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# Comets from Ancient Superstitions to Scientific Facts

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## Abstract

Comets are icy celestial bodies that enter the solar system due to their elliptical orbits. As they approach the Sun, heat causes part of their ice to evaporate of a part of the ice on the surface of their cores, and the gas and dust particles come out into the space under pressure as a trail. This research was done with the aim of introducing comets, superstitions of ancient times to the scientific facts surrounding them. This review research has been conducting using a qualitative research design in which data has been collected from various theoretical books, various online reputable journals such as Astrophysical Journal and Google Scholar. The findings of the research show that the idea of the past was very different from what we know about comets today. In ancient times, comets were considered as harbingers of disaster and prophets of God. But today we know comets very well. Comets are cosmic snow balls made of frozen gases, rock and dust. The research conclusion shows that comets are magnificent sights in the night sky and their nature has always been a challenging to topic in the history of astronomy. These objects are the remaining ice planets from the time of the formation of the solar system, and some of them have brought water and carbon molecules necessary for the formation of life on Earth to this planet, and the existing water on the surface of the moon depends on them.

**Keywords:** Comets, coma, nucleus, solar system, trail.

## Introduction

Comets are objects that revolve around the sun. Their orbits are elongated in an ellipse. They reflect the light of the sun, and especially in the perigee position, they become so bright that it seems that they emit light themselves. In the past, radiant comets were considered as harbingers of evil and bad luck, and sometimes they were considered a sign of divine punishment and threat (Royan & Sulaimankhil, 2014, p 208). Comets very in size and shape, and some comets are quite large. In 1811, a hug comet appeared in the sky, the head of which was a cloud of dust that was bigger than the Sun (Haidar Zada, 2009, p 17). From the point of view of structures and composition, comets are composed of a nucleus to which most of the comet's mass belongs, coma, and one or more trail (Degani, 2011, p 32). Until recently, astronomers believed that the nucleus of comets is made of solid heavy materials, but later it was found that such a theory is not correct. Today, it is believed that

the nucleus of comet composed of solid particles that are inside a frozen gas (Madani & Shafiqi, 2010, p 30).

Since the solar system of the planets, in addition to the sun, planets, moons and asteroids, has other celestial bodies called comets, therefore it is necessary for us to have information about the celestial bodies around the sun neighborhood of the earth, especially comets. Also the study of comets is important because new studies shows that the water on the surface of the moon could have been created by the collision of many comets after the birth of this sphere (Ghobar, 2008, p 58). Some scientists also believe that some comets brought water and carbon molecules necessary for the formation of life on Earth to this planet (Sajjadifar, 2008, p 131). This research first investigated the history of the appearance of comets, then clarified the issue such as superstitions surrounding comets in different cultures of ancient times and scientific facts surrounding them in the present.

## Material and Method

This review research has been conducting using a qualitative research design in which data has been collected from various theoretical books, various online reputable journals such as Astrophysical Journal and Google Scholar. Thematic method was used to analyze and describe the data.

### What are comets?

Comets are celestial bodies that occasionally appear in the night sky. Each comets consists of a light path and long trail, the head of which may be as large as the Sun and the tail of several hundreds of millions of kilometers. Every comet, despite its speed of hundreds of kilometers per second, appears motionless to the naked eye like the moon. Their speed can be determined from the change in their position relative to the fixed stars in the sky. So far, nearly 800 comets have been discovered and named. Most comets are moving in a closed orbit. Such comets were very important and after a period they came close to the earth and were observed. The most famous of them is Halley's comet (Sadat, 2017, p 128).

Comets are icy objects that reach the inner solar system after leaving distant reservoirs beyond Neptune (Kuiper Belt) and dynamically evolving onto elongated orbits with very low perihelion distances. Comets are short lived, implying that they must be resupplied from external reservoirs (Nesvorny & others, 2017). The orbits of other comets are such that most likely once they appear and are seen in the vicinity of the earth, they go around and then they do not return to the vicinity of the earth. Most people think of a comet as a speck of dust in the sky. At first, the comet is a dusty object in the sky, it moves slowly among the A trail gradually emerges from the dusty patch, which is stretched in the direction opposite to the direction of the sun. likewise, when the comet becomes brighter, its tail becomes longer, then the comet shortens and disappears. The trail is just one of the many features of a comet (Sadat, 2017, p 129).

