

Hayah and the New Moon

Abstract

There are verses in chapter twenty of the First Book of Samuel that show that David and Jonathan knew when a new calendar month was due, nearly three thousand years ago.

One author has claimed these verses show that the current religious calendar of Judaism was in use at that time. Much of his reasoning is based upon claims about the meaning of the ancient Hebrew word *hayah* and assertions regarding the visibility of the new crescent (in the day following the lunar conjunction).

The critical foundations of his arguments are investigated in this publication, and found to be false.

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An explanation regarding this document

This article is written in response to some claims in a certain document. My analysis and conclusions are at variance with those in the original document. No attack on the original author is implied, and no offence is intended. To avoid causing any possible negative feelings towards that author in the minds of readers of this article, I have omitted his name and even the name of his document, to provide him anonymity as much as it is feasible. I have a high regard for that author, recognizing that he has put quality effort and research into his lengthy booklet. My article concentrates on one point of his, but a crucial point which is a basis for the rest of his document.

1 Introduction

One author has written persuasively concerning 1 Samuel 20:24 that this verse demonstrates that a calendar based on physical sightings of a crescent was in use at the time of David and Jonathan.

His argument centres around the use of the ancient Hebrew word identified as Strong's H1961, and commonly represented in English as *hâyâh* or *hâyâh* or *hayah*. His document claims this word means "to arise or appear", based on a publication by Brown Driver Briggs. Using these meanings, he states "Here is undeniable evidence that the new moon of Scripture is not the astronomical conjunction. ". Apparently he interprets the English "when the new moon was come" as "when the early waxing crescent was arisen and in view" in the sense of some object becoming physically visible, rather than as "when the first day of the month was come" with no physical object involved.

He also makes claims about the visibility of the conjunction: "The astronomical conjunction takes place during the 'dark of the moon,' and is not visible from any point on earth. No part of the moon can appear in the sky during the astronomical conjunction."

Continuing with his selected meanings for H1961, he wrote "Yet the verb *hây-yâh*' records that the new moon appeared in the sky above the palace of Saul and the field where David was hiding."

The New Testament admonishes us to "Prove all things, hold fast to that which is good" (1 Thessalonians 5:21).

The people at Berea were commended as being "more fair-minded than those in Thessalonica, in that they received the word with all readiness, and searched the Scriptures daily *to find out* whether these things were so". They did not just accept a good story, but checked out what Paul and Silas told them, "*to find out* whether these things were so".

In this document, let us consider the claims concerning *hayah*. As a related side issue, let us test the claims concerning the visibility of the conjunction.

2 The Case for “arise or appear”.

In this section, we will look at the verse which is the crux of the argument. Initially, we will read the whole setting to gain an overview, then review the verse itself, and with Strong’s Hebrew numbers which will lead us to more detailed research of the original words.

2.1 The Verse In Context

To understand the context of the discussion, the passage is: ¹

1 Samuel 20:1 And David fled from Naioth in Ramah, and came and said before Jonathan, What have I done? what is my iniquity? and what is my sin before your father, that he seeks my life?

1 Samuel 20:2 And he said unto him, Elohim forbid; you shall not die: behold, my father will do nothing either great or small, but that he will show it me: and why should my father hide this thing from me? it is not so.

1 Samuel 20:3 And David swore moreover, and said, Your father certainly knows that I have found grace in your eyes; and he said, Let not Jonathan know this, lest he be grieved: but truly as YHWH lives, and as your soul lives, there is but a step between me and death.

1 Samuel 20:4 Then said Jonathan unto David, Whatsoever your soul desires, I will even do it for you.

1 Samuel 20:5 And David said unto Jonathan, **Behold, tomorrow is the new moon**, and I should not fail to sit with the king at meal time: but let me go, that I may hide myself in the field unto the third day at even.

1 Samuel 20:6 If your father at all miss me, then say, David earnestly asked leave of me that he might run to Bethlehem his city: for there is a yearly sacrifice there for all the family.

1 Samuel 20:7 If he say thus, It is well; your servant shall have peace: but if he be very wroth, then be sure that evil is determined by him.

1 Samuel 20:8 Therefore you shall deal kindly with your servant; for you have brought your servant into a covenant of YHWH with you: notwithstanding, if there be in me iniquity, slay me yourself; for why should you bring me to your father?

1 Samuel 20:9 And Jonathan said, Far be it from you: for if I knew certainly that evil were determined by my father to come upon you, then would not I tell it you?

1 Samuel 20:10 Then said David to Jonathan, Who shall tell me? or what if your father answer you roughly?

1 Samuel 20:11 And Jonathan said unto David, Come, and let us go out into the field. And they went out both of them into the field.

1 Samuel 20:12 And Jonathan said unto David, O YHWH Elohim of Israel, when I have sounded my father about tomorrow any time, or the third day, and, behold, if there be good toward David, and I then send not unto you, and show it you;

1 Samuel 20:13 YHWH do so and much more to Jonathan: but if it please my father to do you evil, then I will show it you, and send you away, that you may go in peace: and YHWH be with you, as he has been with my father.

1 Samuel 20:14 And you shall not only while yet I live show me the kindness of YHWH, that I die not:

1 Samuel 20:15 But also you shall not cut off your kindness from my house for ever: no, not when YHWH has cut off the enemies of David every one from the face of the earth.

