

## Science background

**Extrasolar planet** ('exoplanet'): planet that orbits a star other than our Sun.

- First confirmed detection: 1992
- First detection of a (giant) planet orbiting a Sun-like star: 1995
- Only some exoplanets have been directly imaged; most are detected indirectly (e.g., via transit or radial-velocity methods)
- NASA's *Kepler* space telescope: active from 2009 to 2013. Identified a few thousand *candidate* exoplanets (over 1000 confirmed). One-in-five Sun-like stars have an Earth-sized planet within the *habitable zone*.

**Search for extraterrestrial intelligence** (SETI): collective name for all scientific activities involved in the search for *intelligent* extraterrestrial life (e.g., searching for radio signals from other civilisations).

**Drake equation**: Probabilistic argument used to estimate the number of active, communicative extraterrestrial civilisations in our galaxy. Some estimates: >10,000 civilisations in the Milky Way!

**Astrobiology**: study of the origin, evolution, distribution, and future of life in the universe (both extraterrestrial life and life on Earth). Involves:

- Search for habitable environments within, and outside, our Solar System
- Study of *extremophiles* (organisms that can thrive in physically/chemically harsh conditions)
- Detection of extraterrestrial life through 'biosignatures'

Likely places for microbial life elsewhere in our Solar System: Mars, Europa, Titan.



Scanning electron microscope image of the Allan Hills 84001 meteorite. Found in Antarctica in 1984, originated from Mars. Fossilised bacteria or non-biogenic material?!

## The Jewish angle

### (1) Devarim 14:2

כִּי עַם קְדוֹשׁ אַתָּה לַיהוָה אֱלֹהֶיךָ וַיִּבְרַךְ בְּחַר יְהוָה לְהִיּוֹת לּוֹ לְעַם סְגֻלָּה מִכָּל הָעַמִּים  
אֲשֶׁר עַל פְּנֵי הָאָדָמָה:

For you are a holy people to the Lord, your God, and the Lord has chosen you to be a treasured people for Him, out of all the nations that are upon the earth.

### (2) Bereshit 2:18

וַיֹּאמֶר יְהוָה אֱלֹהִים לֹא טוֹב הִיּוֹת הָאָדָם לְבַדּוֹ אֶעֱשֶׂה לוֹ עֶזֶר כְּנֶגְדּוֹ:

And the Lord God said, "It is not good that man is alone; I shall make him a helpmate opposite him."

### (3) Bereshit 1:5

לְאוֹר יוֹם וְלַחֹשֶׁךְ קָרָא לַיְלָה וַיְהִי עֶרֶב וַיְהִי בֹקֶר יוֹם אֶחָד וַיִּקְרָא אֱלֹהִים:

And God called the light day, and the darkness He called night, and it was evening and it was morning, one day.

### (4) Bereshit Rabbah 3:7

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.'

### (5) Rabbi Joseph H. Hertz, *Additional Notes to Genesis A: The creation chapter (The Pentateuch and Haftorahs, Soncino, 1981), p. 193*

Now, while the *fact* of creation has to this day remained the first of the articles of the Jewish Cree, there is no uniform and binding belief as to the *manner* of creation, i.e., as to the process whereby the universe came into existence.

In the face of this great diversity of views as to the *manner* of creation, there is, therefore nothing inherently un-Jewish in the evolutionary conception of the origin and growth of forms of existence from the simple to the complex, and from the lowest to the highest. The Biblical account itself gives expression to the same general truth of gradual ascent from amorphous chaos to order, from inorganic to organic, from lifeless matter to vegetable, animal and man; *insisting, however, that each stage is no product of chance, but is an act of Divine will, realising the Divine purpose and receiving the seal of the Divine approval.*

**(6) Sanhedrin 37a**

... Therefore every single person is obliged to say: The world was created for my sake

**(7) Aryeh Kaplan, *Extraterrestrial Life* (essay)**

(<http://www.torah.org/features/secondlook/extraterrestrial.html>)

It is an axiom of Judaism that the entire universe was created for the sake of man. In one place (*Berachot 32b*), the Talmud reckons that there are some  $10^{18}$  stars in the observable universe, and explicitly states that they were all created for the sake of man.

**(8) Rambam, *The Guide for the Perplexed*, 3:25**

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 man's error about himself and his supposing that all of existence is for his sake alone. Every fool imagines that all of existence is for his sake... but if man examines the universe and understands it, he knows how small a part of it he is.

