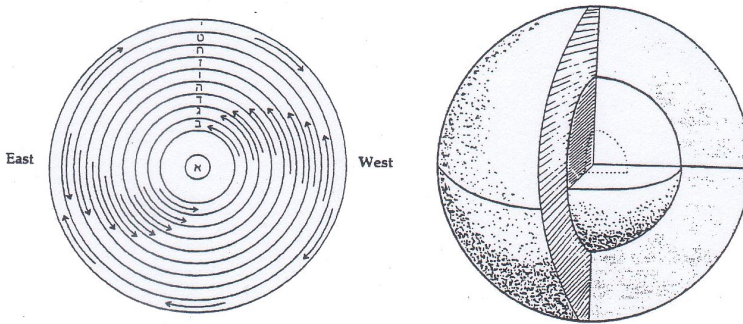


CHAPTER 4. SPACE: TORAH AND NEWTONIAN MECHANICS

The essential reality: G-dly unity and the order of creation



The above diagrams of the geocentric model of the universe are based on the *Mishneh Torah* of Maimonides. The left hand diagram portrays nine concentric spheres with the earth stationary at their centre. The outer sphere, called the *galgal hayomi*, turns all the spheres within it, from east to west, each day. The inner spheres (together with the “stars”, including the sun and the moon, fixed in them) have, upon this, an independent movement from west to east. This diagram places east on the left, assuming the perspective of (one standing on) the earth (facing the reader). The right hand diagram brings out the spherical character of the spheres. See below an explanation, based on Maimonides, of how the orbits of certain heavenly bodies can appear elliptical, notwithstanding the sphericity of the spheres.¹

The order of creation

An important starting point in Jewish sources for a study of the structure of the universe according to Torah is the *Mishneh Torah* of Maimonides. As Maimonides himself writes in the introduction to his work, its task was to gather the “oral

¹ These diagrams are from Rabbi M.M. Glitzenstein, *Sefer Kiddush HaChodesh P'ho Rambam* 5753, pp. 14,17. They are reproduced with the kind permission of the author.

Torah”, the commentary and detailing of the commandments of the written Torah, “in its entirety”. A further feature of this work, Maimonides wrote, would be its *ordering* of halachah, according to its topics. This ordering is not simply a filing into categories of mutually relevant halachos (laws). The *connection* and *sequence* of topics as well as the organisation of halachos *within* each topic discloses the actual conceptual structure of the halachah itself².

The first four chapters of the first grouping of halachos in the *Mishneh Torah*, called the “halachos of the *foundations* of the Torah”, treat five *fundamental* mitzvos. Chapter 1 contains the halachos of the mitzvos pertaining to knowledge of the existence of G-d, His uniqueness and unity, while chapters 2 to 4 include the halachos pertinent to the mitzvos of loving and fearing G-d. These chapters include “cosmological information”, or more precisely halachos relating to the character of the physical Universe. The first chapter deals with the existence, uniqueness³, unity and incorporeality of G-d. The second chapter presents the spiritual realm of angels, according to their various kinds and also with the nature of G-d’s relationship - in terms of His “knowledge” - to all of Creation, both in its spiritual and material realms. The third chapter is devoted to the subject of this study, the structure of the *heavens*, called the *galgalim*, the system of concurrent spheres in the centre of which the earth stands. Finally in chapter four, there is the discussion of *earth*, the component entities of which are composed of the “four foundational elements”, fire, air, water and earth, which in their purer form

² As may be elaborated from the extreme attention of Maimonides to the division and order of the halachos. See *Sefer K’lallei HoRambam*, Kehot, K’far Chabad 5751, p. 22. Note also the concluding of the words of Maimonides himself at the end of his Introduction to the *Mishneh Torah*.

³More precisely, “that one should not think that there is any G-d besides Him”. See caption to *Hilchos Y’sodei HaTorah*.

are found already beneath the “sphere of the moon”⁴. (Parenthetically, the sphericity – roundness – of the spheres is not in contradiction to the elliptical or imperfectly circular appearance of the *orbit* of certain heavenly bodies⁵.)

⁴ *Hilchos Y'sodei HaTorah* 3:10.

⁵ As Maimonides sets this out in *Hilchos Y'sodei HaTorah* (chapter 3) and in *Hilchos Kiddush HaChodesh*, the earth is the centre of the greatest and comprehensive sphere, known as ninth, or daily, sphere (*galgal hayomi*), as it completes a rotation every day around the earth, which is fixed at its centre. All the lesser spheres rotate “on” and “relative to” its motion. Collapsing this three-dimensional entity – the ninth sphere – and all the lesser spheres into two dimensions, we could picture the ninth sphere as a large disk rotating (like an old-fashioned phonograph turn-table) around the earth at its centre. Upon this large “disk” all the other lesser spheres (visualized in two dimensions as disks) have their own rotations. That is to say, they themselves move – and so are “dragged” – on this larger disk (sphere) and their movement is the aggregate of the motion of the ninth sphere and their own motion, which may be same- or counter-directional to that of the ninth sphere. In addition to this, there are some small spheres, which rotate around a point on one of the spheres that turn around the earth. One of these is a small sphere in which the moon is “embedded”. Consequently, the motion of the moon is the product of the motion of a sphere (the sphere of the moon [*galgal ha'yarei'ach*]) rotating around the earth *and* the rotation of a small sphere, in which the moon is embedded, rotating around a point on the “general” sphere of the moon.

Most significant for the explanation of the elliptical course of the orbits of the sun and the moon, from the standpoint of the earth, is that the centres of their spheres are not identical with the centre of the earth, but their centres rotate around the centre of the earth. In other words (amongst other spheres in which other heavenly bodies are embedded) the centres of the sphere in which the sun is embedded and of the sphere of the moon do not coincide with the earth, but themselves rotate circularly around the earth. The term “geocentric” means that the earth is either the centre of a sphere or the centre of the rotation of the centre of a rotating sphere, in which a heavenly body is embedded. This accounts for their elliptical orbits vis-à-vis the earth. I am grateful to Rabbi Hershel Krinsky for discussion of this point.

