

Kurdistan Regional Government-Iraq

Ministry of Higher Education and Scientific Research

University of Salahaddin-Erbil

College of Basic Education- 4<sup>th</sup> grade



## **The Miracle of Lightning From the Presepective of Science and Prophetic Hadith**

The research

Dedicated to the College of Basic Education

Part of the requirement of the bachelor's degree in the Department of

General Science

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2024 A.D

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## **Dedication:**

This research project is the work of one academic year. It is dedicated to:

- My beloved family
- To all my teachers, who taught me throughout my life, especially Dr. Abbas Hussien Rostam who supervised this research work.

## **Acknowledgments:**

I would like to send my warm and endless thanks and gratitude to my family who supported me during all the years of the study without which I was not able to continue my education. Also my special thanks is extended to Dr Abbas Hussien Rostam for supervision of the study. Appreciations are due to the department of general science and the College of Basic Education for their support during the four years of the study.

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# Chapter 1

## 1-1 Abstract

It is worth noting that lightning, is one of the oldest observed natural phenomena on earth. It is the occurrence of a natural electrical discharge of very short duration and high voltage between a cloud and the ground or within a cloud, accompanied by a bright flash and typically also thunder. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges builds up enough, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning. The flash of lightning temporarily equalizes the charged regions in the atmosphere until the opposite charges build up again. Novel experiments have shown that any flash of lightning is not continuous as we see it; it is composed from different phases. The most important phases are: the downward phase, in which the beam passes through the clouds towards the earth, and the upward phase, in which the spark returns towards the cloud. This means, the lightning beam passes and returns during a time that cannot be detected by the naked eye. This time is typically estimated in a range of a millisecond. The identical description about this phenomenon is stated by the Holy Prophet (P.U.H) more than 1400 years ago. The Prophetic Hadith about the straightway (Sirrat) in Day of Resurrection is considered to be one of the scientific miracles in the Prophetic Sunnah. In this Hadith the Holy Prophet says: “don't you see that the lightning comes and go back in an eye blink” (Sahih Muslim Vol. 1, Book 1, Hadith 380). Thus, to our best knowledge, this Hadith involves a scientific miracle where the full correspondence between the Prophet's speech and the recent revelations of complicated and accurate processes occur in the lightning flash. Therefore, in this study we will see that the Great Prophet (P.U.H) mentioned the phases of lightning with astonishing accuracy. The scientific miracle about this Holy Hadith is very clear, especially if we know that scientists use the same word that has been used, very carefully, by the Holy Prophet (P.U.H), by expressing the downward and upward phases, and these two phases take a period of time which is equal to the necessary time of an eye blink. The time needed for each lightning phase is estimated to be in milliseconds, and of course the eye cannot analyze the information coming to it during such a time, and this proves that the Holy Prophet (P.U.H) tells us about things we could only see with sophisticated cameras that capture more than thousand images in every second. These descriptions, of course, prove the sincerity of the message of our Prophet (P.U.H) and he is a messenger of Allah (S.W.T), and he came with these precise information that required the discovery of scientists for a long time. gravity, which in turn distributes the charge, and the positive charge is at the top of the cloud. This happens in the so-called thunder clouds that always cause lightning [18]. The electric charge, or static electricity, is exactly what we feel when we touch the grip of the door after the friction of our feet with the carpet, or when we touch the computer screen sometimes. We feel a light electric bulb, and it is only a mini electric spark. Also, when we connect two wires, one positive, the other negative connected to the poles of a small battery, we see a spark generated between them. When there is an increase in the number of electrons at the bottom of the cloud, a