**(9) Rabbi Chasdai Crescas, *Or Hashem*, 4:2**

- Talmudic teaching (*Avodah Zarah 3b*): God flies through 18,000 worlds
- Concludes: nothing in Jewish theology to preclude the existence of life on other worlds

**(10) Rabbi Yosef Albo, *Sefer Ikkarim***

- Since the universe was created for the sake of man, no other creature possessing free will can exist
- Any extraterrestrial life would therefore neither have free will nor be able to serve a creature that has free will (e.g., animals and plants)
- Such life forms would be superfluous and therefore extraterrestrial life cannot exist

**(11) Rabbi Yehudah ben Barzilai, *commentary on Sefer Yetzira***

All of them are full of glory of God, like this world, but it is possible that this world is more beloved by Him. For it may be that He did not give them Torah. And even if we say that these 18,000 worlds do possess Torah, it may yet be that this world is more beloved. It may however be possible that in those worlds there are no sinful creatures, they may be spiritual beings created for His glory. However, we have no definite authority for any of these explanations. It seems clear on a rational basis that these worlds are not part of our own world, but each of them is rather a complete universe with earth and spheres, unrelated to our own.

(12) Shoftim 5:23

אָרוֹ מֵרוֹז אָמַר מַלְאָךְ יְהוָה אָרוֹ אָרוֹר יִשְׁפִּיחַ כִּי לֹא בָאוּ לְעֶזְרַת יְהוָה לְעֶזְרַת  
יְהוָה בְּגִבּוֹרִים:

'Curse Meroz!' said the angel of the Lord. 'Bitterly curse its inhabitants because they came not to the aid of the Lord, to the aid of the Lord against the warriors'.

(13) Shoftim 5:20

מִן שָׁמַיִם נִלְחְמוּ הַכּוֹכְבִּים מִמְּסֻלוֹתֵם נִלְחְמוּ עִם סִסְרָא:

From the heaven they fought, the very stars (planets) in their orbits did battle with Sisera.

(14) Rabbi Pinchas Eliyahu of Vilna, *Sefer Habrit Hashalem*

- Takes opinion (*Moed Katan 16a*) that Meroz is a star/planet as proof that extraterrestrial life does exist
- Should not expect the creatures of another world to resemble earthly life, any more than sea creatures resemble those of land
- Although extraterrestrial forms of life may possess intelligence, they certainly cannot have freedom of will

(15) Vayikra 25:2 (Shmita)

בִּי יִשְׂרָאֵל וְאָמַרְתָּ אֲלֵהֶם כִּי תָבֹאוּ אֶל הָאָרֶץ אֲשֶׁר אָנֹכִי נֹתֵן לָכֶם וְשָׁבַתָּה דְבַר אֵל בִּי  
הָאָרֶץ שְׁבֵת לַיהוָה:

Speak to the children of Israel and you shall say to them: When you come to the land that I am giving you, the land shall rest a Sabbath to the Lord.

- *Vaykira Rabba* (29:11): there are seven 'earths' (the last/ours is 'tevel')
- *Ibn Ezra*: these are the seven continents
- *Zohar*: they are separated by a *firmament and are inhabited*

(16) Rabbi Norman Lamm, *The religious implications of extraterrestrial life, (Challenge: Torah Views on Science and its Problems, 1976)*

It is true that the doctrine of man's creation in the Divine Image bestows transcendent value upon man, lifting him out of the order of the purely natural; but this is by no means necessarily an exclusivist principle. It is quite possible that *homo sapiens* on this planet and other equivalent races elsewhere represent the interpenetration of the natural and the supernatural. Whether the idea of "the divine Image" is interpreted rationally as intelligence, or ethically as freedom of will, or mystically as possessing creative powers, there is nothing in it (that is, in the Biblical doctrine per se) that insists upon man's singularity... All human beings are created in this divine Image, despite the fact that people are born unequal, some with superior endowments and

some with a tragic poverty of both talent and opportunity. In the same manner, races of intelligent beings that differ from each other as radically as an idiot from a great genius may both be impressed by the divine Image, by the summons to transcend the merely natural. If the Image of the Absolutely One God can be impressed upon the manifold individuals within the human race, it can be similarly bestowed upon a multitude of races.