These halachos are stated in a way accessible to all. Yet, as Maimonides writes, their *deeper* study is the province of an esoteric study. The first two chapters, speaking of the Creator and of the “invisible” spiritual realm of the angels, relate to the Kabbalistic teaching termed *Ma’aseh Mercova*, and that of the third and fourth chapters dealing with the structure of Heavens and Earth, the physical creation, is the subject of the teaching of *Ma’aseh B’raishis*, also within the realm of Kabbalah. In short, the subject alluded to in these chapters is the teaching of the structured *unity* of creation. In terms of Kabbalah and Chassidic thought it presents the *seder his’talshalus*, the serial ordering of the totality of enlivened creation, bringing out its unity, and the oneness of the Creator in the details of creation. For Maimonides this bears also on the mitzvos of loving and fearing G-d, as explained in halachah 12 of chapter 4: For “when one contemplates these, and perceives all the creations from angel, sphere and man, and the like, and sees the wisdom of the Holy One blessed be He in all fashioned and created entities, his *love* for G-d will be increased and his soul will thirst and his flesh expire in love to G-d...”. Similarly, when he compares himself to the levels in the order of creation, above him, he will be filled with “*fear* and dread from his lowliness, poverty and insignificance”. A teaching of the unity of the creation, incorporating a notion of a geocentric universe (the *galgalim*), forms the *halachic* content of the fulfilment of five foundational mitzvos of the Torah⁶.

Stages in the order of creation

The inner, Kabbalistic import of these chapters is intimated by Rabbeinu Bachyeh, in his commentary on the dream of the

⁶ See the commentary of the *B’ris Moshe* on the *S’mag, mitzvas aseh 3*, who points to the way in which Maimonides *unites* the mitzvos of *Yichud HaShem* (perceiving the unity of G-d) with those of the love and fear of G-d.

Patriarch Ya'akov⁷, in which Ya'akov beheld a ladder, standing upon the earth and its top reaching into the Heavens. He writes that the vision “hints at the [order of] being [*m'tzius*]. And because a ladder has many levels, one above the other, the verse finds in it an analogy for the [order of] being, in that being is divided into three parts: the part of the angels, the part of the spheres (*galgalim*) and the part of the lowly world”⁸. In terms of Kabbalah and Chassidic thought, after speaking in the first chapter of the Creator “Himself”, we have in the next three chapters, the order of creation, *sefer his'talshalus* (the sequence of the descent of worlds), with this world as its goal.

In the first chapter, Maimonides sets out the principle that G-d enlivens the entirety - both the spiritual and the material realms - of creation. The totality of enlivened reality, however, is structured as a progressive descent. One level is contained in and derived from the one above it: it has the character of cause and effect, the effect of a prior cause becoming the cause of a new effect⁹. Moreover, the purpose and goal of this descent is this lowly world, the earth, inhabited by man. Rabbeinu Bachyeh states this in connection with continuation of the account of the dream of Ya'akov, “For the Holy One blessed be He, Who is above all, transmits His power into the angels and the angels transmit power into the spheres and the spheres by their movements give power into the lowly creatures. It turns out that the cause of all that is effected in the lowly worlds is the spheres, and the cause of the spheres is the angels and the cause of the angels is G-d, be He exalted, Whose influence extends over everything.” The heavens - the spheres and the stars fixed within them - are, therefore, a link in the “chain of worlds” through which the immanent enlivening of the worlds, is measured out to each entity,

⁷ *V'ayeitzei, B'reishis* 28:12.

⁸ Cf. Maimonides, *Moreh N'vuchim*, Part 2, chapter 10.

⁹ *Hilchos Y'sodei HaTorah*, 2:6.

according to its level. Specifically the *mazolos* (constellations)¹⁰ and the spheres, with their individual stars, in concert, channel all the specific influences from above upon the human, animal, vegetable and inanimate levels of earthly existence¹¹.

The fact that the unity of creation is built out of stages is brought out by the phenomenon of idolatry. The term for idolatry in Torah is generally *Avoidas Cochovim u'Mazolos*, the deifying “service of the stars and constellations”, although it consists equally of the service of any other part of creation. In *Hilchos Avoidas Cochovim v'chukos ordeho*¹² (“Laws relating to idolatry and the statutes of its servants”), Maimonides sets out the origins of idolatry. He explains that the *first step* towards idolatry, taken in the days of Enosh, was through the association of a degree of *independent* importance to the intermediaries - the stars, spheres, angels - used by G-d in the creation. It was erroneously believed that it was the will of G-d that, as the mediaries of Divine influence to the physical earth, they be accorded some honour and significance of their own. The practice, in accordance with this belief, thus did not carry with it any *denial* of G-d as the ultimate Creator of all, but wished to establish a relationship of *partnership* (*shitus*)¹³ of the intermediary with G-d, Who was presumed to have “withdrawn” from active supervision of the creation. From this came a *further* step and decline, namely, fixation on an intermediary, a creature, as the *sole* deity.

¹⁰ Stars of the zodiac, found in the eighth sphere. *Ibid.*, 2:6-7.

¹¹ See Rabbeinu Bachyeh, *loc. cit.*, and as explained in many places in Chassidic thought.

¹² The full title of these halchos is in accordance with version of Maimonides *l'Am*, Mosad Horav Kook. See comments of Rabbi Y. Capach on versions of this title in his edition of *Mishneh Torah*.

¹³ See the discourse of Rabbi Menachem Mendel Schneerson, “*Mayim Rabim*” (5717), section 3, reprinted in *Maamarim M'luket Vol.* 1. Kehot.

The significance of the *historical account* of the origins of idolatry in the *Mishneh Torah*, which is a work exclusively of *halachah* is thus to indicate the the kinds of *contemplation*¹⁴ which lead to idolatry, and so are forbidden as idolatry. Idolatry is the contradiction of the unity of creation, it hypostasizes a part of creation and makes it absolute and separate from the source of all creation. The belief, established by the Patriarch Avrohom, on the other hand, is that none of the creatures or stages in the entire order of creation possess *any* autonomy or significance whatsoever: all are nullified “in their existence” to the transcendent G-dly power enlivening everything. The “lesson” of idolatry, however, is that there are “gulfs” and qualitative leaps between the phenomena in creation, especially in the seeming disjuncture of physical and spiritual reality. These permitted the error of perceiving them as *actually separate*, to the point of occlusion of the spiritual *source* of creation.