negative electric field is generated. This increase in the upper cloud is offset by a lack of electrons, so the positive electric field is generated. When suitable amounts of electrons gather at the bottom of the cloud, the negative charges are transported by the wet air between the cloud and the surface of the positively charged earth. A very fine channel is formed at the base of the cloud. And then precede through this channel what scientists call the beam leader from the cloud towards the earth, and this beam that passes and steps in successive steps is the first stage of lightning. When this leader reaches the earth, through the negative field nearby it, the positive charges are attracted to the surface of the earth. These positive charges move towards the leading beam and collide with it tens of meters above the earth's surface. Then the air is broken down and becomes a transmission of electricity, and a strong current is generated that lights up in the shape of a flash upward, called the return stroke, and this reaction is what we actually see because most of the light is generated by it. The speed of the lightning beam at this stroke is 160000 km/s, remaining only 40 microseconds and producing a returning current of about 10000 to 20000 amperes. Followed by, a period of 3 to 100 milliseconds the process is restart again by using the same channel that was established before and so several strokes will happen [19].

## **1-1:Introduction**

This research consist one of important nature phenomena in physics, which concerned the some electrical process that occur in the nature this process is called lightning in the seventeenth and eighteenth century scienitific revolution began scientists are looking into the secrets of this phenomenon began, but the knowledge and time to know people were limited to that lightning is an electric spark that is what the world of Benjamin Franklin and his grandfather in 1752, but the knowledge remained limited until the twentieth century came when the scientists were able to the invention of digital cameras, and in 2000 specifically able to manufacture high-speed cameras can capture more than a thousands images per second. When scientistis tried to figure out the secrets of this phenomenon, they sent the labs inside the ballons and used the satellites and used all the techniques available to them to learn the secrets of lightning. After more than 100 years of research they found that lightning dose not happen suddenly but in multiple stages and explained this phenomenon as in chapter two.this research contain into three chapters, chapter one describe the historical background of lightning, and all idea about this phenomenal, chapter two indicate the define of lightning, the type of lightning and steps of occurring process and last chapter consist of result, conclusion and reference.

# Chapter 2

## 2-1 Lightning

Lightning is a natural phenomenon caused by separation of electrical positive and negative charges by atmospheric processes. When the separated charge gets very large, the air between the positive and negative regions breaks down in a giant spark (an intra-cloud stroke), or a charged region breaks down to ground (a cloud-ground stroke). (7) The resulting current flow ionizes and heats the air along the path to  $\sim 30,000$  K ( $54,000^\circ$  F). The ionized air glows brightly (the lightning), and the sudden increase in temperature expands the channel and nearby air, creating a pressure wave that makes the thunder. Most ( $\sim 80\%$ ) lightning strokes are within a cloud; most of the remainder are cloud-ground strokes. Strokes between clouds are relatively rare. Most cloud-ground strokes transfer negative charge from the cloud to ground. The smaller particles tend to acquire positive charge, while the larger particles acquire more negative charge. These particles tend to separate under the influences of updrafts and gravity until the upper portion of the cloud acquires a net positive charge and the lower portion of the cloud becomes negatively charged. This separation of charge produces enormous electrical potential both within the cloud and between the cloud and ground.

Figure (1) The lightning occur as shown in the below figure





## 2-2 Types of lighting

They are four classification of lightning. They are:

1. Intra-cloud: the most common type of lightning .it happens completely inside the cloud, jumping between different charge regions in the cloud .intra-cloud lightning is sometimes called sheet lightning because it lights up the sky with sheet of light.
2. Cloud to cloud: lightning that occurs between two or more separate clouds.
3. Cloud to ground: lightning that occurs between the cloud and the ground.
4. Cloud to air: lightning that occurs when the air around a Positively charged cloud top reaches out to the negatively charged air around it. (7,8)

**Table (2-2)**

### Types of lightning

Category	Orginate form	Leader charge	types	Return stroke
1	Cloud	Negative	1a	None, air discharge, open corn try, no bulding
			1b	Yes, ground strike.
2	Earth	Positive	2a	Charge flow to Erath, tower is negative
			2b	Multiple flash, example empire state building.
3	Cloud	Positive	3a	Intra – cloud displacement current.
			3b	Positive up return stroke, rare.
4	Earth	Negative	4a	Tip cathode, positive cloud and positive continuous current, rare
			4b	Imitated as 4a, after 4.25 MS sever positive down discharge, mountain areas.

