

Concepts of Space, Time, and Causality in Relation to the Bahá'í Writings

Dinesh Singh

Department of Physics

University of Regina

(dinesh.singh@uregina.ca)

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1 Introduction and Motivation

- *All events* in the physical Universe occur at a given **location in space** and a given **moment in time**.
- *Every single event* in the history of the Universe is **unique**, and the prevailing scientific position is that we can *never revisit the past*.

Question 1: While these facts are **intuitively obvious** to everyone, is there anything more that can be said?

Question 2: How do statements from the **Bahá'í Faith** relate to this overall understanding of the Universe?

- Albert Einstein's theory of **General Relativity** (GR) establishes a successful understanding of the relationship between *space, time, matter, and motion* at the macroscopic level.

1.1 “Academic” Interests

- The Bahá'í Faith addresses many topics of a **philosophical or “academic” nature** that concern the **intersections** between the *spiritual* and the *material* nature of “reality.”
- **Examples:**
 - **Human free will** in relation to the **Will of God**;
 - The nature of the **human soul/consciousness** in relation to the **human body**;
 - The concept of **prayer**—as well as other forms of human expression—and its potential for *material effects* on others;
 - The intrinsic nature of **knowledge** about the physical Universe and whether human beings can determine—in principle—*everything* there is to know about “physical reality.”

1.2 “Practical” Interests

- There are numerous “**practical**” reasons for examining the nature of space, time, and causality in relation to the Bahá'í Faith:
- **Examples:**
 - Supporting the **Core Activities**, as directed by the **Universal House of Justice**;
 - Understanding references to **past/present/future**, as given by the **Central Figures and the Guardian**;
 - Improving the **functioning capacity** of the **Institutions**:
 - * Bahá'í Elections;
 - * Local and National Spiritual Assemblies;
 - * The Fund and Huqúqu'lláh;
 - **Defense of the Faith** from hostile sources who would question its legitimacy, such as **religious fundamentalists and atheists**.

2 Definitions and Technical Concepts

2.1 Scientific Definitions of Space, Time, and Causality

- To fully appreciate the nature of this discussion, **precise definitions** are needed. From the *Oxford Dictionary of Physics*, 3rd Edition:

space: *A property of the universe that enables physical phenomena to be extended into three mutually perpendicular directions.*

In **Newtonian physics**, space, time, and matter are treated as quite **separate entities**.

In **Einsteinian physics**, space and time are combined into a **four-dimensional continuum** (*see space-time*) and in the general theory of relativity, matter is regarded as having an **effect on space**, causing it to **curve**.

time: *A dimension that enables two otherwise identical events that occur at the same point in space to be distinguished (see **space-time**).*

The **interval** between two such events forms the basis of **time measurement**.

For **general purposes**, the earth's rotation on its axis provides the units of the clock (see **day**) and the earth's orbit round the sun (see **year**) provides the units of the calendar.

For **scientific purposes**, intervals of time are now defined in terms of the frequency of a specified electromagnetic radiation (see **second**).

causality: *The principle that effect cannot precede cause.*

The principle is **particularly useful** when combined with the principle that the **highest attainable speed** in the universe is the **speed of light** in a vacuum.

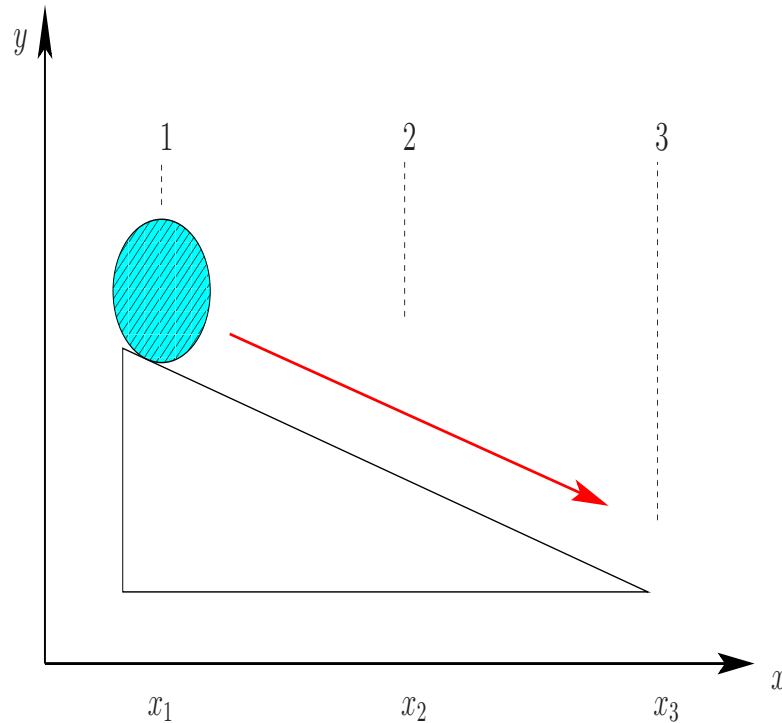
space-time: *A geometry that includes the three dimensions (of space) and a fourth dimension of time.*

In **Newtonian physics**, space and time are considered as **separate entities** and whether or not events are **simultaneous** is a matter that is regarded as obvious to any competent observer.

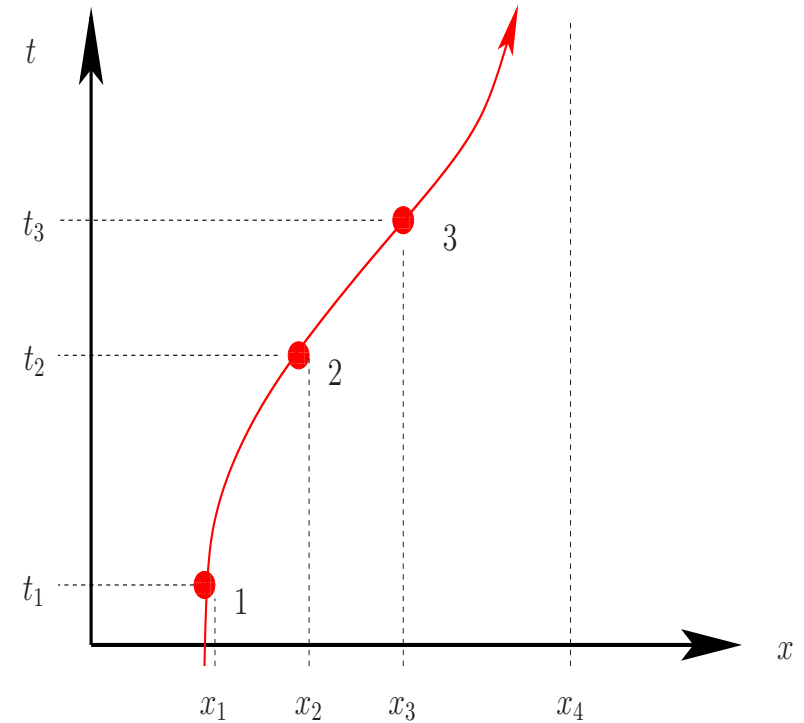
In **Einstein's concept of the physical universe**, based on a system of geometry devised by H. Minkowski (1864-1909), space and time are regarded as **entwined**, so that two observers in relative motion could **disagree** regarding the **simultaneity of distant events**.

