fringes of the universe as well as from the depths of my tormented soul mean?" (3) Adam the second keeps on by Maimonides as "And the tree of experiencing the pleasant and unpleasant." The Lonely Man of Faith wondering: "Who is He who trails me steadily, uninvited and unwanted, like an everlasting shadow, and vanishes into the recesses of transcendence the very instant I turn around to confront this numinous, awesome and mysterious 'He'?”[35]

Sagan would most certainly identify with Soloveitchik’s description of the one who wonders and asks, stopping short of concluding that there is a great Creator responsible for the beauty in the universe. All three thinkers, Maimonides, Sagan, and Soloveitchik, confront truth and knowledge. How can humanity gaze at the heavens without desiring to reach it? The answer is they cannot with faith alone. It takes science. Just as Jews reach yearningly to the moon during *Birkat Ha-Levana*, humanity continues to reach for the seemingly unreachable.

Humanity’s insignificance is one of my inspirations for writing this thesis. To stand on the edge of the precipice of space and to take a leap is to gain further knowledge of humanity beyond Earth. To look back from the moon, Mars, or any other celestial body and to see the calm of the planet is to reach higher levels of truth and knowledge. It is to know and accept humanity’s insignificance. Other Jews may argue it is precisely our insignificance that denies us

[35] Joseph B. Soloveitchik, *The Lonely Man of Faith* (Crown Publishing Group, 2009), 15–16.

the right to approach the heavens which are deemed the realm of God. I will expand this side of the theological argument later.

The 18th-Century Rabbi Moshe Chaim Luzatto, or the Ramchal, writes in his work, *Derech HaShem,* "Jewish tradition explains that God created the universe as a place where human beings could earn closeness to God and develop a relationship of love with [God]."[36] In other words, regardless of our significance in the universe, we exist in order to gain a more intimate relationship with God. If this is true, then the universe has always been out there, waiting for us to explore it. To do so allows us to know our universe, and in turn to gain a relationship with the Divine. How can sitting on an arguably dying planet enhance our relationship with God when there is so much more out there than there is here? We are a pale blue dot. There is almost certainly other life in the universe, given the estimated two-trillion galaxies, yet Judaism contends the universe was created with us partially in mind.[i]

The entire debate of the Jewish relationship between science and faith is labeled as the difference between "*Torah u'Madda*", or "Religious Learning and Worldly Knowledge."[37] The question is whether study of Torah is most important or whether the study of secular subjects is most important. Observing various Jewish Day Schools, we find that this is a common debate amongst teachers and students: Do we focus more on secular studies or religious studies? I have seen Jewish Day Schools more closely resemble a secular environment with Hebrew and Jewish values mixed in. Meanwhile on the other side I have met Jews raised in Jewish Day School who could not identify commonly known animals.

[36] Moshe Ḥayyim Luzzatto, *Derech HaShem* (Feldheim, 1983). 1:2:1-5
[37] Based on Rabbi Norman Lamm, *Torah Umadda: The Encounter of Religious Learning and Worldly Knowledge in the Jewish Tradition* (Maggid Books, 2010).

Rabbi Norman Lamm, a modern Orthodox author and Jewish thinker, addressed this issue. He writes, "In one sense [religious learning and worldly knowledge] are autonomous; in another, they are interdependent in that both are necessary for the attainment of this knowledge of God, each with its own role to play, as each enlightens the other. But neither can be reduced to the role of a mere instrument for the other, otherwise devoid of innate value." Lamm makes the same point as Maimonides that Torah and human reason are both necessary in order to access the Divine. I would shape the idea a bit differently. I would say that Torah and scientific query are just as necessary for the survival of the Jewish people and Judaism. Thus, to those Jews who would reject space exploration and settlement I would say both Torah and *Madda* are to guide us so as we may continue to worship and serve God.

Rabbi Joseph Elias, in his book which translated and commented on the work of Rabbi Samson Raphael Hirsch entitled, The Nineteen Letters: The World of Rabbi S. R. Hirsch, directly disputed Lamm's arguments. Elias states in the Editor's Notes, "While Torah, as given to us, represents objective truth, man's use of his reason, and his understanding of the world, embodied in philosophy and science, are inevitably time-bound and suffering from human limitations; therefore, they cannot produce results as legitimate as the teachings of Torah."[38] Hence, the great internal argument within Orthodoxy.

In response to Elias' argument, I reject the claim that Torah is "objective truth." If anything, I would say that reason and philosophy is as objective as truth can get. My response is based on my acceptance that Torah was influenced by many hands at many times for many reasons. Yes, I do believe that Torah is Divinely revealed and inspired; however, I cannot say it is the objective truth while science and philosophy are flawed.

[38] Samson Raphael Hirsch and Joseph Elias, *The Nineteen Letters* (Feldheim Publishers, 1995), 315.

Again, Lamm stresses the balance between science and Torah. He writes, "Torah, faith, religious learning on one side, and *madda*, science, worldly knowledge on the other, together offer us a more overarching and truer vision that either one set alone."[39] He takes his argument even further, claiming the two types of knowledge are basically one and the same by saying, "So long as we continue to learn Scripture and Oral Law, to acquire new knowledge and to refrain from forgetting what we know, then the study of science and humanities is, in effect, the study of Gemora and thus a fulfillment of the study of Torah."[40] Concerning Lamm's argument, Rabbi Yonasan Rosenblum writes, "This conclusion leads [Lamm] to entertain seriously such questions as: Should one recite *birkhat ha-Torah* on entering the chemistry lab? May one study calculus all day and thereby fulfill his obligation of Talmud Torah?"[41]

Though Rosenblum attacked this idea, the truth is that there will be many Jews in the early years of space exploration and settlement who cannot or will not actively pursue *talmud Torah*. It is necessary for all Jews, including rabbis and lay-people, to accept that fulfilling one's scientific duty to their mission and crew will be a fulfillment of their Talmud Torah.

Rabbi Nachum Rabinovitch, a modern Israeli author and *posek*, describes the holiness of space exploration quite eloquently:

> "The Jew believes in order to live and he lives because he believes. And because he believes in God, he also believes in God's creature, man, and he takes man and man's mind seriously; and because he trusts God's wisdom, he also trusts man's reason as far as it will go . . . In fact, the very commitment to inquiry - to probe the universe and uncover its mysteries - is that indicated by reason? That rare courage which impels a man to defy the unknown terrors of space in order to extend man's dominion to the moon and the planets beyond - is that the result of logical analysis? . . . Surely this is a scientist's article of faith!"[42]

[39] Lamm, *Torah Umadda*, 232.
[40] Lamm, 165.
[41] Yonasan Rosenblum, "'Torah Umadda': A Critique of Rabbi Dr. Normal Lamm's Book and Its Approach to Torah Studey and the Pursuit of Secular Knowledge," *The Jewish Observer*, Absorbing Lessons in an Era of Rapid Change, XXV, no. 2 (March 1992): 29.
[42] Nachum Rabinovitch, "Torah and the Spirit of Free Enquiry" in Carmell and Domb, *Challenge*, 57–58.

Conclusion:

Though some would say that science and faith are at odds with each other, the Jewish tradition teaches that, in fact, they are not. On the contrary, science and faith are complementary and even interdependent. Jews of all streams should take no issue with the scientific inquiry that is necessary to pursue settlement on celestial bodies because it is a way to preserve Judaism and the Jewish people. If an asteroid were to strike the Earth tomorrow wiping out humanity, Judaism would cease to exist. However, if we can help to make humanity a multi-planet species, then Judaism will be a multi-planet faith and the Jewish people will continue to survive.

Torah and *Madda* are, in fact, interdependent and are necessary for one to access the Divine. Jews should not shy away from secularism, secular studies, or secular disciplines because *Madda* is just as important for the Jew. Consider R. Simeon b. Yochai who isolated himself in a cave, far away from the rest of the world, and buried himself up to his neck. He spent decades away from the world, and when he emerged, all he beheld turned to fire.[43] We humans are not meant to neglect worldly interactions, i.e., worldly knowledge, in exclusive pursuit of Torah. The two must work together in balance to help Jews fulfill the messianic ideal of peace and harmony for humanity.

[43] B. T. Shabbat 33b-34a

1.2: Astronomy and the Rabbis

Though I can say my thesis topic has never been explored to this level and depth, rabbis have grappled with describing the universe for millennia. It is a misconception that until very recently rabbinic tradition treated space as if it were the heavens. In fact, rabbinic literature has attempted to describe the celestial spheres in very detailed manners. Upon reading such descriptions of the cosmos, one even gets the sense the rabbis were astronomers to a certain extent.

For Judaism to thrive off-planet, it is essential to understand the basic relationship between the rabbis and astronomy. It is essential because there will no doubt be many Jews who will claim the rabbis had no part in contemplating the galaxy and beyond. I will point out the opposite: that, on the contrary, the rabbis understood the heavens in a manner similar to that of today's astronomers. This section is here to aid future Jews when they wish to adapt Jewish theology and practice for off-planet living. This section will also lay the necessary groundwork for preparing an off-planet halacha.

The truth is that the rabbis understood the heavens to be made of independent bodies which all followed complex geometric patterns. It is a modern-day myth to say our primitive ancestors were baffled by the cosmos; in fact, they could make precise predictions. The entire Jewish calendar exists because the rabbis understood celestial bodies so well. For instance, the Talmud mentions that although the rabbis did not predict lunar eclipses, they did calculate their calendar solely on the lunar cycle.[44] Furthermore, the twelfth-century poet and philosopher,

[44] B. T. Sukkah 29a

Yehudah Ha-Levi,[45] writes on the precise nature of the rabbinic calculation of the moon to determine the Jewish calendar. He writes:

> "על עקרי תקופת לבנה אשר באו אלינו בקבלה מבית דוד חשבון אשר לא נשתנה בו דבר זה אלף ומאות בשנים וכבר נשתנו קביעות הקובעים אשר ביון וקובעים אחרים והיה צרך לתקנן ולהוסיף עליהן אחת למאה שנה אולם הקביעה שלנו נשארה באמתתה הואיל והיא תלויה בנבואה."
>
> “The calendar, based on the rules of the revolution of the moon, as handed down by the House of David, is truly wonderful. Though hundreds of years have passed, no mistake has been found in it, whilst the observations of Greek and other astronomers are not faultless. They were obliged to insert corrections and supplements every century, whilst our calendar is always free from error, as it rests on prophetic tradition.”[46]

If Martian Jews, as an example, decide to base their calendar on the Martian heavens, they will immediately notice two moons rather than one. It may be their job to integrate their areocentric[47] view of the sky into their Jewish practice. This is a *halakhic* issue which I will discuss further in the next chapter. The important *halakhic* issue is that it is the obligation of all Israel to calculate the movement of the heavens to determine the calendar. The Talmud assigns this responsibility to all Jews: “Rabbi Shimon ben Pazi said that Rabbi Yehoshua ben Levi said in the name of Bar Kapara, ‘If someone knows how to calculate equinoxes, solstices and the passage of the stars but does not do so, Scripture says, “They do not look at God’s work, and they have not seen what God’s hands have made!”’”[48]

The rabbis even portray Judaism’s patriarch Abraham as a skilled astronomer. The Talmud states, “there was great knowledge of astronomy [*itztagninut*] in his heart. He was able to precisely calculate the movements of the heavenly bodies and was therefore able to discern

[45] "The question of Judah Halevi's birthplace is still unsolved. Schirmann (Tarbiz, 10 (1939),237-9) argued in favor of Tudela, rather than Toledo..." [Encyclopaedia Judaica, pages 355–356]
[46] *Sefer Kuzari* 2:64
[47] The term “geocentric” refers to a model in which celestial bodies orbit around the Earth. This is the case for the Earth’s satellite, Luna, or the moon. The term “areocentric” refers to the system of objects which orbit Mars. The prefix “areo” is based on the name Ares which is the Greek name for the warrior god Mars. See "Areocentric." Merriam-Webster.
[48] B. T. Shabbat 75a

immediately after noon that the sun had begun its descent."[49] On Abraham's ability to read the heavens, Alvin Radkowsy, a nuclear physicist and member of the Association for Orthodox Jewish Scientists, writes, "The limitless promise and power available to mankind by 'subduing' the physical universe is inherent in the blessing to Abraham in which God says: 'Look now up to the heavens and count the stars...Thus (*koh)* shall thy seed be.' [(Gen. 15:5)] But the attainment of this potential is dependent on the other *koh*: 'Let us go yonder' (*koh)* to the Mountain of Moriah, of Abraham at the offering up of Isaac' [(Gen. 22:5)]".[50]

The rabbis could only imagine a Jewish patriarch who had the drive and ability to interact with the stars in the sky. Knowledge of the cosmos in the rabbis' mind made one a stronger leader and prophet. In a list of permitted and forbidden inquiries, questions concerning the makeup of the heavens was allowed. One could not inquire of the metaphysical worlds, "what is above, what is below," nor could one inquire of "pre-creation" or what happens after the universe. Yet the *amoraim* state, "[Concerning the things that are] from one end of heaven unto the other thou mayest inquire."[51]

Astronomy has been with our people as long as any other tradition. They did the best with what knowledge and tools were available at the time. Maimonides, a proponent of human reason and rational inquiry, attempted to describe the universe as best he could. His astronomical approach was based in "the distinctive features of the western Islamic astronomical tradition" of his time.[ii] Maimonides' comments on the makeup of the celestial spheres and bodies followed in the footsteps of Muslim philosophers who already described the cosmos, namely the son of Jabir

[49] B. T. Yoma 28b
[50] Alan Radkowsky, "The Relationship Between Science and Judaism" in Carmell and Domb, *Challenge*, 72.
[51] B. T. Hagigah 11b

ibn Aflah,[iii] and pupils of Ibn Bājja.[iv] Maimonides describes how the planets and stars are fixed upon the celestial spheres:

> "The spheres are that which are called 'sky,' 'firmament,' 'Zevul,' and 'Aravot,' and they are the nine spheres. The sphere that is closest to us is the sphere of the moon. The second that is above us is the sphere within which is the star called Mercury. The third that is above us contains Venus. The fourth sphere that is above us contains the sun. The fifth sphere contains Mars, the sixth sphere contains Jupiter, the seventh sphere contains Saturn, and the eighth sphere contains all the other stars that appear in the firmament. The ninth sphere is the one that rotates every day from east to west, and it surrounds and encircles everything. All of the stars appear to be in one sphere even though one is above the other because the spheres are pure and transparent like glass and sapphire. Therefore, the stars that are in the eighth sphere appear to be below the first sphere."[52]

In his time, the natural philosopher knew this to be the makeup of the cosmos. This geocentric model is based on the best evidence at the time and would remain an accepted paradigm until Copernicus. After the *Mishneh Torah*, Maimonides continued to write and describe what he felt evidence supported as to the makeup of the universe. In Guide for the Perplexed, he tries to contemplate and relay the "enormous distance between ourselves and these corporeal objects."[53] For example, on the distances between the spheres he writes, "It has been proven that the distance between the center of the Earth and the outer surface of the sphere of Saturn is a journey of nearly eight thousand seven hundred solar years."[54] Notice Maimonides focuses on what has been proven. His knowledge of the universe was based both on revelation as it was for the mystic, and on observation and reasoning. Maimonides continues:

> "ושיהיה המהלך בכל יום ארבעים מיל מן המילים של תורה שכל מיל מאלפים אמה באמת המלאכה. והסתכל זה הרוחק הגדול המבהיל! והוא כמו שנאמר "הלא אלוה גובה שמים וראה ראש כוכבים כי רמו" - יאמר הלא מגובה שמים תלמד ראיה על רוחק השגת האלוה - כי אחר שאנחנו ברוחק מזה הגשם על זאת ההפלגה הגדולה והוא נבדל ממנו במקום זה ההבדל ונעלם ממנו עצמו ורוב פעולותיו - כל שכן השגת פועלו שאינו גשם: וזה הרוחק הגדול אשר התבאר במופת - אמנם הוא לכל הפחות שאי אפשר כלל שיהיה בין מרכז הארץ ובין קיבוב גלגל הכוכבים הקיימים

[52] M. T. Hilchot Yesodei HaTorah 3:1
[53] *Moreh Nevuchim* 3:14
[54] Ibid.

פחות מזה השיעור ואפשר שיהיה יותר מזה כפלים רבים; כי עבי גרמי הגלגלים לא התבאר במופת אלא על המעט שאפשר כמו שיתבאר מאיגרת הרחקים."

“Suppose a day's journey to be forty legal miles of two thousand ordinary cubits, and consider the great and enormous distance! or in the words of Scripture, "Is not God in the height of heaven? and behold the height of the stars, how high they are!" (Job 22:12); that is to say, learn from the height of the heavens how far we are from comprehending God, for there is an enormous distance between ourselves and these corporeal objects, and the latter are greatly distinguished from us by their position, and hidden from us as regards their essence and most of their actions. How much more incomprehensible therefore is their Maker, who is incorporeal! The great distance which has been proved is, in fact, the least that can be assumed. The distance between the centre of the Earth and the surface of the sphere of the fixed stars can by no means be less, but it may possibly be many times as great: for the measure of the thickness of the body of the spheres has not been proved, and the least possible has been assumed, as appears from the treatises On the Distances.”[55]

In Maimonides’ time, there was no question the universe was vastly enormous beyond any human comprehension. It is beautiful to think this sentiment holds true even today. His purpose to describe the distance between celestial objects and the distance between humans and God are part of the same struggle. There was no separation between Maimonides’ faith and reason. One could not exist without the other, as mentioned earlier. To know the universe was and is to know God.

Though Maimonides was against astrology, he did believe one could conclude the celestial spheres “serve to regulate the affairs of mankind, since these mighty individual beings would serve to give existence to the individual members of the species, the number of which, according to the philosophers, will never come to an end.”[56] His argument here is that humanity can utilize the celestial spheres for its own benefit. Regarding space travel and settlement, I believe Maimonides would support utilizing the heavens’ celestial bodies as humanity sees fit.

[55] Ibid.
[56] Ibid.

Maimonides also understood that the rabbis were working with what they had in their time to debate the heavens. He writes that if they had known what he knew, they would have agreed with him:

"ולא תבקש ממני שיסכים כל מה שזכרוהו מענין התכונה למה שהענין נמצא - כי החכמות הלימודיות היו בזמנים ההם חסרות ולא דברו בהם על דרך קבלה מן הנביאים אבל מאשר הם חכמי הדורות ההם בענינים ההם או מאשר שמעום מחכמי הדורות ההם. ולא מפני זה אומר בדברים שנמצא להם שהם מסכימים לאמת - שהם בלתי אמיתיים או נפלו במקרה; אבל כל מה שאפשר לפרש דברי האדם עד שיסכימו למציאות אשר התבאר מציאותו במופת הוא יותר ראוי באדם המעולה המודה על האמת - לעשותו."

“You must, however, not expect that everything our Sages say respecting astronomical matters should agree with observation, for mathematics were not fully developed in those days: and their statements were not based on the authority of the Prophets, but on the knowledge which they either themselves possessed or derived from contemporary men of science. But I will not on that account denounce what they say correctly in accordance with real fact, as untrue or accidentally true. On the contrary, whenever the words of a person can be interpreted in such a manner that they agree with fully established facts, it is the duty of every educated and honest man to do so.”[57]

Maimonides was not the first in the rabbinic tradition to try and calculate or quantify the distances and number of celestial bodies in the heavens. The earliest rabbis had attempted to use their available knowledge and Torah to surmise the makeup of the cosmos. As far back as the Talmud, the question arises as to how many worlds, beings, or bodies makeup the heavens. In tractate *Avodah Zara* we read:

""בליליא מאי עביד איבעית אימא מעין יממא ואיבעית אימא רוכב על כרוב קל שלו ושט בשמונה עשר אלף עולמות שנאמר)תהלים סח ,יח(רכב אלהים רבותים אלפי שנאן אל תקרי שנאן אלא שאינן ואיבעית אימא יושב ושומע שירה מפי חיות שנאמר)תהלים מב ,ט(יומם יצוה ה' חסדו ובלילה שירו עמי."

“And what does He do by night? — If you like you may say, the kind of thing He does by day; or it may be said that He rides a light cherub, and floats in eighteen thousand worlds; for it is said, The chariots of God are myriads, even thousands shinan. Do not read Shinan, [repeated], but she-enan [that are not]; or it may be said, He sits and listens to the song of the Hayyoth, as it is said, By the day the Lord will command His lovingkindness and in the night His song shall be with me.”[58]

[57] Ibid.
[58] B. T. Avodah Zara 3b

Here we encounter the notion of eighteen thousand worlds in the heavens. This number is explained in the Talmud as related to the word “she-enan,” which is interpreted as not quite twenty thousand. The justification for the eighteen thousand number in the Talmud would suggest there was already a tradition of eighteen thousand worlds before. Though I will not explore why eighteen thousand is the chosen number, I will explore what other rabbis have said on the subject.