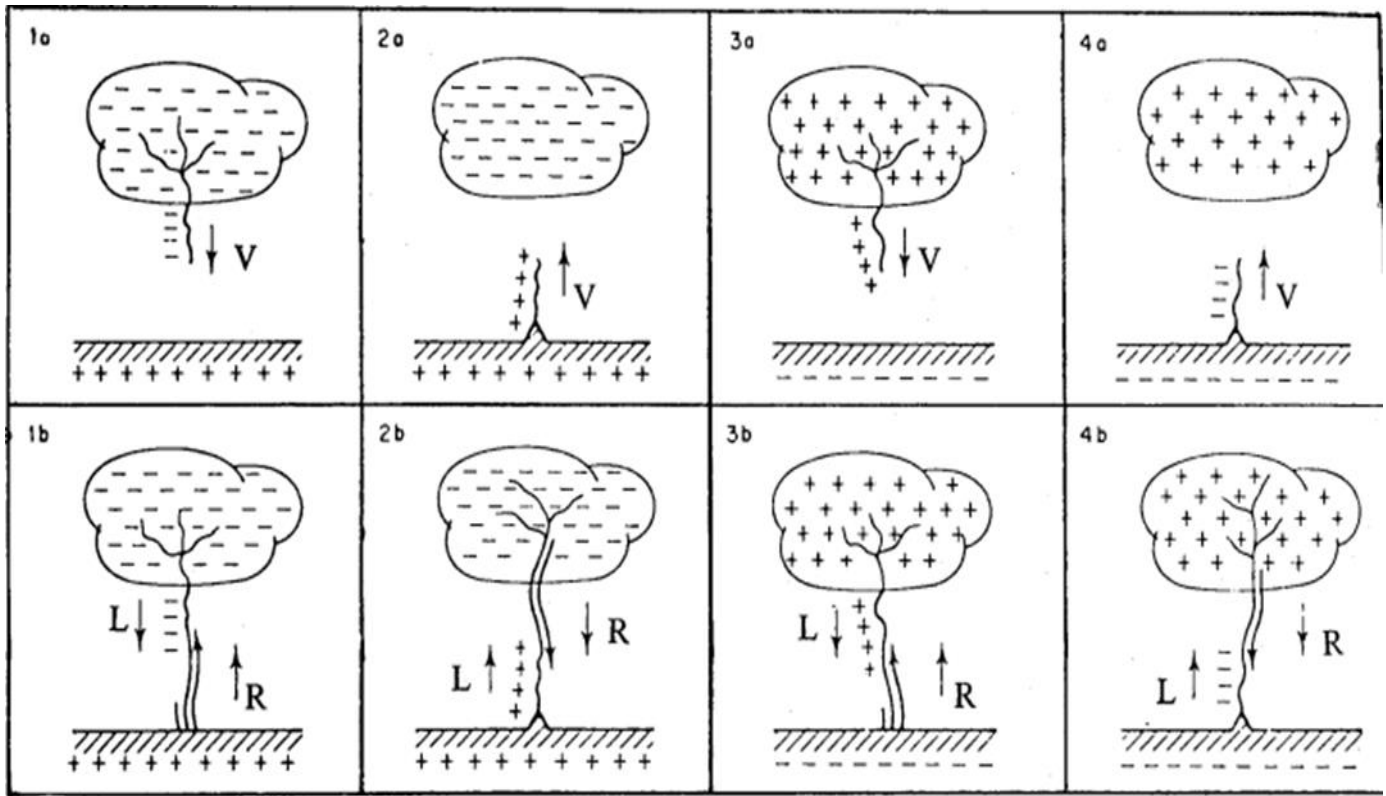


Figure (2) indicates the four types of the cloud to ground lightning

## **2-3 Lightning step by step**

In order to make it easier to see exactly what happens in lightning, we use illustrations in Fig. 7 which represents the lightning process in five different steps [27]. These drawings are a close approximation of what is happening, and indeed the enormity of the processes, and their incredible speed in sparkling lightning, can never be understood. A total of 47 lightning strikes were recorded in one flash. It is worth noting that the longest flash recorded is not exceeding 1.5 seconds. Scientists would not have known these scientific facts had they not been able to invent rapid imaging devices, as well as the invention of precision measuring devices, i.e. the invention of the computer by which the data coming from the measuring devices are analyzed in digital form [28].