The names of things

What is the structure of the heavens and earth? To answer this question one needs to make a general point about explanation. In physical description and explanation, we have two levels, “theoretical constructs” - ideas - and “data” - the information supplied to us by *our* senses. Theory provides a way to make sense of data and it is data which substantiate theory. Even in giving a *name* to something we have reference to an idea or concept or theory. The issues of naming and theory are essentially one. For even the simplest particular data of experience, for example “red” or “round” raise the issue of a general concept of “redness” or “roundness” in which these participate. At issue here is the relationship of a supra-empirical or *metaphysical* plane and an empirical or *physical*

¹⁴ Rabbi Menachem Mendel Schneerson, *Likkutei Sichos*, Vol. 20, pp. 17-18.

plane. This is a question which, in many forms, agitates philosophy throughout its history: namely, does a metaphysical realm exist, or are there only experiential particulars; and if the ultimate reality is the empirical one, how could *general ideas* be abstracted from it?

From the viewpoint of Torah's teaching of the *seder his'talshalus*, the physical realm is comprehended also as a realm of essence, *like* the spiritual realm, not as a disjoint realm of appearance and experience. The "invisible" spiritual realm, dealt with by the teaching of *Ma'aseh Mercova*, is prior to, and explains, the physical, "visible" realm of "Heavens and Earth", the subject of the *Ma'aseh B'raishis* inasmuch as the latter is *descended and derived* from the former. The *seder his'talshalus* presents *all* of reality, spiritual and material, as a meaningful unity in which essence is differentiated from, and yet bound to, essence¹⁵. Each level (with its entities) is included in the foregoing until all is included in the level corresponding to the "one utterance", with which G-d "could have created the world", but instead chose to create it with (to divide it into) ten¹⁶.

Thus, it has been explained¹⁷ that the names of things in the Holy Language (Hebrew) describe their *essence*, in that the "*chayus*", the specific spiritual vitality of the entity denoted by that name, comes *through* its name. As elaborated at length in Chassidic thought, the letters of Hebrew relate to particular elicitations and channellings ("*hamsbochos*") of the ten *s'firos* (G-dly attributes) above. Their combinations and permutations,

¹⁵ Unlike the philosophy of empirical science, which is concerned to *make sense* of the "structure of appearance", physical phenomena, through induction or hypothesis or theory. The world of essence, revealed by Torah, is from the outset a *unity*. No unity has to be *construed* in it.

¹⁶ See *Likkutei Sichos* "B'raishis" 5750, section 5.

¹⁷ See at length Rabbi Schneur Zalman or Liadi, *Sha'ar HaYichud v'ho'emunah*, chapters 1, 12.

forming names, indicate a particular webbing of those G-dly powers, together with a factor of contraction of these powers, revealing the spiritual code and significance of the item or phenomenon called by this name. The source of things in the visible, empirical world - coded in their names - are the *marcovos ho'ehyonos*, angels, "above" the heavenly spheres and the earth. In terms of the ladder, the phenomena below have their origins above in the spiritual realm or world of angels¹⁸.

The names of things and the study of *sefer his'talshalus* speak in the realm of essence. Its language is metaphorical. It describes the anatomy of the "soul" of reality, not the "external" body of nature. When we come to the realm of appearance, the concrete description and "handling" of physical reality from "below", we have recourse to that which deals with the structure of external appearance and reality. This is science.

Science and the externality of nature

Nature

Names in Hebrew, as explained above, tell about things. Nature is called *teva* and it is explained in Chassidic thought¹⁹ that it is associated with the expression *tub'u b'yum suf*²⁰ - "were drowned in the Sea of Reeds". Nature obscures the G-dliness which animates it and this too finds expression in relationships of the Holy Language, the language of creation: *HaTeva* (literally "the nature") has the *gematria* (numerical value) of *Elokim*, the Name which represents the G-dly power of "contraction" or "restraint" which "screens out" the *infinite*

¹⁸ See *Likkutei Sichos*, Vol. 15, p. 13, where it is explained how each entity below has its source in the *marcovos ho'ehyonos*, which "indeed are angels".

¹⁹ See *Likkutei Sichos*, Vol. 3, p. 966, Rabbi Sholom Ber Schneersohn, *Sefer Maamarim* 5560, p. 86.

²⁰ *Sh'mos* 15:4.

G-dly enlivening force *maintaining* the created existence of all things out of nothingness. The screening out of the infinite enlivening power is in order to create a “place” for creatures such that they should not lose their existence through this immense revelation. “Truly You are a hidden G-d”²¹, that is, G-d is present in, and exerts an immediate and individual providence over everything; but, for earthly eyes, in a way of *concealment*.

In relation to the human “below”, however, the “contraction” of G-dliness *does* constitute a reality. Nature is concrete, even if its G-dly essence is obscure. The contraction of G-dliness has issued the *tagboras hisgalus hayesh al ha’ayin*²², the immense manifestation of the physical “something” over the uncomprehended “Nothing”, the infinite G-dly Power beyond and behind it. The significance of nature, is not then that it is not G-dly, but that its meaning, its sense and essence, is not comprehended. The *degree* of “difficulty” of nature, and obscurity of the Divine essence and purpose in it, is in turn affected by man’s conduct. Before the sin of the tree of knowledge, the tree and its fruit tasted the same, a woman conceived and gave birth on the same day (as will be again in the times of the redemption)²³. The G-dly *essence* in nature manifested itself spontaneously and outwardly, in that nature was the intimate servant of man. With the sin of the tree of knowledge, the earth was “cursed on account of you”²⁴. Instead of expressing its Divine purpose as a vehicle for the revelation of G-dliness through man’s service, nature appears as the intransigent object of man’s labour - “by the sweat of your brow you shall eat bread”. There is an interruption and

²¹ *Isaiah* 45:15. *Sefer Maamarim* 5560, p. 86.

²² *Sefer Maamarim* 5560, p. 86.

²³ See references at the beginning of *Likkutei Sichos* “B’chukosai” 5751.

²⁴ *Breishis* 3:17. See here and in the following at length *Likkutei Sichos* “B’chukosai” 5751.

delay between human actions and responses of nature. The *factuality* of nature is to be unlocked as an objective *process* of cause and effect, not the spontaneous response of the Divine essence *in* nature to man. Nature is a riddle. The purpose of science is to solve that riddle.