Saadiah Gaon believed there to be only one world on which God focuses, and that the eighteen thousand number refers to previously extant worlds. According to his view, our world is the eighteen thousandth world God created, and it is the only one with which God is the happiest. The previous worlds can be considered attempts at a perfect world.[59] Saadia Gaon bases his interpretation on the midrash that mentions previous worlds:

> "אָמַר רַבִּי יְ ·וּדָה בַּר סִי ֹון, יְהִי עֶרֶב אֵין כְּתִיב כָּאן, אֶלָּא וַיְהִי עֶרֶב, מִכָּאן שֶׁהָיָה סֵדֶר זְמַנִּים קוֹדֶם לָכֵן. אָמַר רַבִּי אַבָּ ·ו מְלַמֵּד שֶׁהָיָה ֹורֵא ֹולָמוֹת וּמַחֲרִיבָן, עַד שֶׁבָּרָא אֶת אֵ ·ו, אָמַר דַּיִן הַנָּיָן לִי, יַתְ ֹון לָא הַנָּיָן לִי. אָמַר רַבִּי פִּנְחָס סַבָּ·ה דְּרַבִּי אַבָּ ·ו)בראשית א ,לא(: וַיַּרְא אֱלֹהִים אֶת כָּל אֲשֶׁר עָשָׂה וְהִנֵּה ֹוב מְאֹד, דַּיִן הַנָּיָן לִי יַתְ ֹון לָא הַנָּיָן לִי."
>
> “Rabbi Judah bar Simon said: it does not say, ‘It was evening,’ but ‘And it was evening.’ Hence we derive that there was a time-system prior to this. Rabbi Abbahu said: This teaches us that God created worlds and destroyed them, saying, ‘This one pleases me; those did not please me.’ Rabbi Pinhas said, Rabbi Abbahu derives this from the verse, ‘And God saw all that He had made, and behold it was very good,’ as if to say, ‘This one pleases me, those others did not please me.’”[60]

In other words, the qualifier “very” indicates that the goodness of this world can be compared to the goodness of other worlds. Thus, God created 17,999 other worlds and found them to be good, but ultimately destroyed them. It was not until our world that God felt comfortable saying it was “very good.”

[59] Norman Lamm in Carmell and Domb, *Challenge*, 375.
[60] Breishit Rabbah 3:7

Rabbi Yehudah ben Barzillai of Barcelona[61] believed the Talmudic passage to refer to eighteen thousand co-existing worlds, perhaps populated by intelligent beings. He wondered about whether God would have given Torah to those beings, as well, and how that would affect humanity.[62]

In addition to the Talmud's attempt to quantify the universe in tractate *Avodah Zara*, the rabbis come much closer to current astronomical calculations in tractate *Berachot* which reads:

> " 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 וששים וחמשה אלפי רבוא כוכבים כנגד ימות החמה וכולן לא בראתי אלא בשבילך ואת אמרת עזבתני ושכחתני?"
> "The Holy One, Blessed be He, said to Israel: My daughter, I created twelve constellations in the firmament, and for each and every constellation I have created thirty armies, and for each and every army I have created thirty legions [*ligyon*], and for each and every legion I have created thirty infantry division leaders [*rahaton*], and for each and every infantry division leader I have created thirty military camp leaders [*karton*], and for each and every military camp leader I have created thirty leaders of forts [*gastera*], and on each and every leader of a fort I have hung three hundred and sixty-five thousand stars corresponding to the days of the solar year. And all of them I have created only for your sake; and you said the Lord has forsaken me and the Lord has forgotten me?"[63]

Norman Lamm represents this passage with this equation: 12 x 30^5 x 365.10^7 = appx. 10^18.[64] Given that the current estimate is that there are two trillion galaxies in the universe[65], and given that each galaxy can have on average hundreds of billions of stars, this Talmudic passage is the most accurate estimate. Of course, one cannot ignore the passage does not refer to galaxies and stars, but in fact refers to legions of heavenly hosts. However, as Maimonides wrote, we must forgive the rabbis for working with the knowledge and information of their day.

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[61] C. 11th Century
[62] Judah b. Barzillai, *Commentary on Sefer Yetzirah* (Berlin: Halberstamm, 1885), 171–73.; cf. endnote i.
[63] BT Berachot 32b
[64] Norman Lamm in Carmell and Domb, *Challenge*, 356.
[65] "Hubble Finds 10 Times More Galaxies Than Thought | NASA," accessed November 27, 2017, https://www.nasa.gov/feature/goddard/2016/hubble-reveals-observable-universe-contains-10-times-more-galaxies-than-previously-thought.

In the late fourteenth century, Rabbi Hisdai Crescas[66] postulated that there is more than just this universe, in fact. He suggested there may be infinite worlds within an infinitely large universe, or even that there are infinite universes, a theory known today as the multiverse theory.[67] Crescas' view of the universe, was not even necessarily a geocentric model; rather, our world was one existing universe among the infinite.[68] Furthermore, Crescas felt the Earth was not the *axis mundi* as other rabbis and philosophers had proposed. According to the entry for Crescas in the Stanford Encyclopedia of Philosophy, written by Dr. Shalom Sadik, Aristotle was among those who felt there needed to be a body around which all movement revolves. Sadik writes that according to Aristotle, "The definition of a natural movement is the movement of a body to its natural place in the world. Aristotle explains that the natural place attracts the body, while the body moves naturally to its natural place." Aristotle placed Earth's place as the *axis mundi* for all existence. Crescas' opinion was that the "place" of a body needed to consider its place among an infinite expanse of universe. Thus, an object only has the potential of its place, rather than a natural place.

Crescas' argument is relevant because it secures the notion that the Earth is insignificant amongst the enormity of the universe. In this thesis, humanity's insignificance plays a major role in my point that we and the Earth are not so special that we cannot expand and travel to other parts of the universe. Crescas' argument also dispels any modern Jewish claim that rabbinic tradition never dealt with space and other celestial bodies.

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[66] Shalom Sadik, "Hasdai Crescas," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, Winter 2016 (Metaphysics Research Lab, Stanford University, 2016), https://plato.stanford.edu/archives/win2016/entries/crescas/.

[67] Cf. Rabbi Hasdai Crescas, *Or HaShem*, ed. Rabbi S. Fisher, Itri Edition (Jerusalem, 1990), 64-67 and 83–84.; For more about the multiverse theory or "M-Theory", see Greene, B. (1999). *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*. W.W. Norton.

[68] Nachum Rabinovitch in Carmell and Domb, *Challenge*, 49.

Conclusion:

It is inaccurate to claim rabbinic tradition did not concern itself with the makeup of the heavens. Our earliest texts portray an elite of natural philosophers who favored those with the ability to read the sky. Various hypotheses and theories many consider to be modern can be found throughout rabbinic tradition from one infinite universe to infinite finite universes.

As far back as the Torah itself, we find our ancestors engaging with the celestial bodies in our universe. Very early rabbinic literature, both *aggadic* and *halakhic*, places an emphasis on those who surmise the exact makeup of the cosmos. From Abraham to modern rabbis, Judaism has constantly tried to quantify the bodies in the heavens.

One must keep in mind the language available to the rabbis in addition to their knowledge. They were not able to observe the constellations closely enough to determine each point of light's characteristics. It was impossible for any rabbi to describe the galaxies and stars as a modern scientist could. Hence, even a calculation of the number of stars in the universe is described as legions of angelic hosts whose purpose was to praise God. I would argue that for the rabbis through to the middle ages, celestial bodies and heavenly beings were the same.

1.3: Humanity's Realm, God's Realm

The first time I mentioned this thesis topic to a professor he responded that Judaism cannot exist off planet. He said Judaism is about the relationship between God, humanity, and the Earth. He said that without the Earth there is no Judaism because the Earth is the realm of humanity and the heavens are the realm of God. He was no doubt thinking of Ps. 115:16, which I will discuss further in this section. If humans go off-planet, he continued, there can be Jews, but there cannot be Judaism. His response compelled me to seek an answer to the issue of whether God and Torah can apply to Jews off-planet. Indeed, such a pursuit inspired me to prove him wrong. Perhaps he was merely being provocative, but he has a valid point. If God revealed Torah to a certain people within a certain species on a certain planet, can that Torah exist anywhere else? For that matter, can the *brit* between Israel and God exist anywhere else but Earth?

Repeatedly, the Torah reminds us that God promised the Land of Israel to the Israelites.[69] The entire Covenant between God and Israel assures the Land of Israel will belong to the descendants of Abraham, Isaac, and Jacob. The Torah assumes that if Israel is exiled from the land, it will one day return to perform the *mitzvot* that can only be performed within the Land of Israel, which I will discuss further in the next chapter. Therefore, what place does God, Torah, and the Covenant have off-planet? Moreover, does humanity even have the right to enter the heavens if they are the realm of God? I side with Norman Lamm who writes, "God makes Himself available to His creatures wherever they are in His immense universe; He is not a social snob who will not be seen in the cosmic slums and alleys."[70]

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[69] Cf. Gen. 12:7; 13:15, 17; 15:7, 18; 17:8; 24:7; 26:3; 28:4, 13; 35:12; 48:3-4; 50:24; Ex. 6:4, 8; 12:25; 13:5, 11; 20:12; 32:13; 33:1; Lev. 14:34; 20:24; 23:10; 25:2, 38; Num. 11:12; 13:2; 14:15-16, 23, 30; 15:2; 20:12, 24; 27:12; 32:7, 9, 11; 33:53; 34:2; Deut. 1:8, 21, 25, 35, 39; 2:12, 29; 3:18, 20, 28; 4:1, 5, 21, 37-38; 4:40; 5:16, 31, 33; 6:10, 18, 23; 7:13; 8:1, 10; 9:5, 6, 23, 28; 10:11; 11:9, 17, 21, 31; 12:1, 10; 15:4, 7; 16:20; 17:14; 18:9; 19:1-3, 8, 10, 14; 21:1, 23; 24:4; 25:15, 19; 26:1-2, 3, 9, 15; 27:2, 3; 28:8, 11, 52; 30:20; 31:7, 20, 21, 23; 32:49; 32:52; 34:4

[70] Norman Lamm, "The Religious Implications of Extraterrestrial Life" in Carmell and Domb, *Challenge*, 378.

The Tanach, however, lists in several spots that the heavens and the Earth are meant to be separated. Deuteronomy would seem to support my professor that there is no Torah or Judaism in space. It reads, "The Torah is not in the heavens, such that you might say, 'Who will go up for us into the heavens and get it for us, so that we could learn it and perform its commandments?' . . . But really, it is very close to you - in your mouth and in your heart, to do it."[71] One could interpret this section to mean humans do not need a mediator to receive Torah from God; Torah flows directly from God to Israel. Yet the Jewish commentator, Rashi[72], adds that if Torah were in the heavens, it would be one's duty to climb to heaven to reach it.[73] Theoretically one could use this statement to argue there is no Torah in the heavens, i.e., off-planet. Hence, Jews should not live off-planet because there is no Torah. However, one may also assume Torah does exist off-planet as God is omnipresent and Torah flows from God. If that is the case, the Talmud compels Jews and humanity to seek Torah where they venture, even off-planet.

Still our tradition maintains humanity resides on Earth and our relationship with God is from here. God remains in the heavens and humanity remains within the bounds of our biosphere. God does not speak to Israel on the same level. God speaks to us "from the heavens"[74] while we bow from our lowly place. In fact, we would not even have a relationship with the Divine unless God allowed us to "hear God's voice from the heavens."[75] Herein lies the theological challenge for living off-planet: we sing, "To you I lift up my eyes, You who dwell in the heavens."[76] We do not sing, "We look straight ahead into your eyes, you are right in front of us."

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[71] Deut. 30:11-14
[72] B. France 1040-1105
[73] Rashi on Deuteronomy 30:12:1, based on BT Eruvin 55a
[74] Ex. 20:19
[75] Deut. 4:6
[76] Ps. 123:1

Though modern Jewish theology stresses God’s omnipresence, God is still spiritually beyond our reach, residing beyond our grasp. If we cross into God’s realm, i.e., outer space, do we break that theological boundary?

We are told, “God is in heaven and you are on the Earth,”[77] and “The heavens are My throne and the Earth is My footstool.”[78] Bear in mind that in the last section, I illustrated that what we consider extra-terrestrial celestial bodies and the “heavens” are the same. One may think there is reason to forbid Jews from traveling to the heavens. Yet one of Jewish mystical literature’s goals is to find a path to the heavens.

Eighteenth-century kabbalist Rabbi Nachman of Breslov wrote of a map one could follow to the heavens:

> "וְכֵן הָיָה נִרְשָׁם בָּהּ הַדֶּרֶךְ מֵ וֹלָם לְ וֹלָם כִּי יֵשׁ דֶּרֶךְ וְנָתִיב, שֶׁעַל יָ ו יְ וֹלִין לַעֲ וֹת מֵאֶרֶץ לַשָּׁמַיִם]כִּי אִי אֶפְשָׁר לַעֲ וֹת לַשָּׁמַיִם, מֵחֲמַת שֶׁאֵין וֹדְעִין הַדֶּרֶךְ וְשָׁם הָיָה נִרְשָׁם הַדֶּרֶךְ לַעֲלוֹת לַשָּׁמַיִם[וְהָיָה נִרְשָׁם שָׁם כָּל הַדְּרָכִים שֶׁיֵּשׁ מֵ וֹלָם לְ וֹלָם כִּי אֵלִיָּ ּו עָלָה לַשָּׁמַיִם בְּדֶרֶךְ פְּ וֹנִי, וְהָיָה כָ ּוב שָׁ אוֹתוֹ הַדֶּרֶ ּומשֶׁה רַבֵּ ּו עָלָה לַשָּׁמַיִם בְּדֶרֶךְ אַחֵר, וְהָיָה כָ ּוב שָׁ אוֹתוֹ הַדֶּרֶךְ גַּם כֵּן וְכֵן חֲנוֹךְ עָלָה לַשָּׁמַיִם בְּדֶרֶךְ אַחֵר, וְהָיָה כָ ּוב שָׁם גַּ אוֹ וֹ הַדֶּרֶךְ וְכֵן מֵ וֹלָם לְ וֹלָם הַכֹּל הָיָה נִרְשָׁם בְּשִׂרְטוּטֵי הַיָּד הַנַּ"ל."
>
> “...And also imprinted on the Hand was the way from one world to another world. For there is a path and a course on which one can ascend from Earth to heaven (for, one cannot go up from Earth to heaven, due to not knowing the way; but depicted there was the way to go up to heaven). So depicted there were all the paths that exist from one world to another world. For, Eliyahu ascended to heaven with this path, and that path was written there; Moshe Rabbeinu [Moses] went up to heaven with a different path, and that other path was also written there; and likewise Chanokh [Enoch] ascended to heaven with yet another path, and that path was also written there. Thus from one world to the other (farther, higher) world was all depicted by the ruts and folds of the Hand.”[79]

Of course, one could argue the mystic distinguished between spiritually traveling to the heavens and physically traveling toward the stars. Here, Rabbi Nachman seems to describe a physical map with a physical drawing he believes leads to heaven which has been used by

[77] Ecc. 5:2
[78] Is. 66:1
[79] *Sippurei Ma’asiyot 12*

several religious figures. Though later Kabbalism, such as Hasidic Kabbalism, stressed God's immanence, that God is everywhere and in all things, most Jewish mystical circles described ways to access God's place in the heavens.[80]

To further analyze the tension between whether Jews should be permitted to travel toward the heavens, I will explore the rabbinic commentary on Psalm 115:16 which reads, "הַשָּׁמַיִם שָׁמַיִם לַיהוָה וְהָאָרֶץ נָתַן לִבְנֵי־אָדָם:," "The heavens belong to the Eternal, but the Earth God gave over to humanity." Here, the Hebrew for "heavens" is "שָׁמַיִם" which is defined as both a physical location[81] and as the realm of God[82].

Rabbi Abraham ibn Ezra[83], interprets the word *shamayim* to mean a physical place. He writes:

> "השמים - אמר רבי משה: כי השמים כמו מקום. ואני כבר פירשתיו בספר השם, כי שמים על מתכונת שנים וגזרתו משם, בעבור שני מקומות בסדן שהם נטועים. וכן כתוב: לנטוע שמים וליסוד ארץ, וחסרי דעה חשבו כי ממשלת האדם בארץ כממשלת השם בשמים ולא דברו נכונה, כי מלכות השם בכל משלה רק פירוש נתן לבני האדם - שהאדם כמו פקיד אלהים בארץ, על כל מה שיש בה והכל בדבר השם."
>
> "Rabbi Moshe says that *hashamayim* (the heavens) means "place." I have previously explained in the book *Sefer Ha-Shem* (The Book of God's Name) that the word *shamayim* (heavens) is like the word *shenayim* (two). It is related to the word *sham* (there). *Shamayim* is so called because of the two places where the axis is located. Scripture similarly write, *that I may plant the heavens and lay the foundations of the Earth* (Is. 51:16). [But the Earth hath He given to the children of men.] Those who lack knowledge think that man's rule of the Earth is like God's rule of the heavens. They do not speak correctly, for God's Kingdom rules over all. The meaning of *hath He given to the children of men* is that man acts like God's representative over the Earth and upon all that is in it. Everything is by the word of God."[84]

[80] Moshe Idel, *Hasidism: Between Ecstasy and Magic* (Albany: SUNY Press, 1995), 17.
[81] Francis Brown, S. R. Driver, and Charles A. Briggs, *The Brown-Driver-Briggs Hebrew and English Lexicon: With an Appendix Containing the Biblical Aramaic : Coded With the Numbering System from Strong's Exhaustive Concordance of the Bible*, Reprint edition (Peabody, Mass: Hendrickson Pub, 1996). 1029; It is further defined as "visible heavens, sky, where stars, etc. are [cf] Jud. 5:20; Gen. 15:5; Deut. 4:19; Gen. 1:14, 15, 17
[82] Brown, Driver, and Briggs, 1030. Defined "as abode of God [cf] I Kings 8:30, 32; where [God] sits enthroned [cf] Isaiah 66:1.
[83] B. Tudela, Navarre 1089-1167
[84] Abraham Ibn Ezra, *Rabbi Abraham Ibn Ezra's Commentary on the Second Book of Psalms: Chapters 42-72*, trans. H. Norman Strickman (Boston: Academic Studies Press, 2009).

Here, it would seem Ibn Ezra supports the idea that *shamayyim* is not simply a spiritually separate place than that of our reality, but it is, in fact, an actual place. Furthermore, Ibn Ezra maintains that there is a vast difference between humanity's role in ruling the Earth and God's role in ruling the heavens.

Metzudat David[85], written by Rabbi David Altschuler, also called the Radbaz, reiterates that God rules the heavens and that they are designated for God specifically. In it, the Radbaz writes, "Although the heavens are designated for God's dwelling, He oversees the Earth and has given it to those who please Him. Therefore, you will be a blessing in the midst of the Earth."[86]

Rabbi Joseph di Trani[87], also known as the Maharit, interprets Psalm 115:16 to mean that the celestial bodies have no free will because they fall under the rulership of God. Humans, on the other hand, do have free will on Earth. Theologically, the Maharit's interpretation can cause issues for Jews traveling into the heavens. Can humans have freewill according to the rabbis off-planet? Or is our free will solely dependent on our residing on Earth?[88]

Rabbi Avrohom Chaim Feuer, a well-known teacher and author[89], writes that God charged humanity to care for the Earth and to make it heavenly.[90] By his interpretation, it is more humanity's place to stay put on Earth and tend to it. By this reading, humanity may have business traveling to the heavens if our duty is to perfect the Earth.Rabbi Moshe ben Chayim

[85] Written by the Radbaz, Dan Cohn-Sherbok, *Dictionary of Jewish Biography* (A&C Black, 2010), 307.
[86] Metzudat David on Book of Psalms 115:16:1
[87] B. 1568-1639, Cohn-Sherbok, *Dictionary of Jewish Biography*, 285.
[88] Maharit on Psalm 115:16 in Joseph di Trani, *Sefer Tehillim Simchat Yehoshua*, Schottenstein Edition (Art Scroll, n.d.).
[89] "Rabbi Avrohom Chaim Feuer," Kollel Ateres Mordechai, accessed November 28, 2017, http://www.kollelateresmordechai.org/avrohom-feuer/.
[90] Avrohom Chaim Feuer, *Sefer Tehillim*, Schottenstein Edition (Art Scroll, n.d.).

Alshich[91]writes that the heavens belong to God exclusively and that God "disposed" of ownership over the Earth by "allocating" some to humanity.[92]

Not only does God dwell and rule in the heavens, but humanity was given the Earth to rule it. What is not mentioned so far is whether humans can even physically cross into the heavens. The Talmud describes the heavenly curtain that separates God from other creations called the *pargod.* The rabbis tell us this *pargod*, this curtain, is unpassable. The spirit itself, or even the heavenly hosts themselves, can only hear what happens behind the *pargod.*[93] Thus, Jewish tradition has the precedent that none can pass into the realm of God.