### Step 1

Lightning begins with the first step of the leader. This beam does not fall away at once, but it passes through steps. This beam charge is often negative. It takes the stepped leader about 50 milliseconds to reach its full length, though this number varies depending on the length of its path. Studies of individual strikes have shown that a single leader can be comprised of more than 10,000 steps.

### Step 2

As the stepped leader approaches the ground, its strong, negative charge repels all negative charge within the immediate strike zone of the earth's surface, while attracting vast amounts of positive charge. When one of these positively charged streamers connects with a negatively charged stepped leader (30 to 100 meters) above the surface of the earth, the following steps occur in less than 100 microseconds.

### Step 3

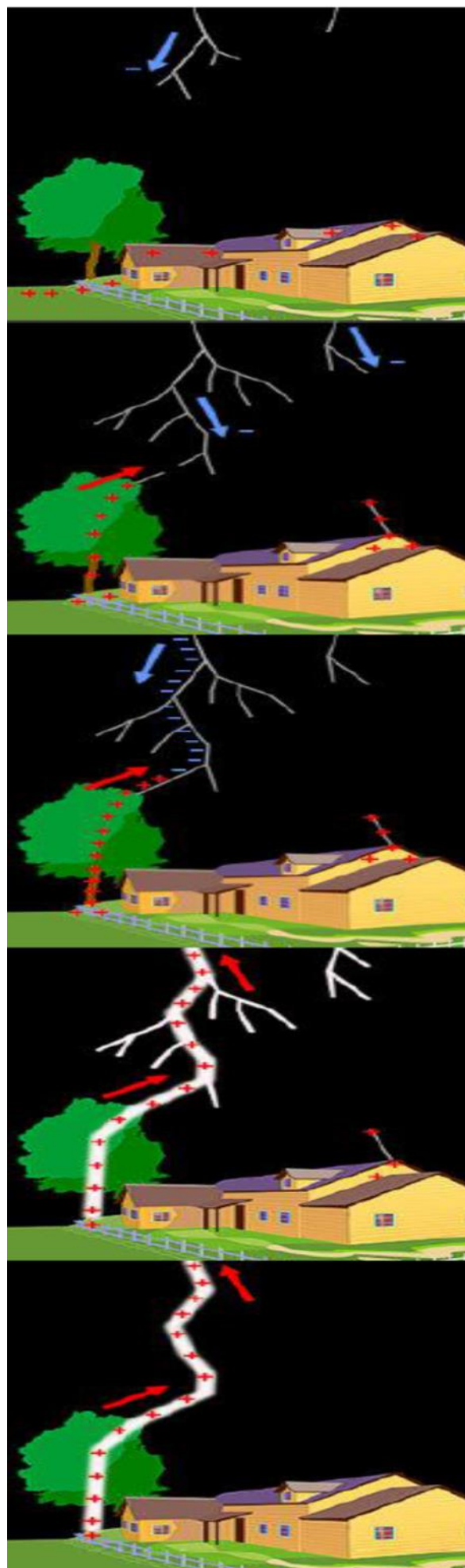
The electric potential of the stepped leader is connected to the ground and the negative charge starts flowing down the established channel.

### Step 4

An electric current wave, called a "return stroke", then shoots up the channel producing a brilliant pulse. It only takes the current about 1 microsecond to reach its peak value, which averages around 30,000 amperes. This "return stroke" is more than 99% of a lightning bolt's luminosity and is what we see as lightning. The stroke actually travels from the ground into the cloud, but because the strike takes place so quickly, to the unaided eye it appears the opposite is true.

### Step 5

Finally, the lightning strike ends with the rise of the beam back to the cloud, and there is a pause in the tens of parts of the millisecond, and then the strike is repeated again according to the same steps, so the lightning strike can be repeated a number of times to give one flash. It takes the current about 1 microsecond to reach its peak value, which averages around 30,000 amperes.