**(17) Tehillim 8:4–9**

כִּי אֶרְאֶה שָׁמַיִךְ מַעֲשֵׂה אֲצַבְעֹתֶיךָ יְיָ וְכֹכָבִים אֲשֶׁר כִּנְנַנְתָּהּ:  
מָה אָנוּשׁ כִּי תִזְכְּרֵנוּ וּבֶן אָדָם כִּי תִפְקְדֵנוּ:  
וּתְחַסְרֵהוּ מֵעַט מֵאַלֹהִים וְכְבוֹד וְהָדָר תַּעֲטֶרְהוּ:  
תַּמְשִׁילֵהוּ בְּמַעֲשֵׂי יָדֶיךָ כֹּל שֵׁתָה תַּחַת רַגְלָיו:  
צִנָּה וְאַלְפִים כָּלֵם וְגַם בְּהֵמוֹת שָׂדֵי:  
צִפּוֹר שָׁמַיִם וְדָגֵי הַיָּם עֵבֶר אַרְחוֹת יָמַיִם:

When I see Your heavens, the work of Your fingers, the moon and stars that You have established, what is man that You should remember him, and the son of man that You should be mindful of him? Yet You have made him slightly less than the angels, and You have crowned him with glory and majesty. You give him dominion over the work of your hands; You have placed everything beneath his feet. Flocks and cattle, all of them, and also the beasts of the field; the birds of the sky and the fish of the sea, he traverses the ways of the seas.

**(18) Rabbi Norman Lamm, The religious implications of extraterrestrial life,  
(Challenge: Torah Views on Science and its Problems, 1976)**

Here a consideration of celestial grandeur points to man's insignificance; yet man's central worth is salvaged, and proof is adduced from his superiority over other terrestrial creatures. What we are given here is not a hesitation, an uncertainty, but a marvellous paradox. Man is both important and insignificant, central and peripheral, worthy and trivial. In the context of the vast cosmos, man shrinks almost into nothingness; in the framework of his own habitation he is supreme, worthy, extremely important. Both are true. The young man who leaves his home and family for the first time to make his lonely way in the wide world, experiences the same ambivalence about himself: in terms of his home and family, he is of vital importance; in the outside world, he is unknown and ignored. It is only when he can retain his inner dignity even when apparently mocked by the indifference of the unfriendly world, that he has achieved maturity. Mankind today, on the threshold of this voyage to the far-out reaches of the cosmos, experiences the same paradox described by the Psalmist.

**(19) Rabbi Menachem Mendel Schneerson (Lubavitcher Rebbe)**

[http://www.chabad.org/therebbe/article\\_cdo/aid/2436891/jewish/The-Rebbe-and-the-Scientist-Looking-for-Life-on-Mars.htm](http://www.chabad.org/therebbe/article_cdo/aid/2436891/jewish/The-Rebbe-and-the-Scientist-Looking-for-Life-on-Mars.htm)

Dr Greene, look for life on Mars! And if you don't find it there, look somewhere else in the universe for it. Because for you to sit here and say there is no life outside the planet Earth is to put limitations on the Creator and that is not something any of his creatures can do!

**(20) Rabbi Norman Lamm, *The religious implications of extraterrestrial life, (Challenge: Torah Views on Science and its Problems, 1976)***

The uniqueness of man is not a racial doctrine or biophysical phenomenon. It refers to the spiritual dignity of creatures endowed with reason and free will. On earth, only man fulfils these conditions. If we should discover other free and rational species, we shall of course include them in the community of the uniquely bio-spiritual creatures. Still excluded, will be the multitudes of other creatures from bacteria through elephants, and the various inferior biological forms that may populate other globes elsewhere.

**So why haven't we found E.T.?**

**Fermi paradox:** apparent contradiction between high estimates for Drake equation and the lack of evidence for intelligent civilisations.

Some possible reasons:

- **Rare Earth hypothesis:** origin of life and evolution of biological complexity (e.g., sexual reproduction, multicellular organisms, intelligence) requires improbable combination of astrophysical and geological events and circumstances.
- **Great filter theory:** intelligent life is incapable of technologically advancing enough for long-distance space communication or travel. A barrier or catastrophe will inevitable wipe out civilisations or cause technology to devolve.
- **Unidentifiable signals:** no reason to believe extraterrestrial life evolved in the same way as on Earth. We just cannot recognise other life forms.

**(21) Rabbi Jonathan Sacks, *The Great Partnership: God, Science and the Search for Meaning* (Hodder, 2011) p.97**

*Faith is not certainty. It is the courage to live with uncertainty.* Faith is never easy. The great heroes of moral life, like the great artists and scientists and thinkers, like anyone who has undertaken to live a life of high ideals, know failure after failure, disappointment after disappointment. What made them great is that they refused to despair.