The Talmud further stresses the separation of the heavens and the Earth by maintaining neither Moses nor Elijah ever actually crossed into the heavens. These men, the most spiritually elevated in all human history, could not cross the boundary into God's domain.[94] In the *Ein Yaakov*, however, we read a *Baraita* taught by R. Jose which reads:

"מֵ ֹולָם לֹא יָרְדָה שְׁכִינָה לְמַטָה)מעשרה(, וְלֹא עָלָה מֹשֶׁה וְאֵלִיָ ּו לַמָרוֹם, שֶׁנֶּאֱמַר:)תהלים קטו("הַשָׁמַיִם שָׁמַיִם לַה' וְהָאָרֶץ נָתַן לִבְנֵי אָדָם". וְלֹא יָרְדָה שְׁכִינָה לְמַטָה? וְהָכְתִיב:)שמות יט("וַיֵּרֶד ה' עַל הַר־סִינַי"! לְמַעְלָה מֵעֲשָׂרָה טְפָחִים! וְהָכְתִיב:)זכריה יד("וְעָמְ ּו רַגְלָיו בַיּוֹם הַ ּוא עַל הַר הַזֵּיתִים"? לְמַעְלָה מֵעֲשָׂרָה טְפָחִים! וְלֹא עָלָה מֹשֶׁה וְאֵלִיָ ּו לַמָ ֹום? וְהָא כְתִיב:)שמות יט(ּומֹשֶׁה עָלָה אֶל הָאֱלֹהִים"? לְמַטָה מֵעֲשָׂרָה! וְהָכְתִיב:)מלכים ב ב("וַיַּעַל אֵלִיָ ּו בַסְעָרָה הַשָׁמָיִם"? לְמַטָה מֵעֲשָׂרָה! וְהָכְתִיב:)איוב כו("מְאַחֵז פְּנֵי כִסֵּה, פָּרַשׂ עָלָיו עֲנָנ ֹו", וְאָמַר רַבִי תַּנְ ּום: מְלַמֵּד, שֶׁפָּרַשׂ שַׁדַי מִזִּיו שְׁכִינָתוֹ וַעֲנָנ ֹו עָלָיו.]לְמַטָה מֵעֲשָׂרָה[! מִכָּל מָ ֹום, "מְאַחֵז פְּנֵי כִסֵּא" כְתִיב? דְּאִשְׁתַּרְבּוּבֵי אִשְׁתַּרְבֵּבלֵ·ה כִּסֵּא עַד עֲשָׂרָה, וְנָקִיט בֵּיהּ!"

"Never did the Shechina come down below [on Earth], and Moses and Elijah never ascended to heaven; for it is written (Ps. 115, 16) The heavens are the heavens of the Lord, but the Earth hath He given to the children of man." Then, the Shechina, you contend, never came down below? Behold, it is written (Ex. 19, 20) And the Lord came down upon Mount Sinai. This was ten spans above the ground. But it is written (Zech. 14, 4) And his feet will stand on that day upon the mount of Zeithim (Olives). This was ten spans above the ground. Again, [let me ask], is it indeed a fact that neither Moses nor Elijah ever ascended to heaven? Behold, it is

[91] "Jewish Commentator: Moses Ben Hayyim Alshich | Etz Hayim—"Tree of Life"",," accessed November 28, 2017, http://www.etz-hayim.com/commentators/commentator.php?id=moses-ben-hayyim-alshich.
[92] Eliyahu Munk, *The Book Of Psalms With Romemot El. Two Volume Set.* (Eliyahu Munk, 1990).
[93] B.T. Berakhot 18b
[94] B.T. Sukkah 5a

written (Ex. 19, 3) And Moses went up unto God? This means below ten spans. But it is written (II Kings 2, 11) And Elijah went up by a storm wind into heaven. This also means below ten spans. But it is written (Job 26, 9) He lays hold of the face of His throne and spreads His cloud over him; and R. Tanchtum said: "This means to teach us that the Almighty spread the brightness of the Shechina and enveloped Moses with encouragement." This also refers to below these ten spans. However, it is written, he (Moses) lays hold of the face of His throne [hence they were both together]. He brought down His throne close to ten spans, where Moses took hold of it."[95]

In other words, R. Jose argues the opposite, that both God and Israel are crossing the boundary into each other's domains all the time. In the *Mekhilta d'Rabbi Yishmael,* we read that God bent the heavens and spread them over the top of Mount Sinai.[96] In this text, it would seem the separation between the realms exists but only God has the power to bend them to cross into the other.

Midrash Tanchuma tells us that God first decreed none shall pass between the realm of the Earth and the realm of God, or the heavens. In it we read:

"וַיֹּאמֶר ה' אֶל מֹשֶׁה נְטֵה אֶת יָדְךָ עַל הַשָּׁמַיִם ויהי בָּרָד)שמות ט, כב(. זֶה שֶׁאָמַר הַכָּ ·וב: כֹּל אֲשֶׁר חָפֵץ ה' עָשָׂה בַּשָּׁמַי ·וּבָאָרֶץ)תהלים קלה, ו(. הַשָּׁמַיִם, אָמַר הַקָּ ֹוש בָּרוּךְ הוּא, הַשָּׁמַיִם שָׁמַיִם לַה' וְהָאָרֶץ נָתַן לִבְנֵי אָדָם)תהלים קטו, טז(. מָשָׁל לְמַה הַדָּבָ דּוֹמֶה? לְמֶלֶךְ שֶׁגָּזַר וְאָמַר: בְּנֵ רוֹמי לֹא יֵר ·ו לְ ·ורְיָא, וּבְנֵי ·ורְיָא לֹא יַעֲ ·ו לְ ֹומי. כָּךְ כְּשֶׁבָּרָא הַקָּ ֹוש בָּ ·ו הוּא אֶת הָ ֹולָם, גָּזַר וְאָמַר: הַשָּׁמַיִם שָׁמַיִם לַה' וְהָאָרֶץ נָתַן לִבְנֵי אָדָם. כְּשֶׁבִּקֵּשׁ לִתֵּן אֶת תּ ֹורָה, בִּטֵּל אֶת הַגְּזֵרָה הָר שׁוֹנָה וְאָמַר: הַתַּחְ ֹונִים יַעֲ ·ו לָעֳלְ ֹונִים, וְהָעֳלְ ֹונִים יֵר ·ו לַתַּחְ ֹונִים, וַאֲנִי הַמַּתְחִיל, שֶׁנֶּאֱמַר: וַיֵּרֶד ה' עַל הַר סִינַי ו ֹו')שמות יט, (.·וּכְתִיב: וְאֶל מֹשֶׁה אָמַר עֲלֵה אֶל ה')שמות כד, א(. הֱוֵי, כֹּל אֲשֶׁר חָפֵץ ו ֹו'."

And the Lord said unto Moses: "Stretch forth thy hand toward heaven that there may be hail" (Exod. 9:22). Scripture says (elsewhere in allusion to this verse): Whatsoever the Lord pleased, that hath He done, in heaven and in the Earth (Ps. 135:6). In reference to the heaven, the Holy One, blessed be He, said: The heavens are the heavens of the Lord (Ps. 115:16), and in regard to the Earth, The Earth hath He given to the children of men (ibid.). *This may be compared to a king who decreed that the people of Rome should not migrate to Syria and that the people of Syria should not migrate to Rome.* And similarly, the Holy One, blessed be He, decreed when he created the world: *The heavens are the heavens of the Lord;* and the Earth He hath given to the children of men. However, when He decided to give the Torah, *He abrogated the first*

[95] Sukkah 1:1 in Jacob ben Solomon Ibn Ḥabib, *Ein Yaakov: The Ethical and Inspirational Teachings of the Talmud* (Jason Aronson, 1999).
[96] Mekhilta d'Rabbi Yishamel on Exodus 19:20:1

> *decrees* and declared: Let the Earthly beings ascend on high and the heavenly creatures descend below, and I will be the first (to do so), as it is said: And the Lord came down upon Sinai (Exod. 19:20). And it is also written: And to Moses He said: "Come up unto the Lord" (ibid. 24:1). Hence, Whatsoever the Lord pleased, that hath He done (*emphasis mine)*.[97]

The analogy here is that of a king who decrees that none of his subjects may pass into another land and vice versa, thus creating a law separating the two realms. Only the king can change the decree. When God gave the Torah to humanity, God nullified the decree because it was the only way to make that happen. So, as we saw in the *Mikhilta d'Rabbi Yishmael*, God needed to break the rules, thus breaking the barrier, in order interact with humanity on Earth. Ever since receiving Torah, according to the Midrash, humanity should have no issue crossing into the realm of God.

A question to go along with interpreting Psalm 115:16 is what Jewish tradition is to do about God's ownership of the land on Earth. If humanity is supposedly the owner and cultivator of the land, then certainly humanity can dictate what is to be done with the land. Does Jewish theology dictate God has zero interaction with the realm of humanity? If God owns and rules the heavens and humanity owns and rules the Earth, can humanity do what it wants with the land?

In the Talmud, in tractate *Gittin*, we read:

> "גמ׳ אמר רבה אע"פ שאין קנין לעובד כוכבים בארץ ישראל להפקיע מידי מעשר שנאמר)ויקרא כה, כג(כי לי הארץ לי קדושת הארץ אבל יש קנין לעובד כוכבים בא"י לחפור בה בורות שיחין ומערות שנאמר)תהלים קטו, טז(השמים שמים לה' והארץ נתן לבני אדם."
>
> "GEMARA: Rabba says: Even though a gentile has no capability of acquisition of land in Eretz Yisrael to cause the abrogation of the sanctity of the land, thereby removing it from the obligation to tithe its produce, as it is stated: 'For the land is Mine' (Leviticus 25:23), which teaches: The sanctity of the land is Mine, and it is not abrogated when the land is sold to a gentile; a gentile does have, however, the capability of acquisition of land in Eretz Yisrael to allow him to dig pits, ditches, and caves in the land he has purchased, as it is stated: 'The heavens

[97] Midrash Tanchuma Vaera 15:1

> are the heavens of the Lord; but the Earth has He given to the children of men'(Psalms 115:16)."[98]

Here, in *Gittin*, we see that God claims ownership over the land. At least, as the text reads, the sanctity of the land belongs to God. In other words, though humanity may dwell in and own the realm of the Earth, God still owns all. Herein lies a huge theological question of the immanence of God.[99] If God is within all matter in the universe, how can God be separate from humanity in another realm? Clearly our laws maintain God's ownership over the sanctity of the Earth. So, our ownership really is merely an illusion. We may feel that we own the realm of the Earth, but it really belongs to God.

In *Midrash Rabbeinu Bachya*, we read that Psalm 115:16 is a reminder of the Jubilee year in which all land reverts to God's ownership. In fact, this midrash takes the Jubilee further to say, "the terrestrial Earth reverts to Tohu Vavohu ["Void and Chaos"] at the end of seven Jubilee cycles each of seven thousand years."[100]

Maimonides writes in his *Guide for the Perplexed* that Psalm 115:16 tells us, "God alone has a perfect and true knowledge of the heavens, their nature, their essence, their form, their motions, and their causes; but [God] gave [humanity] power to know the things which are under the heavens: here is [humanity's] world, here is [their] home, into which [they have] been placed, and of which [they are themselves] a portion."[101] Maimonides seems to be perfectly happy that humans remain in our realm and God remains in the heavens. In fact, Maimonides' point is to say that humans can never fully grasp the enormity and vastness of the heavens. He writes, "It is

[98] B.T. Gittin 47a
[99] Idel, *Hasidism*, 17.
[100] Bachya Ben Asher, *Torah Commentary: Midrash Rabbeinu Bachya*, trans. Eliyahu Munk, 2nd edition (Jerusalem: Urim Pubns, 2003). Vayikra 25:23:3.
[101] *Moreh Nevuchim,* Part 2, 2:24.

in fact ignorance or a kind of madness to weary our minds with finding out things which are beyond our reach, without having the means of approaching them. We must content ourselves with that which is within our reach, and that which cannot be approached by logical inference let us leave to him who has been endowed with that great and divine influence, expressed in the words: 'Mouth to mouth do I speak with Him' (Num. 12:8)."[102]

How splendid would it be if we could, indeed, reach the heavens? Maimonides stresses how mind-bendingly complex of a process it would be to reach the heavens. Today, though, we can. Not only can we reach the heavens, but we are planning, relatively soon, on making it humanity's future home. I believe if Maimonides were alive today and witnessed the revolution in technology so that we can reach the heavens, he would fully support the endeavors of such pioneers as Elon Musk.

[102] Ibid.

Conclusion:

There is certainly a part of the Jewish tradition which insists there is to be a separation, or a barrier, between the realm of humans on Earth and the realm of God in the heavens. Some sources believe humans cannot traverse the gap, and others insist God does not traverse the gap. Yet other sources insist the firmament between God and humanity has been overcome one several occasions.

This conversation is so important because we as a faith tradition will need to redefine the heavens. Are the heavens, indeed, the celestial bodies? If so, what are the implications, then, that we can reach them? On the other hand, are the heavens part of a spiritually separated plane?

Judaism will need to define our relationship with the attainable celestial bodies. For instance, if Mars is part of the heavens, does that alter Martian Jews' relationships with God? I believe as time goes on, Judaism will need to broaden the definition of the heavens to mean anything in the cosmos humans cannot, or have not, reached. Perhaps God's realm is within another galaxy. Perhaps we can make it easy on ourselves and agree that God's realm lies beyond the observable universe. That way, however long it takes humanity to populate the heavens, God will always lie beyond our understanding.

Chapter Two:
Halakhic Challenges

After confronting the theological issues, the first Jewish settlers on the Moon, Mars and beyond may face, the next question is that of the *halakhah*. Theological challenges may prevent Jews from even undertaking the journey off-planet at all. Assuming the theological barriers are solved, the next challenge begins. Just how does one live Jewishly off-planet? As I have stated previously, this thesis is intended for all streams of Judaism. Some Jews place a higher emphasis on following *halakhah* while others do not.

A Reform Jew may have an easier time on another celestial body keeping Shabbat because it does not require following *halakhah*. However, despite what some think, Reform Jews do not wholly reject *halakhah*; rather, they incorporate *halakhah* into their lives, beliefs, practice, and worship. *Halakhah* guides everything that they do. I acknowledge the necessity to harmonize *halakhah* as Jews settle the heavens.

To my fellow Jews, no matter how they identify, I say that Judaism needs a strong *halakhic* basis for its continued existence. *Halakhah* defines all aspects of Jewish life including liturgy, Shabbat and festival observance, the calendar, life-cycle ceremonies, etc. There is no question that *halakhah* is fundamentally part of Reform Jewish life. Yet the question of how the *halakhah* functions and who decides on it is debated among different Jewish communities. Reform Jews believe they are continuing the millennia-long discourse as to how to apply Jewish tradition and *halakhah* to their daily lives. This why I believe it is imperative that we, as a people, begin the process of adapting Judaism and *halakhah* for life off-planet. As I have stated earlier, visionaries, such as Elon Musk, plan to settle Mars as soon as possible, and NASA has plans for a permanent lunar base in the next couple of decades. This conversation is not one to be

had a century from now, or even a decade from now; we need to begin preparing now. By opening the conversation, I hope to create avenues for *halakhah* to adapt to ever-changing worlds and environments.

For instance, let us imagine a nation or corporation that sets up a small mining colony on an asteroid to mine its resources.[103] Let us then say that one of the miners on that asteroid wonders when to begin Shabbat or when to observe Sukkot. That Jew will likely turn to a rabbi or rabbinic source. What if the rabbi answers that *halakhah* does not exist off-planet at all? That Jew may abandon the question and may fall out of Jewish practice entirely. This is why *halakhah* must work off-planet, so as to retain Jewish identity and culture amongst ExoJews. This mining scenario is hypothetical, but it brings up key issues that have not fully been addressed by the rabbinic community, including the Orthodox community.

So far, which I will present at greater length, the *halakhah* does not come to any sort of agreement as to how to live *halakhically* on another celestial body. Furthermore, some rabbinic interpretation concludes *halakhah* cannot even exist off-planet. In all, there is no *halakhah* specifically addressing the issue of *settling* off-planet. Even the *halakhah* that exists which confronts the challenge of living in an environment with an irregular daily cycle merely addresses a Jew who is traveling.[104] The Jews who travel to Mars are most likely not coming back, at least not for a long while. Any *halakhah* that treats them as travelers, able to return home to Earth, will be unusable. The *halakhah* must confront the reality that Jews will settle other planets, moons, and asteroids in the relatively near future, and that they are settlers, not travelers.

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[103] Viorel Badescu, *Asteroids: Prospective Energy and Material Resources* (Springer Science & Business Media, 2013), 647.
[104] cf. *Mishnah Berurah, Bi'ur Halakhah* 344:1

2.1: Rabbinic Sources on the Lunar Calendar

The most basic *halakhic* challenge for any ExoJew will be the Hebrew Calendar. On Earth, the Jewish tradition has always been tied to the lunar cycle. The Hebrew Calendar is, indeed, a lunar-solar hybrid, but the monthly cycles are entirely based on Earth's moon, Luna.[105] Maimonides lists why it was so essential for the Hebrew Calendar to have been hybridized. He writes:

"שָׁנָה מְעֻבֶּרֶת היא שָׁנָה שֶׁ ֹוסיפין בָּהּ חֹדֶש. וְאֵין מוֹסיפין לְ ֹולָם אֶלָּא אֲדָר ו ֹושני אוֹתָהּ שָׁנָה שְׁנֵי אֲדָרִין אֲדָר ר ֹאשון וַאֲדָר שֵׁני. וּמִפְּנֵי מָה מוֹסיפין חֹדֶש זֶה מִפְּנֵי זְמַן הָאָבִיב כְּדֵי שֶׁיִּהְיֶה הַפֶּסַח בְּאוֹתוֹ זְמַן שֶׁנֶּאֱמַר)דברים טז-א('שָׁ ֹומור אֶת חֹדֶש הָאָבִיב' שֶׁיִּהְיֶה חֹדֶש זֶה בִּזְמַן הָאָבִיב. וְלוּלֵא הוֹסָפַת הַחֹדֶש הַזֶּה הַפֶּסַח בָּא פְּעָמִים בִּימוֹת הַחַמָּה וּפְעָמִים בִּי ֹות הַגְּשָׁמִים."

"A leap year is a year in which another month has been added. And we only ever add an Adar and make two Adars, an Adar Rishon (first Adar) and an Adar Sheini (Second Adar). And why do we add this month? Because of the spring time, so that the Passover will fall at that time, as it is said (Deuteronomy 16:1) 'Guard the month of the spring', that this month should be in the spring. And if it wasn't for the addition of this month, Passover would sometimes come in the days of the sun (the summer) and sometimes in the days of the rain (the winter)."[106]

In other words, it is necessary for the Hebrew Calendar to be corrected so as to preserve the seasons in which the festivals fall. For instance, Passover must remain a spring festival, so the extra leap month must be added to realign the lunar and solar calendars. Without the extra leap month, Jewish holidays would slowly shift throughout the solar year. Passover would eventually work its way into summer or winter. Muslim holidays, as Islam follows a strictly lunar calendar, shift thusly throughout the year.[107]

[105] "Introduction to the Jewish Calendar," accessed November 29, 2017, http://www.chabad.org/library/article_cdo/aid/55194/jewish/Introduction.htm.
[106] *M. T. Hilchot Kiddush HaChodesh* 4:1; cf. ibid. *siman* 3: The rabbis chose to add another Adar to ensure the weather conditions in the spring time were proper and ideal for the spring festivals.
[107] Yvonne Yazbeck Haddad and Jane I. Smith, *The Oxford Handbook of American Islam* (Oxford University Press, 2014), 169.

The Hebrew Calendar began as a lunar calendar before adjusting to the solar calendar. Rashi's commentary on Genesis 1:14 explains that God placed each celestial body in its place to Israel can determine its calendar. Including his words in the brackets, the Genesis chapter one reads:

> "And God said: Let there be [suspended] luminaries in the firmament of the heaven [(The luminaries, like all things pertaining to heaven and to earth, had been created on the first day, but each of the particular creations was activated on its particular day.)] to divide between the day and the night, [after the first light had been secreted for the righteous for the world to come.] And let them serve for signs [(eclipses being omens of ill)], and for festivals, [reckoned by the New Moon], and for days, [the sun and the moon serving for half a day respectively], and for years, [completing their course through the zodiac in 365 days]."[108]

In other words, according to Rashi, God's plan from the beginning was for Israel to determine its calendar based on what it sees from Earth. We Jews are entirely tied to what we see in the heavens. In turn, our *halakhah* is entirely based on what we can see from the Earth. For example, in Exodus we read, "On the third new moon after the Israelites had gone forth from the land of Egypt, on that very day, they entered the wilderness of Sinai."[109]

Furthermore, the book of Isaiah recounts that God stopped the sun to prevent King Hezekiah's death. We read, "'I am going to make the shadow on the steps, which has descended on the dial of Ahaz because of the sun, recede ten steps.' And the sun['s shadow] receded ten steps, the same steps as it had descended."[110] Thus, to stop the heavenly luminaries is to stop time itself. The Tanach already assumes time is based on what is seen in the sky.