2.2 Space-Time Diagrams and Relativity

- The concepts of space, time, and causality are best represented in terms of **space-time diagrams**, which are **pictorial descriptions** of how objects in the Universe appear in space over a *sequence of time steps*, as measured by a common definition of time.



(a) A ball rolling down an incline.



(b) Worldline of the ball in space-time.

Figure 1: Space-time description of a ball rolling down an incline along the x -direction, as shown in Fig. 1(a). It is shown in Fig. 1(b) that the ball accelerates to maximum speed at x_3 while moving past x_1 and x_2 , and eventually comes to a stop at x_4 . The y - and z -directions are suppressed in Fig. 1(b).

- For a given **time interval** $\Delta t \equiv t_1 - t_0$ and a corresponding **space interval** $\Delta r \equiv r_1 - r_0$ for an object's position in space, the **space-time interval** $\Delta\tau$ defined by:

$$(\Delta\tau)^2 \equiv c^2 (\Delta t)^2 - (\Delta r)^2$$

has a **fixed “length”** in space-time, where c is the **speed of light**.

- For a given object in space-time, $\Delta\tau > 0$ is called **proper time**.
- Proper time describes an *internal measure of time*, such as that given by an observer's **wristwatch**.

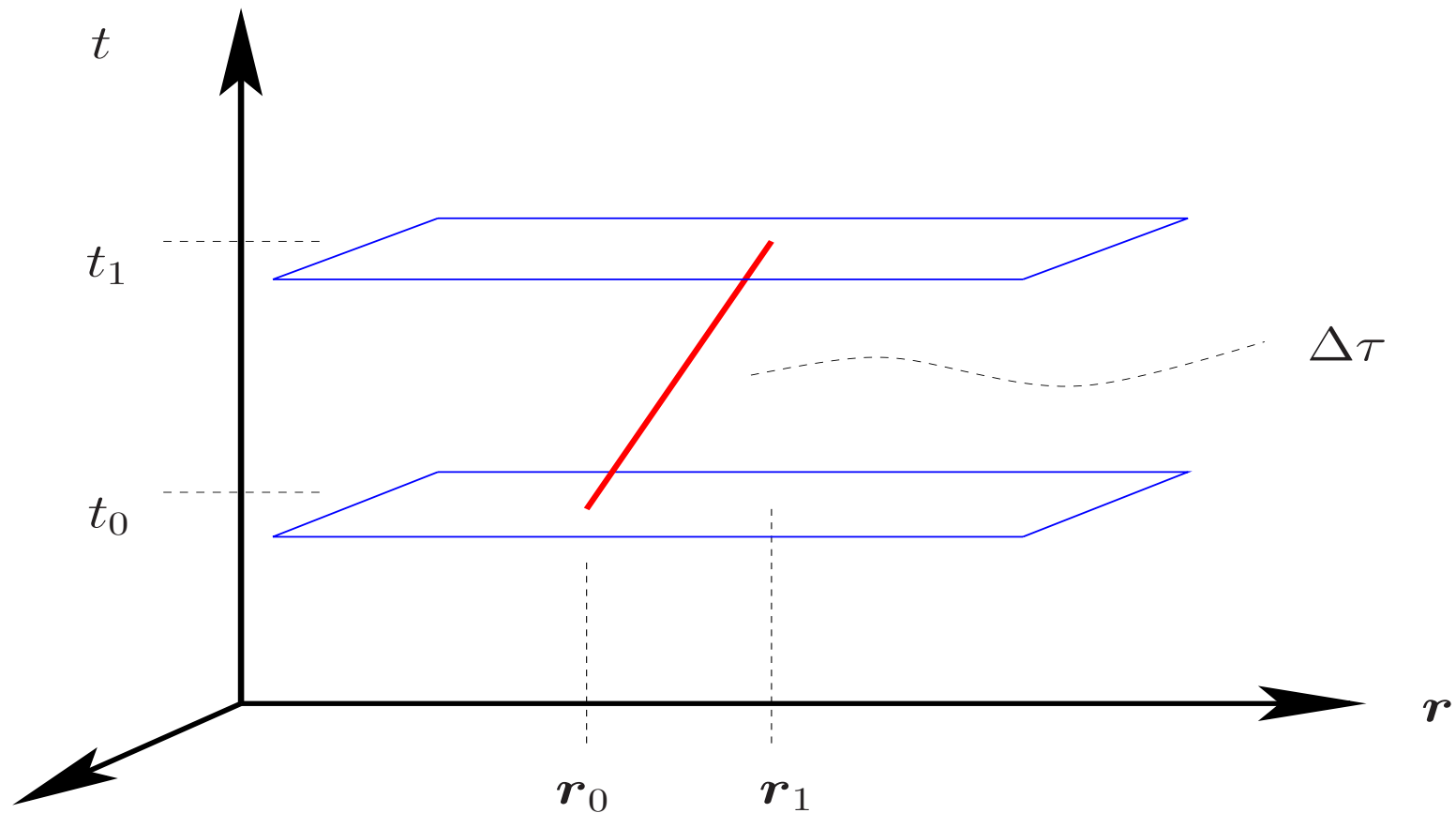


Figure 2: Description of the proper time interval $\Delta\tau$ for the segment of an object's worldline within two time slices defined by t_0 and t_1 .

- From the *McGraw-Hill Dictionary of Physics*, 2nd Edition:

worldline: *A path in four-dimensional space-time that represents a continuous sequence of events relating to a given particle.*

light cone: *The set of all points in space-time that are reached by signals travelling at the speed of light from a specified point, or from which signals travelling at the speed of light reach that point.*