The Middle Ages of Western civilisation were, by in large, characterised by a universal religiosity. Until, and even into, modern times, science was called “natural philosophy”²⁵: it revealed its inheritance as the study of the *meaning* and *origin* of things, which frankly acknowledged and *began* with the metaphysical and spiritual foundations of nature. This was dispelled in stages by the Renaissance and the Enlightenment. Galileo, the Renaissance forerunner of modern, Newtonian science, announced that the function of religion was simply to tell “how to get to Heaven, not how the Heavens work”. As the “humanism” of the modern epoch ever more excluded a G-dly essence from nature, that Essence in turn obscures Itself more. While the Renaissance and the Enlightenment constitute stages in the dawn of modern science, there enters a fundamentally idolatrous metaphysic: the physical realm is *separated* from a spiritual source and is regarded as an autonomous, if not the *only* legitimate reality. Conceivably, this spiritual decline thickens the veil of nature itself. Nature has become for man *solely* a realm of appearance, a *mere* physical given (*datum*).

Science as the successful negotiation of nature

The characteristic of *modern*, post Renaissance science, with Newton *par excellence*, is that science has become *experimental*. That is, its interest is to predict and to manipulate physical phenomena. In both Galileo as well as Newton functioned a

²⁵ See Professor A. Koshelevsky, “Hayesodot badaati'im shel hamada”, B'Or HaTorah, Vol. 7E, p.43-44.

basic assumption that nature's occurrences are regular and reproducible. Consequently they are subject to universal laws. *Empirical* reality fills the vision of the scientist. If there is room left for a Creator, it is for One Who is committed to laws of nature which *science* has found. There are no supra-empirical or metaphysical parameters, which have *in advance* assigned meaning to reality, and limited or guided empirical knowledge. Any *scientifically* established solution to the riddle of empirical reality is acceptable.

In the recent discussion of the nature of scientific discovery we find two strains. The "positivist"²⁶ view of the development of science is that science progresses by setting forth ever more powerful theories. The power of a theory is its *tested* ability to include *more* phenomena in its explanation than previous theories. A second school²⁷ claims that non-experimental - i.e. *non-testable* - concepts or theories precede and "select" data. The history of scientific ideas, according to this view, represents a sequence of paradigms or "Gestalt-switches". Accordingly, a new or more advanced theory *cannot* be said to *include* and *extend* previous theories. Nevertheless, even for this second school, the criterion for the rationality of a scientific theory is its greater "success" than its predecessors²⁸. This point transcends and unifies both "positivist" and "Gestalt" positions on the theory-data question. The purpose of science is to "negotiate" and "manage" the phenomena, the data of our senses. Science has to do with mastery, and mastery is achieved through theories which successfully predict and achieve *results*.

²⁶ As exemplified, for example, by K. Popper, *The Logic of Scientific Discovery*, Hutchinson, London, 1959.

²⁷ Pre-eminent in which is T.S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed., University of Chicago Press, Chicago, 1970.

²⁸ W. Stegmüller, *Probleme und Resultate der Wissenschaftstheorie und analytischen Philosophie*, Band II, Teil E, Springer, Berlin, 1973, p. 313.

The success of a scientific theory is not baseless. In the shadows of empirical reality, the scientist has found correct connections, but has not necessarily found their true *significance*. Indeed, the scientist may even have inverted their proper significance and connection. A formula may be successful and indeed even primitive peoples have what seem to us bizarre formulas and procedures which also work. But *why* they work, what the *meaning* and *validity* of the *theoretical terms* of the formula are, is well outside the realm of physical science: they are *metaphysical*.

Indeed Torah itself endorses the “rationality” of the quest of science²⁹, namely to formulate theories, to establish regularities and to seek to make predictions on the basis of theories, *except* where these rest on metaphysical presuppositions or reasoning *contrary* to those of Torah³⁰. Thus one finds that when Rabbi M. M. Schneerson treated the Darwinist theory of evolution or heliocentrism, he took pains to dismiss them not *only* because their first principles conflict with Torah (which is the case), but also because of their lack of compulsion from a *scientific* point of view. In the case of Darwinism he stated that the hypothesis had simply not been corroborated *by evidence*³¹; so too, with regard to heliocentrism, the Rebbe writes that from the point of view of relativity theory itself, one cannot say which of the Sun and the earth is

²⁹ Cf. Maharal of Prague, *N'sivos Olam, N'siv Hatorah*, chapter 14. See also Rabbi M.M. Schneersohn, “*A Letter on Science and Judaism*” in A. Carmel and C. Domb, eds, *Challenge: Torah Views on Science and its Problems* (London/Jerusalem: Feldheim, 1976): “Needless to say, it is not my intent to cast aspersions on science or to discredit the scientific method. Science cannot operate except by accepting certain working theories or hypotheses, even if they cannot be verified.. No technical progress would be possible unless certain physical ‘laws’ are accepted, even though there is no guarantee that the ‘law’ will repeat itself...” (p. 149).

³⁰ *N'sivos Olam, loc. cit* (at end of ch. 14)

³¹ “*A Letter on Science and Judaism*”, pp. 148-49

revolving about the other, and consequently there is no reason to take the verses of Torah indicating geocentrism other than literally³². Science is rational, from the point of view of Torah, in its goal of explaining nature. The Maharal stated this. But it cannot arbitrate the rightness or the limits of its explanation.

The redemptive “twist”: science as a vehicle for G-dliness

In an essay Rabbi M. M. Schneerson³³ analyses the prophecy of the *Zohar* that in the 600th year of the sixth millenium there would be a great advance of science and that this would serve the redemption. This is not only by virtue of the technology built on this science which enables the actual dissemination of Torah to such an extent that the world can be literally permeated with , for example , radio waves carrying “shiurim [lessons] in Tanya”. It is also, and more deeply, in the sense that scientific *theory itself* becomes a vessel for the revelation of G-dliness. The Rebbe gives an example of this in the following terms. Contemporary science - and indeed the progress of science in general - has achieved an ever more unified conception of reality to the point where it comprehends reality as the unification of quantity and quality: “material which bears force, and the force”. This is the “undiscovered” analogy of the unity of G-dliness, the “substratum” of all being, with the entities “formed” within it. All that is required is that the terms should be changed, and

³² *Likkutei Sichos*, Vol. 10, p. 181 in the letter of 25 Iyar 5719. This concern with evidence bears on criteria set out by Rabbi Saadia Gaon (in the *Sefer Emunos u'deos*, first *maamar*, section 5) for interpretation of verses of Torah other than according to their literal sense. For since, as Rabbi M. M. Schneerson writes in this letter there is no compelling contradiction from *empirical* science (and certainly from the data of the senses, mentioned by Rabbi Saadia Gaon) to verses indicating geocentrism there is no reason to learn them other than literally.

³³ In relation to this section see *Likkutei Sichos*, Vol. 15 pp. 42-48.

one see that the unity of nature is nothing other than “the simple unity of G-dliness”³⁴.