## 2-4 some typical values for the leader are as follows

- 1) The time for the leader to move to the next step is 1  $\mu$ sec duration
- 2) The length of the leader is tens of meters.
- 3) The pause time between steps is (20 -50  $\mu$ sec).
- 4) A fully developed leader can effectively lower 10 C or more of negative charge
- 5) Charge is lowered in tens of milliseconds.
- 6) Downward speed of propagation is about  $2 \times [10]^{+5}$  m/sec
- 7) The average leader current is between 100 and 1000 Ampere
- 8) The leader steps have peak pulse currents of at least 1KA
- 9) The starting and stopping of the leader produce downward branches.
- 10) The potential difference between the leader and  
The earth is in excess of  $10^7$  V.

As the electric field increases, additional ionization in the form of point discharges occurs on the ground. With the potential difference between the leader and the earth in excess of  $10^7$  V

## 2-5 some typical values for the return stroke are as follows

- 1) Upward speed of the return stroke is typically one third to one-half the speed of light near the ground and decreases as it approaches the cloud.
- 2) The total time between ground and cloud is on the order  $100\mu\text{ sec}$
- 3) Peak current of the first return stroke is 30 kA
- 4) Time from zero to peak is a few microseconds.
- 5) Hundreds of amperes may flow from a few seconds to hundreds of milliseconds
- 6) Leader channel is heated to 30000 K.
- 7) All the charge contained in the leader, step branches,
- 8) The total charge transferred is from 2 to 200 C.
- 9) Currents range from 20 to 400 kA.
- 10) The leader travels for 1 to 210 MS-1.
- 11) The time between return strokes 3 to 100 Ms.
- 12) The number of return strikes ranges from 1 to 30, With the average being 4.

**This figure we can show typical values for the return and typical values for the leader**

**Fig (4) Steps of leader and return of lightning**

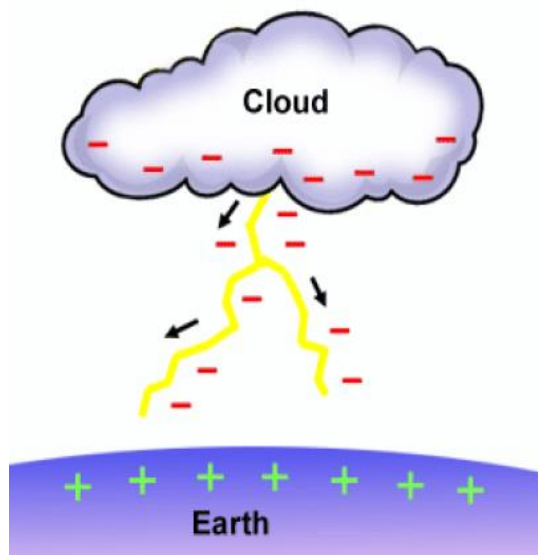


Fig. 1 The formation of the step leader.

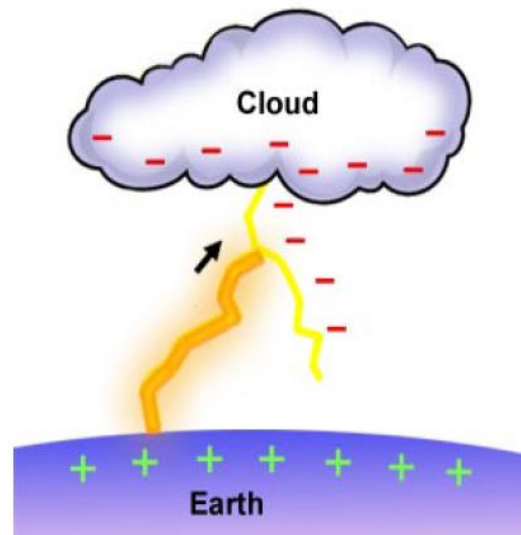


Fig. 2 The formation of the returning stroke.