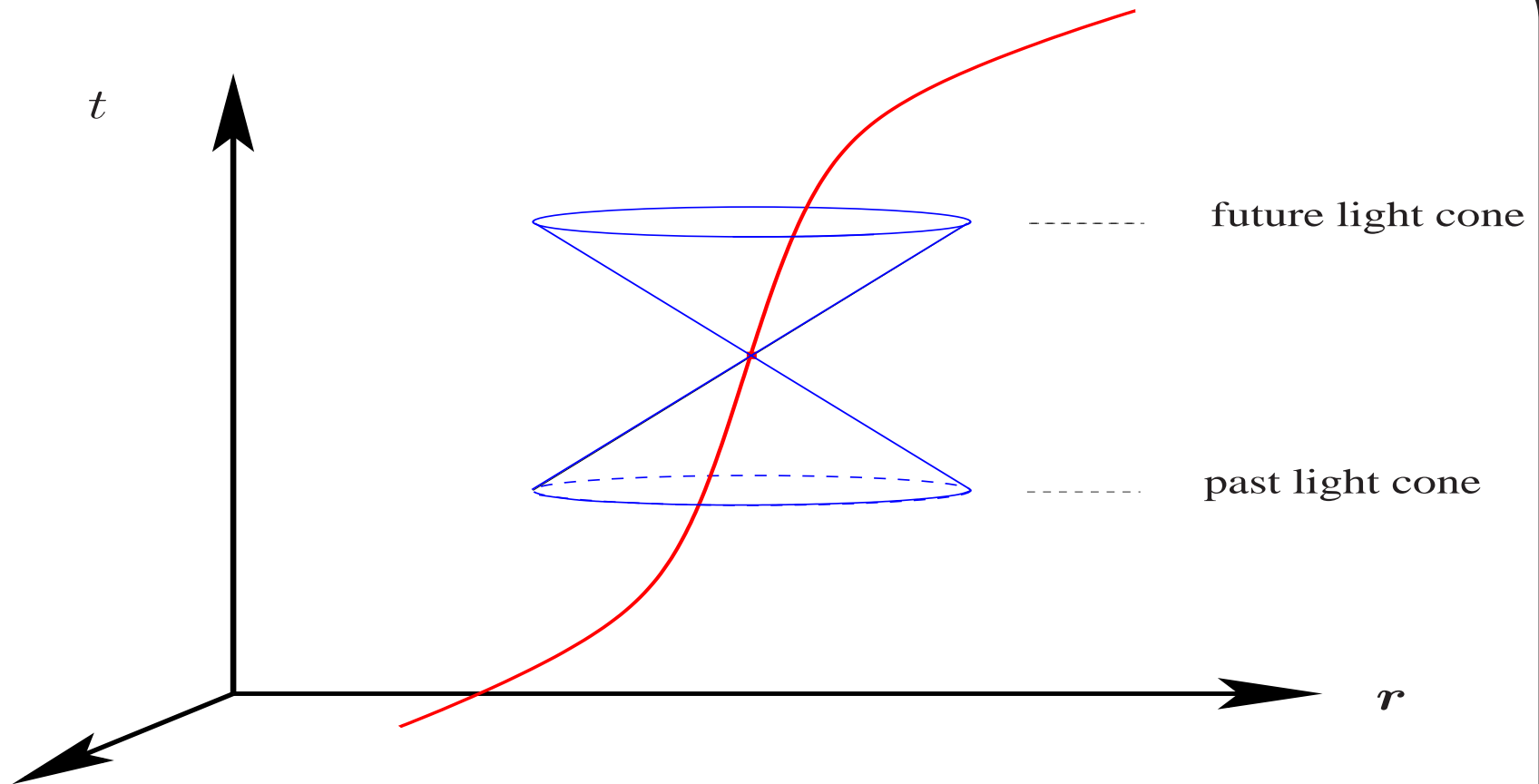


Figure 3: Worldline of an object in space-time with past and future light cones shown. Only points inside the past light cone can causally affect the behaviour of the object. As well, the particle can only influence events confined to the inside of the future light cone.

- For the purposes of this discussion, there is **one more definition** to introduce (not given in the two dictionaries):

worldtube: *A four-dimensional volume in space-time that contains a collection (or a family) of non-intersecting worldlines.*

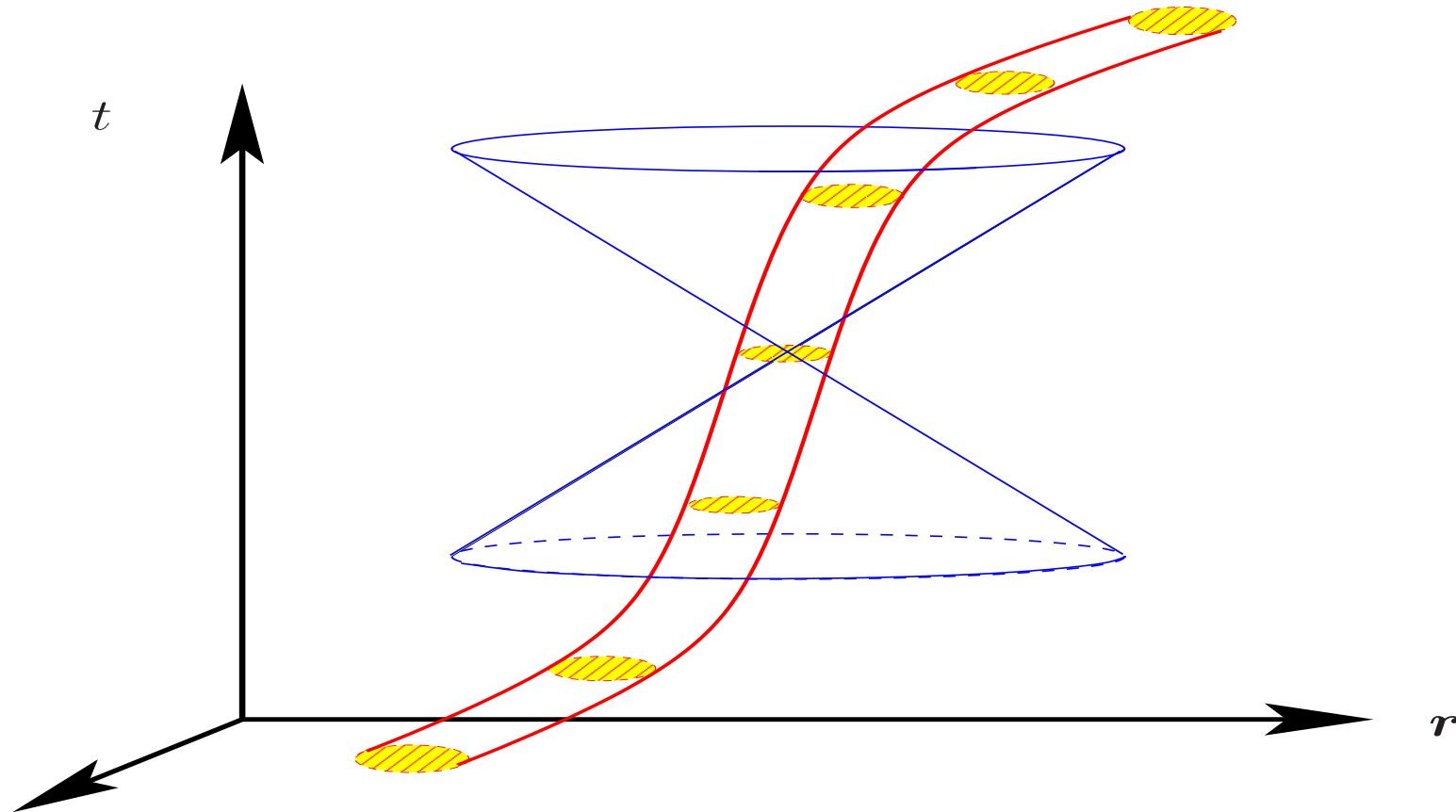


Figure 4: Worldtube in space-time, containing a *family* of nonintersecting world-lines, with a lightcone superimposed. It is implied by the diagram that the world-lines contained inside the worldtube are in perpetual causal contact with each other.