The purpose of science is to provide a vehicle for the perception of G-dliness *in* nature. This is not so much the view from *above*, that the G-dly enlivening, *G-dliness*, is all. Rather it is the acquisition of this *same* perception from *below* - standing within “empirical” nature and within its language, “science”, that (the *physical*) *all* is G-dliness. The time spoken of in the prophecy of the *Zohar*, the Enlightenment and the scientific dawn of the industrial revolution, is also the time of the emergence of the individual sciences, including the beginnings of social sciences. Science began then to *explore and detail* the “departments” of empirical reality. The redemptive goal of a “dwelling place for G-d in the lower realms” is that empirical reality and its sciences should *themselves* become expressive of the unity of G-dliness. But this can be only when empirical science is also a *true* science.

Torah cosmology and the metaphysics of Newtonian science

The physical world as analogue of a G-dly metaphysic

It is explained in Chassidic thought and Kabbalah that the concept of the *his'havus* (enlivening *ex nihilo*) of all entities in creation, from the most sophisticated to the simplest, inanimate object, is associated with a transcendent level of G-dliness called *sovev kol almin* “enveloping all worlds”, so termed in that it pervades all levels and aspects - “worlds” - of creation equally. The metaphor used for transcendent encompassing G-dliness is that of a *circle*, which has no beginning and no end, symbolising its relevance to all “within”

³⁴ *Ibid.*, p. 47.

it and *its indifference to the distinctions* of the entities encompassed by it. The concept of encompassing G-dliness in its “pristine” sense is comprehended by the metaphor of the *igul hagadol*, the “great circle” which encompasses all levels of creation³⁵. The graded descent of worlds, the realm of *immanent* G-dliness (termed *memaleh kol almin* [“filling all worlds”]), within this great circle is, on the other hand, comprehended metaphorically as a downward directed “line” (*kav hamidah*). It measures out an *ordered and differentiated* creation, in which “upper” and “lower” are significant distinctions. The *kav* - representing the overall descent of immanent spiritual levels of creation - however, also incorporates within it the *transcendent* aspect of G-dliness: at a given juncture it forms a lesser circle³⁶ and then again descends as a line, again forming a circle and then again proceeds as a downward line. Thus although the *igulim* found in the *kav* are themselves stages in the *descent* of *seder hishtalshalus*, they nevertheless derive from and have something of the *encompassing* (*makif*) character of the *igul hagadol*³⁷.

All the foregoing, as mentioned before, is a *metaphor* describing a *spiritual* realm. It is explained, however, in discourses³⁸ of the first Grand Rabbi of Chabad, Rabbi Schneur Zalman of Liadi, that the *physical* heavens, the nine spheres of physical creation (*Asiyah gashmis*) model the nine *igulim* of *Asiyah ruchnis* which forms their spiritual essence, and from which level in the *seder hishtalshalus* they are enlivened. The individual spheres, including the very sphericity of the earth, partake of the character of the general *igul hagadol*, i.e. have the characteristic of *sovev kol almin*. It is this also which

³⁵ See Rabbi Schneur Zalman of Liadi, *Likkutei Torah, Korach* 52a-d.

³⁶ See Rabbi Dov Ber, *Sh'ar Hayichud*, chs. 16, 17.

³⁷ Rabbi Menachem Mendel (the *Tzemach Tzedek*), “*Mitzvas tzitzit*”, ch. 2 in *Derech Mitzposecho*.

³⁸ See *Sefer Maamarim* 5562 pp. 475-479.

explains why a person standing on the “bottom” of the world does “not fall off” - a phenomenon, according to Kabbalah, *falsely* accounted for by modern science with the concept of “gravity”³⁹. The earth forms *with* the heavens encompassing it a structural unity: in which the heavens may be viewed as “prior” in the sense as the transmitters of *higher* influences to the earth; or as secondary in that they merely *serve* the earth⁴⁰ (as a peel serves the fruit). The Ptolemaic *scientific* theory, which sets forth an order of *concentric spheres*, is thus a valid analogy or *application* of the *essential, spiritual* relationship of the

³⁹ *Ibid.* The *igulim* in the spiritual realm have, as mentioned above, the quality of *sover kol almin*. That is to say, just as the level of *sover kol almin* in general animates all entities from the highest to the lowest, equally, so too the *igulim* exert a *general* influence upon all which they encompass. Everything is equal in relation to this general influence. To illustrate this, Rabbi Schneur Zalman employs the analogy of a young student and a great teacher. The teacher *knows* - takes in all aspects of the student from head to foot, in one glance, in which all of the details are equal. When, on the other hand, the teacher comes to involve himself in a specific way with the student (in the manner or immanent - *memale* - G-dliness) in a manner of enclothement, so to speak, he will deal first the superior, and then proceed to the lesser aspects of the student. Here we are speaking not of the general *comprehension* by the teacher of the student, but of the general *influence* of the sphere upon the earth which is within it. Now, the physical spheres, the *heavens*, have the characteristics of place (of upper and lower) unlike the spiritual metaphor of the *igulim* of *Asiyah ruchnis*, which encompasses all equally within it equally, and nothing is upper or lower in relation to them. Nevertheless, since the *galgalim* (the spheres) “descend” from the *igulim* they have a similar quality and power. In relation to the sphere of the heavens which encompasses the earth, everything on the earth is equally “uppermost” vis-a-vis the centre of the earth from all sides. In terms of this *general* enlivening, nothing is “below”, that it should “fall”. All is held in its position, as an expression of its essential enlivening. See Rabbi M.M. Schneerson, *Hayom Yom* for the day 14 Tammuz and its source in Rabbi Y.Y. Schneerson, *Igros Kodesh*, Vol 2, letter 617 (p.496).

⁴⁰ See *Maharsha*, *Chagiga* 12a s.v. “*Beis Shamai Omrim*”.

heavens and earth, the inwardly descending spheres of *Asiyah ruchnis*.

Maimonides states that the spheres (and the stars fixed within them) possess a “soul” (*nefesh*) and “understanding” (*da’as*):

They live and stand and recognise the One, by Whose word the world came into being. Each one of them according to its greatness and its level praise and glorify their Creator just as do the angels which are above them. And the understanding of the stars and the spheres is less than the understanding of the angels and greater than the understanding of man⁴¹.