## 2-6 Clouds Thunder

Today, scientists have been studying and monitoring lightning from space for many years. They have come up with many facts about this phenomenon, so it can be said that the details about the lightning mechanism in this study is a discussion of the facts of determinism. Because it is not acceptable for us to construct a scientific interpretation of a dignified verse or a prophetic Hadith only if we possess certain facts. The lightning does not happen in any clouds, but there are specific clouds, in which scientists called them thunder clouds, the suitable environment for the occurrence of lightning. There may be one cloud or several clouds, which is the actual case. These clouds are normally filled with electric fields because of the wind that drives the molecules of water vapor, pushing it up, causing these particles to interact with each other, these in turn generating electric fields. At the same time, negative and positive charges accumulate in the cloud, but positive charges often rise, and the negative remains at the bottom of the cloud near the Earth. Studies have also shown that there is a difference in electrical voltage between the Earth's surface and the ionosphere by about 500 000 volts, and this difference is produced because of the global distribution of thunderstorms, which are necessary to maintain this difference [13]. Thus, lightning requires dense, heavy clouds weighing millions of tons. That is exactly explain, what Allah (S.W.T) said in Surah Ra'd 12 "It is He who shows you lightening, [causing] fear and aspiration, and generates the heavy clouds" .

## 2-7 The Prophetic Hadith

After we saw the results of researches and experiments lasted two and a half centuries, and after we saw scientists who spend their lives, and some died in order to know the identity of lightning and its phases and stages, and how much money spent in order to identify lightning strike does not exceed the time parts of milliseconds. We come after these scientific facts to see the truthful truths of the Prophet, and come to live a pleasant journey with the words of the Prophet (P.U.H) (Fig. 9), and we compare and manage without carrying the Prophetic hadith unreliable interpretation then we will ask: why this Hadith totally agrees with today's scientific findings? Prophet Mohammed (P.U.H) in this Hadith talking about the path (Sirrat), a bridge that will be set up over Hell, on the Day of Resurrection. The ways in which people will pass over the Path will vary according to their deeds. Some will cross running like lightning, some walking, some crawling, and some will be snatched and thrown into the Fire, each according to his deeds

فقد روى الإمام مسلم رحمه الله تعالى في صحيحه عن أبي هريرة رضي الله عنه في وصف الصراط، ومرور الناس عليه يوم القيامة قال: قال رسول الله صلى الله عليه وسلم: (وترسل الأمانة والرحم فتقومان جنبتي الصراط يميناً وشمالاً، فيمُرُّ أولكم كالبرق)، قال: قلت بأبي أنت وأمي، أي شيء كمرّ البرق؟ قال: (ألم تروا إلى البرق كيف يمرُّ ويرجع في طرفه عين؟ ثم كمرّ الريح، ثم كمرّ الطير وشدّ الرجال، تجري بهم أعمالهم، ونبئكم قائم على الصراط يقول ربِّ سلم سلم، حتى تعجز أعمال العباد، حتى يجيء الرجل فلا يستطيع السير إلا زحفاً)<sup>(١)</sup>.

(١) صحيح الإمام مسلم، كتاب الإيمان، باب: «أدنى أهل الجنة منزلة فيها»، رقم ٣٢٩ / ١٩٥

Fig (5) The Prophetic Hadith Narrated by Imam Muslim[24]

The Prophetic Hadith about the Path in Day of Resurrection is considered to be one of the scientific miracles in the prophetic Sunnah. It is clear through this Hadith that the companion narrated the Hadith surprised by the expression of the Prophet (P.U.H) on the passage of lightning and its speed. In this Hadith narrated by Muslim the prophet says: “don't you see that the lightning comes and back in an eye blink” [24]. there is complete identification between our prophet saying and the most recent discovery concerning the lightning flash as scientists had found that the lightning flash happens when a ray of lightning get out of the cloud toward the ground and back again to the cloud. In this Hadith there is a sign that prophet Mohamed(P.U.H) talked very carefully about phases of the lightning, and also he determined the time as it is the time of an eye blink. It can be noted that, the average duration for a single blink of a human eye is 0.1 to 0.4 seconds, or 100 to 400 milliseconds[25]. As stated previously scientists had found that lightning has many phases and the most important phases are going down phase and going back phases. Time of the lightning flash is in milliseconds and this is the same as time of eye