Comets are objects that revolve around the sun and their orbits are completely elongated in an ellipse. Those objects reflect the light of the sun, and especially in the perigee position, they become so bright that it seems that they emit light themselves. Comets are visible when they approach the earth and the sun, but there are also comets that appear on the other side of Jupiter's orbit. Some comets are so far from the earth that either they are

not known yet, or one round of their rotation has not been calculated and predicted so far, or they are so far from the earth that one round of their rotation takes several hundred years and it even lasts thousands of years, and some of them only appear in the sky for a short time, which does not exceed few weeks to a few months. In front of this group, there are other comets whose one cycle does not exceed a few years (Royan & Sulaimankhil, 2014, p 209).

## History of comets

The report of the appearance of comets goes back thousands of years. By estimating the distance of comets from earth. Tico Brahe created a fundamental change in the knowledge of these objects and showed that they do not belong to the atmosphere and are located at a much greater distance from the Earth. At the same time, Brahe put a big problem in front of astronomers and philosophers; Where in the sky and among which types of celestial bodies should these unusual objects be placed? When in the Aristotelian world, type and movement of all heavenly bodies were known; Comets, which were unconventional objects and neither their number, nor their types, nor their movement, were known, how could they be placed in their proper place.

After Brahe, the first astronomers who became famous in Europe were Galileo and Kepler. Galileo, who is considered of the founders of the scientific revolution in the 17th century, had a completely Aristotelian theory about comets. Although he could not deny measurements that placed comets outside the earth's atmosphere, he did not believe they were celestial. According to the Galileo, steam and smoke rose from the earth directly to the sky and even to the interplanetary space. Then the sunlight would be re-radiated after hitting this mass, but as the re-irradiated light passed through the earth`s atmosphere, the impurities in the atmosphere would cause this re-irradiated light to fail. This refraction of light was seen as a comet. In this theory Galileo tried to explain all the phenomena related to comets. Kepler, however had a completely different theory. According to him, comets were heavenly bodies that did not move in a circular motion like planets and stars, but moved in straight paths. For this reason, no trace of comets can be seen in all of Kepler's writings about the laws of planetary motions. Kepler's opinion about the nature of comets changed over the years. In the early years of the 17th century, he thought that the body of comets is like a glass that refracts sunlight and the broken feathers are seen as trail.

As mentioned earlier, the report of the appearance of comets goes back thousands of years. Some of them are regular guests. For example, Halley's comet appears once every 75 years since BC. The viewing conditions of this comet were not good in Europe and North America, but it was clearly visible in Australia and New Zealand. The huge comet seen in 1843 had a trail 330 million kilometers long (Sadat, 2017, p 129).

## Superstitions about comets

Historical beliefs about comets differ significantly from our current understanding. In ancient times, comets were considered harbingers of disaster and prophets of God. The appearance of comets goes back thousands of years. In different cultures, comets have taken titles such as the forerunner of punishment and the threat of destiny. In the beginning comets were the most remarkable objects in the night sky. In many cultures, comets are carriers of messages from the gods. For example, in some cultures, the tail of comets is the appearance of a woman`s head with long hair behind her head, and in fact, the name comet is derived from the Greek word meaning hair. Initially, when a comet appeared in the sky,

people trembled with fear. They believed that comets were signs of calamity and predict the arrival of calamity and plague or war and death (Sadat, 2017, p 129).

Since long ago, people considered the appearance of comets as dangerous and believed that these objects kill people through deceptive superstitions. Shakespeare believed that the appearance of comets heralds the change of nations and governments. This idea has long been in the minds of kings that the appearance of a comet during their rule means that their rule is in danger. For example, During Nero's reign in 60 AD, a comet appeared, leading astrologers to warn him of impending doom. In response, he initiated a massacre among the nobles, including his mother and wife, before ultimately committing suicide at age 33. Comets are interesting objects that wander among the planets and have been known since the distant past. At one time, they were considered signs of futures events, and even some people were afraid of it until recently. Others saw them as a good omen. In the late 1990s, many believed that Halley's star approaching the Earth would mean the end of the world (Sadat, 2017, p 127).

Such ideas can be seen even in the minds of the people of our times. We have not forgotten the reaction of the people of the Arab countries involved in the war with Israel to the bright comet Bennett that appeared in the sky in 1970, and we recall how they perceived this harmless celestial event as a dangerous weapon and consider it a threat from Israel? All these ideas are related to the time when people were at low level in their understanding of comets and astronomy, but nevertheless, in the past not so far from today, in the 1980s, a scientist named Hoyle, who is an astrophysicist, considered Halley's comet to be the causes of influenza (Royan & Sulaimankhil, 2014, p 208).