- According to Einstein's theories of relativity, there exist **two fundamental postulates** for describing **motion in space-time**:

Postulate 1: The laws of physics which describe motion in space-time are **independent** of how the observer moves in space.

Postulate 2: The speed of light c is **constant** for *all* observers, irrespective of their relative motion in space.

Implication: It follows that c is the **fastest possible speed** that information can travel in space, leading to a **time delay** for when different observers experience a **given event in space-time**, such as a camera flash.

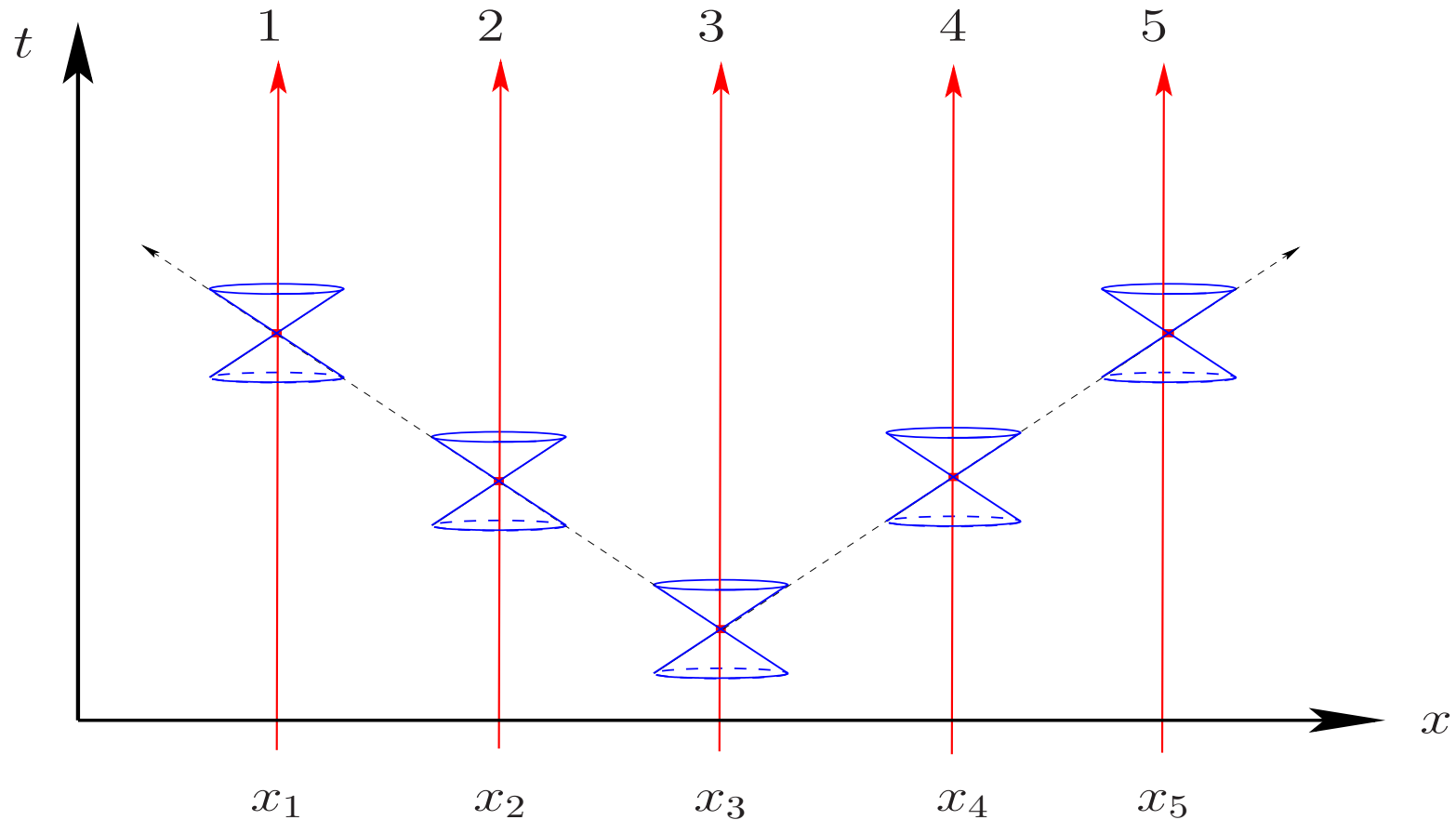


Figure 5: A light signal emitted along the future light cone of worldline 3 at x_3 will be observed first by worldlines 2 and 4, followed by worldlines 1 and 5.