blink which was described precisely by our Prophet (P.U.H). If we ask ourselves what made the narrator, i.e. Abu Huraira, surprised, and why he asked about the passage of lightning? The answer easily is people at that time thought that lightning, or light, does not need time to pass. But no one imagined that the light has a speed. At that time the dominant belief was the light is running in the blink of eye that is why Abu Huraira said: “O my beloved Prophet, is there anything like lightning’s speed? This great companion, Abu Huraira, was surprised by the saying of the Prophet (P.U.H): “As a lightning speed,” he did not imagine that lightning was passing and moving and walking. This is the first sign we can take from this Hadith that lightning is going at a certain speed. In the Prophetic Hadith: “The first of you will pass like lightning” which is a very clear reference to the existence of a time for the passage and the movement of lightning, and as we have seen, the strike is going faster than 300,000 kilometers per second. Although we cannot realize this speed with our eyesight, our Prophet (P.U.H) told us about it and referred to it in saying: “How pass and return back”. If we focus on this Hadith when the Prophet saying “doesn’t you see that the lightning comes and back in an eye blink” we can easily state that it corresponds to a hundred percent with revelations of recently scientific researches. Scientists have ended up as we presented before that lightning is nothing but only a huge electric spark, occur as a result of contact of negative electric charge in the cloud with a positive electric charge in the ground, and that there are two main phases that lightning never occur without them, i.e. passing and returning phases. Not only this but also the scientific terms are “step”, used by scientists to express the first stage means passes, and “return” which scientists used to express the process of returning. Surprisingly, these two terms agrees well with the expressions of our Prophet Muhammad (P.U.H). This indicates the accuracy of the Prophet’s Hadith, and its compatibility with the scientific facts in 100%. But what does it mean for us that today scientists use the same prophetic expressions? It means one thing: that the Holy Prophet (P.U.H) told us about certain facts as if we were seeing them, before the scientists of our time saw them. It also shows the miraculous mysticism in the words of this Prophet (P.U.H). Who told him that scientists fourteen centuries later would use same words? And if the Great Prophet (P.U.H) has learned this science from scientists of his era, he came with myths and superstitions descriptions, which was dominated at that time. Regarding the period time of lightning, we have found that time is a few parts of a second, and this time varies from place to place and from time to time, and the average lightning time is the fraction of a thousandth of a second. We ask ourselves: “is there any relationship between the time needed to strike the lightning, and the time necessary to blink the eye?” If the times are equal or equate, then the Prophetic Hadith will set the time of the lightning strike before scientists fourteen centuries ago. The surprise was that when we looked for the blink of an eye, and how long will take for eye remained closed during this blink? We found that the time is also tens of parts of the millisecond in average. This is exactly what we expected, i.e. the time needed to blow lightning. We also found that the time of the lightning strike varies from one cloud to another according to the distance from the ground, depending on the surrounding weather conditions, the density of clouds and the extent of saturation with water vapor. Nevertheless, this time remains estimated several tens of milliseconds, and also found that the time necessary to blink

the eye differs from one person to another according to the psychological, physiological and age conditions, but it is also estimated to be several tens of milliseconds. Glory be to Allah (S.W.T) for this accuracy in determining the times. The Messenger of Allah (P.U.H) gave us time, and time ranges. Does anyone could regret this miraculous talk which exactly agrees with the scientific findings? It can be stated that scientists believe that a lightning strike can heat the air in a fraction of a second. When air is heated that quickly it expands violently and then contracts like an explosion that happens in the blink of an eye[26]. The phrase “in a blink of an eye” that has been used by scientists describe the events that take place in the lightning ray. This phrase is the same used by the Holy Prophet (P.U.H). Thus, scientists of the space and computer age use the same Prophetic metaphor, which means that these are not Prophet’s words, but he learned from Allah (S.W.T). Allah (S.W.T) honored his beloved Prophet (P.U.H) with miracles in his Hadith during his life and after his death and to the Day of Resurrection. These miracles are nothing but only witness to the sincerity of his message to all people.