1 Samuel 20:16 So Jonathan made a covenant with the house of David, saying, Let YHWH even require it at the hand of David’s enemies.

1 Samuel 20:17 And Jonathan caused David to swear again, because he loved him: for he loved him as he loved his own soul.

1 Samuel 20:18 Then Jonathan said to David, **Tomorrow is the new moon:** and you shall be missed, because your seat will be empty.

1 Samuel 20:19 And when you have stayed three days, then you shall go down quickly, and come to the place where you did hide yourself when the business was in hand, and shall remain by the stone Ezel.

1 Samuel 20:20 And I will shoot three arrows on the side, as though I shot at a mark.

1 Samuel 20:21 And, behold, I will send a lad, saying, Go, find out the arrows. If I expressly say unto the lad, Behold, the arrows are on this side of you, take them; then come you: for there is peace to you, and no hurt; as YHWH lives.

1 Samuel 20:22 But if I say thus unto the young man, Behold, the arrows are beyond you; go your way: for YHWH has sent you away.

1 Samuel 20:23 And as touching the matter which you and I have spoken of, behold, YHWH be between you and me for ever.

1 Samuel 20:24 So David hid himself in the field: and when the new moon was come, the king sat him down at meal time.

¹Text from the Restored King James Version, 2009 mono YHWH OT edition, rkjv.org

2.2 The Verse Itself

The particular verse under consideration is:

1 Samuel 20:24 So David hid himself in the field: and when the new moon was come, the king sat him down at meal time.

The argument is based on the phrase “ **when the new moon was come** ”.²

2.3 The Verse With Strong’s numbers

1 Samuel 20:24 So David ^{H1732} hid himself ^{H5641} in the field: ^{H7704} and when the new moon ^{H2320} was come, ^{H1961} the king ^{H4428} sat him down ^{H3427} to eat ^{H0398} meat. ^{H3899}

2.4 The Claims

The following quotation is from the document.

The account in Verse 24 shows that this observance was not held at the time of the astronomical conjunction, or ‘dark of the moon.’ The noun ‘ghōh’-desh is used in this verse with the Hebrew verb hāy-yāh’ H1961, translated “was come.” Hāy-yāh’ means to arise or appear (see Brown Driver Briggs, p. 225) and is used with this meaning in Genesis 1:5 in reference to the appearing of the evening (erev, or sunset) and the morning (bo’ker, or sunrise) on the first day of Creation.

The use of hāy-yāh’ in I Samuel 20 reveals that when the king sat down to observe the Feast of Trumpets, the new moon was clearly visible in the evening sky. The new moon had appeared before King Saul and those who were feasting with him at the palace, and before David, who was hiding in the field. Here is undeniable evidence that the new moon of Scripture is not the astronomical conjunction. The astronomical conjunction takes place during the ‘dark of the moon,’ and is not visible from any point on earth. No part of the moon can appear in the sky during the astronomical conjunction. Yet the verb hāy-yāh’ records that the new moon appeared in the sky above the palace of Saul and the field where David was hiding.

Note the explicit claims

1. “Hāy-yāh’ means to arise or appear”
2. “the new moon was **clearly visible in the evening sky.** ”
3. “The new moon had appeared before King Saul and those who were feasting with him at the palace, and before David, who was hiding in the field.”
4. “The astronomical conjunction takes place during the ‘dark of the moon,’ and is not visible from any point on earth. No part of the moon can appear in the sky during the astronomical conjunction.”
5. “the new moon appeared in the sky **above** the palace”

The matter under discussion is important and we should check if these claims are so.

The first claim will be investigated in the next section. The claim that no part of the moon is visible in the sky during a new moon is considered in section 4. The other claims that the new crescent was clearly visible in the evening sky, and it appeared before the king in the palace and David in the field, and that it appeared in the sky above the palace are examined in sections 5 and 6.

It appears that the reviewed author believes that the sun had set, then the crescent moon arose from below the horizon, and travelled up into the sky where it became clearly visible in the early night to Saul in the palace and to David hiding in the field, and, moving further along its course, eventually it appeared in the sky above the palace and above the field. Presumably it continued its orbit through the night and set after traversing the remainder of the sky. That view would explain some of the reviewed author’s claims.

If you cannot see anything wrong with that explanation for the rise and movement of the crescent moon, be sure to read the behaviour of the moon in section 4 *Visibility of the New Moon* , especially in 4.2.1 .itfPhases of the Moon , and 4.2.3 *Direction of Travel of the Crescent* .

²Emphasis in this report has been added by me.

3 Checking Further

In this section, other references are checked for the meaning of H1961. First is Strong himself, then another detailed reference using Strong's numbers and the King James Version text.

3.1 Explanation by Strong of word H1961

hâyâh , *haw-yaw'* ; A primitive root (compare H1933); to exist, that is, be or become, come to pass (always emphatic, and not a mere copula or auxiliary): - beacon, X altogether, be (-come, accomplished, committed, like), break, cause, come (to pass), continue, do, faint, fall, + follow, happen, X have, last, pertain, quit (one-) self, require, X use.

There is nothing here to support a claim of "arise or appear" by the moon or any object in a visual way. There are no indications of the movement of any object, such as a star or planet rising into the sky.

There are potential meanings of "become", "come to pass", "happen"; which fit into the concept of change in time or date, such as a new day came, a new day came to pass, or a new day happened. In this sense, hayah could be used to indicate a new month or a new moon came, came to pass, or happened.