## The origin of comets

Long period comets originate from a spherical region of frozen bodies called the Oort cloud. These objects are located in the farthest part of the solar system and are composed of frozen ammonia, methane, water ice and rock. Usually a gravitation disturbance causes them to enter the solar system. Comets are primarily found in two regions: the Kuiper Belt and the Oort Cloud. Short period comets usually come from a region called the Kuiper belt. This belt is located beyond the orbit of Neptune. The first mass belonging to the Kuiper belt was discovered in 1922. These objects are usually small and their size varies from 10 to 100 kilometers.

Mathematical theories suggest that many comets originate from distant regions, about 100,000 AU in the solar system. Each astronomical unit is equal to the distance between the Earth and the Sun and is about 100,000,000, miles. Comets originate from very distant regions and come from all directions towards the solar system Therefore, where they originate from must be a giant region around the solar system. But some originate from a closer region called the Kuiper belt. In 1950, a Dutch astronomer named Jan Evert said that comets come from far away around the solar system. He called this region the Oort cloud, which contains many objects in this giant clouds. The Oort cloud occupies a space of 5000 to 10000 astronomical units and is located in a region of space where the influence of the Sun`s gravity on it is weaker than the influence of the gravity of the nearby stars. The Oort cloud probably has 100 billion to 2 trillion bodies in solar orbit (Sadat, 2017, p 131).

## Discovery of comets

Comet explorers often discover them at great distances from the Sun. Usually, at that distance, comet does not have a clear trail, and only its wisps are seen in the form of a faint

and small nebula. After making sure that the observed object is neither a nebula nor a galaxy, it will have to wait until it is confirmed as a comet. At the same time, one should be aware of the approach of periodic comets and their location so as not to make a mistake. Discovering comets is hard work. Statistics show that usually every observer with good facilities spends an average of 400 hours of observation work to discover his first comet (Dalki, 2006, p 879).

## Discovering the origin of the moon water in the heart of comets

New studies show that the water on the surface of the moon could have been created by the collision of many comets after the birth of this sphere. According to Mehr news agency, the water found in samples collected from lunar rocks differs from that on Earth, and instead, its properties match those of water found in comets. Wesleyan university researchers believe that if the water on the moon's surface is formed from comets, a compelling theory may emerge regarding the collision of numerous comets with Earth that contributed to the formation of its oceans, and this will eventually it will lead to finding the answer to one of the most important questions about the evolution process and the origin of the Earth's oceans.

By examining the chemical characteristics of water in the rock samples that NASA astronauts brought to earth from the moon during the Apollo missions, researchers found that the geochemical signs of water in moon minerals such as apatite have amounts of deuterium and hydrogen compounds, which the compounds are not found in the water that exists on Earth. According to researchers, this amount of deuterium and hydrogen have been found together in the water found in comets and some meteorites. In fact, the blue features found in moonstone samples have many similarities with the blue features found in comets Halley and Hale-Bopp. The water that is found in deep in the Earth's mantle has the same chemical characteristics as meteorites water, which means that the chemical composition of the early Earth is comparable to the chemical composition of the planet Earth at its current age. In other words, it is believed that the moon was formed due to the strong impact of a mass equal to the size of Mars with the Earth, during which the disintegrated materials gradually condensed and turned in to moon. Maybe the deuterium and hydrogen in the water of the moon were formed during this collision, and in the case, the chemical composition of the water should be more or less similar on the surface of the moon. However, researchers have found differences between the composition of water in highland and lowland areas of the Moon. According to the space report, these differences cloud mean that the water sampled had different origins, and the only phenomena that cloud explain this diversity of water sources in the moon is the impact of comets with the nearby surface is the cosmic friend of the planet Earth (Ghobar, 2008, p 58).

## Characteristics of comets

Comets are the beautiful and spectacular objects that consist of three parts. The diameter of the nucleus of these objects is only a few kilometers and their trail continues for millions of kilometers (Ragheb & others, 2021, p 11). A comet in the early stages of its appearance looks like a piece of luminous cloud, but as it moves closer to the Sun, its brightness increases. The trail of most of them is so transparent that you can see the light of the stars through it. Halley's comet is exceptional and despite having a short orbital period, originates from the Oort cloud. Comets are non-periodic and periodic. Non-periodic comets originating from the Oort cloud are not gravitationally bound to the Sun, and their orbits are such that they

see the Sun only once and never return. Periodic comets also include long-period and short-period comets that originate from the Oort cloud and the Kuiper belt, respectively (Tjarbi, 1980, pp 13-15).