The *Pirush* (“Commentary”) printed beside Maimonides in standard texts states concerning the nature and order of their perception:

At first [the star or sphere] recognises itself and afterwards it recognises its cause, which are the removed intelligences [i.e. the angels]. And after they recognise their cause they know that these possess a cause which must exist (*m’chuyov ham’tzius*) and that is the Holy One, blessed be He.

Rabbi Sholom Dov Ber (the Rebbe *Rashab*) further qualifies this: “and the sense in which they recognise G-d is that they recognise that there is a necessary existing Cause, but not that they recognise Him”⁴². In terms of Chassidic thought this is the notion of *bitul hayesh*, conscious self-nullification. This does not proceed from recognition of the essence (*m’bus*) of G-dliness, which would call forth an utter self nullification (*bitul b’m’tzius*). Rather, it follows from a perception, and acknowledgement of the *existence* of G-dliness. And the service

⁴¹ *Hilchos y’sodei haTorah* 3:9.

⁴² *Sefer Maamarim* 5666 p. 18.

prompted by *bitul hayesh* is to be *drawn* towards the uncomprehended source of one's existence. The *movement* of the spheres is their *singing* (*shira*) of praises and bowing (*bishtachavoyob*) towards the Divine presence, beyond and outside the spheres, "in the west"⁴³. Thus it is explained that when Joshua stopped the sun by saying "*sbemesh b'Givon dom*" ("Sun be silent over Givon")⁴⁴ he was in fact giving instructions that the sun be silent from its singing and *therefore* stand still⁴⁵. Moreover, the *circular* motion of the heavenly spheres is like that of the angels called *Ofanim*, "wheels", which expresses the simplicity of their acknowledgement of G-d⁴⁶. In summary, an

⁴³ See *Tanya*, ch. 42, p. 61a in the note (*hago'ob*) . An issue arises here as to how it could be said that all are bowing towards the west, if in fact it is the outer sphere, the *galgal bayomi*, which turns all the inner spheres with their stars in that direction, while they have slower opposite motions "upon" (or within) that sphere. Is their acknowledgement in a sense forced by a higher cognitive sphere, or shall we say, as the *Tzemech Tzedek* quotes from another source, that in truth they are all turning towards the west (not as Maimonides writes) but at different rates, such that some spheres *appear* to be following a motion contrary to other spheres, in which case the acknowledgment would seem to be voluntary amongst *all* the spheres (see *Tzemech Tzedek, Sefer HaLiklutim erech galgalim* p. 289). The latter, writes the *Tzemech Tzedek* is the view of *Chazal* in the Gemorra *Bava Basra*, which forms the basis of the words of the Alter Rebbe in chapter 42 of *Tanya*, while in a number of other places in Chassidic thought the view of Maimonides is followed.

⁴⁴*Joshua* 10:12.

⁴⁵Rabbi Sholom Dov Ber of Lubavitch, *Sefer Maamarim* 5672, Vol. 2 p. 685.

⁴⁶The Rebbe Rashab explains that the *galgalim* are like the angels, from which they receive influence, termed *Ofanim*. These are distinguished from higher angels called *S'rafim*, which perceive G-dliness and their movement is one of *Rotzu* and *Shuv*, of ascent and return. On the other hand, the *Ofanim*, which have no substantive perception of G-dliness, but are intensely aware of the the existence of G-d have an undifferentiated movement not characterised by ascents and return, i.e. which possess degrees of substantive perception of essential (*m'bus*) G-dliness in perception but rather a uniform motion of acknowledgment. This is why they are called "*ofanim*", "wheels" Nevertheless, even in this there is an

immanent level of G-dliness functions in the “soul” (*nefeesh*) of each sphere and is expressed in its movement.

Chassidic thought, moreover, explains⁴⁷ how several phenomena of the system of the spheres express the *unity* of G-dliness, as the unity of transcendent and immanent G-dly powers. The first of these is to be seen in the *constancy* of the rotations of the spheres, with the stars fixed in them. For, although the spheres are *finite* entities, their movement is *constant, without limit*. This is due, as mentioned above, to an *infinite*, transcendent G-dly power (*sovev*) which keeps them in motion. *At the same time* we have seen that the “motor” of the movement of the spheres is *finite*, immanent (*memaleh*) G-dliness, the *nefesh*, in the singing and praises of the sphere. It is explained to resolve this, that the *sovev unites with, and works through, memaleh* to produce the constant motion. The second phenomenon is in *individual* movements of the spheres: the ninth sphere (*galgal hayomi*) turns from east to west, while the others turn from west to east; and the latter themselves are turning independently. Yet all the spheres function together to produce a *concerted* direction of Divine influence upon the earth. That bodies moving independently, and in opposite directions, could yet be considered as “one body”, to produce this unified agency, is possible only because of a supernal force, which binds them together, namely the Creator. Both of these paradoxical phenomena are manifestations of the deepest level in G-dliness (*Atzmutus*) which is able to manifest the level of *sovev*, the infinite, in the level of *memaleh*, the finite. Physical creation, in the geocentric order of the heavens, is

“upper” part of the circular motion and a “lower” one. The upper part of the circular motion is the perception that it is necessary to acknowledge and praise and the lower part is the endeavour (*eseke*) to cleave to G-d. So it is also with the spheres. See *Sefer Maamarim* 5665 p. 161.

⁴⁷For the following see *Sefer Maamarim* 5672, *loc. cit.* pp. 685-686; *Sefer Maamarim* 5655, pp.153-152.

thus seen to manifest *externally* the unity of G-dliness, its *essential* being.

The metaphysics of Newtonian science

Briefly, the Newtonian celestial mechanics is based on a mathematical model with a physical interpretation. Starting with the principle of inertial movement, in a straight line, of an object which is unimpeded by any contrary force or friction, we find that its movement in relation to a point “P” will sweep out over equal areas (triangles), over equal time intervals, as may be demonstrated by simple geometry⁴⁸.

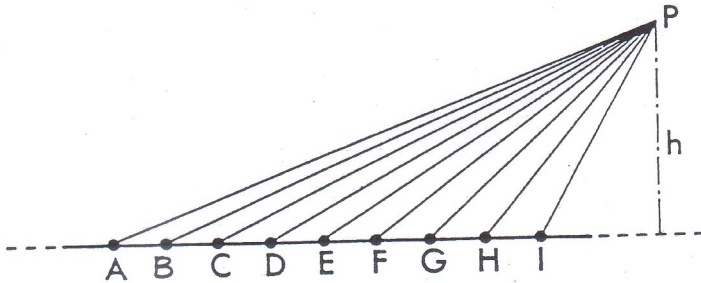


Figure 2

All the triangles ABP, BCP, ... have the same area since their altitude *b* and their bases AB, BC, ... are equal.