Looking at the related word for H1981, viz. H1933, we see no supporting evidence either.

hâvâ' , *haw-vaw'* ; or **hâvâh** , *haw-vaw'* , A primitive root (compare H183, H1961) supposed to mean properly to breathe; to be (in the sense of existence): - be, X have.

So, the Hebrew word hâyâh itself does not mean either arise or appear as claimed by the author. Let us consult further in case we can find some confirming views. I do not have a copy of the Brown Driver Briggs publication, so I will use the following tome which I consult frequently.

3.2 Consulting "The Complete Word Study Old Testament"

Here is information from "The Complete Word Study Old Testament" King James Version (1994)

3.2.1 Hâyâh

From *Lexical Aids to the Old Testament* , page 2311:

1961. Hâyâh: probably related to hâwâh (1933), "to breathe". This verb means to exist, to be, to become, to come to pass, to be done, to happen, to be finished. It is notable that this verb was not used in a copulative construction in Hebrew. Boman maintains that the Hebrews thought only in dynamic categories, not static ones. The key to the meaning of Jehovan / Yahweh is undoubtedly found in this verb. See the footnote on Ex. 3:24. Perhaps "I AM THAT I AM" should be translated "I am He who is," or "I am He who exists." The Sept. has *ego eimi ho on* (*ego* 1470) I (intensive); *eimi* (1510), I am; *ho* (3588) he who; *on* (5607), is). The timelessness of God, as well as His ever-present existence, is something which must be believed (Heb 1:3).

3.2.2 The use of Hayah in 1 Samuel 20:24

Checking the grammatical use of the verb in this verse reveals nothing unusual, and the reader may skip this investigation if preferred.

"The Complete Word Study Old Testament" indicates H1961 in this verse is grammatically type "wcs,qmf", meaning wcs: "Waw Consecutive", and qmf: "Qal Imperfect". (The other two verb forms in this verse are "hid (wcs,nimf)" and "sat him down (wcs,qmf)".)

"Waw Consecutive" refers to a Hebrew way of writing. "If two verbs are referring to the past in one continuous narration, only the first verb is in the Perfect, while any following verb is in the Imperfect with a prefixed *waw* ." In this sentence/verse, the first verb is (David) "hid", and the following verbs are (the new moon) "was come" and (the king) "sat him down".

Nothing special here: David hid himself in the field and remained hidden, later the "new moon" "was come", and later again the king "sat down" to dine.

"Qal Imperfect" refers to a verbal form.

- "The QAL Stem is the basic verbal stem in Hebrew language. Approximately two thirds of the verbal forms in the Old Testament are in this stem. The Qal stem can be divided into two main classes: verbs that represent action (fientive) and verbs that describe a state of being (stative). ..."
- "The Qal Imperfect (qmf) indicates, in the active voice, simple imperfective action, viewed as part of a whole event or situation."

We have two “active voice, simple imperfective action”: the “new moon” “was come”, and “the king” “sat himself down”. Again, nothing unusual in the usage.

3.3 Conclusions

The claim that hayah in 1 Samuel 20:24 means “to arise or appear” in a visible sense, is not supported by Strong’s reference material or by the “The Complete Word Study Old Testament”.

Let us continue and investigate the nature of the early waxing crescent, and its visibility. Perhaps it is feasible that the tiny crescent did arise and did appear above the palace, and was visible to David in hiding and to Saul and his associates in the palace.

The next section will consider general properties of the moon around the time of the conjunction, i.e. the new moon and the very small crescent which follows in the next several days, and the difficulties of observation of the early crescent, followed by a real life example using times and angles above the horizon in section 5.

4 Visibility of the New Moon

In this section, we will investigate the claim:

The astronomical conjunction takes place during the 'dark of the moon,' and is not visible from any point on earth. No part of the moon can appear in the sky during the astronomical conjunction.

4.1 “New Moon” and “Waxing Crescent”

First let us pause to clear up any misuse of the term “new moon” as referring to a crescent.

The term “new moon” is often incorrectly used, when the person means the “new crescent” or “early crescent” or, more correctly, “early waxing crescent”. We should not confuse the terms. For explanations, read on, about moon phases.

4.2 Behaviour of the Moon

In this section we will review the basic behaviour of the moon, the new moon and the new crescent. Let us start with a review of the phases of the moon.

4.2.1 Phases of the Moon

The earth travels in orbit around the sun, spinning approximately 365 times on its north-south axis during a complete cycle. During this time, our moon travels with our planet, doing a complete orbit around the earth in around 27.3 days, its sidereal period³. The moon does not spin on its axis, and keeps the same face towards earth. From the perspective of the sun, the moon orbits the earth.

For simplicity, let us consider regions of the earth closer to the equator, and ignore polar regions which have extended periods of continuous summer days and continuous winter nights.

The earth and the moon both receive light from the sun. Some of the light which is reflected from the face of the moon is visible at parts of the earth. When the moon is on the far side of the earth from the sun, the earth receives the maximum reflected light. The instant of maximum exposure is known as the full moon. By custom, the day when this occurs is also referred to as the full moon, e.g. “Tomorrow is the full moon”. At the time of the full moon, the moon rises very close to sunset and sets very close to dawn.