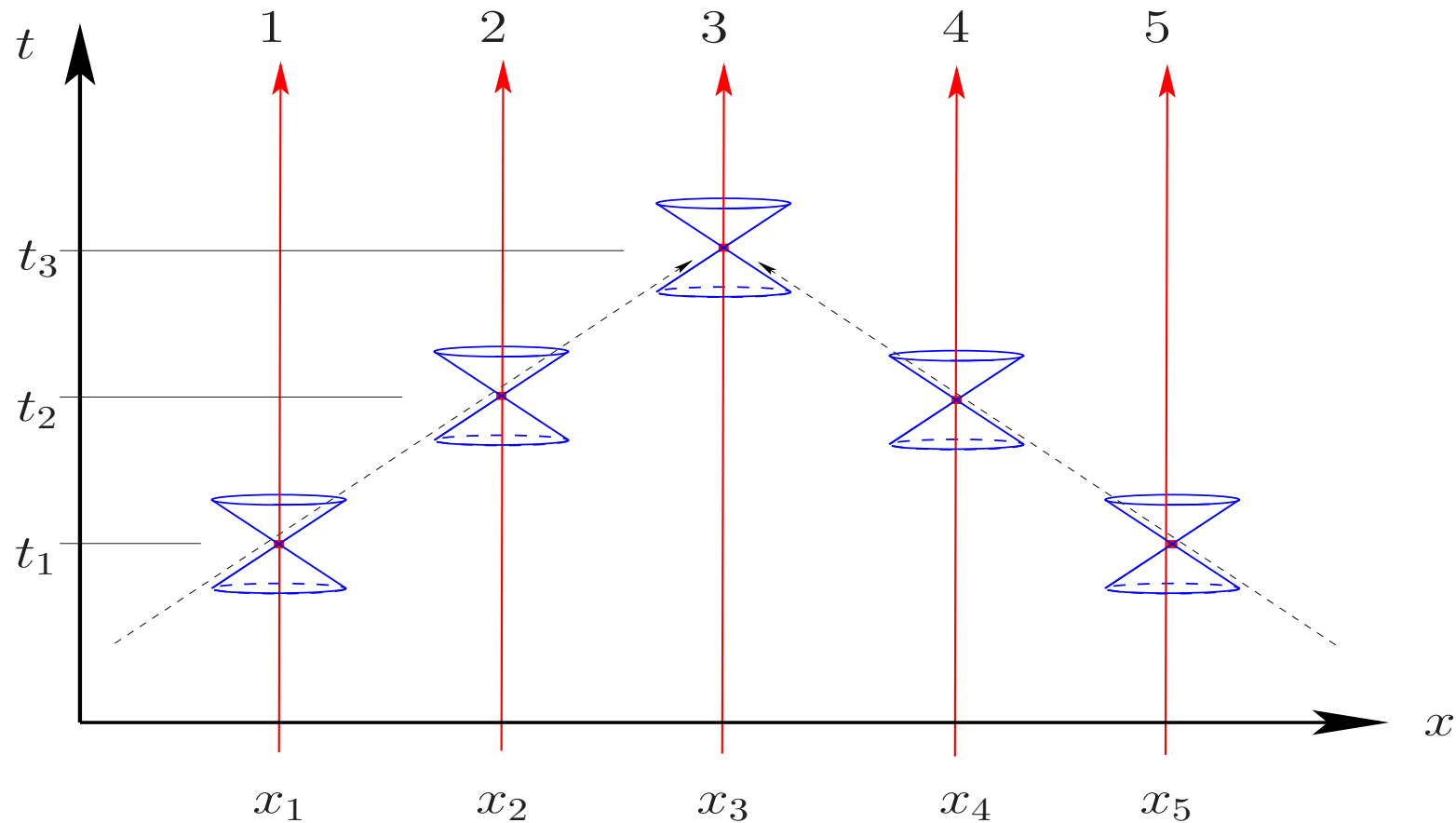


Figure 6: Light signals emitted along the future light cones of worldlines 1 and 5 will be observed first by worldlines 2 and 4, followed by worldline 3 at x_3 . Furthermore, worldline 3 also receives *independent* information from worldlines 2 and 4 and *to the past* of worldlines 1 and 5, all at the *same time* t_3 .

3 Analysis in the Context of the Bahá'í Writings

- There are *numerous* statements in the Bahá'í Writings of both a ***philosophical and practical nature*** that, when merged with Einstein's description of space-time, lead to multiple layers of insight about the nature of ***physical and spiritual reality***.
- At best, it is possible to show only a ***small fraction*** of all the **examples** available to illustrate this essential point.

- Concerning the **influence of the stars on human experiences:**

O handmaid of God! **The stars in the sky do not exert any spiritual influence on this world of dust; but all the members and parts of the universe are very strongly linked together in that limitless space, and this connection produceth a reciprocity of material effects.** Outside the bounty of the Holy Spirit, whatsoever thou hearest as to the effect of trances, or the mediums' trumpets, conveying the singing voices of the dead, is imagination pure and simple. As to the bounty of the Holy Spirit, however, relate whatsoever thou wilt – it cannot be overstated; believe, therefore, whatsoever thou hearest of this. But the persons referred to, the trumpet-people, are entirely shut out from this bounty and receive no portion thereof; their way is an illusion.

(Abdu'l-Bahá, *Selections from the Writings of Abdu'l-Bahá*, pp. 160-161)

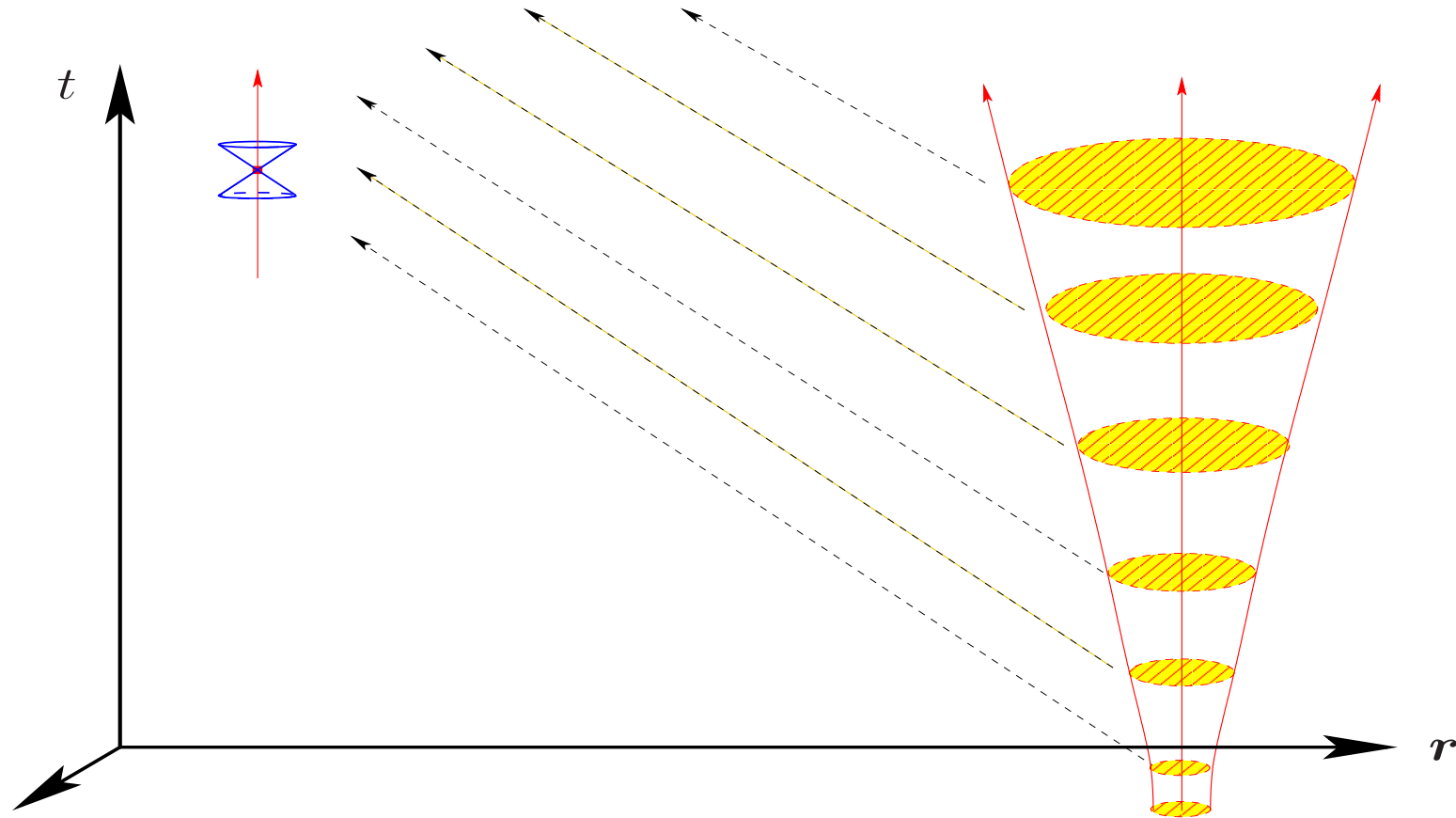


Figure 7: Consider an astronomer who observes for the first time a supernova that occurred *several thousands of years ago*, where t denotes the time in terms of the age of the Universe. Though separated by thousands of light-years in distance and time, this event can have a significant effect on the *local future* of this astronomer and others nearby.