The rabbis inform us in the Mishnah that in ancient times a witness must attest to a new moon, and thus a new month. In tractate Rosh Hashanah, we read:

[108] *The Rashi Chumash: With the Complete Metzudoth-Chazal Haftaroth* (Targum, 1997).
[109] Ex. 19:1
[110] Is. 38:8

"אָ ·וּבְ ֹו שֶׁ ְך ·ו אֶת הַחֹדֶשׁ, יֵ ְל ·ו. לֹא שֶׁמִצְטָרְפִין זֶה עִם זֶה, אֶלָּא שֶׁאִם יִפָּסֵל אֶחָד מֵהֶן, יִצְטָרֵף הַשֵּׁנִי עִם אַחֵר. רַבִּי שִׁמְ ֹו אוֹמֵר, אָ ·וּבְ ֹו וְכָל הַקָּ ֹובִין, כְּשֵׁרִין לְעֵ ·ות הַחֹדֶשׁ. אָמַר רַבִּי ֹוסֵי, מַעֲשֶׂה בְּטוֹבִיָּה הָרוֹפֵא, שֶׁרָאָה אֶת הַחֹדֶשׁ ב ִירוּשָׁלַ ִי , הוּא וּבְ ֹו וְעַבְ ֹו מְשֻׁחְרָר, וְקִבְּ ·ו הַכֹּהֲנִי אוֹתוֹ וְאֶת בְּנוֹ, וּפָסְ ·ו אֶת עַבְדּוֹ. וּכְשֶׁבָּ ·ו לִפְנֵי בֵּית דִּין, קִבְּ אוֹתוֹ וְאֶת עַבְדּוֹ, וּפָסְ ·ו אֶת בְּ ֹו."

If a father and son saw the new moon, they must [both] go to the court [that will take their testimony to potentially confirm that sighting and ratify the new month accordingly]; not that they may be combined [together to act as witnesses], but rather that in the event that one of them be declared unfit, the other may join [to give evidence] with another [witness]. Said Rabbi Shimon, "A father and his son, and all relatives, are fit to [join together and] give evidence about the [appearance of the] new moon." Said Rabbi Yose, "It once happened that Toviah the physician, his son, and his freed slave saw the new moon in Jerusalem, [and when they testified before them,] the *Kohanim*[members of the priestly caste, a subgroup of tribe of Levi, which is uniquely responsible for maintaining and carrying out the sacrificial services in the Temple] accepted him and his son [as witnesses together], but declared his slave unfit; but when they came to [testify before] the court, they accepted him and his slave [as witnesses together], but declared his son unfit."[111]

Here, witnessing the new moon is so important, a person must be deemed fit to do so. Regarding the first ExoJews, one must ask what happens on another celestial body. What happens if we cannot observe the heavens? In the Talmud we read:

"א"ל רב אדא בר אהבה לרבא אחרים מנינא אתא לאשמועינן הא קמ"ל דלא בעינן מצוה לקדש ע"פ הראיה מתקיף לה רבינא והאיכא יומא דשעי ויומא דתלתין שני כיון דליתיה בכל שתא לא קא חשיב ואף שמואל סבר לה כרב הונא דאמר שמואל אין שנת לבנה פחותה משלש מאות וחמשים ושתים יום ולא יתירה על שלש מאות וחמשים וששה יום הא כיצד שניהם מלאין ששה שניהם חסירין שנים אחד מלא ואחד חסר ארבעה."

“Said R. Adda b. Ahabah to Raba: Do ‘Others’[112] intend teaching us [how to count] the number? This is what they convey to us: *That it is not obligatory to proclaim a new moon on the basis of having seen it.* Rabina demurred: But there are days made of hours, and days of thirty years?— Since they do not occur every year, he does not count them. Samuel, too, agreed with the view of R. Huna, for Samuel said: The lunar year consists of no less than three hundred and fifty-two, nor of more than three hundred and fifty-six days. How is that? — If the two are full, there are [fifty] six; if the two are incomplete. [fifty] two; if one is complete and one incomplete, [fifty] four.” (Emphasis mine)[113]

[111] M. Rosh Hashanah 1:5

[112] From B. T. Arachin 9b: “It was taught: ‘Others’ taught. Between one Feast of Weeks and the other, and between one New Year and the other, there is an interval of no more than four days [of the week], or in the case of a prolonged year, five days.” The others are not mentioned by name in the Talmud.

[113] B. T. Arachin 9b

This section of Talmud illustrates that in the first centuries of the Common Era it became less important whether someone actually witnessed the moon. By the Fourth Century, the calendar no longer needed a witness to testify to the new moon. Hillel II is recognized as the rabbi to have standardized the calendar so that it fit both the lunar and solar calendars.[114] Since then, the days of each month are fixed, though they still coincide with the lunar cycle. However, Rav Saadia Gaon[115] believed the fixed calendar was given to Israel at Sinai by God, and that witnessing the moon only became a practice in the Second Temple Period.[116]

The great *halakhic* question off-planet is what role the Earth's moon plays in determining the cycle. Because the calendar is fixed, and the witnessing of the of moon is no longer necessary, the answer is none. The Earth's moon should not play a role in determining the Hebrew Calendar. This is obvious if one is on a lunar base, but even on the Moon there are stars and the Earth in the sky. In fact, Mars has two moons in the sky. So here is the larger question that should, at least be considered. Should Jewish time be adjusted on different celestial bodies based on what is observed in the sky?

The Martian moons, Phobos and Deimos, have been part of popular culture as far back as the Mars series of novels by Edgar Rice Burroughs.[117] They will be a significant presence for all future travelers to Mars. Are ExoJews to ignore them entirely for Luna? Our moon is such a presence on Earth, we Jews have a blessing to recite while reaching for it. *Birkat Ha-Levana*, the Blessing for the Moon, reads, "Blessed are you, Lord our God, King of the Universe . . . who

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[114] Isidore Singer, *The Jewish Encyclopedia, Vol. 3: A Descriptive Record of the History, Religion, Literature, and Customs of the Jewish People from the Earliest Times to the Present Day; Bencemero Chazanuth (Classic Reprint)* (Fb &C Limited, 2016), 500.; cf. Maimonides, *Sefer HaMitzvot*, gloss to *Mitzvat Asei* 153.
[115] B. in Fayyûm (upper Egypt) 882 – d. in Baghdad in 942, cf. Sarah Pessin, "Saadya [Saadiah]," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, Fall 2008 (Metaphysics Research Lab, Stanford University, 2008), https://plato.stanford.edu/archives/fall2008/entries/saadya/.
[116] *Otzar HaGeonim* Rosh Hashanah 20a:40, *B'shem Sefer Yesod Olam*
[117] Edgar Rice Burroughs, *A Princess of Mars* (Grosset & Dunlap, 1917), 49.

told the Moon that it should renew itself as a crown of glory for [Israel] who are carried in the womb [from Isaiah 46:3] and are destined to renew themselves like [the Moon] and honor their Creator for His glorious kingdom."[118] It is shortly said after the new moon, so it is really the first time each month one sees the crescent of the moon. Reaching for the moon, as I stated earlier, represents our yearning to touch the moon, since it is our closest reminder that God controls the heavens.[119] The proper *halakhah* is to begin the blessing standing while looking at the moon because we act as though we are welcoming the *Shechinah* herself.[120]

Additionally, the people of Israel tie our physical and spiritual life to the lunar cycle itself. The Talmud implies that the Moon is a representation of the People of Israel. As the Moon is smaller, but necessary, so are the People of Israel.[121] Some say even the waxing and waning of the Moon correlates to the waxing and waning of the Jewish people in history.[122]

As David Lister, author of *Intergalactic Judaism*, explains, the cycle of the Moon explains the underlying spiritual process of the High Holy Day season. He says that Rosh Hashanah, the Jewish New Year, falls on a new moon, which represents Israel's chance for renewal, or a fresh start. Yom Kippur, the Day of Atonement, is on the tenth day of the month when the Moon is almost full, working us up to soon observing the glory of God. On Sukkot, which falls on the fifteenth of the month, the Moon is at its fullest. Likewise, God's Divinity is at its fullest at that moment, as is our joy. At the end of Sukkot, on Shemini Atzeret, the moon

[118] Simcha H. BenYosef, "Blessing the New Moon," accessed November 29, 2017, http://www.chabad.org/kabbalah/article_cdo/aid/1794230/jewish/Blessing-the-New-Moon.htm.
[119] Mishnah Berura 462:2.
[120] B. T. Sanhedrin 42a, Shulchan Aruch, Orach Chayim 426:1.
[121] B. T. Chullin 60b
[122] Cf. Philip Ginsbury and Raphael Cutler, *The Phases of Jewish History* (Devora Publishing, 2005).

continues its cycle as it wanes and we "bid farewell to this special time."[123] By the following full moon, the month of Cheshvan, the season is over.

The full moon is essential for many Jewish festivals, which makes sense because in ancient times, devoid of electricity, the full moon provided the most evening light with which to celebrate. For instance, Tu Bishevat, the New Year of the trees, falls on the fifteenth of the month, as do Pesach[124] and Tu b'Av. The rabbinic festival of Purim falls on the fourteenth of the month. Chanukah, meanwhile, a rabbinic Jewish holiday partially meant as a way to bring light into the dark days of the Winter Solstice[125], falls at the time of the new moon, when the world is at its darkest.

Luna's cycle plays such a huge part in our calendar, how can we have a similar spiritual experience without it? In the Book of Psalms, we read, "God made the moon to mark the seasons…"[126] Not only does the Moon help us determine our months, it determines our seasons. The sun is responsible for our time day-to-day, but to mark the changing of the seasons throughout the year, the Jewish people need the Moon. About the above quote from the Book of Psalms, *Midrash Rabbah* reads, "R. Yoḥanan commented: The orb of the sun alone was created to give light. If so, why was the moon created? 'For seasons': in order to sanctify new moons and years thereby."[127]

Judaism is inextricably connected with the moon and its cycles. Can Judaism exist on another planet with a different calendar? If humans go to Mars, for instance, and establish a calendar that is slightly different than the Terran calendar, do Martian Jews follow the Terran

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[123] David Lister, *Intergalactic Judaism: An Analysis of Torah Concepts Based on Discoveries in Space Exploration, Physics and Biology* (Urim Publications, 2011), 51.
[124] *Pesach Sheni* begins on the fourteenth of the month of Iyyar.
[125] B.T. Avodah Zara 8a; Flavius Josephus, *Jewish Antiquities* (Wordsworth Editions, 2006). 12:7.6-7
[126] Ps. 104:19
[127] Breishit Rabbah 6:1

calendar or the Martian calendar? The Hebrew Calendar is adjusted so as to match up with the Terran solar calendar. The Hebrew Calendar on Mars, which has its own seasons and lunar cycles, would never match up with the year. I say this on two levels because the Hebrew Calendar would conflict with the orbital cycles of Phobos and Deimos, Mars’ diurnal cycle, and Mar’s annual cycle. The Hebrew Calendar would also conflict with whichever calendar is established by hypothetical Martian authorities if it differs from the Terran calendar.

For instance, let us imagine a Jewish child is born on Earth then is brought to Mars. Must that child’s family always live by and be aware of the Terran calendar so as to know when the child becomes a Bar or Bat Mitzvah? Similarly, let us imagine a Jewish Martian settler who wishes to observe the *yahrzeit* of their loved one who died on Earth. How can they determine when to observe the *yahrzeit* on Mars unless they are always tied to Terran time? I believe it would be impossible for the Jewish people to thrive off-planet if they must always be tied to the Terran lunar cycle.

The Talmud gives Jews the leeway to change our calendar yet remain within Jewish time. In tractate *Arachin*, we read:

"הריני נזיר כימות החמה מונה נזירות ג' מאות וששים וחמשה ימים כמנין ימות החמה כימות הלבנה מונה נזירות ג' מאות וחמשים וארבעה ימים כמנין ימות הלבנה."

“[If one said,] I shall be a Nazirite according to the number of the days of the solar year, then he must count for his Naziriteship three hundred and sixty-five days according to the years of the sun; [if he said,] According to the days of the lunar year, he must count for his Naziriteship three hundred and fifty-four days according to the days of the lunar year.”[128]

Here, it is important to note that Jewish time, at least for Nazaritic vows, can run on different calendars, even different yearly calendars based on one’s intention. If one made a vow

[128] B.T. Arachin 9b

according to the solar calendar, their vow must be sustained for that length of time; however, if one made the vow according to the lunar calendar, it must be sustained for the length of the lunar calendar. Both the solar and lunar calendars were necessary, then, for Jewish ritual. If a new calendar exists for Lunar or Martian Jews, or even new hours and minutes, their intent or their vow to follow Jewish time should be adjusted according to the structure of the new calendar which may be based on the dynamics of the celestial body. If, for instance, the day consists of 24 hours and 39 minutes, and if the colony incorporates those extra minutes into the day, the Hebrew Calendar should adjust to the schedule and calendar. It happened in Jewish history on Earth because it was necessary. I believe it should happen again when we live off-planet.

There is precedent for humanity's authority over the calendar. In 2 Kings, Jeroboam declared new festive times. We read, "And Jeroboam ordained a feast in the eighth month, on the fifteenth day of the month, like unto the feast that is in Judah."[129] On these appointed festivals, *Midrash Rabbah* declares, "Our festive seasons, however, will never be abolished, neither will the New Moons. Why? Because they belong to the Holy One, Blessed be He; as it says, 'These are the appointed seasons…etc.' (Lev. 23:4), and similarly, 'These are My appointed seasons…etc.' (Ibid. 2)"[130] Another midrash reads, "When the ministering angels assemble before God and ask, 'When is the New Year and when is the Day of Atonement?'[131] God says to the: 'Why do you ask Me? You and I, let us all go to the Court on Earth [and inquire of them].'"[132] This midrash goes even further, perhaps, describing God's full abdication of authority over the calendar.

[129] 2 Kings 12:32
[130] *Bemidbar Rabbah* 21:25 in Harry Freedman and Maurice Simon, *The Midrash Rabbah*, vol. VI (Soncino Press, 1977), 852.
[131] Cf. *Shemot Rabbah* 25:2
[132] *Devarim Rabbah* 2:14

The phrase, "you shall proclaim," is the most significant piece of Leviticus 23:2. God transfers authority to humanity in this passage to set the times of the festivals. This human authority is for festivals, though not for Shabbat, which I shall discuss in greater detail later. Only God may determine when Shabbat is, but a *beit din* may determine dates for festivals. Maimonides lays out the *halakhah* in his *Mishneh Torah*:

"רָאוּהוּ בֵּית דִּין עַצְמָן בְּ ֹוף ֹום תִּשְׁעָה וְעֶשְׂרִים. אִם עָדַיִן לֹא יָצָ כּוֹכַב לֵיל שְׁלֹשִׁים. בֵּית דִּי אוֹמְרִים מְקֻדָּשׁ שֶׁעָדַיִן ֹו הוּא. וְאִם רָאוּהוּ בְּלֵיל שְׁלֹשִׁים אַחַר שֶׁיָּצָ ·ו שְׁנֵ כּוֹכָבִים. לְמָחָר ֹושִׁיבִּין שְׁנֵי דַּיָּנִין אֵצֶל אֶחָד מֵהֶם וְיָעִ דּוּ הַשְּׁנַיִם בִּפְנֵי הַשְּׁלִשָּׁה וִיקַדְּשׁוּהוּ הַשְּׁלִשָּׁה. בֵּית דִּין שֶׁקִּדֵּשׁ בְּי ·ו אֶת הַחֹדֶשׁ שׁוֹגְגִין בֵּין מֵטְעִין בֵּין אֲ·וסִים הֲרֵי זֶה מְקֻדָּשׁ וְחַיָּבִין הַכֹּל לְתַקֵּן ה ֹוֹת עַל הַיּוֹם שֶׁקִּדְּ ·ו ֹו. אַף עַל פִּי שֶׁזֶּה ֹודַעַ שֶׁטָּ ·ו חַיָּב לִסְמֹךְ עֲלֵיהֶם שֶׁאֵין הַדָּבָר מָ ·ור אֶלָּא לָהֶם וּמִי שֶׁצִּוָּה לִשְׁמֹר ה ֹועֲדוֹת הוּא צִוָּה לִסְמֹךְ עֲלֵיהֶם שֶׁנֶּאֱמַר אֲשֶׁר תִּקְרְ ·ו אֹתָם ן ֹו'."

"A court which sanctifies the month, whether by accident, whether they were mistaken, whether they were forced, *it is sanctified, and everyone is obligated to fix the festivals on the day they sanctified.* Even though one knows that they made a mistake, he is obligated to rely on them for the matter is only given over to them and the one who commanded to keep the festivals is the one who commanded to rely on them as it is said (Leviticus 23:2) 'that you call them…' *If the court sanctified the new moon erroneously, incorrectly or forcibly, the sanctification remains valid and everyone must fix the dates of the festivals in accordance with the day in which the members of the court sanctified the new moon.* Even if someone knows that they have made a mistake, he must rely on their decision, because the authority in this matter rests only with them. He who has commanded us to observe the festivals has also commanded us to depend on them, as it is written: 'The festivals … which you shall proclaim' (Leviticus 23:2)." (Emphasis mine)[133]

This *halakhah* is as significant as the moment in the Talmud when we read Torah is in the hands of the rabbis on Earth, rather than in God's.[134] Essentially a *beit din* has full authority to determine dates for festivals on the calendar, whether they change something intentionally or not. Maimonides assumes a change would only happen accidentally, but if there were a necessity

[133] *M. T. Hilchot Kiddush HaChodesh* 2:9-10 based on B. T. Rosh Hashana 25a
[134] cf. *B. T. Baba Metziah* 59b

to change the calendar, there is clear *halakhah* permitting it. An earlier text, in the Jerusalem Talmud, demonstrates the same point. It reads:

> "The Beit Din said: 'Today is Rosh Hashanah.' The Holy One, Blessed be He, says to His ministering angels... 'My children have said, today is Rosh Hashanah.' [But] if the Beit Din changed to make the month full [so that Rosh Hashanah will fall the next day], the Holy One, Blessed be He says to the ministering angels... 'My children have decided to make the month full…This situation can be compared to a king who had a time-piece. When his son grew up, he gave it into his keeping.'"[135]

As in other instances, here God relinquishes control over the calendar to the people to decide for themselves. In this case, God is compared to one who gives a precious time-piece, i.e., the calendar, over to their child when they are of age.

However, the Fifteenth Century rabbi Isaac ben Moses Arama[136] responds to Maimonides and the rabbis that God is still in control when allowing humanity to make decision vis-à-vis the calendar:

> "*God agrees with the decisions made by Israel,* in contrast to earthly rulers. When an earthly ruler promulgates a law, his parliament cannot revoke it, but the king himself is at liberty to cancel his decree. Not so with God. *He accommodates Himself to the laws enacted by the Sanhedrin.* For instance, if the Sanhedrin decides to proclaim New Year's day on a certain day, God assembles His Court to arrange to sit in judgment of mankind on that day. 'God arose when there is blowing of the *teruah*,'. (Psalms 47,6) The Torah says, 'it will be a day of *teruah* for Me.' (Numbers 29,1) It also says 'These are the appointed times for God, which you will proclaim.' (Leviticus 23,2) This means that Israel is the final arbiter concerning the dates of these holydays. 'These,' implies that 'I, God, have no other holydays but these.'"[137] (Emphasis mine).

First R. Yitzchak reiterates the midrash which states that God consults humanity to determine God's appointed times. Here, R. Yitzchak describes that God's decrees bend to the majority. R.

[135] Y.T. Rosh Hashana 1:28, 1:32
[136] b. Spain c. 1420-1494
[137] *Akeydat Yitzchak* 67:2:4 in Yitzchak Arama, *Akeydat Yitzchak: Commentary of Rabbi Yitzchak Arama on the Torah*, trans. Eliyahu Munk (Jerusalem: Lambda Pub Inc, 2001).

Yitzchak is sure to point out that God "accommodates" humanity by stepping back and giving the authority to human courts. This may be to ensure this concept is not to be interpreted as the limit of God's power and authority. Surely, it is not that God *cannot* prevent humanity from changing decrees, but that God *does not* prevent human courts from changing dates and times. Then, R. Yitzchak challenges the implications of this midrash. He writes:

> "*Both solar and lunar orbits determine anniversaries, i.e. new years, new moons etc. as is well known from antiquity; it therefore seems quite irrelevant whether or not the Sanhedrin gives its sanction to the dates on which these anniversaries occur.* The [Babylonian] Talmud Rosh Hashanah 25, interpreting the word *otam*, them as *attem*, you, as the basis for the authority of the Sanhedrin to make such *halakhic* rulings, is even stranger. Moreover, the Talmud broadens the authority of the Sanhedrin to include both willful and erroneous decisions to change the apparent calendar dates for either the holydays or new moons. Surely, God does not have to adjust His conduct to human error, and even less so to human caprice! Furthermore, what can be the meaning of God saying, 'I have no holydays but these?' Is time in Heaven measured then in a similar manner to the way we measure time on Earth?"[138] (Emphasis mine).