In the days following, the moon moves to positions where the amount of reflected light is less and decreasing. While more than half of the face of the moon is illuminated, it is known as “gibbous”. When the degree of illumination is decreasing daily, we see a “waning gibbous”. During the time of decreasing reflected light, the moon rises later and sets later each day, by an amount which depends on the local season and latitude.

About a week after the full moon, half of the moon has become dark. This is “last quarter”. The moon rises around midnight.

As it progresses in its orbit, the moon is then known as a “waning crescent”, with moon rise progressing closer to dawn, and moon setting progressively later in the afternoon.

Around a week after the last quarter, the waning crescent has become quite thin as the moon rises near dawn. Very soon, from the viewpoint of the sun, the moon crosses directly between it and the earth, or, more correctly, the centre of the moon crosses an imaginary plane which is perpendicular to the plane of the earth's orbit, and which contains the centre of the sun and the centre of the earth. This is the time of the new moon, or the conjunction. It is a precise instant of time which can be relatively easily calculated.

At the time of the new moon, the moon sets closer to sunset than on the several days earlier or later. The new crescent is very close to the horizon, and very close to the setting sun, the relative brilliance of which makes observation of the relatively dim new crescent quite difficult or impossible. In the days following the new moon (conjunction), the moon sets progressively later after sunset, and movement along its orbit results in a larger waxing crescent. Because the moon sets later, the light from the sun has dimmed more, the background sky is darker, and a crescent is less difficult to locate. As the days since the new moon increase, the crescent is further above the horizon, and less susceptible to being obscured by hills, trees, forests, buildings, etc.

The combination of difficult factors means that seeing a crescent at the time of, or even within hours of, the new moon does not happen, and even spotting a crescent the day after a new moon is “exceptional” (see the information from the United States Naval Oceanography in 4.5.3). The USNO reports that the record fastest time for spotting a new crescent after a new moon is 15.5 hours:

The sighting of the lunar crescent within one day of New Moon is usually difficult. The crescent at this time is quite thin, has a low surface brightness, and can easily be lost in the twilight. Generally, the lunar crescent will become visible to suitably-located, experienced observers with good sky

³See, for example, Larousse Encyclopedia of Astronomy, Chapter “THE MOON”.

conditions about one day after New Moon. However, the time that the crescent actually becomes visible varies quite a bit from one month to another. The record for an early sighting of a lunar crescent, with a telescope, is 12.1 hours after New Moon; for naked-eye sightings, the record is 15.5 hours from New Moon. These are exceptional observations and crescent sightings this early in the lunar month should not be expected as the norm.

As the moon progresses in its orbit, it becomes a “waxing crescent” for around a week. During this time, the moon rises after dawn by increasing times, and sets later and later after sunset.

Around a week after the new moon, the illumination of the face of the moon increases to half, and it is the time of “first quarter”. The moon rises in the afternoon, moving closer to sunset.

Over the next week or so, the illumination is above half, increasing progressively to a maximum at the next full moon. During this time it is a “waxing gibbous”. Eventually, it is full moon again, with the centre of the moon crossing the imaginary plane which is perpendicular to the orbit of the earth, and which passes through the centre of the earth and the centre of the sun.

Thus the cycle of the moon is full moon – waning gibbous – last quarter – waning crescent – new moon – waxing crescent – first quarter – waxing gibbous – full moon.

4.2.2 New Moon – An Instant in Time

From the above astronomical description, it should be clear that the new moon relates to a particular event with the location of the moon at an instant of time, which is easily and accurately predicted by astronomers.

It is the same instant of time for everybody everywhere, but of course the local time will vary depending on location on the planet. New Moon times and other moon phase data are readily available on the Internet for years to come, typically in Universal or Greenwich Mean Time.

4.2.3 Direction of Travel of the Crescent

Everyone knows the sun rises in the east and sets in the west. This direction of travel is a result of the rotation of this planet, and causes us to see the moon also rising in the east and setting in the west.

It is important to note that on the day following a new moon, the new crescent is in the sky for the whole day but is impossible to see with the naked eye because the light from the sun completely swamps the negligible light reflected by the miniscule crescent. The moon follows the sun closely across the sky from east to west but it can not be observed. The sun will set slightly before the moon, and it is at that time, in the diminished light from the sun which has now dropped below the western horizon, that there is a chance of detecting the faint reflected light from the crescent (which is also setting). Note that the crescent is **not** rising. Under ideal viewing conditions, if the moonset is lagging sufficiently behind sunset, an experienced observer may have success.

It is also important to note that the first crescent will not be observable for long. It is moving down into the western horizon following the setting sun. In minutes, it will be completely out of sight.

4.3 Visibility of the New Moon

Can a new moon ever be seen?

Any non-transparent object on which light shines casts a shadow.

When the moon travels between the earth and the sun, light from the sun bathes the moon, and the moon casts a region of darkness, a shadow, behind it. When the moon is in a suitable location, its shadow can fall on some parts of the earth. This is the phenomenon of an “eclipse of the sun” or “solar eclipse”. Depending on the location of an earth observer, it may be a “partial eclipse” or a “total eclipse”.