- The distinction between the **physical Universe and human beings within it:**

The phenomenal world is entirely subject to the rule and control of natural law. **These myriad suns, satellites and heavenly bodies throughout endless space are all captives of nature. They cannot transgress in a single point or particular the fixed laws which govern the physical universe.** The sun in its immensity, the ocean in its vastness are incapable of violating these universal laws. All phenomenal beings – the plants in their kingdom, even the animals with their intelligence – are nature's subjects and captives. All live within the bounds of natural law, and nature is the ruler of all except man. **Man is not the captive of nature, for although according to natural law he is a being of the earth, yet he guides ships over the ocean, flies through the air in airplanes, descends in submarines; therefore, he has overcome natural law and made it subservient to his wishes.**

(Abdu'l-Bahá, *The Promulgation of Universal Peace*, p. 16)

- About **predestination and its relationship to free will:**

Thou hadst asked about fate, predestination and will. **Fate and predestination consist in the necessary and indispensable relationships which exist in the realities of things. These relationships have been placed in the realities of existent beings through the power of creation and every incident is a consequence of the necessary relationship.** For example, God hath created a relation between the sun and the terrestrial globe that the rays of the sun should shine and the soil should yield. These relationships constitute predestination, and the manifestation thereof in the plane of existence is fate. **Will is that active force which controlleth these relationships and these incidents.** Such is the epitome of the explanation of fate and predestination.

(Abdu'l-Bahá, *Selections from the Writings of Abdu'l-Bahá*, pp. 197)

Question: If God has knowledge of an action which will be performed by someone, and it has been written on the Tablet of Fate, is it possible to resist it?

Answer: The foreknowledge of a thing is not the cause of its realization; for the essential knowledge of God surrounds, in the same way, the realities of things, before as well as after their existence, and it does not become the cause of their existence. It is a perfection of God. But that which was prophesied by the inspiration of God through the tongues of the Prophets, concerning the appearance of the Promised One of the Bible, was not the cause of the manifestation of Christ.

The hidden secrets of the future were revealed to the Prophets, and They thus became acquainted with the future events which They announced. This knowledge and these prophecies were not the cause of the occurrences. **For example, tonight everyone knows that after seven hours the sun will rise, but this general foreknowledge does not cause the rising and appearance of the sun.**

Therefore, the knowledge of God in the realm of contingency does not produce the forms of the things. **On the contrary, it is purified from the past, present and future.** It is identical with the reality of the things; it is not the cause of their occurrence.

(Abdu'l-Bahá, *Some Answered Questions*, p. 138)

- The distinction of the “**spiritual**” **Universe** when compared to the **physical Universe**:

You question about eternal life and the entrance into the Kingdom. **The outer expression used for the Kingdom is heaven; but this is a comparison and similitude, not a reality or fact, for the Kingdom is not a material place; it is sanctified from time and place.** It is a spiritual world, a divine world, and the center of the Sovereignty of God; it is freed from body and that which is corporeal, and it is purified and sanctified from the imaginations of the human world. **To be limited to place is a property of bodies and not of spirits. Place and time surround the body, not the mind and spirit.** Observe that the body of man is confined to a small place; it covers only two spans of earth. But the spirit and mind of man travel to all countries and regions – even through the limitless space of the heavens – surround all that exists, and make discoveries in the exalted spheres and infinite distances. **This is because the spirit has no place; it is placeless; and for the spirit the earth and the heaven are as one since it makes discoveries in both.** But the body is limited to a place and does not know that which is beyond it.

(Abdu'l-Bahá, *Some Answered Questions*, p. 240)

4 Open Issues to Consider

4.1 Understanding the “Spiritual” Within the Physical Universe

- Concerning **dreams and perceiving future events:**

Indeed, O Brother, if we ponder each created thing, we shall witness a myriad perfect wisdoms and learn a myriad new and wondrous truths. One of the created phenomena is the dream. Behold how many secrets are deposited therein, how many wisdoms treasured up, how many worlds concealed. Observe, how thou art asleep in a dwelling, and its doors are barred; on a sudden thou findest thyself in a far-off city, which thou enterest without moving thy feet or wearying thy body; without using thine eyes, thou seest; without taxing thine ears, thou hearest; without a tongue, thou speakest. **And perchance when ten years are gone, thou wilt witness in the outer world the very things thou hast dreamed tonight.**

(Bahá'u'lláh, *The Seven Valleys*, p. 32)

- About the **effects of prayer** within the context of the **physical Universe**:

Intone, O My servants, the verses of God that have been received by thee, as intoned by them who have drawn nigh unto Him, that the sweetness of thy melody may kindle thine own soul, and attract the hearts of all men. **Whoso reciteth, in the privacy of his chamber, the verses revealed by God, the scattering angels of the Almighty shall scatter abroad the fragrance of the words uttered by his mouth, and shall cause the heart of every righteous man to throb. Though he may, at first, remain unaware of its effect, yet the virtue of the grace vouchsafed unto him must needs sooner or later exercise its influence upon his soul.** Thus have the mysteries of the Revelation of God been decreed by virtue of the Will of Him Who is the Source of power and wisdom.

(Bahá'u'lláh, *Bahá'í Prayers*)

4.1.1 The Concept of “Spiritual Forces” Interacting Within the Physical Universe

- Because all religions, including the Bahá'í Faith, describe at length the existence of **spiritual forces** that are present in the operations of human existence, it would be very interesting to ascertain **how the effects of their influence** manifest themselves within the physical Universe.
- In Einstein's theory of **General Relativity** (GR), space-time gets **warped due to the presence of matter**, such that otherwise simple worldlines would get forced into following **more complicated paths** in response to **space-time curvature**.

Caveat: The following is a *personal* attempt to represent spiritual forces within a **GR-inspired framework**. Because this approach is **very speculative** and *not* well-grounded in the Bahá'í Writings, it should be treated with *caution*.