R. Yitzchak asks how *beit din* can be allowed to determine *halakhic* time when the time is based on natural phenomena set into motion by God? Certainly, God does not need to adjust these appointed times due to our own reasons. If the Day of Atonement is a Divinely decreed festival, it is written on the fabric of the universe; it is no concern of God's whether we know the correct date or not.

[138] Ibid.

Conclusion:

There are a few key issues to consider in determining how to address the calendrical challenges. Firstly, diurnal cycles on other celestial bodies will not match up with Earth's. Again, let us take Mars as an example: If a colony on Mars bases its time on Martian days, called "sols"[139], it will no longer synchronize with Terran time. Martian dates will cease to match Terran dates. The Hebrew calendar, though, is adjusted to match up with the solar calendar *on Earth.* It will most certainly not match up with the Martian calendar, so it will be necessary to adjust the Hebrew Calendar to, at least, keep festivals in their seasons.

Secondly, however, the seasons will not match up with Terran seasons. Jewish festivals are connected to the Land of Israel and are meant to be held when a particular season occurs in the Land of Israel. For instance, Pesach is a spring holiday in Israel, but a winter holiday in the southern hemisphere. It would seem a solution for the Hebrew Calendar off-planet would be to stick to the seasons as they occur in the Land of Israel. This would, however, mean ExoJews will be forever tied to the Terran calendar. Again, if any changes are made to secular calendars off-planet, it would mean ExoJews' time will no longer synchronize with their non-Jewish neighbors.

Thirdly, if it takes a *beit din* to determine the calendar, it would mean a new ruling would occur on each celestial body. Taking the earlier example of an asteroid mining colony, a *beit din* would need to be assembled on or for each new asteroid to determine the calendar. Alternatively, I would propose a system to allow for the Hebrew Calendar to be adjusted by any ExoJew on any celestial body.

[139] "NASA GISS: Mars24 Sunclock — Technical Notes on Mars Solar Time," accessed November 30, 2017, https://www.giss.nasa.gov/tools/mars24/help/notes.html.

Finally, there is the question of whether the Hebrew Calendar should be influenced by the natural phenomena on any given celestial body. If the Hebrew Calendar on Earth is based on the natural Terran phenomena, it would make sense to do the same on other celestial bodies. God appointed humanity to set the dates for the appointed times on Earth. God’s time is different from Terran time, as R. Yitzchak points out. Would, then, God expect Martian Jews to appoint the festivals according to Terran time? Or, rather, would and should Martian Jews appoint God’s festivals according to Martian time?

2.2: Can Halakhah Exist Off-Planet?

There is a fundamental question that needs to be addressed to decide how to live *halakhically* off-planet. Can *halakhah* even exist off-planet? Many Torah laws and rabbinic decrees are based on what one witnesses in the heavens. Exploring further, many *halakhot* are based on one's existence on Earth. For example, *halakhah* addresses one's relationship to the land on Earth, specifically in the Land of Israel, as we shall see later. Time-bound *halakhot* are intimately tied to the Terran diurnal cycle, as shall be detailed in the next section. Even the most basic interactions with the natural world assume one is interacting with the natural Terran world.

If one is settled on another celestial body, can one live within *halakhic* time or space at all? Or will Exo-Judaism be inevitably non-*halakhic*? As I have stated before, all streams of Judaism rely on *halakhah*. Reform Jews, though many would say are not bound by *halakhah*, incorporate it into the very core of their Jewish practice. Thus, Judaism may fall by the wayside as humanity settles the stars unless *halakhah* can be directly applied.

Furthermore, I fear if *halakhah* can only apply on Earth, many Jews will discourage interplanetary travel. If this happens, a great piece of human history and future will be without Jews and Judaism.

On the one hand, there are indications in traditional Jewish literature that would seem to allow for the sort of adjustment I am speaking of here. In his *Sefer HaIkkarim,* Rabbi Joseph Albo[140] writes, "Therefore Moses was given orally certain general principles, only briefly alluded to in the Torah, by means of which the wise men in every generation may work out the

[140] (c. 1380–1444) Dror Ehrlich, "Joseph Albo," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, Winter 2016 (Metaphysics Research Lab, Stanford University, 2016), https://plato.stanford.edu/archives/win2016/entries/albo-joseph/.

details as they appear."[141] In other words, there are factors in each generation that were unknown to previous generations when they applied Torah. As for off-planet *halakhah*, there was no way for previous rabbis to have known of the technological advances that brought us to this point. It would only be natural to evolve *halakhah* to apply to space travel. In Ramban's commentary on Deuteronomy, he reminds us that we must do what is right even if God did not explicitly state it in the Torah. He writes:

"גם באשר לא צוך תן דעתך לעשות הטוב והישר בעיניו כי הוא אוהב הטוב והישר וזה ענין גדול לפי שאי אפשר להזכיר בתורה כל הנהגות האדם עם שכניו ורעיו וכל משאו ומתנו ותקוני הישוב והמדינות כלם אבל אחרי שהזכיר מהם הרבה כגון לא תלך רכיל)ויקרא יט טז(לא תקום ולא תטור)שם פסוק יח(ולא תעמוד על דם רעך)שם פסוק טז(לא תקלל חרש)שם פסוק יד(מפני שיבה תקום)שם פסוק לב(."

"…Even regarding what God did not command, pay attention to do what is good and right in God's eyes, because God loves goodness and righteousness. And it is important because it is impossible to mention in the Torah (what should be) everyone's conduct; with their neighbors and friends, in any business matter, and regarding ordinances of any town or country, because the Torah already mentions many of these laws, such as: 'Do not gossip' (Leviticus 19:16); 'You shall not take vengeance or bear a grudge' (Leviticus 19:18); 'You shall not stand idly by the blood of your neighbor' (Leviticus 19:16); 'You shall not insult the deaf' (Leviticus 19:14); 'You shall rise before the aged' (Leviticus 19:32), etc."[142]

Yet it would appear as if there is a consensus in rabbinic literature that the Earth is necessary to observe *halakhah*. Maimonides writes how necessary God's Divine plan is for creating our calendar, but that humans have the power to affect change:

"כָּל מַה שֶּׁאָמַרְ·ו מִקֹּב עוֹת רֹאשׁ חֹדֶשׁ עַל הָרְאִיָה וְע ·ור הַשָּׁנָה מִפְּנֵי הַזְּמַ ֹאוֹ מִפְּנֵי הַצֹּרֶךְ. אֵי ֹין ֹושי ֹאוֹתוֹ אֶלָּא סַנְהֶדְרִין שֶׁבְּאֶרֶץ יִשְׂרָאֵ ֹאוֹ בֵּית דִּין הַסְּ ·וכִים בְּאֶרֶץ יִשְׂרָאֵל שֶׁנִּתְ·ו לָהֶן הַסַּנְהֶדְרִין רְשׁוּת. שֶׁכָּךְ נֶאֱמַר לְמֹשֶׁ ·ולְאַהֲרֹן)שמות יב ב("הַחֹדֶשׁ הַזֶּה לָכֶם רֹאשׁ חֳדָשִׁים" ומִפִּי הַשְּׁ ·ועָה לָמְ·ו איש מֵאִישׁ ממשֶׁה רַבֵּ·ו שֶׁכָּ ֹהוא פִּ ·וש הַדָּבָר עֵ·ות ֹ תִּהְיֶה מְ·ורָה לָכֶ ·ולְכָל הָ ֹומֵד אַחֲרֵיכֶם בִּמְ ֹומָכֶם. אֲבָל בִּזְמַן שֶׁאֵין שָׁם סַנְהֶדְרִין בָּאָרֶץ יִשְׂרָאֵל אֵי ֹין ֹובְעִין חֳדָשִׁים וְאֵין מְעַבְּרִין שָׁנִים אֶלָּא בְּחֶשְׁ ֹון זֶה שֶׁאָ·ו מְחַשְּׁבִין בּוֹ הַיּוֹם:

[141] *Sefer HaIkkarim, Ma'amar* 3:23:3
[142] Ramban on Deut. 6:18

וְדָבָר זֶה הֲלָכָה לְמֹשֶׁה מסיני הוּא. שֶׁבִּזְמַן שֶׁיֵּשׁ סַנְהֶדְרִין וּבָעִין עַל פִּי הָרְאִיָּה·ובִזְמַן שֶׁאֵין שָׁם סַנְהֶדְרִין וּבָעִין עַל פִּי הַחֶשְׁוֹן הַזֶּה שֶׁאָנוּ מְחַשְּׁבִין וְהַיּוֹם וְאֵין נִזְקָקִין לִרְאִיָּה. אֶלָּא פְּעָמִים שֶׁיִּהְיֶה יוֹם שֶׁקּוֹבְעִין בּוֹ בְּחֶשְׁבּוֹן זֶה הוּא יוֹם הָרְאִיָּה אוֹ קוֹדֵם לוֹ בְּיוֹם אוֹ אַחֲרָיו בְּיוֹם. וְזֶה שֶׁיִּהְיֶה אַחַר הָרְאִיָּה בְּיוֹם פֶּלֶא הוּא וּבַאֲרָצוֹת שֶׁהֵן לְמַעֲרַב אֶרֶץ יִשְׂרָאֵל:"

"All that we have said concerning the fixation of Rosh Hodesh on the basis of observing the new moon, and concerning intercalation of the year because of the season or because of some other necessity, is applicable only to the Sanhedrin in Eretz Yisrael or to the members of the court who were ordained in Eretz Yisrael, to whom the Sanhedrin gave permission to act. Moses and Aaron were told: 'This month shall be to you the beginning of months' (Exodus 12:2), and the sages have derived from an oral tradition going back to our teacher Moses that the meaning of this verse is: This evidence shall rest with you and your successors. *When, however, no Sanhedrin exists in Eretz Yisrael, the new-moon days and the leap years are determined only by such methods of calculation as we are employing today.*

And this matter is a law of Moses from Sinai. *That at a time that there is a Sanhedrin, we fix by the sighting, and when the Sanhedrin doesn't exist, we fix by this calculation that we calculate today and we don't relate to the sighting.* Rather, sometimes the day we fix with this calculation will be the day of sighting, or a day before, or a day after. And that it will be after the sighting by a day is a wonder (i.e. very rare), and [this is so] in lands that are to the west of the land of Israel." (Emphasis mine)[143]

Maimonides appears to suggest here the calendar can be readjusted according to the needs of the people and the generation. However, it is important to note that when a *Sanhedrin* is not present, the calendar is to be determined by fixed calculations. On the unbreakable link between the calendar and *halakhah,* Rabbi Moshe Meiselman, an Orthodox rabbi and Dean of *Yeshiva Toras Moshe* in Jerusalem[144] writes, "Note that according to the Rambam the calculations upon which the calendar is based were not derived from the astronomical and mathematical knowledge of any ancient people. They were all part of the *halachah leMoshe miSinai*. The

[143] M. T. Hilchot Kiddush HaChodesh 5:1-2

[144] "About Yeshivas Toras Moshe," accessed December 6, 2017, https://torasmoshe.adjournal.com/about.aspx; Unknown, "Rav Meiselman: Yo'atzot to Poskot, Maharat and Rabbah Is a 'Natural Progression' | Matzav.Com," accessed December 6, 2017, http://matzav.com/rav-meiselman-yoatzot-to-poskot-maharat-and-rabbah-is-a-natural-progression/.

precise astronomical information necessary for the application of the *halakhah* was contained with the Torah itself, so that no additional input from external sources was required."[145] In other words, God gave the fixed calendar that is necessary to follow *halakhah* to Moses at Sinai. Only the Sages in the Sanhedrin were worthy enough to understand the message from God. Thus, only by following the fixed times given to us throughout the generations can we follow *halakhah.* Furthermore, each date was give to Moses at Sinai for the sake of following *halakhah*.[146]

The dates that were Divinely given to humanity to follow *halakhah* depend entirely on a geocentric existence. Unless God is revealed to a new prophet on another celestial body, providing a new set of dates and calendar, how can *halakhah* be observed? I ask this because one could argue God revealed the dates of the Hebrew Calendar to humanity as it existed on Earth at the time of the revelation. If that were so, how could a *beit din* establish new dates for the Hebrew Calendar precisely enough for *halakhic* purpose? A new Sanhedrin would need to be established.

Consider the recitation of *ten tal u'matar*, "[O, God,] send the dew and rain." The *Shulchan Arukh*[147] instructs that the prayer be recited sixty days after the autumn equinox in the Diaspora, while those living in the Land of Israel recite *"ten tal u'matar"* beginning of 7 *Chashvan*. Not only is this *halakhah* tied to the seasonal climate in the Land of Israel, it is entirely tied to the Earth itself. Wherever a Jew lives on Earth, they must beckon for proper rains in the Land of Israel. This begs the question of whether this *halakhah* can be done at all off-planet. The rabbis were as accommodating as possible for those who could not live in the Land of Israel, but they

[145] Rabbi Moshe Meiselman, *Torah, Chazal & Science* (Israel Bookshop Publications, 2013), 65.
[146]Rabbeinu Bachye (*Shemos* 12:2) quotes Rabbeinu Chananel (990-1053) "Rav Hai Gaon (939-1038) also espoused this view. For a full discussion on the matter see Chaim Yechiel Bornstein, *Machlokes Rav Saadiah Gaon uBen Meir* (1904), pp. 140-158." From Meiselman, *Torah, Chazal & Science*. Note 177.
[147] *Shulchan Arukh, Orach Chaim* 117:1

had always assumed Jews would reside in the Land of Israel and Earth obviously. Yet the *halakhah* has always been adjusted throughout our history to accommodate diasporic communities.

On Earth, time is certain, to an extent: the sun rises in the East and sets in the West; the day lasts approximately twenty-four hours; the moon will determine the length of a month; seasons occur. Off-planet, though, that certainty flies out the door. In Jewish sacred literature, many examples demonstrate that the rabbis despised uncertainty because certainty is required for *halakhah*. For example, in the Talmud we read:

"ת"ר ביה"ש ספק מן היום ומן הלילה ספק כולו מן היום ספק כולו מן הלילה מטילין אותו לחומר שני ימים."

"The Sages taught a *baraita* which discusses the range of problems that arise with regard to the twilight period. Twilight is a period of uncertainty. It is uncertain whether it consists of both day and night, it is uncertain whether it is completely day, and it is uncertain whether it is completely night. Therefore, the Sages impose the stringencies of both days upon it."[148]

Here, the rabbis describe someone who lives in a state of liminality, i.e., twilight. It is neither day nor night but between. One living off-planet would essentially live in a perpetual state of uncertainty. It would be nearly impossible to judge whether it is day or night on any spot on Earth. Even with a clock, it will most likely be difficult to synchronize up the times off-planet with Terran times. Andrzej Stewart[149,] an astronaut and crewmember of HI-SEAS IV, a year-long simulation of a mission to Mars, wrote in a blogpost that time on future colonies off-planet will almost certainly fail to synchronize with Terran clocks.[150] Furthermore, an ExoJew may find themselves on a celestial body without a constant diurnal cycle, such as an asteroid. Additionally, ExoJews living in a colony may or may not have visual access to the sun, rendering

[148] B. T. Shabbat 34b
[149] "About," *Surfing with the Aliens* (blog), August 3, 2015, https://hiseasandrzej.wordpress.com/about/.
[150] Andrzej Stewart, "Clocks, Calendars, and Colonies," *Surfing with the Aliens* (blog), October 21, 2015, https://hiseasandrzej.wordpress.com/2015/10/21/clocks-calendars-and-colonies/.

it impossible to determine whether sundown has occurred. Thus, ExoJews would theoretically live in a constant state of liminality. This Talmudic passage potentially dooms future Jews to higher stringency so as not to desecrate Shabbat or a festival. We will discuss this topic further in the next section.

Another major issue in following *halakhah* off-planet is that there are so many *halakhot* and *mizvot* which are tied to the Land of Israel.[151] These *mizvot* are mainly agricultural in nature and involve one's obligation toward the Temple in Jerusalem, as well. The rabbis ask the question in the Talmud as to which *mizvot* are dependent on the Land of Israel itself. We read:

"מתני׳ כל מצוה שהיא תלויה בארץ אינה נוהגת אלא בארץ ושאינה תלויה בארץ נוהגת בין בארץ בין בחוצה לארץ חוץ מן הערלה וכלאים ר"א אומר אף החדש.

גמ׳ מאי תלויה ומאי שאינה תלויה אילימא תלויה דכתיב בה ביאה ושאינה תלויה דלא כתיב בה ביאה והרי תפילין ופטר חמור דכתיב בהן ביאה ונוהגין בין בארץ בין בח"ל אמר רב יהודה ה"ק כל מצוה שהיא חובת הגוף נוהגת בין בארץ בין בח"ל חובת קרקע אינה נוהגת אלא בארץ."

"Mishnah: Every mitzvah that is dependent on the Land [of Israel] is only observed in the Land [of Israel], and any mitzvah that is not dependent on the the Land [of Israel] is observed both inside of the Land [of Israel] and outside of the Land [of Israel], except for *orlah* and *kilayim*. Rabbi Eliezer says: Even [the prohibition] of *hadash*.

Gemara: What is the meaning of "dependent" [on the Land of Israel] and "not dependent" [on the Land of Israel]? If we say: "dependent" refers to those [commandments] where "coming [into the Land]" is written, and "not dependent" refers to those where "coming [into the Land]" is not written, but, look, [the commandments of] tefillin and the [redemption of] the firstborn of a donkey – about which "coming" is written – they are observed both inside and outside of the Land! Rav Yehudah said: This is its meaning: every commandment that is a

[151] The following is a list of some of the Mitzvot ha-Teluyot ba'Aretz: 1. Leket: gleanings (Lev. 19:9-10; 23:22; Deut. 24:19-22) 2. Shikhehah: forgotten sheaf (Lev. 19:9-10; 23:22; Deut. 24:19-22) 3. Peah: corner of the field (Lev. 19:9-10; 23:22; Deut. 24:19-22) 4. Shevi'it: Sabbatical year (Exodus 23:10-11; Lev. 25:1-7; Deut. 15:1-3) 5. Ma'aser Ani: poor person's tithe (Deut. 26:12-15) 6. Bikkurim: first fruits (Exodus 23:19; 34:26; Numbers 18:13; Deut. 26:1-11) 7. Hallah: separation of dough (Numbers 15:17-21) 8. Terumah: tithes (Numbers 18:8; 11-12; 25-32; Deut. 18:4) 9. Ma'aser Rishon: the first tithe (Numbers 18:21-32) 10. Terumat Ma'aser: heave-offering of the tithe (Numbers 18:21-32) 11. Ma'aser Sheini: the second tithe (Deut. 14:22-27; 26:12-15; Lev. 27:30-31, 19:23-25) 12. Kilayim: the prohibition of the mixing of species (Lev. 19:19; Deut. 22:9-11) 13. Orlah: fruit of young trees (Lev. 19:23) 14. Hadash: the prohibition of new grain (Lev. 23:9-14)

personal obligation is observed both inside and outside of the Land, but something that is an obligation of the soil is only observed inside the Land."[152]

This passage describes that various obligations are, indeed, required both within and beyond the Land of Israel, but many *mizvot* are entirely dependent on the land itself. No matter where a Jew lives on the Earth, the Land of Israel is the holiest spot. There is no other land on the planet which has *mitzvot* tied directly to it. What is it that makes the land so holy? According to a passage in the Mishnah, the acts tied with the Temple are precisely the reason for the land's holiness. We read:

"עֶשֶׂר קְדֻ ׳ שׁוֹת הֵן, אֶרֶץ יִשְׂרָאֵל מְקֻדֶּשֶׁת מִכָּל הָאֲרָצוֹת. וּמַה הִיא קְדֻשָּׁתָהּ, שֶׁמְּבִיאִים מִמֶּנָּה הָעֹמֶר וְהַבִּ ׳ כּוּרִי ׳ וּשְׁתֵּי הַלֶּחֶם, מַה שֶּׁאֵין מְבִיאִים כֵּן מִכָּל הָאֲרָ ׳ צוֹת:"

"There are ten different levels of holiness. The Land of Israel is holier than all of the other lands. And what is [the essence] of its holiness? It is that from it they bring the *omer*, the first fruits, and the two loaves [that are in the Temple], and these are not brought from any other land."[153]

Here, the rabbis stress again the Land of Israel is the holiest land to the Jews, but it is only because the there are festivals which are dependent on the land itself. Gathering and bringing the first wheat harvest (the *omer*), the first fruit, and the loaves of bread in the Temple. These, among other examples, are actions and objects which cannot be done in nor come from any other land.