When the Creator placed the moon on the fourth day (Genesis 1:14–19), He made the sun and the moon of the same angular size, i.e the size of the disc of the sun as seen from earth is the same size as the disk of the moon. This allows us to occasionally experience a “total eclipse” of the sun, when the moon is located directly between the observer and the sun. As the earth rotates and the earth and moon continue in their orbital journeys, the moon’s shadow moves across the surface of the earth. Those directly in the complete shadow see a total eclipse. At other times, some will see a partial eclipse if they can see the sun only partially covered by the moon, and most will see no moon shadow at all (half the earth will be in the earth’s shadow, i.e. night time).

Thus the conjunction **can** be seen. Because of the orientations of the three bodies, it is *not* a regular monthly sight, but it does happen. Many people will see several in their life times.

The opposite phenomenon is eclipse of the moon, where the moon is on the far side of the earth from the sun, and the earth casts its shadow onto the moon. Again, this is unusual, but it does happen and many people will remember having seen at least one.

4.4 How You can Observe the 'Dark of the Moon'

There are two interesting phenomena to explore: an eclipse of the sun, and the halo or fringe of the new waxing crescent after sunset (or late waning crescent before dawn if you are an early riser).

4.4.1 Observing a solar eclipse

There are numerous ways of observing an eclipse of the sun. Never look directly at the sun!

One easy method is to take a plain sheet of white paper and a larger sheet of opaque material, such as dark cardboard or metal cooking foil. The aim is to produce an image of the sun on the white paper. An effective "lens" is made by piercing the opaque sheet with a small pin or needle. A tiny hole behaves like a focussing lens.

Hold the opaque sheet facing the sun, so that the light shines through the hole onto the sheet of white paper. Move the paper closer to or away from the sheet to obtain the best focus. The small image on the paper will show the sun and the dark disk of the sun moving across it. If you look carefully, it is possible to see the outline of the whole of the dark moon. Even though the side of the moon facing you is in shade, the light from the sun illuminates the fringe of the moon's disk, and it is possible to see the illuminated fringe.

4.4.2 Observing the Halo

You can observe the halo or fringe of the early waxing crescent with the naked eye shortly after sunset. Depending on the lighting circumstances, when the waxing crescent is close to the horizon and soon after sunset, you will see not just the thin crescent but also the circular halo around the entire dark disk of the moon, which is lit on the far side by the sun which is now out of sight but close enough to light the halo.

Alternatively, you can see a halo in the early morning for several days before the new moon, when the moon is close to setting but before the sun has risen.

4.5 Difficulties in Observing the First Waxing Crescent

Most people in the English speaking western world live in cities, go to work during the day, come home at the end of the day, watch TV during the evening in an illuminated house, then try for a night's sleep. They use calendars, on the wall, in their phones, on their computers. They do not observe a lunar month and make no attempt to spot the first new crescent after the new moon. Consequently they have little idea of the practical difficulties involved in seeing the first crescent. In this section, we will review the challenges in predicting the conjunction, predicting a crescent, and observing the first crescent in real time.

First, predicting the conjunction is relatively easy for those skilled in it. Large computers are not needed, satellites are not needed. Accurate predictions were being made well before the modern age, as the following relates.

4.5.1 Predicting a new moon – an ancient skill

The JewishEncyclopedia.com, article "Calendar, History of", reports that the ancient Babylonians produced almanacs predicting eclipses, i.e. conjunctions where the shadow of the moon passed across the observer. This is a step beyond predicting the monthly conjunctions; it is predicting not just a conjunction, but a conjunction during which some part of the shadow of the moon will fall on the observer.

Were the Babylonians the first with such astronomical skills? The ancient Egyptians preceded the Babylonians. The ancient Egyptians were impressive astronomers before the time of the Babylonians, as shown by features of their pyramids, and may have had similar predictive skills.

We are told that the "lights in the firmament of the heavens" are "for signs and seasons, and for days and years" (Genesis 1:14). So perhaps the knowledge of solar and lunar events was passed down by the Creator to Adam and his descendants, including the Egyptians and Babylonians.

Considering that people somewhere have been predicting the new moon for at least three millenia, there has been a choice between new moon and new crescent. Which is easier to predict?

The new moon is a predictable instant, and cannot be rigged by unscrupulous priests or officials. On the other hand, the new crescent is subjective, and is open to manipulation. Why would anyone want to manipulate the start of a month? One reason is to move religious festivals to more convenient days, as is done in the modern Jewish calendar by means of its "postponements".

As the Astronomical Applications Department of The United States Naval Oceanography informs us below, it is quite difficult to predict the time of appearance of the first crescent. Unlike the conjunction, it is not a matter of one time applies everywhere: the time of appearance of the first crescent depends on location on the earth, height above sea level, local obstructions, local weather, etc.

4.5.2 Difficulties in predicting new crescents – the Muslim Calendar

In current times, with networks of computers and data from satellite and astronomical observations, new crescents can be predicted but there are complications and difficulties, as explained by the Astronomical Applications Department of The United States Naval Oceanography.

In their page “Crescent Moon Visibility and the Islamic Calendar”, they explain the problem faced by Muslims because of the use of an observed event. Note that the “modern Hebrew calendar” is not based on observed new crescents, it is a fixed nineteen lunar-year table based on calculated conjunctions (with contentious postponements inserted at certain times).

The Islamic calendar is based on lunar months, which begin when the thin crescent Moon is actually sighted in the western sky after sunset within a day or so after New Moon. The ancient Hebrew calendar was also based on actual lunar crescent sightings, although the modern Hebrew calendar is calculated.