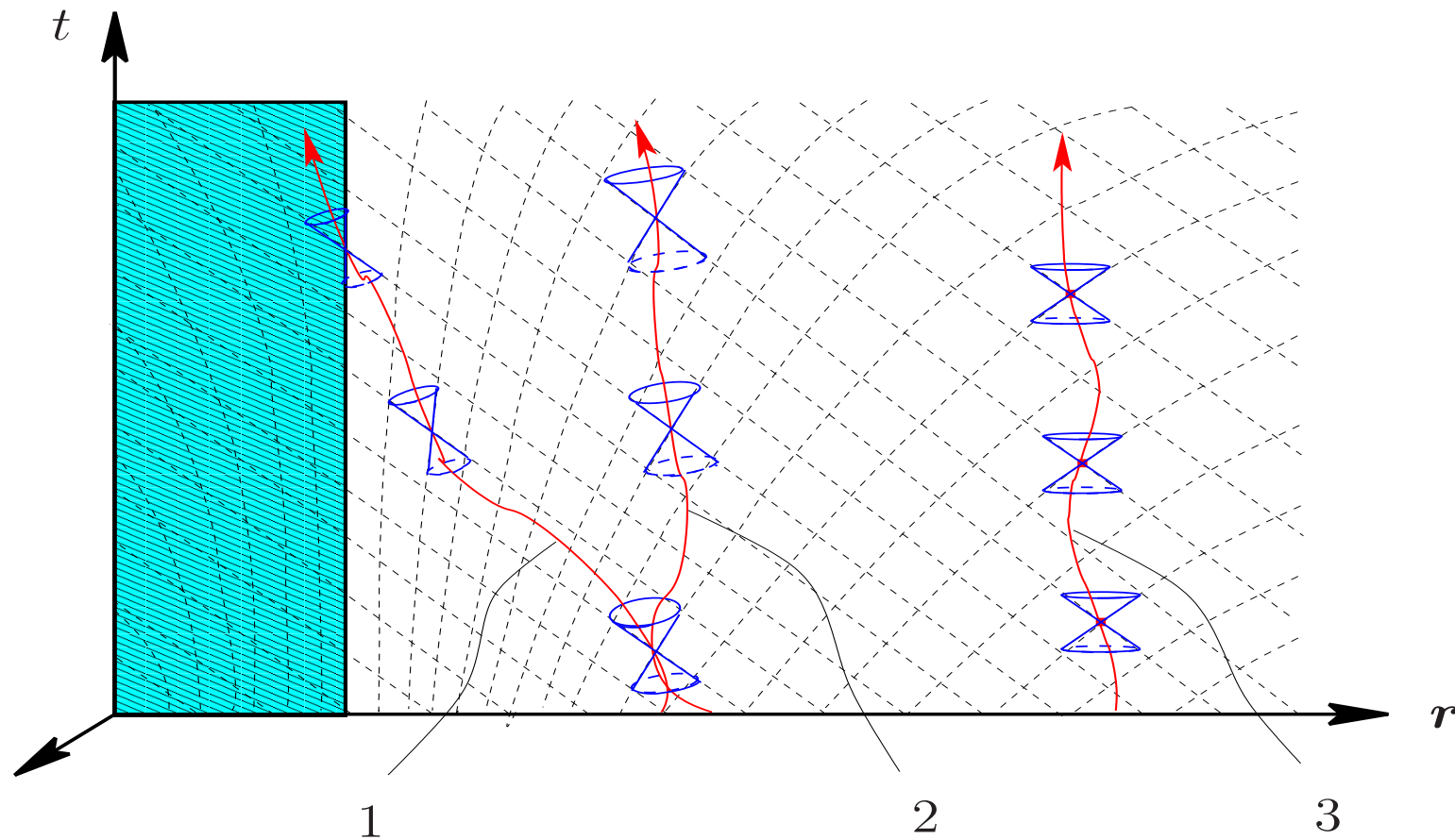


Figure 8: Worldlines of objects near a non-rotating black hole. The matter inside the event horizon of the black hole causes the space-time outside to be strongly warped. Some worldlines cross the event horizon in *finite* time t , such as worldline 1, while others like worldline 3 never make contact. (For worldline 2, the situation is unclear.)

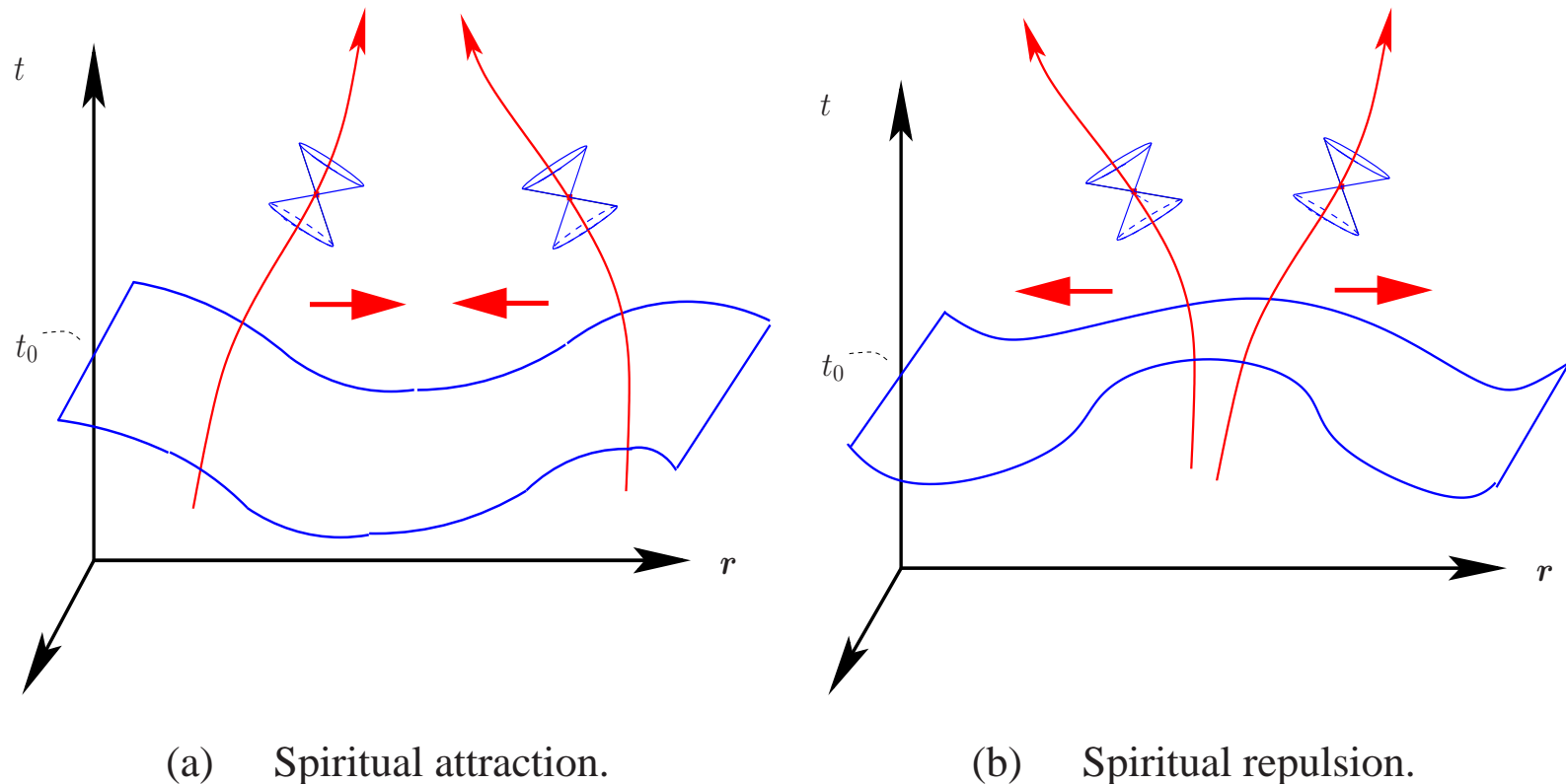


Figure 9: Worldlines, intended to represent two people (or groups of people), subject to spiritual forces of attraction and repulsion, as shown in Figs. 9(a) and 9(b), respectively. The warped time slices t_0 are intended to represent “curvature effects” within a “spiritual space” superimposed on physical space. The “spiritual forces” in the bold red arrows are *not* subject to causal constraints of space-time.