Another example of a ritual object dependent on the land, especially on the Land of Israel, is the *etrog* for the festival of *Sukkot*. Though the *halakhah* does not insist the *etrog* must come

[152] B.T. Kiddushin 36b-37a
[153] M. Kelim 1:6

from the Land of Israel, the *etrog* is very tied to the land itself and to the Land of Israel. For example, *halakhah* dictates that enough be taken off the *etrog* for tithes to the Temple or else it is unusable for the festival of *Sukkot*.[154] However, a special blessing must simply be made for any produce that is untithed.[155] Furthermore, concerning an *etrog,* the rabbis denote it can be grown anywhere, but the Jews of the land may only an *etrog* from their land. For example, though an Ethiopian *etrog* does not resemble one grown in the Land of Israel it is still permissible, but only for those Ethiopian Jews. Jews in Babylon were not allowed to use Ethiopian *etrogim* because it was closer to the Land of Israel, so it could only use locally grown *etrogim* or those grown in Israel.[156]All this means a colony of Jews on the Moon or on Mars will find there are many *halakhot* they simply cannot follow. Neither *halakhot* tied to Israel nor those tied to land itself can be followed.

Maimonides proposes why it would be important and meaningful for Jews to keep laws in mind which are connected to the Land of Israel, even when living in the Diaspora. He writes:

> "The reciting of a certain portion of the Law when the *bikkurim*/first fruits are brought to the Temple, tends also to create humility. For he who brings the first fruits takes the basket upon his shoulders and proclaims the kindness and goodness of God. *This ceremony teaches man that it is essential in the service of God to remember the times of trouble and the history of past distress, in days of comfort.* The Law lays stress on this duty in several places; comp. "And you shall remember that you have been a slave" (Deut. 5:15). *For it is to be feared that*

[154] Rambam (Hilchot Sukkat 8:9), Kolbo (Siman 72), Eliyah Rabba 649:4, Pri Megadim A"A 649:20, Bikkurei Yacov 649:29, S"A HaRav 649:15, Mishna Brurah 649:45, Natai Gavriel 36:2, Chazon Ovadyah Sukkot (pg 248)

155 "ומעשרות תרומות להפריש וצוונו במצותיו קידשנו אשר העולם מלך אלוקינו ה' אתה ברוך." "Rambam (Hilchot Terumot 1:26) writes that Terumot and Maaserot is only Derabbanan nowadays, while the Raavad (Hilchot Terumot 1:26) argues that the obligation is Deoritta. The Maggid Mishna (Hilchot Terumot 1:26) writes that most Rishonim hold like the Rambam including the Smag (Mitzvah Aseh #133), Sefer HaTerumah (Hilchot Eretz Yisrael pg 80b), Rashba (Yevamot 82b, Shevuot 16b), Ritva (Yevamot 82a), and Sefer HaChinuch (Mitzvah 507). S"A Y"D 331:2 rules like the Rambam. Nonetheless, the Rambam (Hilchot Terumot 2:16) writes that there is an obligation to make a Bracha upon separating untithed produce even nowadays. S"A Y"D 331:78 and Chazon Ovadyah (Tu Beshevat pg 47-49) agree. This is opposition to the opinion of Shulchan Gavoha 331:15 who contends that since the obligation is only Derabbanan one shouldn't make a Bracha nowadays." From "Terumot and Maaserot - Halachipedia," accessed December 19, 2017, http://www.halachipedia.com/index.php?title=Terumot_and_Maaserot.

[156] B. T. Sukkah 36a

> *those who become great in riches and comfort might, as is generally the case, fall into the vices of insolence and haughtiness, and abandon all good principles.* Compare "Lest you eat and be full…and your heart be lifted up and you forget the Lord" (Deut. 8:12-14)... On account of this fear the Law commanded us to read each year a certain portion before the Lord and his glory, when we offer the first fruit. You know how much the Law insists that we shall always remember the plagues that have befallen the Egyptians; compare "That you may remember the day when you left the land of Egypt all the days of your life" (Deut. 16:3); "That you may tell in the ears of your son what things I have wrought in Egypt" (Ex. 10:2). *Such a law was necessary in order to perpetuate the memory of the departure from Egypt; because such events verify prophecy and the doctrine of reward and punishment. The benefit of every commandment that serves to keep certain miracles in remembrance, or to perpetuate true faith, is therefore obvious...* As to the precepts enumerated in the laws concerning the year of release and the jubilee some of them imply *sympathy with our fellow men, and promote the well-being of mankind;* for in reference to these precepts it is stated in the Law, "That the poor of your people may eat" (Ex. 23:11); and besides, the land will also increase its produce and improve when it remains fallow for some time. Other precepts of this class prescribe *kindness to servants and to the poor, by renouncing claims to debts [in the year of release] and relieving the slaves of their bondage [in the seventh year]*."[157] (Emphasis mine)

Maimonides stresses that our rituals and laws, whether we *can* fulfill them, hold special value and insight into a peaceful existence. They may teach us humility, sympathy, or faith. Thus, Maimonides would almost certainly agree ExoJews should find ways to observe *halakhot* that are tied to the Land of Israel or the land on Earth, even if they cannot perform the rituals precisely.

Future ExoJews will have to figure out their allegiance to the Land of Israel. Because they will be settlers, and not travelers, they will most likely never see the Land of Israel. What is to become of their tie to the land? Indeed, this issue has existed for all Jews living in the Diaspora. Only recently have there been more affordable opportunities for Jews to visit the land. Yet

[157] *Moreh Nevuchim*, Book 3:39

ExoJews will be cut off from the Land of Israel and from the land itself. Lunar Jews will not grow produce from the Lunar surface, nor will Martian Jews on the Martian surface.

Rabbi Isidor Grunfeld writes that it does not matter whether Jews live in or own the Land of Israel; it remains sanctified regardless.[158][159] He points out there were two sanctifications of the land itself: The first was when Joshua conquered the land, known as the *Kedushah rishonah*,[160] and the second was when Ezra and the Jews returned to the land after the Babylonian exile, known as the *Kedushah shniyah*.[161] Maimonides maintains the two sanctifications were enough to last forever.[162] Thus, the Land of Israel is forever to remain a sanctified land for Jews wherever they live. After all, it belongs to God in the end, not to humanity, as I detailed earlier.[163]

Our tradition speaks of *halakhot* that must be followed in the Land of Israel, and others followed in the Diaspora. Maimonides defines these terms as the following:

"נִמְצָא כָּל הָ ֹולָם לְעִנְיַן מִצְוֹת הַתְ ּו ֹות בָּאָרֶץ נֶחְלָקֶת לְשָׁלֹשׁ מַחֲ ֹו ֹות .אֶרֶץ יִשְׂרָאֵל .וְ ּו ֹורְיָא .וְ ּו ֹוצָה לָאָרֶץ .וְאֶרֶץ יִשְׂרָאֵל נֶחְלֶקֶת לִשְׁנַיִם .כָּל שֶׁהֶחֱזִי ּו ֹולִי בָּבֶל חֵלֶק אֶחָד .וְכָל שֶׁהֶחֱזִי ּו ֹולִי מִצְרַיִם בִּלְבַד חֵלֶק שֵׁנִי .וְ ּו ֹוצָה לָאָרֶץ נֶחְלֶקֶת לִשְׁנַיִם .אֶרֶץ מִצְרַיִם וְשִׁנְעָר וְעַ ֹון ו ֹואֲב הַמְצָוֹת ֹוהַגּוֹת בָּהֶם מִדִּבְרֵי ֹופְרִים וּנְבִיאִים .וּשְׁאָר הָאֲרָ ֹות אֵין תְ ּו ֹות וּמַעֲשֶׂ ֹות ֹוהֵ ֹות בָּהֶן."

“Hence, the entire world is divisible into three classifications: Eretz Yisrael, Syria, and the Diaspora. Eretz Yisrael, in turn, is divisible into two parts: the one which was occupied by the returned exiles from Babylonia, and the second which was occupied only by those who had come up from Egypt. The Diaspora is divisible into two parts: Egypt, Babylonia, Ammon and

[158] Isidor Grunfeld, *The Jewish Dietary Laws: Dietray Laws Regarding Plants and Vegetables, with Particular Reference to the Produce of the Holy Land* (Soncino Press, 1982), 17.
[159] The *Tur* and the *Shulchan Aruch* (*Yoreh De'ah* 331:3-4) follow the Rambam's ruling here. See also *Hilchot Shemitah VeYovel* 4:29 where this issue is also discussed.
[160] B.T. *Chaggim* 3b; M. T. *Hilchot Terumot* 1:5
[161] Tos. Shevi’it 1:6; Sifrei Deut. 51 to Deut. 11:24
[162] See M. T. *Hilchot Terumot* 1:5
[163] *Gittin* 47a derives this concept from Leviticus 25:23: "The entire land is Mine." Implied is that the land belongs to God and His ownership cannot be absolved through conquest by any earthly power. From Grunfeld, *The Jewish Dietary Laws*, 17.; cf. Rashi on Gen. 1:1

> Moab are lands where the special laws are to be observed by the authority of sages and prophets; while in the other countries the laws of heave-offerings and tithes are not to be observed."[164]

Yet what if you are neither in the Land of Israel nor in the Diaspora? What if you are not even on Earth? Are *mitzvot* and hence *halakhot* obligatory in one is off-planet? In the 5730 issue of the journal, *No'am*, Rabbi Ben-Zion Firrer claims that *mitzvot* can only exist on the earth. His evidence is a discussion in the Talmud on Deuteronomy 12:1 which reads, "These are the decrees and laws you must be careful to follow in the land that the LORD, the God of your ancestors, has given you to possess—as long as you live in the land." The rabbis argue whether one is obligated to do the *mitzvot* both in the land and in the Diaspora.[165] Rabbi Firrer maintains that "עַל־הָאֲדָמָה:" "in the land" or "upon the earth" means one must be on the planet Earth to be obligated by *mitzvot*. Thus, anyone living off-planet are not obligated to observe *mitzvot*.[166] Rabbi Shlomo Goren[167] claimed that *mitzvot* and *halakhot* are dependent on a twenty-four-hour cycle which does not exist off-planet.[168] However, Goren says that humans should be obligated to perform such *mitzvot* off-planet regardless because there are no natural conditions off-planet in which a human could survive. Humans can only survive in artificial atmosphere composed of "elements transported from Earth."[169] Thus, ExoJews are technically still living on Earth since they are still entirely dependent on it. Yet Firrer counters this argument by citing the Talmud which states that, since the bodies of water in the Land of Israel are not part of the land itself, a ship carrying supplies to the Land of Israel is not yet within its borders. The moment the bottom

[164] M. T. *Hilchot Terumot* 1:6
[165] B. T. Kiddushin 37a
[166] Ben-Zion Firrer, *No'am*, no. 5730 (1969).
[167] (b. 1917-1994) from "Goren, Rabbi Shlomo," Orthodox Union, accessed December 21, 2017, http://www.ou.org/judaism-101/bios/leaders-in-the-diaspora/rabbi-shlomo-goren.
[168] Shlomo Goren, *Ha-Zofeh*, July 25, 1969, 10 Av 5729 edition.
[169] J. David Bleich, *Contemporary Halakhic Problems* (KTAV Publishing House, Inc., 1977), 212.

of the ship scrapes the land, it is officially within the borders and the sailors are obligated by *mitzvot* observed in the Land of Israel.[170] Similarly, Firrer argues, any Terran ship that comes in contact with another celestial body would be subject to the rules of that body. Anyone aboard the ship is no longer obligated to observe Terran *halakhah*.[171] In the same issue of *No'am*, Rabbi Menachem Kasher[172] refutes Firrer's argument, maintaining that *halakhic* obligations are personal ones which follow Jews anywhere they live.

Rabbi J. David Bleich[173], author and Rosh Yeshiva at Rabbi Isaac Elchanan Theological Seminary, writes that there is practically a bubble around the Earth of *halakhic* time, which will be discussed at greater length in the next section. His argument is that when a person leaves the Earth, they leave the bubble of time since there is no longer a twenty-four-hour cycle, and that humans are not obligated for time-bound *mizvot* any longer. Once they return, they are obligated once again.[174]

[170] B. T. Gittin 7b
[171] Firrer.
[172] (b. 1895-1983) from "Kasher, Menahem," accessed December 21, 2017, http://www.jewishvirtuallibrary.org/kasher-menahem.
[173] "J-David-Bleich," Cardozo Law, accessed December 21, 2017, https://cardozo.yu.edu/directory/j-david-bleich.
[174] Bleich, *Contemporary Halakhic Problems*, 100.

Conclusion:

As a Jew in the Diaspora, I still yearn for the day that all Jews will live as one in the Land of Israel, or at least in a land we can call our own. Yet ExoJews, especially those born and raised off-planet, will most likely never visit or live in the Land of Israel. Their seasons will not correspond to Israel's, their year will not coincide with Israel's, even their days will fall out-of-sync. Since Lunar, Martian, and other ExoJews will have virtually no tie to Earth, it makes sense they may lose their tie to the Land of Israel. There are no materials that can be shipped from Israel to the Moon or Mars as it would be incredibly cost prohibitive. ExoJews will need to find ways to grow their own ritual produce, such as citron, palm, myrtle, and willow trees.

A great deal of *halakhah* depends on the Land of Israel itself, yet there are separate rules already in place for Jews living in the Diaspora. Still, though, all *halakhah* assumes a twenty-four-hour cycle on the planet Earth. ExoJews will live in an environment that does not require a similar hourly division to that of Terran time. As Firrer argues, there is already precedent to suggest Lunar or Martian Jews should not be obligated to observe Terran *mitzvot* at all. However, Kasher's argument calls to question the very nature of *halakhah*: which *mitzvot* count as personal ones? Should those which count as personal *halakhot* follow Jews wherever they reside, even off-planet?

Two major arguments, presented by Rabbis Firrer and Bleich, support the idea that *halakhah* is Earth-bound. *Halakhah* is something that is done within Earth's time and space, according to our entire tradition. Though one can argue the rabbis never foresaw the possibility of settling off-planet, all *halakhah* assumes one resides on Earth.

I agree with Firrer over Goren that Lunar Jews or Martian Jews are no longer tied to the Earth because Goren's argument is out of date. We now know that future settlers off-planet will need to manufacture much of their own material that never existed on Earth.[175] Thus, one will not be able to argue that a space habitat is like a microcosm of Earth.

I do not believe there is reason for ExoJews to observe most Terran *halakhah*, yet I do believe in the role *halakhah* has to play in Judaism. Hence, it will be vital for Judaism's survival that new *halakhah* be devised for off-planet existence. Kasher's assertion that *halakhot* are personal seem to justify that *halakhah* must be established off-planet. How that is to be done is another question beyond the scope of this thesis.

[175] "The Future of Space Colonization – Terraforming or Space Habitats?," accessed December 21, 2017, https://phys.org/news/2017-03-future-space-colonization-terraforming-habitats.html.

2.3: The Jewish Exo-Calendar

So far, this thesis has built up to this ultimate issue: how to follow the Jewish calendar off-planet. We have established the rabbis' connection to the Lunar calendar on Earth, and we have determined that *halakhah* can and should exist off-planet in its own fashion. Now we must tackle the question that sparked my pursuit of this topic. How does one observe Jewish time in an alien environment? When does a Jew begin and end the Sabbath, observe festivals, or even pray throughout the day? We will explore these questions further, but there may not be a resolvable answer, at least not today. There is not yet a rabbinical will or pressing reason to solve the issue of living off-planet yet so there is not a rabbinical way. It is becoming, though, more relevant and important each passing day.

This section will mainly analyze three sets of *halakhic* rulings. The first set was created when Jews began traveling into polar regions. Since the sun does not rise and set in those regions as it does closer to the equator, rabbis needed to rule on how to observe *halakhic* time. The second was created when humans landed on the Moon, and the third was created when Ilan Ramon, a Jewish astronaut who tragically lost his life in the Columbia Shuttle disaster, went into space.

We begin by defining the year. According to Shmuel[176], the great *Amora*[177], the calendar was to assume the year was exactly 365 days and a quarter day.[178] Rav Ada bar Ahavah's opinion was that the year was specifically 365 days, five hours, 997 *chalakim* (minutes), and 48

[176] Rav Sherira Gaon, *The Iggeres of Rav Sherira Gaon*, ed. Rabbi Nosson Dovid Rabinowich, Unstated Hardcover edition (Moznaim Pub Corp, 1988), 98.
[177] For more on the *Amoraim*, see Judith R. Baskin and Kenneth Seeskin, *The Cambridge Guide to Jewish History, Religion, and Culture* (Cambridge University Press, 2010).
[178] B. T. Eruvin 56a

regaim (seconds), which came to an extra 55 minutes and 25.4 seconds.[179] One needs to assume this annual breakdown to properly observe the calendar. Again, this establishes that *halakhah* is really meant to be observed on Earth. Let us assume now that someone is off-planet. What are their options?

The main argument used by the rabbis who have written on this subject refers to a discussion concerning the hypothetical case of a lost traveler in the desert found in the Talmud:

> "היה מהלך)בדרך או(במדבר ואינו יודע אימתי שבת מונה ששה ימים ומשמר יום אחד חייא בר רב אומר משמר יום אחד ומונה ששה במאי קמיפלגי מר סבר כבריתו של עולם ומר סבר כאדם הראשון מיתיבי היה מהלך בדרך ואינו יודע אימתי שבת משמר יום אחד לששה מאי לאו מונה ששה ומשמר יום אחד לא משמר יום אחד ומונה ששה."
>
> "Rav Huna said: One who was walking along the way or in the desert, and he does not know when Shabbat occurs, he counts six days from the day that he realized that he lost track of Shabbat and then observes one day as Shabbat. Ḥiyya bar Rav says: He first observes one day as Shabbat and then he counts six weekdays. The Gemara explains: With regard to what do they disagree? One Sage, Rav Huna, held: It is like the creation of the world, weekdays followed by Shabbat. And one Sage, Ḥiyya bar Rav, held: It is like Adam, the first man, who was created on the sixth day. He observed Shabbat followed by the six days of the week. The Gemara raises an objection to the opinion of Ḥiyya bar Rav from a *baraita*: If a person was walking along the way and does not know when Shabbat occurs, he observes one day for every six. What, does this not mean that he counts six and then observes one day in accordance with the opinion of Rav Huna? The Gemara rejects this: No, it could also mean that he observes one day and then counts six."[180]

In other words, a Jew lost in time needs to count seven days, whatever counts as a day, from when they realized they were lost in time. Their sanctified day will be Shabbat to them, and they are to treat it as such. However, in order not to desecrate the actual Shabbat the lost traveler must remain in a perpetual state of Shabbat. They may only do enough work to avoid death, and

[179] Rav Ada bar Ahavah's opinion was contained in a collection of *baraitot* that was known to the *Rishonim*; Meiselman, *Torah, Chazal & Science*, 67.
[180] B. T. *Shabbat* 69b; cf. S"A *Orach Hayyim* 344:1, *Translation mine.*

they can keep walking and traveling to find civilization.[181] Rabbi Jacob Emden[182] is quoted in *Sha'arei Teshuvah* as saying that no matter where the traveler is, they must count six twenty-four-hour days.[183]

Bleich points out the *halakhah* codified in the Shulchan Arukh is meant to be six solar days, not six twenty-four-hour periods. He also writes the days are not to be calculated individually in an "arbitrary" manner. Doubt of Shabbat's start, in his opinion, is not "dispelled" by counting days; thus, the Jew is to "refrain from activity forbidden on Shabbat and every day."[184]

Herein lie two major issues for ExoJews: the first issue is that according to this ruling, they would need to exist in a perpetual state of Shabbat, so they don't desecrate the actual Shabbat; the second issue is that if they needed to count twenty-four-hour days to calculate their own Shabbat, they may fall out-of-sync with their neighbors. For example, if Martian colonists exist on a twenty-four-hour-and-thirty-nine-minute day while Martian Jews exist on a twenty-four-day, their schedule will slip. Shabbat would eventually begin in the middle of the night or in the morning. Let us imagine Shabbat began at two in the morning, and an ExoJew wanted to mark the beginning. They would need to wake up, make *kiddush*, say Shabbat blessings, then immediately make *Havdalah*.[185]

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[181] See *Mishnah Berurah, Bi'ur Halakhah* 344:1, who rules that such a person must also don tefillin every day, including the day he observes as Shabbat. Cf., however, *Kaf ha-Ḥayyim, Oraḥ Ḥayyim* 344:6, who cites a conflicting opinion. See also R. Simcha Levy, *Simḥat ha-Levi*, no. 32.
[182] (b. 1697-1776) from Jacob Emden, Sidney B. Leperer, and Meir H. Wise, *Megilat Sefer: The Autobiography of Rabbi Jacob Emden* (Baltimore, MD: Shaftek Enterprises LLC, 2016).
[183] *Sha'arei Teshuvah, Orach Hayyim* 344:1
[184] Bleich, *Contemporary Halakhic Problems*, 80.; cf. *Mishnah Berurah, Bi'ur Halakhah* 344:1
[185] See *Mishnah Berurah* 344:3. Cf., however, *Kaf ha-Ḥayyim* 344:5 who cites authorities who maintain that the weekday payer should be recited even on the day observed as Shabbat. *Kaf ha-Ḥayyim* himself rules that the Sabbath prayer should be recited but that the *musaf* prayer should be omitted. Thus, the prayers on the day that is designated to be Shabbat is a hybrid of Shabbat and weekday.