# Chapter three

## 3-1 result

To summarize the most important results that we have reached in this research, which represent scientific miracles in the field of electricity and lightning

1-The Hadith included a clear indication of the movement of the lightning and its passage as well as it has specific speed, not as it was thought and believed that the lightning goes at a glance without time.

2-The Hadith included a description of the lightning phases exactly like recent discovery by scientists, and that the lightning occurs in stages as identified by the Holy Prophet (P.U.H). (peace and blessings of Allah be upon him)

3-The Hadith defines the name of each stage (passing and returning), in its real and actual name, and corresponding with the scientific names. The Holy Prophet (P.U.H) is the first whoever talked about a scientific fact, namely the return of lightning and evolution back, and this scientific miracle in the Prophetic Hadith.

4-This Prophetic Hadith defines the time of one lightning strike with a blink of an eye, and we have seen how these two times are equal, i.e., the prophetic analogy of lightning with the eye is very accurate and scientific. Through accurate measurements one can realize that a huge amount of negative charges come from the cloud to the Earth in less than a thousandth of a second, and then generate a backlash that travels through a specific channel at a speed of more than half the speed of light which gives the seeable flashing light

The channel of the back stroke is used again for other strikes, i.e., the passage and return of the lightning beam. Thus, there is a repetition of lightning strikes can reach 3 or 4 or more, all of which is seen as a single flash. One of the conditions of the miracle in the Prophetic Hadith is that it is impossible to know the scientific truth that the great Prophet (P.U.H) told us about in his time. To examine the scientific development of lightning experiments, the precise study of this phenomenon began in the seventies of the twentieth century in America, Europe and Australia, and then in 1995 began the study of lightning from space through the satellites of the Space Agency (NASA). Therefore, we can say that, without a doubt, the Hadith is a scientific miracle, because it told us a scientific fact which was not confirmed with certainty and real images only at the end of the twentieth century.

## 3-2 Conclusion

At the end of this study, it is necessary to answer a question that may concern the reader of this research for the first time: If this talk includes all this scientific accuracy and details about the complex lightning process, why did not Muslim scientists detect these stages? On the contrary, we see Western scientists who are non-Muslims discover these stages and they did neither read this Hadith nor see it. The answer is simply that Muslims believe everything that Muhammad (P.U.H) said but non-Muslim will benefit from these facts and these miracles thus this will be tangible proof of the truthfulness of the message of Islam. When the Prophet (P.U.H) addresses atheists with scientific facts, they will discover them. This is the summit of superiority and persuasion that the Prophet is right. What is truly miraculous is that the Great Prophet (P.U.H) used this scientific miracle during the talk of the Resurrection, which is denied by the atheists, as if he wanted to address them in the language of science which they understand well and affirms to them. Therefore, as they saw the truth of the lightning passage and its return they certainly will face the Resurrection day. This also indicates that Islam addressed His enemies through the science language. +The believer increases his faith when he sees this prophetic miracle, and if he cannot see this miracle or any other, his faith will never be broken. While, the atheist, nothing convinced him except scientific proofs and this Hadith is one of them. We ask Allah (S.W.T) to make good, guidance and encouragement in this research for anyone who doubts the message of Islam and the prophecy of the Prophet (P.U.H). We also ask Allah (S.W.T) to inspire us to cooperate on righteousness and piety, each according to His competence, to reach the satisfaction of Allah Almighty. And we ask Allah (S.W.T) among the people who described him in Surah Al-Imran: 191: “Who remember Allah while standing or sitting or [lying] on their sides and give thought to the creation of the heavens and the earth, [saying], "Our Lord, You did not create this aimlessly; exalted are You [above such a thing]; then protect us from the punishment of the Fire”.[11]

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