Note the USNO remark: “ **the modern Hebrew calendar is calculated.** ”

To get around some of the problems of waiting for observations of something that has already happened, the USNO informs us Muslims use a second Islamic calendar, one which is predictable and used for non-religious purposes.

A *tabular* Islamic calendar has been established for some non-religious purposes in which the lengths of the months alternate between 29 and 30 days; in leap years an extra day is added to the last month, Dhu al-Hijjah. This calendar consists of a 30-year cycle in which 11 of the 30 years are leap years. Civil dates corresponding to important Islamic dates in this tabular calendar are:

- * Islamic New Year 1428 - 2007 January 20
- * First day of Ramadan - 2007 September 13
- * Islamic New year 1429 - 2008 January 10
- * First day of Ramadan - 2008 September 2
- * Islamic New year 1430 - 2008 December 30
- * First day of Ramadan - 2009 August 22
- * Islamic New year 1431 - 2009 December 17
- * First day of Ramadan - 2010 August 11
- * Islamic New year 1432 - 2010 December 8

The Islamic dates begin at sunset on the previous evening and end at sunset on the date listed above. These dates may or may not correspond to the evenings on which the crescent Moon is first visible, and it is the visibility of the crescent Moon that determines when the religious observance begins. The Moon’s visibility at these times varies with location; generally, the visibility increases to the west, and locations in the tropics are favored over those in middle or high latitudes.

4.5.3 The New Crescent is Hard to Spot in Real Time

Could David in hiding and Saul in his palace have observed the new crescent rise and become visible in the evening sky at the time of the conjunction or even one day later?

On crescent visibility, the USNO begins (my emphasis is added):

The visibility of the lunar crescent as a function of the Moon’s “age” - the time counted from New Moon - is obviously of great importance to Muslims. The date and time of each New Moon can be computed exactly (see, for example, Phases of the Moon in Data Services) but the time that the Moon first becomes visible after the New Moon depends on many factors and cannot be predicted with certainty.

In the first two days after the New Moon, the young crescent Moon appears **very low in the western sky after sunset**, and must be viewed through bright twilight. **It sets shortly after sunset.**

The sighting of the lunar crescent within one day of New Moon is usually difficult.

The crescent at this time is quite thin, has a low surface brightness, and **can easily be lost in the twilight.** Generally, the lunar crescent will become visible to suitably-located, experienced observers with good sky conditions about one day after New Moon. However, the time that the crescent actually becomes visible varies quite a bit from one month to another. The record for an early sighting of a lunar crescent, with a telescope, is 12.1 hours after New Moon; for naked-eye sightings, the record is 15.5 hours from New Moon. These are **exceptional** observations and crescent sightings this early in the lunar month should not be expected as the norm. For Islamic calendar purposes, the sighting must be made with the unaided eye.

Obviously, the visibility of the young lunar crescent depends on sky conditions and the location, experience, and preparation of the observer. Generally, low latitude and high altitude observers who

know exactly where and when to look will be favored. For observers at mid-northern latitudes, months near the spring equinox are also favored, because the ecliptic makes a relatively steep angle to the western horizon at sunset during these months (tending to make the Moon's altitude greater).

“Crescent Moon Visibility and the Islamic Calendar”, at <http://www.usno.navy.mil/>

The web page then continues with a discussion on the four factors which affect sightings. Interested readers can read the details at [usno.navy.mil](http://www.usno.navy.mil/) in “Crescent Moon Visibility and the Islamic Calendar.htm”

4.6 Summary

The moon cycles through its phases, always rising in the east and setting in the west.

The new moon occurs at an instant of time, the time of conjunction of the sun, moon, and earth. The new moon time has long been able to be predicted well in advance. In contrast, the prediction of the time of the first sighting of the new crescent is very difficult and is location dependent.

Detecting the new crescent is an art and requires very favourable viewing conditions and location. The new crescent is difficult to detect in the light of sunset and disappears below the western horizon shortly after.

The early crescent never rises after sunset! It **sets** soon after sunset!

The early crescent may become visible shortly after sunset, as the sky darkens, before it sets below the western horizon. It is not clearly visible, and is never in the sky above.

5 An Example from Real Life

Let us consider an example to illustrate the difficulty of seeing the new crescent and to test the claims:

1. “the new moon was **clearly visible in the evening sky.** ”
2. “The new moon had appeared before King Saul and those who were feasting with him at the palace, and before David, who was hiding in the field.”
3. “the new moon appeared in the sky **above** the palace”

For this real life example, consider the Gregorian year 2010, in which the month of Tishri was postponed one day in the modern Jewish calendar. The astronomical new moon was on Wednesday 8th September at 10.30 am Greenwich Mean Time / Universal Time, i.e. 12.30 pm Jerusalem standard time. The problem here for Judaism is that the Day of Atonement, the tenth of the lunar month, is thus on a Friday (17th September), resulting in a clash between the annual sabbath on which work is not permitted under Judaism and the requirement under Judaism to do work on Friday afternoon in preparing for the weekly sabbath. Judaism avoids this work / no-work dilemma by “postponing” its religious month one day, thus in their postponed month the tenth day is on the weekly sabbath and their traditions for both the annual and weekly sabbaths can be accommodated. Atonement or Yom Kippur is celebrated on the tenth of the “postponed” month, but in reality is on the eleventh of the lunar month.