The chemical compositions of long-lived and short-lived comets are similar, although the constituents of long-lived comets tend be more volatile. The reason for this difference could be the origin of the Oort cloud and the Kuiper belt. In fact, during the formation of the solar system, small bodies were formed in the inner parts of the disk near the giant planets. Then these objects were removed from the solar system by gravitational forces, and those objects that escaped completely formed the Oort cloud. Those objects that could not escape and had no gravitational interaction with the planets remained as Kuiper belt objects (Eshrati, 2000, p 28).

## The structures of comets

Comets vary greatly in size and shape, and some comets are quite large. In 1811, a hug comet appeared in the sky, the head of which was a dust cloud larger than the Sun the length of its trail reached millions of kilometers. Its trail consisted of only very small scattering of dust, but it looked magnificent (Haidar Zada, 2009, p 55).

The trails of comets are divided into two types of dust trail and gas trail. The gas trail usually shows a straight line, while the dust trail is often disturbed or curved. Some comets have both a dust trail and gas trail. From the point of view of structures and composition, comets are composed of a nucleus to which most of the comet's mass belongs, coma, and one or more trail (Degani, 2011, p 172).

## Nucleus

The main and central body of the comet is its nucleus and its dimensions are several kilometers. At distance far from the Sun, these objects are inactive and cannot to be distinguished from asteroids. It is believed that the nucleus of the comet has dark crust that, when heated by the Sun's heat, bursts and ejects ice and subsurface material in the form of steam. The comet's nucleus or heart is the solid chunks at the center of the comet and is like an impure snowball made of ice. The nucleus, which is the central part of comet, is a reservoir of dust and frozen gases. The nucleus of comet is spongy and has a large number of holes and cavities in its interior, and these holes are made of water ice, carbon dioxide and carbon monoxide. When a comet approaches the Sun, it begins to evaporate and a spectacular and attractive plume and tail is created (Sajjadifar, 2008, p 171).

## Coma

When the ice in the comet's nucleus evaporates, it becomes a large clod around the central part of the comet and expands rapidly. This cloud is called coma and can extend for millions of miles. the density of particles in the coma surrounding the nucleus is very low and about 10,000 times less than the density of particles in the terrestrial clouds. This cloud is very thin and narrow and 10,000 times thinner than an atmospheric cloud on Earth. The natural particles inside this cloud are converted into ions under the influence of the solar wind and participate in the formation of the ion trail. When the comet is in its perihelion, its plume is usually about 100,000 kilometers and has been torn by the solar wind like a teardrop (M. Yasin, 2013, p 23).

### Tail

When a comet approaches the Sun, a tail usually follows it. This tail is made of very thin gases and small particles that jump out from the nucleus of the comet under the influence of the Sun. The tails of comets are different in shape and size, some are short and root-like, while others are elongated and narrow. Their length usually reaches nine million kilometers and sometimes reaches 160 million kilometers. Some comets do not have tails at all. The comet's tail on the opposite side of the Sun, because light and other radiation from the Sun keeps the small particles that are in the comet away, but in some special situation, due to the angle of view, it looks like the tail is pointing towards the sun. it is what is called anti-tail (Gallagher, 2011, p 26).

### The trajectory of comets

The orbit of planets is close to a circle, while a comet's orbit is highly elliptical. Due to gravitational efforts, comets move faster at perigee than at apogee. Comets are classified according to their period of rotation around the Sun. Accordingly, comets are divided into short-period comets and medium-period comets. Comets with short periods like Halley's comet spend more than 76 years between the Sun and Pluto. These comets are initially in the Kuiper belt, but the gravitational force of one of the planets, specially Jupiter, pushes them closer to the Sun, and their period is less than 200 years. Shoemaker-Levy 9 was one of the short-period comets that eventually crashed into Jupiter. Long-period comets with a period of more than 200 years are mostly in the Oort cloud. Comet Hale-Bopp is an example of these comets (Royan & Sulaimankhil, 2014, p 210).

Every time comets pass by the Sun, they lose some of their material due to evaporation. A star trail has a short orbital period, it is very bright, but every time it passes by the Sun, it loses some of its material, and thus, it becomes less possible to see them. Some of these comets are seen only once before disintegrating, although the typical lifetime of a short-period comet is about 10,000 years. Many long-period comets travel around the Sun for thousands or even millions of years. Therefore, the lifespan of these stars is much longer than other types (Lokum, 2010, p 82).