To avoid this future for ExoJews, we must ask when Shabbat is meant to begin. Much *halakhah* was written on this question for those traveling near or at the Terran poles. I will attempt to apply the *halakhah* to this conversation. The challenge in the polar region is that the diurnal cycle changes throughout the year. There are periods in which the sun almost never sets, and there are periods of perpetual darkness. On this Emden writes:

> "It is necessary to reflect upon [the manner in which] those who dwell or travel in the lands near the poles should conduct themselves. For, in proportion to proximity [to the pole], the day becomes lengthened. There [are places in which] a month or two months and even longer may be a day to the extent that there exists a place where the day is prolonged to half a year and similarly the night is half a year. And under the pole there is no day and night at all; rather there is twilight [during] the entire year for in that place there is no sunrise or sunset because the [celestial] equator is its horizon. *If so, how should they establish Shabbat there?"* (Emphasis mine.)[186]

Bleich connected the question of polar calendrical calculation to space travel. He writes:

> "The issue of Sabbath observance aboard a space ship is a novel extension of the much older question of Sabbath observance in the polar regions and adjacent areas in which daylight and darkness extend for months at a time rather than alternating in periods of approximately twenty-four hours. Determination of the prescribed time for morning, afternoon and evening prayers as well as for other time-bound *mizvot* presents the identical problem. *Jewish commercial travelers reached areas relatively close to the North Pole long before anyone, Jew or gentile, seriously dreamed of space travel. (Emphasis mine.)*[187]

Bleich believes the key to understanding Emden's ruling is in the concluding phrase, "and he sanctifies the seventh in the manner that has been mentioned earlier with regard to a traveler in the desert."[188]

The sun follows a very different path in the poles, as it would on any other celestial body. So, if a traveler is lost and needs to begin calculating twenty-four-hour periods, do they begin

[186] R. Jacob Emden, *Mor U-Kezi'ah* 344
[187] Bleich, *Contemporary Halakhic Problems*, 77.
[188] R. Jacob Emden, *Mor U-Kezi'ah* 344

counting when they realize they are lost? Or do they begin counting when they arrive in an uncertain location? Rabbi Chaim Joseph David Azulai[189] understands the *Mor u-Kezi'ah* as saying a lost traveler need not count a whole week of seven day when they realize they are lost; rather, they are to count twenty-four-hour days beginning from the day of the week that they arrive in such a locale.[190] If we were to apply the *halakhah* without Azulai's interpretation, every new arriving Jew on another celestial body would have their own Shabbat. For example, if I were to arrive on the Moon on a Wednesday, I would remain in my perpetual state as a lost traveler and establish my own Shabbat, refraining from work all other days, as well. Without Azulai's interpretation of Emden's *halakhah*, I would calculate six twenty-four-hour periods, then have my own Shabbat which would technically begin on a Tuesday. If another Jew landed on the Moon on a Thursday, their Shabbat would be on Wednesday. If everyone calculates from the day of the week on which they landed, their *Shabbatot* would align.

Nothing in the polar regions, and thus in space travel, is or should be determined by the sunrises and sunsets. Otherwise, Shabbat would only occur once every seven months on the moon, while lasting an entire month.[191] However, the Torah mandates Shabbat be observed "in all your habitations."[192] The Radvaz[193] interprets this verse to mean Shabbat is determined in every region according to the sunrises and sunsets.[194] Ibn Ezra identifies in the Torah a moment

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[189] (c. 1724-1806), cf. Yehuda Azoulay, *A Legend of Greatness: The Life & Times of Hacham Haim Yosef David Azoulay* (Israel Bookshop, 2013).
[190] R. Chaim Yosef David Azulai, *Mahazik Berakhah* 344:4; cf. Bleich, *Contemporary Halakhic Problems*, 79.; *Maḥazik Berakhah's interpretation of Mor u-Keẓi'ah is, however, accepted by R. Betzalel Stern, Ahalekh be-Amitekha (Jerusalem, 5752) 30:16, note 24, who rules in accordance with the view of Mor u-Keẓi'ah.*
[191] "How Long Is One Day on Other Planets? :: NASA Space Place," accessed December 25, 2017, https://spaceplace.nasa.gov/days/en/.
[192] Lev. 23:3; cf. Bleich, *Contemporary Halakhic Problems*, 81.
[193] (c. 1479-1589); cf. Louis Gizberg, Isaac Broyde, "David ben Solomon ibn Abi Zimra or Zamiro (also known as RaDBaZ)" in Isidore Singer, *The Jewish Encyclopedia*, vol. 4 (Funk & Wagnalls, 1907), 469.
[194] *Teshuvot ha-Radvaz*, I, no. 76; *A similar interpretation of that verse was earlier advanced by Seforno in his commentary ad locum. See also the interpretation of Exodus 31:16 advanced by the Zohar, Genesis 56a. The verse "And the children of Israel observed the Sabbath to make the Sabbath for their generations (le-dorotam)" is*

when the sun rises for Jacob due to his location but did not in other locations simultaneously.[195] To avoid timing issues, time should be determined by the fixed counting of hours or use of clocks. In the case of the Terran poles, that can mean Shabbat is observed at the same "day" it is observed in other places on Earth. It would not shift throughout the year, but a set time would be chosen for its start.[196] On the Lunar or Martian surface, this would most likely need to happen, as well. If Martian or Lunar clocks match Terran ones, then Shabbat can be set to begin around when it begins in a chosen Terran locale. On this, Bleich writes, "In effect, the North Pole would have its own 'local' time just as the day begins and concludes at every other geographic point on earth in accordance with its own local time. The sole difference being that "local" time at the North Pole is idiosyncratic in that it is to be determined by consulting the clock while elsewhere local time depends upon sunrise and sunset."[197] This means a local *beit din* would need to work together to establish a set time Shabbat and all other festivals would start off-planet.

Rabbi Israel Lipschutz[198] writes that Shabbat must be determined by what is observed in the heavens. In his own city of Daznig, which has brief periods of dusk, he maintains there are ways to determine the beginning of Shabbat, even in places in which the sun never set or rises. In the case of a polar region in which the sun never sets, he writes that days are certainly periods of twenty-four-hour periods marked by the sun completing a full circle in the sky.[v] Thus, according to Lipschutz, any celestial body's rotation should count as a *halakhic "*day". Without citing evidence, *Tiferet Yisra'el*, writes[199] a lost traveler should adopt the clock of "'the place from

rendered by the Zohar as "to make the Sabbath for their dwellings (le-dirotam)."; cf. Bleich, *Contemporary Halakhic Problems*, 81.

[195] See R. Abraham ibn Ezra on Gen. 33:10, commenting on Gen. 32:32.

[196] Bleich, *Contemporary Halakhic Problems*, 79.

[197] ibid.

[198] Aryeh Carmell and Cyril Domb, *Challenge: Torah Views on Science and Its Problems*, 2nd edition (Feldheim Pub, 1988), 133.

[199] See R. Israel Lipschutz, *Tiferet Yisra'el*, an addendum to his commentary on the first chapter of *M. Berakhot*.

which he departed' *(makom she-yatza mesham)* in determining the beginning and end of each day and the various divisions thereof."[vi]

"Makom she-yatza mesham", basing one's clock on the location from which one departed is a possible solution for those traveling in polar regions. However, this *halakhah* is only a temporary measure. Otherwise, the *halakhic* ruling is to leave the area as soon as possible. The lost traveler is *halakhically* permitted to do whatever is necessary to return "emerge from the desert as quickly as possible so that he may return to proper Sabbath observance and he may engage in such travel even on the day that he observes as Shabbat. The confused traveler observes the day designated as the Sabbath solely through recitation of *kiddush, Havdalah,* and Shabbat prayers."[200] These observances are still necessary on the individual's personal day of Shabbat so as not to forget Shabbat entirely.[201]

Bleich believes the *halakhah* present "unresolvable doubt" as to how a lost traveler is to determine Shabbat in their specific location.[202] He writes, "Those questions received serious attention but hardly unequivocal resolution either because of doubt engendered by disagreement with regard to the proper solution of the problem or because measurement of time at the antipodes and/or in space is a matter of intrinsic halakhic doubt to which there is no resolution."[203] The rabbis cannot agree when sunrise or sunset begins in polar regions or in space. Their recommendation is simply to leave as soon as possible. This unresolvable doubt is

[200] Bleich, *Contemporary Halakhic Problems*, 81.; cf. *Mishnah Berurah* 344:3.
[201] See R. Yekuti'el Yehudah Halberstam, *Teshuvot Divrei Yaẓiv, Oraḥ Ḥayyim* (*Netanya*, 5756), no. 108, sec. 15, who understands *Mor u-Keẓi'ah* as positing only a rabbinic obligation.
[202] Cf. *Parashat Derakhim, Drush* 23*, s.v. od nakdim; R. Israel Lipschutz, Tiferet Yisra'el, Berakhot,* note appended to *Bo'az,* end of chapter 1*;* R. Chaim Joseph David Azulai*, Birkei Yosef, Oraḥ Ḥayyim* 242:1*;* R. Joseph Saul Nathanson*, Teshuvot Sho'el u-Meshiv, Mahadura Revi'a'ah,* no. 154*;* and R. Benjamin Aryeh Weiss*, Teshuvot Even Yekarah* (Lemberg, 5654), no. 11.
[203] Bleich, *Contemporary Halakhic Problems*, 77.

illustrated in a letter written by Rabbi Simcha ha-Levi Bamberger[204] to his son who asked when to observe Shabbat while traveling in Norway. Bamberger responds:

> "However, all this is Halakhah but in practice my inclination is: Why should a person, even during weekdays, place himself in a state of doubt with regard to reading the *Shema* and prayer? At the minimum, do not remain in that country on *Shabbat* [where] there is doubt with regard to what to do. Nothing prevents God from bestowing blessing and success wherever your feet tread for good."[205]

In other words, Bamberger’s advice to his son was to leave as soon as possible and to return to a region without *halakhic* doubt. This is obviously an unacceptable ruling for ExoJews. They certainly would not be able to travel home to a place without doubt before the following Shabbat. This ruling also only applies to travelers. There is no *halakhah* which approaches the issue of *settling* in a land that is full of *halakhic* doubt. Lunar, Martian, and other ExoJews will need the *halakhah* to figure out how to handle their settlement in such a place that is outside of *halakhic* time.

Bleich believes the issue is solvable, relating to the previous section asking whether *halakhah* can even exist off-planet. His response reads, “But even that understanding of *Mor u-Kezi'ah*'s position remains problematic if there is no halakhic *time* in such regions. Were that the case, there would be no *Shabbat* and hence no forbidden acts.”[206] His opinion, then, is that there is, indeed, no *halakhah* off-planet due to the unresolvable doubt. The heavens are simply beyond *halakhic* time, and thus, there are no forbidden acts. He believes performing Shabbat rituals keep the concept and spirit of Shabbat alive, but that “the element of doubt that renders proscribed acts impermissible on any day that might possibly be *Shabbat* is not at all present in an area in

[204] (b. 1832-1897) Michael Brocke and Julius Carlebach, *Die Rabbiner der Emanzipationszeit in den deutschen, böhmischen und großpolnischen Ländern 1781-1871* (Walter de Gruyter, 2004), 171.
[205] Rabbi Simcha ha-Levi Bamberger, *Zekher Simḥah, no. 30* (1886).
[206] Bleich, *Contemporary Halakhic Problems*, 83.

which there is no time and hence no Shabbat." He understands Emden to believe there is *halakhic* time in polar regions and off-planet, but that there is no way to determine that time.[207]

It would seem there cannot be *halakhic* resolution until Jews are actually living off-planet due to the principle "*milta de-lo shekhiḥa lo gazru bah rabbanan,*" "The unusual and the unanticipated are not subsumed within the ambit of rabbinic legislation."[208] In other words, the rabbis cannot rule on something which is completely unknown to them. So, until there can be *halakhic* rulings on other celestial bodies by rabbinical courts, I maintain there is, indeed, no *halakhic* time and, indeed, no prescription on Shabbat.[209] Even if one were to establish a system of time that corresponds to a single on Earth, as Lipschutz argues, I maintain that off-planet clocks cannot precisely sync with the time in any Terran spot. Bleich argues that Talmudic interpretation is to be done "on the basis of strict construction" under "specified conditions under specified circumstances."[210] He says that the ruling found in the Talmud vis-à-vis the lost traveler requires that everyone except the lost traveler is aware of when Shabbat begins. The traveler is the one who is unaware and transgressing, yet there are others nearby who do know when Shabbat falls.[211] For those off-planet, due to the unresolvable doubt, there will be no one who knows when Shabbat falls. On this Bleich writes:

> "There is no evidence of a rabbinic decree requiring *kiddush* and *havdalah* on any day in a situation in which no one knows and no one can possibly know which day is *Shabbat*. Even though we might think it wise and spiritually edifying to legislate some form of positive *Shabbat* observance even is such circumstances, the notion of strict construction would lead to the conclusion that, since such a contingency is technically outside the parameters of existing rabbinic legislation, there is, in reality, no such obligation."[212]

[207] Bleich, 83.
[208] Cf. Bleich, 83–84.
[209] Before a reader is inclined to assert my liberal bias in this matter, keep in mind my opinion is based on rabbinic sources which lie beyond the Reform Movement.
[210] Bleich, 84.
[211] See B. T. *Shabbat* 69b
[212] Bleich, *Contemporary Halakhic Problems*, 84.

Conclusion*:*

Essentially, the unresolvable doubt is what prevents *halakhah* from working right now off-planet. There is no consensus as to when Shabbat would begin or end. There is no consensus as to how a Jewish exo-settler can live Jewishly in a region outside of *halakhic* time. The Jewish Exo-Calendar is an unresolvable hypothetical at this point. It will eventually be necessary for a *beit din* to figure out how ExoJews can exist, so they are not within a perpetual state of Shabbat, or at least a state in which they cannot perform any work that counts as *melachah*.

Conclusion

Due to pressures on Earth and a pull toward the heavens, I believe humanity will find itself settling the solar system within the century. Serious complications from Global Climate Change may make it necessary to find a new home. Yet such pessimism is not needed to understand the drive toward space travel. The economic value of cheap space travel cannot be overlooked. Settling another celestial body further ensures humanity's survival, as well. Additionally, asteroid-mining is not far off. As stated previously, Elon Musk plans to have a million-person colony on Mars relatively soon and plans to die on the planet, himself.

Among the very first settlers, Jews will struggle to live Jewishly, as Astronaut Sheyna Gifford described.[213] These early settlers will have very specific tasks to perform and will be essential to the mission. Their Jewish life may be minimal. According to Dr. Gifford, for instance, making *challah* bread and lighting candles were her ways to connect Jewishly while living in cramped quarters for a year with her team in Hawaii.[214] Eventually, Jews will find themselves in communities in need of *halakhic* guidance.

There is no theological reason for Jews to reject traveling into deep space. I believe I have demonstrated there is every reason for Judaism to exist off-planet. As stated previously, there is no conflict between Judaism and science. All the great rabbis have acknowledged the need for both Torah and *Madda*, especially modern Orthodox rabbis who stress both. In fact, as stated earlier, the rabbis have always wondered and theorized as to the makeup of the heavens. Their conjectures bordered on scientific reasoning, while simultaneously grounding natural

[213] Sheyna Gifford, Interview with Dr. Sheyna Gifford on living Jewishly in space, Telephone, June 6, 2017.
[214] For more on Dr. Gifford's NASA training mission, see Nadia Drake PUBLISHED August 29, 2016, "Here's What It Feels Like to Spend a Year on 'Mars,'" National Geographic News, August 29, 2016, https://news.nationalgeographic.com/2016/08/nasa-mars-hi-seas-hawaii-human-mission-space-science/.

philosophy in Torah. They did the best with the knowledge they had at the time and could not be expected to speculate on the unknowable. They certain did have the *Tanach* to consult in matters of Jewish practice, but even the *Tanach* allows for settling the stars. As stated earlier, Ps. 115:16 defines the realm of humanity and of God. Though there is precedent for humans crossing into the heavens, I believe it will be necessary to redefine the Divine realm as that which can never be accessed by humans.

Halakhically, though, it could be challenging enough to live off-planet that some may say it is not worth the risk. Issues like *shomer n'giah*[215], *tz'niyut*[216], and *kashrut* are beyond the scope of this paper, but their off-planet application will need to be faced in the coming decades. Other socio-political issues that face the Jewish people are also beyond the scope of this paper, such as how the various streams of Judaism may clash off-planet. My goal for the Jewish people is to find ways to allow Judaism to thrive off-planet. In a Reform setting, this task may be an easier one, as it is easier to live as a Reform Jew beyond the realm of *halakhah* as that term is understood by Orthodox Jews. However, as stated earlier, Reform Judaism is not devoid of *halakhah*; it very much influences Reform Jewish practice. Hence, *halakhah* must be made accessible to all future ExoJews.

As stated earlier, the Jewish calendar has gone from a calendar entirely dependent on witnessing the heavens to a fixed set of days and months. Yet the Terran calendar may not match the Martian calendar, and if so, it will be necessary to adjust the Hebrew Calendar to, at least, keep festivals in their seasons. This will mean something different on the Moon, Mars or

[215] Lit. "One who protects touching," this refers to the *halakhah* that members of the opposite sex do not touch each other for various reasons. Cf. Rambam Issurei Biah 21:1

[216] Lit. "Modesty", This is the concept of modest dress. God is seen as one who hides modestly, cf. Is. 45:15; We wish to follow in the ways of God, cf. Deut. 28:9, B. T. Shabbat 130a, B. T. Sotah 14a; We are then to act modestly in public, cf. Micah 6:8 which states a person should walk humbly before God, cf. B. T. Makkot 24a.

otherwise because seasons will not match up with Terran seasons. How long would an extraterrestrial human civilization mimic the Terran seasons and calendar before adjusting the calendar to their own needs? Obviously that question cannot be answered now, nor can one even speculate on it. If adjustments need to be made to the calendar, *batei din* must be established. I believe it to be necessary, though, to allow changes in dates and times to be made on a new celestial body without a *beit din* on that particular body.

The greatest issue to be solved, which lies beyond the capabilities of this paper and author, is whether *halakhah* can even exist off-planet. *Halakhic* time certainly does not exist off-planet as it does on Earth. Additionally, there are rabbis who argue *halakhah* is only meant to be followed on Earth and off-planet colonies will not qualify as Earth. Even more damaging is the unresolvable doubt as to how to live Jewishly in environments without 24-hour cycles. If the only solution is to follow a time on Earth, such as following the time of the location from which you departed or of Jerusalem, Lunar or Martian Jews will almost certainly fall out-of-sync with their non-Jewish counterparts.

Perhaps the greatest *halakhic* challenge ahead is that nothing has been written on these unique situations from the perspective of a settler. From what I can tell, this thesis and a paper written by Rabbi Joshua Breindel[217] in 2000[218] are the only academic works asking what *halakhic* challenges may face future Jewish settlers.[219] Otherwise, *halakhic* discussions have

[217] Congregational rabbi at *Anshe Amunim* in Pittsfield, MA. "Our Clergy," Temple *Anshe Amunium*, August 26, 2016, https://ansheamunim.org/node/33.
[218] Joshua Breindel, "Jews in Space: Reflections on Welcoming Shabbat in Exotic and Off-World Environments" (Hebrew College, 2000).

[219] Cf. "Halacha and Space Travel" in Solomon Freehof, *New Reform Responsa* (Hebrew Union College Press, 1980).; and Bleich, *Contemporary Halakhic Problems*.; These works raise the questions of how to apply current *halakhah* to space travel, not to settling on another celestial body.

only revolved around Jews who are traveling, not settling. The *halakhic* consensus is that they should come back to a place with a proper diurnal cycle as soon as possible, an impossible task for most off-planet settlers.

I hope this thesis sparks a revolution in the conversation of ExoJudaism. I wish to see Jewish leaders and thinkers who believe it is time to discuss these issues. I pray others will take up the mantle and develop Jewish resources for ExoJews, such as contemporary liturgy and *siddurim*, and rituals.

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[i] The question of whether non-terran or extraterrestrial life exists and what the implications would be if it were found to exist is beyond the scope of this paper. I will not be speculating as to whether extraterrestrial life exists, nor will I consider it in my theological and halachic arguments. Furthermore, I will not be addressing what the Jewish theological or halachic response should be if and when such an encounter occurs. If and when alien life is encountered, most likely in the distant future, it will be up to that generation of Jews, or perhaps ExoJews, to discuss and to decide how to move forward.