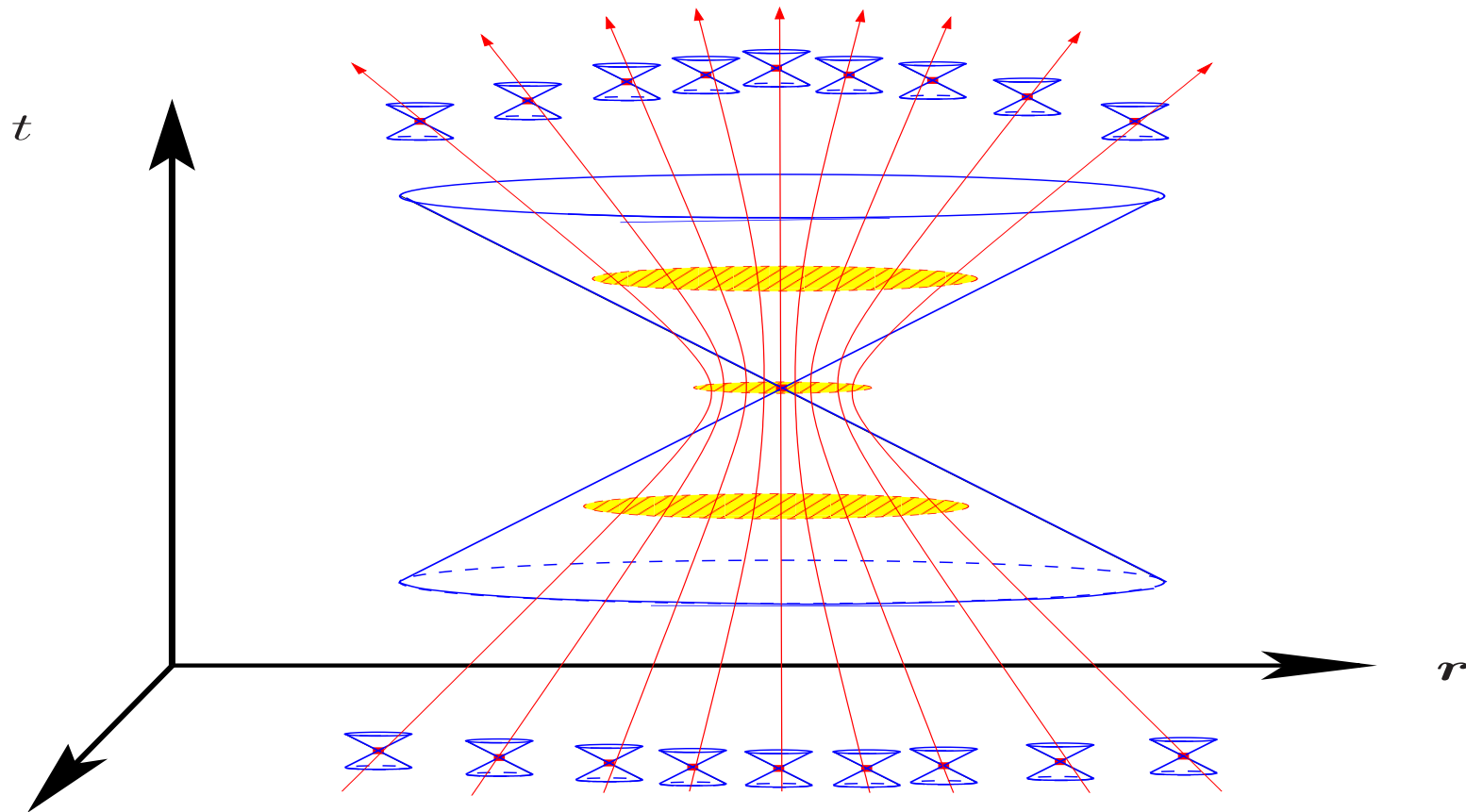


Figure 10: Representation of a Spiritual Assembly (or some other Institution/Bahá'í gathering, such as a Reflection Meeting) forming and then dissolving. The individual members of the Assembly carry with them their personal perspectives, which get shared in consultation as an Assembly, depicted as a worldtube.

4.2 The Role of Quantum Mechanics in Understanding Causality

- In this presentation, it is implicitly accepted that the worldlines of physical objects within the physical Universe are **completely determined**. That is, the underlying assumption within GR is that the **state of motion** for objects within space-time is **arbitrarily precise**.
- However, given what is known in **Quantum Mechanics (QM)**, this statement is clearly *not true*.
- The *entire perspective* given just now—**excluding the Bahá'í Writings themselves**—may need to be **totally re-examined** when taking QM into proper account.
- Given that *much disagreement exists* today about the involvement of QM in questions about space, time, and causality, this exploration is *completely beyond the scope of this presentation*.

4.3 Does Time Even Exist?

- Although **only a minority of physicists** accept this belief, there exists a **legitimate suggestion** claiming that **time *does not* exist**.
(Julian Barbour)
- The issue is that we need to **observe changes in the physical state of an object**, such as the hands of a clock moving around, to *infer* the existence of time, but that in itself ***does not prove*** that time *intrinsically* exists, independent of the existence of an observer.
- This issue raises interesting **philosophical questions** about “proving” the **existence of God**, based on the *physical Universe alone*.

- Space and time are **physical entities** and only exist in the **physical Universe**:

We find God only through the Intermediary of His Prophet. We see the Perfection of God in His Prophets. **Time and space are physical things**, God, the Creator is not in a 'place' as we conceive of place in physical terms. God is the Infinite Essence, the Creator. We cannot picture Him or His state; if we did, we would be His equals, not His Creatures. **God is never flesh, but mirrored in the attributes of His Prophets, we see His Divine characteristics and perfections.**

(From a letter written on behalf of Shoghi Effendi to an individual believer, October 9, 1947)

5 Conclusion

- This presentation **does not even *begin*** to cover the **magnitude and scope** of the issues pertaining to space, time, and causality in relation to the Bahá'í Writings.
- More work is required to address numerous questions about the **intersections** between the **spiritual and the physical** as part of better understanding the “**Worlds of God.**”

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