When a force acts upon the object at point B, in the direction of P, and so again after a similar interval (C) and so forth, equal triangles again result. In *the limiting case*, as these intervals become smaller (and the triangles of equal area become lines of equal length), a circle results around the point P.

⁴⁸ The following diagrams, with explanations, from I.B. Cohen, “Newton’s third law and universal gravity” in P.B. Scheurer and G. Debrock (eds), *Newton’s Scientific and Philosophical Legacy*, Dordrecht, Kluwer Academic Publishers, 1988 are reproduced with kind permission of the Publishers.

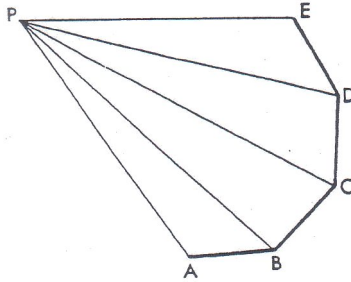


Figure 3

When the body arrives at C, it is again given an instantaneous blow directed toward P and moves from C to D in that same equal time; at D it is again given a blow directed toward P... In the absence of any forces or resistance, a body in motion will continue to move in a straight line uniformly, that is, with constant speed in a straight line. This is the law of inertia. Hence, in a succession of equal time-intervals the body will move through the equal distances AB, BC, CD, DE, EF, ...

A “dynamic’ measure” is subsequently introduced by Newton to account for the claimed “elliptical” movement of the planets, as distinct from a circular one. This is the skeletal mathematical theory of the heliocentric structure of the solar system.

This mathematical model of the orbits of the planets around the sun is interpreted in terms of two physical laws. One is the uninterrupted, constant and lateral *inertial* motion of the planets, all other things being equal. The second is the deflection of the lateral inertial motion of the planets into a curved orbit by a force of *gravity* operating between the central body, the sun, and the planets.

Newton was clearly *concerned* with the meaning of these two fundamental posited “physical laws” of “inertia” and “gravity”. While Newton, in the words of I.B. Cohen, “attempted to reduce universal gravitation to the action of something else: a shower of aether particles, electrical effluvia, or ‘sprints emanated’, variations of an all-pervading aether”⁴⁹,

⁴⁹ I.B. Cohen, *op. cit.*, p. 40

nevertheless, all of these attempts at an *explanation* of gravity “failed”⁵⁰. He acknowledged his failure and made his statement so characteristic of philosophy of modern science that nevertheless it “is enough”⁵¹ that it *works*. So too, the basic concept of “inertia” as that which “would keep bodies in whatever state they were, whether a state of rest or a state of moving uniformly in a straight line”⁵² could only be conceived by Newton as a “passive force”, a “force of remaining in the same state of rest or of motion” in objects. Its validity as a concept, like “gravity” was simply that it could be quantified⁵³ and thus made to “work”.

In that the modern Newtonian science was content to find its validity on the empirical surface of reality, in terms of the “success” criteria of quantifiability, manipulability and predictability, it candidly acknowledged its ultimate indifference to the metaphysical meaning and validity of its key concepts. Indeed, the Rebbe writes that the structure of reasoning itself, the movement from *first principles* through *rules* of reasoning is itself a proof to intellect that “one must come to that which is higher than intellect. For *intellect itself senses* that its origins are not intellect ...[but] first principles, which themselves have no intellectual compulsion, but rather ‘appeal’

⁵⁰ *Ibid.*

⁵¹ *Ibid.*, p. 44

⁵² I.B. Cohen, *The Newtonian Revolution*, Cambridge University Press, 1980, p. 189.

⁵³ “Galilean-Newtonian experimental philosophy requires that physical entities be quantified mathematically. This doctrine accepts only quantities, i.e. the measurable, as real and as a subject of exact science ... the mathematical realizability of the force of gravity as a sufficient proof of its reality, a proof which does not lose its validity even if the phenomenon of gravity itself is not understood physically. Similarly the force of inertia, if it is to be physically real, must have its mathematical measure.” E. Dellian, “Inertia, the innate force of matter: a legacy from Newton to Modern Physics” in P.B. Scheurer and G. Debrock, *op. cit.* p. 229.

– a notion of belief and attitude”⁵⁴. In its professed indifference to the metaphysical, it in fact elects a highly *materialistic* metaphysics. “*Yeshus*” is a term by which Chassidic thought refers to the self-centred consciousness of the creature, which has forgotten its creatureliness and has lost all sense of its being enlivened from a *spiritual* source. “Gravity” represents the apogee of *yeshus*. In the “lonely” physical world of Newtonian science, the bigger body dominates the smaller one, until all are held in place - in their orbits - by the active domination of materiality by a greater materiality. The continuous motion of the heavenly bodies in their circuits, on the other hand, is due to “inertia”, is an equally material but this time “passive” force attributed to objects. Not only are these notions *inconsistent* with a Torah cosmology, as set out above, but we find also in Jewish sources the explicit *rejection* or *contradiction* of the theoretical or *metaphysical* concepts of “gravity”⁵⁵ and “inertia”⁵⁶.

On the arbitration of scientific theories

As Rabbi M. M. Schneerson has pointed out, and as has been elaborated elsewhere, empirical science sustains equally an interpretation of the earth, or of the sun as the centre of the universe. The philosophy of science itself points to a disjuncture, or difference of plane, between *theoretical* concepts and *empirical* study. At issue is the choice of concepts employed by (or pre-structuring) empirical, scientific research. In the case of cosmology, the study of the structure of the universe, the choice for us is a clear one: between the revealed doctrine of Torah, in which the unity of G-d finds its reflection in the harmonies - the movements and bonds - of

⁵⁴ *Likkutei Sichos*, Vol. 2, p. 561.

⁵⁵ *Sefer Maamarim* 5562, p. 675,677.

⁵⁶ See the *Pirush* on Rambam, *Hilchos y'sodei haTorah* 3:9 and elucidation of the argument it advances in *Moreh N'vuchim*, Part 2, ch. 4.

the physical universe as presented by a geocentric model; and the materialistic blank mysteries of “gravity” and “inertia” in the heliocentric “system of the world”, on the other.