However, seeing as Christian circles have been inspired by the prospect of encountering alien life in humanity's push to colonize the heavens, it would be irresponsible of me not to address the possibility briefly. Christian theologians discuss extraterrestrial encounters because they need to tackle the theological question of how to missionize to such a lifeform. According to some scholars, the study of this issue is called "exo-missiology". The debate as a whole of what to do with alien lifeforms has been called "exo-theology" or "astrotheology." I am using the term "Judeo-exotheology," not to refer to the question of missionizing to alien life, but rather to refer to Jewish theology off-planet. As I will address later, Jewish theology may prohibit Judaism to even exist off-planet. Thus, I believe it will be necessary in the coming decades or centuries to rethink and reshape Jewish theology to include the heavens, i.e., other celestial bodies on which we may colonize. For more on the discussion of Christian "exo-missiology," "exo-theology" or "astrotheology," see Peters, Ted. "Astrotheology and the ETI Myth." *Theology and Science* 7, no. 1 (02, 2009): 3-29; "Astrotheology." *Oxford Research Encyclopedia of Religion*, (03, 2014); "Astrotheology: A Constructive Proposal." *Zygon* 49, no. 2 (05, 2014): 443-57.

Jewish tradition mentions the possibility of conscious beings beyond our realm, namely heavenly beings. For instance, in the *Mishneh Torah* in *Hilchot Yesodei Ha-Torah 3:9*, Maimonides describes that the celestial spheres have a soul unto themselves:

"All of the stars and spheres are beings, endowed with a soul, intelligence and understanding; they continue a purposeful life and are conscious of the existence of Him Who spoke and the universe sprang forth. Each one, according to his greatness and degree, extol and glorify the Creator as do the angels; and to the extent that they recognize the Holy One, blessed is He! they also know their own selves and the angels above them. But the intelligence of the stars and spheres is lesser than the intelligence of the angels, but greater than the intelligence of man."

According to an article by Rabbi Benjamin Blech, "Dr. David Weintraub, professor of astronomy at Vanderbilt University and the author of Religions and Extraterrestrial Life: How Will We Deal With It?, affirms that Judaism is spiritually prepared for little green men. 'Judaism accepts the possibility of extraterrestrial life. Jewish theology may require a belief in extraterrestrials since there are no limits on the power of the creator. Thus, for Jews to say that no life beyond the Earth could possibly exist would be unacceptable, as such an idea would appear to place shackles on God's creative power…the universe belongs to God and God can do what God wishes to do with the universe.'" (http://www.aish.com/ci/s/Judaism-and-Life-on-Other-Planets.html)

Furthermore, according to an article by Rabbi Tzvi Freeman, author of "numerous articles and essays on Jewish mysticism, philosophy and practice" for the Chabad movement, "Several Torah scholars of past generations have discussed the possibility of life on other planets. Rabbi Chasdai Crescas (Spain, 1340–1411) wrote that there is nothing anywhere in Torah that negates such a possibility [see *Ohr HaShem* 4:5]. Rabbi Yosef Albo (Spain, 1380–1444), on the other hand, disagreed [see *Sefer Ha'Ikraim]*. Rabbi Pinchas Horowitz (Poland 1765-1861), cites Albo, but rejects his thesis [see *Sefer Ha-Brit HaShalem* 1:3, 4]. (http://www.chabad.org/library/article_cdo/aid/3012/jewish/Is-There-Life-on-Other-Planets.htm#footnote5a3012)

Some maintain Meroz, often believed to be a tribe of Israel at an earlier stage of its history, is indeed a planet with inhabitants. In Devorah's song in Judges 5, we read:

"'Curse Meroz!' said the angel of the Eternal. 'Bitterly curse its inhabitants, Because they came not to the aid of the Eternal, To the aid of the Eternal among the warriors.'"

The question is who is Meroz. In the Talmud, the rabbis conjectured:

"And Ulla said: Barak ostracized Meroz with the blowing of four hundred *shofarot* due to his failure to come. As for the identification of Meroz, some say that he was a great man and that he was ostracized because he did not join in the war effort. And others say that the reference is to a star and not a human being, and that it did not aid the Jewish people in their battle, as it is stated: 'The stars fought from heaven; in their courses they fought against Sisera,' (Judges 5:20). This star, which did not help the Jewish people, was cursed."

On this, Rabbi Benjamin Blech writes, "Rabbi Pinchas Eliyahu Horowitz, (18th century) quotes as his authority a clear Talmud reference –the statement that contends that Meroz is an inhabited planet somewhere in outer space." (http://www.aish.com/ci/s/Judaism-and-Life-on-Other-Planets.html)

Thus, the interpretation of Meroz has morphed into a possible planet with inhabitants who did not come to the aid of Israel and are thus cursed.

[ii] Y. Tzvi Langermann. "Maimonides: Abū ʿImrān Mūsā [Moses] ibn ʿUbayd Allāh [Maymūn] al-Qurṭubī." From: Thomas Hockey et al. (eds.). *The Biographical Encyclopedia of Astronomers*, *Springer Reference*. New York: Springer, 2007, pp. 726-727; For further reading, see Freudenthal, Gad (1993). "Maimonides' Stance on Astrology in Context: Cosmology, Physics, Medicine, and Providence." In *Moses Maimonides: Physician, Scientist, and Philosopher*, edited by Fred Rosner and Samuel S. Kottek, pp. 77–90. Northvale, New Jersey: Jason Aronson.; Langermann, Y. Tzvi (1991). "Maimonides' Repudiation of Astrology." *Maimonidean Studies* 2: 123–158.; Langermann, Y. Tzvi (1999). "Maimonides and Astronomy: Some Further Reflections." Essay IV in *The Jews and the Sciences in the Middle Ages*. Aldershot: Ashgate.; Langermann, Y. Tzvi (2000). "Hebrew Astronomy: Deep Soundings from a Rich Tradition." In *Astronomy Across Cultures*, edited by Helaine Selin, pp. 555–584. Dordrecht: Kluwer Academic Publishers.; Maimonides, Moses (1956). *Sanctification of the New Moon*, translated by Solomon Gandz. New Haven: Yale University Press.

[iii] Emilia Calvo. "Jābir ibn Aflaḥ: Abū Muḥammad Jābir ibn Aflaḥ". From: Thomas Hockey et al. (eds.). *The Biographical Encyclopedia of Astronomers*, *Springer Reference*. New York: Springer, 2007, pp. 581-582; From the article: "Jābir ibn Aflaḥ was a mathematician and astronomer in 12th-century Andalusia, who wrote a treatise entitled *Iṣlāḥ al-Majisṭi* (Correction of the *Almagest*) in which, as the title suggests, the author made a long series of criticisms and corrections of Ptolemy's main astronomical treatise. Little is known of Jābir's life. It seems that he was from Seville, since he is referred to in several sources as al-Ishbīlī. One of these sources is Maimonides; in his *Guide for the Perplexed*, he claims to have met Jābir's son. This reference suggests that Jābir was alive sometime between the end of the 11th century and the first half of the 12th century. Jābir's main work is a commentary on Ptolemy's *Almagest*, a treatise that he had seen in two translations from the Greek. The *Almagest* is both the great synthesis and the culmination of mathematical astronomy of the ancient world, composed in Alexandria in the second century. It was translated into Arabic at least five times, and, from the late ninth century onward, constituted the basis of the mathematical astronomy carried out in the Islamic world."

[iv] Forcada, Miquel. "Ibn Bājja: Abū Bakr Muḥammad ibn Yaḥyā ibn al-Ṣāʾigh al-Tujībī al-Andalusī al-Saraqusṭī". From: Thomas Hockey et al. (eds.). *The Biographical Encyclopedia of Astronomers*, *Springer Reference*. New York: Springer, 2007, pp. 550-551; From the article: "Ibn Bājja's work in natural philosophy has certain implications for the history of astronomy. In his commentaries on Aristotle's *Physics* he accepted – diverging from Aristotle, and supporting John Philoponus – the possibility of motion in the void or in a medium that does not exert resistance, as happens in the celestial bodies, thus applying the physical principles of the sublunary world to the heavens. These ideas were echoed by European Scholastics, and from there may have influenced Galileo Galilei. However, this conception of dynamics cannot be traced, for the moment, in Ibn Bājja's astronomical thought.
The importance of Ibn Bājja's astronomy lies in the fact that he seems to have been the first of the Andalusians to develop a criticism of Ptolemy based on philosophical tenets (the others being Ibn Tufayl, Ibn Rushd, and Bitrūjī). They wished to formulate a cosmos according to Aristotelian principles (uniform and circular motions centered on the Earth) in which planetary models had no need of eccentrics and epicycles. According to Maimonides in *The Guide of the Perplexed*, Ibn Bājja accepted eccentrics but not epicycles. However, a deeper study of his extant works has revealed two important, and hitherto unremarked, facts: On the one hand, Ibn Bājja must have had a profound knowledge of mathematical astronomy (consistent with the fact that he was a mathematician), and the information found in a range of sources, including his own letters, reveal that he observed an occultation of Jupiter by Mars, observed solar transits of Venus and Mercury (seemingly a confusion with sunspots), and predicted a lunar eclipse. On the other hand, Ibn Bājja must originally have been a follower of Ptolemy. In a letter addressed to Abū Jaʿfar Yūsuf ibn Ḥasdāy, he attacks Ibn al-Haytham, one of the most important mathematical astronomers who criticized Ptolemy, arguing that Ibn al-Haytham did not understand Ptolemy's models for Mercury and Venus, something that is fairly clear in the case of Mercury. Again on the subject of Mercury, he disagrees with the Andalusian astronomer Zarqālī, who formulated some alternative models to Ptolemy. Besides, in his commentary to Aristotle's *Physics*, Ibn Bājja introduces a digression following Philoponus in which he accepts the existence of epicycles. However, a short and incomplete treatise has survived entitled *Kalām fī al-hayʾa* (Discourse on cosmology) that criticizes Ptolemy's

method. Here, on the basis of Aristotelian logic, Ibn Bājja tackles the problem of the relationship between what the astronomer can observe and the underlying reality and argues that the planetary models of the Ptolemaic astronomers do not fit the tenets of Aristotelian scientific method."

v From notes 12 and 13 in J. David Bleich, *Contemporary Halakhic Problems* (KTAV Publishing House, Inc., 1977), 86–87.: R. Kalman Kahana, *Ha-Ish ve-Ḥazono* (Tel Aviv, 5724), p. 100, quotes an unpublished section of the manuscript of *Ḥazon Ish's "Kuntres Yod-Ḥet Sha'ot"* in which *Ḥazon Ish* similarly declares that, in the polar regions, the sun's completion of a twenty-four-hour circuit represents a full day and the seventh circuit is the Sabbath day. A similar opinion is also espoused by R. Yechiel Michal Tucatzinsky, *Bein ha-Shemashot*, p. 55, who cites that view as earlier expressed by R. Jehoseph Schwartz, *Teshuvot Divrei Yosef* (Jerusalem, 5621), no. 8. [cf. *Teshuvot Even Yekarah*, no. 11, who also addresses the problem of the biblical reference to "days" prior to the creation of the sun and comments that the biblical "day" is to be defined as the length of time required for the earth to make a complete revolution on the axis, i.e., twenty-four hours.] However, neither Rabbi Tucatzinsky nor *Ḥazon Ish* offer a clue with regard to the point in the sky which, when traversed by the sun, marks the beginning and the end of Shabbat. R. David Spira, *Teshuvot Bnei Ẓion*, III, *Kuntres Midat ha-Yom*, sec. 21, states that, during the polar winter, days are demarcated by the circuit of the stars in the overhead sky. *Teshuvot Divrei Yaẓiv, Oraḥ Ḥayyim,* no. 108, sec. 11, suggests that the day's beginning and end should be regarded as congruent with the beginning and end of the day in the Land of Israel. Cf., infra, note 15. R. Yechiel Michal Gold, *Me'asef le-Khol ha-Maḥanot, Oraḥ Ḥayyim* 18:25, finds what he terms "clear evidence" for the underlying assumption that the "day" may be defined in terms of the revolution of celestial bodies rather than by the appearance of the sun in the comments of Rabbenu Baḥya, Genesis 1:13. Rabbenu Baḥya questions the cogency of the verse that declares "and it was evening, and it was morning" with reference to the first three days of creation, i.e., before the creation of the sun. Rabbenu Baḥya explains that the reference is not to "the light" but to "the sphere in which it revolves for, with regard to every portion of the sky, when it ascends that is its morning and when it sinks [below the horizon] that is its evening." See also Ramban, Commentary on the Bible, Genesis 1:5. However, although Rabbenu Baḥya's comments may provide support for the notion that demarcation of successive days may be determined on the basis of the rising and setting of celestial bodies other than the sun, those comments have no bearing upon the question of whether completion of a 360 degree rotation in the overhead sky has a similar import. See, however, R. Eliezer Ashkenazi, *Ma'asei ha-Shem* (Venice, 5343), Genesis 1:5, who asserts that the first day of creation was determined by circuitous movement of the heavens whose return to the point of creation marked the completion of a day. *Ma'asei ha-Shem* expressly applies that concept to the polar area in declaring, "There is no doubt that even one [for whom] the pole is above his head is obligated to observe Shabbat on the seventh circuit even though there was no darkness there at all." . . . In a note appended to *Mo'adim u-Zemanim*, II, no. 155, R. Moshe Sternbuch opines that "the day changes at precisely the moment that the sun reaches its most distant point and begins to draw closer." The "most distant point" to which *Mo'adim u-Zemanim* refers is presumably the point most distant in the sky from the point at which the sun makes its first appearance at the beginning of the polar spring. *Mo'adim u-Zemanim* declares that "night" in such areas is no more than a split second in duration. See also *Teshuvot ve-Hanhagot*, I, no. 315. See as well *Me'assef le-Khol ha-Mahanot, Oraḥ Ḥayyim* 18:25, s.v. *ve-hineh mah she-katav mori*, who also states that the Sabbath must be observed only for the amount of time that it takes the sun to complete a single circuit.

It may be noted that at the North Pole the sun neither rises nor declines in the course of its daily circuit. Rather, the sun is observed as circling the horizon once each day in a constant orbit that is a bit higher over the horizon each day until it reaches a height of approximately 23.5° at the time of the summer solstice.

However, as one proceeds some distance south of the Pole, the sun, although it does not descend below the horizon during that period, may nevertheless be observed during the course of its daily circuitous movement above the horizon. In those areas—and only in those areas—it might be contended that day and night begin and end when the sun is at its lowest point above the horizon. See R. Eliyahu Baruch Kepetsch, *Kovez Bet Aharon ve-Yisra'el, Tishri-Ḥeshvan*, 5757, p. 150 and cf., R. David Heber, "When Does One Pray When There Is No Day?" *Kashrus Kurrents*, Autumn, 2002, pp. 17f. Adopting a somewhat different position, R. Jehoseph Schwartz, *Teshuvot Divrei Yosef* (Jerusalem, 5622), no. 8 and idem, *Divrei Yosef*, *Tevu'ot Shemesh* (Jerusalem, 5603), *Derekh Mevo ha-Shemesh*, p. 61b, states that the point in the sky occupied by the sun at its first appearance in the polar region in the spring represents the beginning of each "day" and the point at which the sun is last seen before it sets in the fall represents the beginning of each "night."

Accordingly, "day" and "night" commence when the sun reaches those points in the sky during the course of each twenty-four-hour circuit. *Divrei Yosef*, p. 62a, asserts that during the winter months a similar determination is made on the basis of the position of the "two stars of the Little Bear, [which are in the] vicinity of the star of the Pole (the North Star)," i.e., the position of their first sighting in the fall marks the beginning of the "night," and "day" begins when those stars have moved 180 degrees across the sky. *Divrei Yosef's* description of the astronomical phenomena during the polar winter is both imprecise and inadequate as a basis for resolution of the problem. *Pherkad*, a third magnitude star, and *Kochab*, a second magnitude star, are known as the "Guardians of the Pole" because they circle Polaris (the North Star). All three stars are part of Ursa Minor (the Little Bear). The first two stars of Ursa Minor to become visible are *Kochab* and Polaris (the North Star). Both are second magnitude stars. However, the first celestial bodies to become visible are the planets Venus and Jupiter. Those planets do not become clearly visible until close to the end of civil twilight, i.e., when the sun drops six degrees below the horizon. At the North Pole civil twilight does not end until October 8. The first star to become visible north of the celestial equator is the zero-magnitude star Arcturus in the constellation Bootes and is followed closely by the slightly smaller star Vega in Lyra and then by Capella in Auriga. However, even the largest star is not visible to the naked eye until the sun has declined approximately nine degrees below the horizon. At the North Pole, the sun disappears a little after the time of the autumn equinox but does not reach a declension of nine degrees until October 16, a little more than three weeks later. During that intervening period neither the sun nor any star is visible. The same is true during the period immediately prior to the spring equinox when the sun is not visible but is less than nine degrees below the horizon. Thus, for more than six weeks each year neither the sun nor any star is visible. During those periods, days cannot be demarcated by means of the circular rotation of stars in the overhead sky. Even if Venus and Jupiter are used for this purpose, there are four weeks in the year during the polar twilight in which those planets are not visible. I [J. David Bleich] am indebted to Mr. Joe Rao of the Hayden Planetarium for making this information available to me.

[vi] From note 14 in Bleich, 88–89.: In accordance with his view, R. Jehoseph Schwartz, *Teshuvot Divrei Yosef*, no. 8, and idem, *Derekh Mevo ha-Shemesh*, p. 62a, asserts that the twenty-four-hour day should be divided into two equal parts yielding a twelve-hour "day" and a twelve-hour "night." Cf., however, R. Moshe Sternbuch, *Mo'adim u-Zemanim*, II, no. 155. *Rav Pe'alim*, II, *Sod Yesharim*, no. 4, follows *Divrei Yosef* in ruling that in the polar region "day" and "night" are each twelve hours in length "as in places located at the equator."

Rav Pe'alim implies that day and night begin and end at 6:00 A.M. and 6:00 P.M. as is the case at the equator. Moreover, at the North Pole, all longitudes—and hence all time zones-converge. Hence, adoption of an equatorial clock is impossible. Therefore, to say that day and night begin and end at 6:00 A.M. and 6:00 P.M. does not at all resolve the problem. The crucial issue that remains to be determined is according to which time zone is the clock to be set? Cf., R. David Heber, "When Does One Pray When There Is No Day?" *Kashrus Kurrents*, Autumn, 2002, p. 16.

R. Shlomoh Goren, "*Shnei Mikhtavim be-Inyan Shemirat ha-Miẓvot be-Arẓot ha-Ẓefoniyot*," Proceedings of the Associations of Orthodox Jewish Scientists, II (New York, 1969), pp. 1-11, proposes a variant of this position. He advocates adoption of a twenty-four-hour day but argues that the day begins and ends at midnight during the polar summer and at noon during the polar winter. Rabbi Goren develops his thesis on the basis of the observation that, as one approaches the polar area in summer, sunset occurs later and later in the day and sunrise occurs earlier and earlier. He then argues that, if one extrapolates from that pattern and applies that progression in the northernmost areas where there is no sunset and no sunrise, one should conclude that "constructive" sunset and sunrise in that locale occur at midnight. During the polar winter the opposite is true, i.e. sunrise occurs later and later in the morning and sunset occurs earlier and earlier in the afternoon. Hence, where there is no sunrise or sunset, he argues that noon be adopted as the time of "constructive" sunrise and sunset. Rabbi Goren argues that were sunset and sunrise to occur in the polar areas they would occur at midnight during the summer and at noon during the winter and therefore we should regard those times as representative of "constructive" sunset and sunrise.

Professor Cyril Domb, in a letter to the editor, *Tradition*, vol. 37, no: 2 (Summer 2003), p.101, ascribes a somewhat different position to Rabbi Goren. Professor Domb suggests that, in the polar regions, night and day are to be determined on the basis of the proximate areas in which those phenomena can be empirically observed. Accordingly, if night is defined as the "appearance of stars," the governing locale should be "neighboring places when the sun is below the horizon for a short period of time and might consist of a few minutes." Actually, as noted earlier, Rabbi Goren's thesis is somewhat different and involves establishing a "constructive" sunrise and sunset

which occur at midnight during the summer and at noon during the winter. Professor Domb’s formulation is, however, a much more cogent *alot ha-shaḥar* of *Tiferet Yisra’el’s* position. However, that formulation is cogent only for purposes of establishing the time of sunrise and sunset. In order to determine *alot ha-shaḥar* and *ẓet ha-kokhavim* it should be modified in one respect. Instead of determining the beginning of night and day on the basis of “neighboring places when the sun is below the horizon for a short period of time and might consist of a few minutes,” the more logical formulation would require that night and day be determined on the basis of the nearest place in which the phenomenon of *ẓet ha-kokhavim* as determined by the various opinions of halakhic authorities regarding the angle of the sun’s declension below the horizon, does occur. This variation of *Tiferet Yisra’el’s* position is, of course, open to the same objection that has been expressed with regard to *Tiferet Yisra’el’s* own position, viz., there is no logical reason why “day” and “night” in a given locale should be determined by sunrise or sunset in some other area. If, as I believe to be correct, *Tiferet Yisra’el* recognized that there is no way to determine the passing of days in the polar region and is concerned solely with application of the rabbinic provision regarding a confused traveler lost in the desert, the logically applicable times are those of either the traveler’s port of embarkation or of the closest inhabited area.

Alternatively, if there is objective “day” and “night” in the polar regions the only logical criteria are those suggested by *Mo‘adim u-Zemanim* and *Teshuvot Divrei* Yosef.