### Death of comets

Comets revolve around the Sun in a long orbit. They go beyond the farthest planet in deep space and then return to the solar system and pass close to the Sun. As a comet approaches the Sun, its tail becomes larger. The trail is always in the direction opposite to the Sun. The pressure of light and the attack of the solar wind push the trail to the opposite side. Every time the comet passes by the Sun, its material is reduced, which means that every time the comet passes through is the solar equinox, it loses some of its material due to the Sun's heat and tidal forces until the comet finally disappearance. Some comets break up into several pieces with a short periodicity (Sadat, 2017, p 140).

Some other comets lose some of their mass in each orbit around the Sun and finally after several orbits, they will slowly disappear in the space of the solar system. In the orbital path of these objects, a large accumulation of small stones and dust particles are left behind. Whenever the earth passes through one of these gathering on its way around the Sun, we will witness a meteor shower in the sky (Ghobar, 2008, p 218).

## Conclusion

Comets are interesting objects that wander through the planets and have been known since the Ancient time. Comets are other members of our solar system that travel on very long orbits that may take millions of years. These objects are located in the farthest part of the solar system and usually a gravitational disturbance causes them to enter the solar system. Comets consist of a nucleus, coma and a long tail. When the comet comes close to the Sun, its trail changes and it is further away from the Sun due to the solar winds. Astronomers classify comets according to the time it takes to orbit the Sun once. Based on this classification, comets are divided into comets with short orbital period and comets with medium orbital period. Some scientists believe that some comets brought water and carbon molecules necessary the formation of life on Earth to this planet (Sajjadifar, 2008, p 131). Comets are found prominently in two places such as the Kuiper belt and the Oort cloud. The idea of the past was very different from what we know about comets today. In ancient times, comets were the most remarkable objects in the night sky. In many cultures, comets are messengers of the Gods (Sadat, 1396, p 127). The Earth has passed through the trail of these objects several times without being harmed, and even if one day it collides with the nucleus of the biggest comets, it is highly likely that its damage will not be more than a localized destruction. At the same time, the impact of the comet that led to the destruction of Tunguska located in Siberia in 1980 should not be overlooked. Perhaps, the serious impact of comets in the past, has caused tremendous transformations and decorations and left behind terrible and unknown works (Royan & Sulaimankhil, 2014, p 208).

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## Data Availability Statement:

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## *Conflicts of Interest*

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

Degani, M. (2011). Astronomy Made Simple (The Made Simple Series). Tehran: Publications of Gitaology Institute.

Dalki, A. (2006). Earth in space (solar system). Tehran: Institute of Geographical and Cartographic Gitaology.

Eshrati, A. (2000). Science and Scientific Miracles of the Holy Quran. Kabul: Khawar Publications Institute.

Gallagher, B. (2011). Earth and Space. Tehran: Gold Print 80.

Ghobar, Y. (2008). The System of Solar System. Tehran: Publications of Gitaology Institute.

Haidar Zada, T. (2009). The structure of stars and galaxies. Tehran: Cartography and Lithography Publications.

Lokum, A. (2010). From Earth to Galaxy. Peshawar: Enayat Publications.

Mohammad Yasin. (2013). Astronomy. Kabul: Nami Publications.

Madani, H., & Shafiqi, C. (2010). General Geology. Tehran: Publication center of Amir Kabir university of Technology.

Nesvorny, D., Vokrouhlicky, D., Dones, L., Levison, H F., Kaib, N., & Morbidelli, A. (2017). Origin and Evolution of Short-period Comets. The Astrophysical Journal, 845(1), 18-43.

Ragheb, W., Taj Mohammadi, A., Reza Poor, S., Zarqi, N., & Habibi, A. (2021). Knowledge of Astronomy (introductory level). Mashhad: Akhter Negar Publications.

Royan, A., & Sulaimankhil, K. (2014). Solar system (planets). Kabul: Karwan Publications.

Sadat, S. (2017). General Physical Geography (astronomy Section). Kabul. Nawesa Publications.

Sajjadifar, E. (2008). Knowledge of Space and Solar System. Tehran: Institute of Geographical and Cartographic Gitaology.

Tjarbi, M. (1980). How the solar system was formed?. Tehran: Cartography and Lithography Publications.