5.1 Actual Rise and Set Times

The following table shows rise and set times for the moon and sun for the two days before the conjunction, the new moon day, and the following two days.

| Date | 6 | 7 | 8 | 9 | 10 |
|-----------|-------|-------|-------|-------|-------|
| Moon rise | 02:44 | 03:55 | 05:06 | 06:16 | 07:27 |
| Moon set | 16:24 | 17:03 | 17:40 | 18:16 | 18:51 |
| Sun rise | 05:18 | 0519 | 0519 | 0520 | 0520 |
| Sun set | 17:58 | 17:56 | 17:55 | 17:54 | 17:52 |

This data shows how the sun’s rise and set times vary slowly from day to day, but the moon’s rise and set times vary much more from day to day. On the sixth of September, the moon rose 2 hours 34 minutes before the sun and set 1 hour 34 minutes before it. On the seventh, the day before the conjunction, these times had dropped to 1 hour 24 minutes and 53 minutes respectively. On the new moon day, they were only 13 minutes and 15 minutes.

In this case study, on the day of the conjunction, it would have been impossible to see the setting moon with the naked eye because of the glare of the setting sun. The moon set 15 minutes before the sun and the sunlight reflected by the tiny crescent would have been swamped by the comparative brilliance of the disc of the sun.

On the next day, the sun rose 56 minutes before the moon. It would have been impossible for the naked eye to see the tiny crescent as the moon rose above the horizon. Would it have been possible to see the crescent that afternoon just after sunset?

The moon set 22 minutes after the sun. Would the sun have travelled far enough below the horizon to allow the sunlight reflected by the miniscule crescent to be distinguished in the dimming sky?

Astronomers have further information on twilight and its duration which can assist us.

5.2 Twilight Definitions

The following international standard definitions (in quotations) are provided by *Definitions of Astronomical Events* at Geoscience Australia, <http://ga.gov.au>

1. **Sunset** is defined as “the instant in the evening under ideal meteorological conditions, with standard refraction of the sun’s rays, when the upper edge of the sun’s disk is coincident with an ideal horizon.”
Ideally, the direct rays of the sun do not impinge on the eyes of an observer on a flat plain facing the sunset horizon, but there will still be significant scattered light above the horizon which will obscure light sources in the sky. As the sun sinks further, the scattered light diminishes, and slowly the chances of seeing the brighter lights in the sky increases. This period is known as “evening civil twilight”. It is followed by a period known as “evening nautical twilight”. The ending of these periods can be calculated and the times are available from reputable geodesy references.
2. **Ending of evening civil twilight**
“Defined as the instant in the evening, when the centre of the sun is at a depression angle of six degrees (6) below an ideal horizon. At this time in the absence of moonlight, artificial lighting or adverse atmospheric conditions, the illumination is such that large objects may be seen but no detail is discernible. The brightest stars and planets can be seen and for navigation purposes at sea, the sea horizon is clearly defined.”

3. Ending of evening nautical twilight

“Is defined as the instant in the evening, when the centre of the sun is at a depression angle of twelve degrees (12) below an ideal horizon. At this time in the absence of moonlight, artificial lighting or adverse atmospheric conditions, it is dark for normal practical purposes. For navigation purposes at sea, the sea horizon is not normally visible.”

From the above information, at the Ending of Evening Civil Twilight (EECT), under good conditions, the brightest stars and planets can be seen. At the Ending of Evening Nautical Twilight (EENT), under good conditions, the sky has become as dark as it can become.

At EECT, we may be able to see the early crescent, depending on its height above the horizon. At EENT, the contrast of the early crescent against the background sky is as good as it can be.

5.3 Using Twilight Times

Sources of astronomical information such as Geoscience Australia can provide EECT and EENT for any specified date and location on earth. Of further use to us, the “vertical angle” of the moon above the ideal horizon is available at any location for any time, which allows us to know the angular elevation of the moon at Jerusalem at EECT and EENT. If the moon is up at a reasonable angle at EENT, it is against a dark background and may be discernible to the naked eye.

If the moon sets after sunset, and before EECT, it might be possible to see it under ideal conditions, but perhaps not. If it sets after EENT, then we would expect an experienced observer at an ideal observation point to detect it.

Back to the case study of September 2010.

The following table shows, for days ranging from 6 September 2010 to 10 September 2010, the time of sunset that day, the elevation of the moon at that time, the time of EECT and the elevation of the moon at EECT, the time of EENT and the elevation of the moon at EENT, at Jerusalem, latitude 31 degrees 45 minutes north, longitude 35 degrees east 15 minutes north, from Geoscience Australia. This data will allow us to determine where the moon is located, in degrees above an ideal horizon plane, at sunset, at EECT, and at EENT. If the moon has already set, it is below the horizon, and its elevation is represented as a negative angle or “-ve”.

| Date | 6 | 7 | 8 | 9 | 10 |
|----------------|-------|-------|--------|--------|----------|
| Sunset time | 17:58 | 17:56 | 17:55 | 17:54 | 17:52 |
| Moon elevation | -ve | -ve | -4 deg | 4 deg | 11.5 deg |
| EECT | 18:22 | 18:21 | 18:20 | 18:18 | 18:17 |
| Moon elevation | -ve | -ve | -ve | -1 deg | 6.7 deg |
| EENT | 18:51 | 18:50 | 18:49 | 18:47 | 18:46 |
| Moon elevation | -ve | -ve | -ve | -ve | 1.2 deg |

On the day of the new moon, the 8th of September, the moon had set shortly before sunset, and would not be visible to the naked eye. Of course it is not visible at EECT or EENT.