The proponents of modern scientific cosmology have themselves put forward ostensibly *scientific* criteria to justify the suppression of the Ptolemaic paradigm by the Newtonian. One was the greater *simplicity* of its calculations. The thoroughgoing *mathematical* modelling and rigour of the theory is a feature of its preferability and modernity⁵⁷. The claimed *universality* of its laws is a further appealing feature of the modern scientific paradigm. Yet, even these grounds, seemingly neutral, seem fraught with a metaphysical sense. Rabbi M. M. Schneerson points out that not only first principles, but also *rules* (and criteria) of reasoning (*k'lallei hahegion*), are also *elective*⁵⁸. The methodological criteria of the modern sciences, even without consideration of first principles, cannot necessarily be accepted by Torah. An elegant simplicity for the human intellect is of little value beside the true simplicity of G-dliness. The design of an infinite Creator is to be approached with patience and humility⁵⁹, not to be *rushed* as the Renaissance and the Enlightenment wanted, into the mathematical models of a supposedly “sovereign” human intellect.

So, too, in the claimed *universality* of its “laws”, the “sovereign” intellect of modern science may also have been misguided. The knowledge of the *seder his'talsbalus* defines the character of each stage or level of reality. That which applies to the heavenly spheres and the stars or planets cannot apply to entities upon this physical earth. The former are *sentient*

⁵⁷ See fn. 53.

⁵⁸ *Likkutei Sichos*, Vol. 2, pp. 561-62,

⁵⁹ Cf. H. Branover, “The Lubavitcher Rebbe on Science and Technology”, *B'Or HaTorah*, Vol. 9, p. 28.

intelligences. So, too, Maimonides⁶⁰ and other *Rishonim*⁶¹ explain, their material (*chomer*) is different. It is a “fifth foundation”, distinct from the four foundational elements of which earthly entities are composed. While the heavenly spheres in their movement are to a degree *self-impelled*, earthly entities obey the nature which has been *imprinted*⁶² in them. Moreover, not only in “position” in the universe, but also in time, different “ground rules” may apply for the phenomena of empirical reality. The most superficial reading of Chumash indicates a difference in “natural conditions” between the first millennium of history with the immense longevity of humanity, and the second in which the flood occurred and life was contracted to “one hundred and twenty years”. In short for each “field” of reality in time and place there can be another inner logic, depending on its position in the *seder histalshalus*. Where *empirical* science extrapolates backwards or forwards, beyond its proper range, in *time*, or goes outside the *domain* of physical nature, “beneath the sphere of the moon”⁶³, it has exceeded its “jurisdiction”. Beyond that realm, science would have to be informed by Torah of different rules. No extrapolation from regularities in the empirical *here and now* would be *relevant there and then*. In its proper realm, as the Maharal of Prague wrote, it is an imperative for empirical science to pursue explanation of a world of which it has valid experience and which has indeed been imprinted with law-like regularities. This too has the fundamentally *redemptive* purpose

⁶⁰ *Hilchos y’sodei haTorah* 2:3.

⁶¹ See *Radak* at the end of his commentary on the first verse of *B’reishis*, where the heavens are considered a “fifth foundation” after the four foundations from which all earthly entities are composed.

⁶² *Hilchos y’sodei haTorah* 4:2.

⁶³ See Maharal of Prague, *N’sivos Olam, N’siv HaTorah* ch. 14; *Radak loc. cit.* See also the discussion of the Lubavitcher Rebbe in the “Letter on Science and Judaism”, in relation to *different conditions* applying at different historical *times*.

of science's becoming *itself* an acknowledgement, that - not only in the order of the Heavens, but also - in *earthly* nature, "G-dliness is everything"⁶⁴.

Subsequent postscript on Isaac Newton

The notion that the natural science, with which one works, is (until and including now) at some variance with the heart of religious belief, is highlighted in the person of Isaac Newton. There is a famous tension (to which we have briefly alluded) between the Newton who produced a highly mechanistic view of the cosmos and the Newton who himself quested a rigorous monotheism, and was a believer in a transcendent and personal G-d, active in the creation, and in biblical prophecy of a transformed nature. Newton devoted millions of words to religious writing and the study of a seemingly archaic spiritualist natural philosophy – alchemy. There are those who write that Newton's scientific and his spiritual corpuses are to be held apart, and that in the end he is a mechanist or at most a deist in the Enlightenment mode. There are other views that the two bodies of work interpenetrate one another⁶⁵.

⁶⁴ Rabbi Y. Y. Schneersohn, *Sefer Maamarim* 5711, p. 144.

⁶⁵ In the words of Betty Jo Teeter Dobbs, who writes that Newton was guided by the principle of "the unity of Truth. True knowledge was all in some sense a knowledge of G-d; Truth was one, its unity guaranteed by the unity of G-d. Reason and revelation were not in conflict but were supplementary. G-d's attributes were recorded in the written Word but were also directly reflected in the nature of nature", *The Janus Faces of Genius*, Cambridge: Cambridge University Press, 1991, p. 6. In this line of thought there are those who argue that Newton meant alchemy to be the vehicle of G-d's action in the world and find also spiritual explanations of law-like phenomena such as gravity. For an account of this corpus of Newton's work see also Robert Iliffe, *Priest of Nature – The Religious Worlds of Isaac Newton*, Oxford: Oxford University Press, 2017.

In fact, it is possible to resolve the “problem of Newton” differently: namely, that he was, in the spiritual realm, a believer in a personal, active and interventionist G-d, and in the material realm a mechanist. This dualism is understandable. For between the spiritual roots of nature and nature, as it has become, corrupted through human sin, there is a thick veil. Science is the handle – the second nature – of this corrupted nature, and within it, science cannot proceed other than on its ostensible terms, its illusory but operational *external* facade. The inner life of the spirit knows that the transcendent G-d who works in and through nature is *hidden* from science just as He is hidden in nature. Only when nature and the science of nature are refined will the *duality* of nature and G-dliness cease. The believing scientist awaits this moment (as did Newton await the advent of a new world) and perhaps can (and should) also *contribute* to the arrival of that moment. Until then, he or she is like Newton – awaiting redemption, but still “two” Newtons: one who deals with the world as it seems to be and one who quests a deeper, spiritual animus in nature. Whilst Newton did not receive the Torah tradition from Sinai in its purity – though he had strong affinities with it – and so did not fully know its directives, we see in his work the tension – between the nature of historical natural science and the religious sense of nature as a glove of G-dliness – if not its resolution.