On the following day, the 9th of September, the first day of the Judaic month of Tishri in 2010, the moon was just under four degrees above the ideal horizon at the time of sunset. At the time of EECT that day, twenty five minutes after sunset, the moon had descended to one degree below the ideal horizon. An experienced observer with an ideal viewing location may have been able to detect the thin crescent after sunset at 17:54 and before the time at which the crescent (on the lower edge of the moon disc) disappeared below the horizon, which was before EECT at 18:18. There were less than twenty minutes available, with a sky background gradually darkening. It may have been achievable, especially with a telescope, but the angle above the ideal horizon was very small, one degree or so.

The next day, the 10th of September, would have been much more favourable, with the crescent larger and at a vertical angle of 11.5 degrees at sunset (with a bright background), easing to 6.7 degrees at EECT, and still being 1.2 degrees at EENT. If an observer had ideal sky conditions and an excellent viewing location, the crescent could be followed in its descent.

5.4 Summary

Even if the sun has set, it still contributes significant light to the early evening sky, and this light makes observation of the crescent quite difficult for the naked eye.

There are only minutes at the most available for an observer to detect the new crescent in the day after the new moon before it too disappears below the horizon.

Of course, this is a particular example, and other new moon events will be slightly different, but not greatly so. The lesson is that any crescent which may be seen will be very low on the western horizon and dropping. There will be only minutes before it falls out of sight. It could easily be hidden by hills, walls, trees, field animals, sheds, etc.

6 A Closer Look at the Claims

With more knowledge of the situation around sunset at, and soon after, the conjunction, let us now reconsider the claims

- “the new moon was **clearly visible in the evening sky.** ”
- “The new moon had appeared before King Saul and those who were feasting with him at the palace, and before David, who was hiding in the field.”
- “the new moon appeared in the sky **above** the palace”

6.1 “clearly visible in the evening sky”?

As we saw in 4.5.3, the experts at the US Naval Observatory point out that the first crescent, the beginning of a new month for those of the Muslim faith, is certainly **not** “clearly visible in the evening sky”. The example in section 5 gave a sample of the observational difficulties to be expected around the time of the new crescent.

6.2 The “new moon had appeared”?

If the new moon had appeared before them, it would have been an eclipse of the sun, and it would have been during the day. An eclipse of the sun does not happen at night.

If the author meant “the new crescent had appeared”. then, as shown earlier, there are only a few minutes on the day after the conjunction when the tiny new crescent is visible, and without near ideal observation conditions, it would be difficult to see it. Shortly after, it would have disappeared below the western horizon.

The moon had travelled from east to west across the sky through the day with the sun, whose brilliance completely hid the crescent during the day. The new crescent could “appear” only when the light from the setting sun faded sufficiently to allow the reflected crescent light to stand out from the darkening background sky. On the day after the new moon, the crescent, at the bottom of the moon, would soon slip out of sight below the horizon.

6.3 “appeared in the sky above the palace”?

The claim in 2.4 is that Saul was in his palace and could see the new crescent above it, and David was hiding in the field and could see the new crescent above.

As shown in section 5, the angle of the new crescent is so small that even with an ideal observation point, it is difficult to detect. If David had been hiding on the top of a tall building on a large flat plain with no hills or mountains to the west, then it is feasible that he could see the new crescent very close to the horizon, but he would not have been able to see it “above”. We are not told the details of David’s hiding place, but it was unlikely to have had unobstructed views of the western horizon. Even if David had been able to see the setting moon, it would not have been clearly visible, and certainly not in the sky above.

The new crescent could not have “appeared in the sky above the palace”. It would be days after the conjunction before this claim would be possible.

6.4 Conclusion

The situation at the time of the new moon is in contrast to the evening of the Full Moon, when the full moon disc brightly illuminated with light from the sun, rises above the eastern horizon and climbs higher into the sky over a period of hours, against a dark sky and in the absence of spillover light from the sun. To write “the full moon had appeared” and “was clearly visible in the evening sky” and at some time of the night “was above the palace” would be believable, but to claim that of the one day old crescent is not.

In summary,

- The new moon was **not** clearly visible in the evening sky. Neither was the first new crescent.
- The new moon could not have appeared before King Saul and those who were feasting with him at the palace, and before David, who was hiding in the field. Neither could the first new crescent.
- Neither the new moon nor the new crescent could have appeared in the sky **above** the palace.

7 Conclusion

As detailed in section 2.4 on page 5, the author of the article under examination claimed:

The use of *hây-yâh'* in I Samuel 20 reveals that when the king sat down to observe the Feast of Trumpets, the new moon was clearly visible in the evening sky. The new moon had appeared before King Saul and those who were feasting with him at the palace, and before David, who was hiding in the field. Here is undeniable evidence that the new moon of Scripture is not the astronomical conjunction.

Note the assertion of **undeniable evidence** for his proposition.

On closer examination, the bases of his claims have collapsed.

- The Hebrew use of *hâyâh* does not include “arise or appear”.
- Astronomical behaviour and observations simply invalidate the claims about a new crescent being clearly visible, especially to a person in hiding.
- The crescent was physically incapable of being “in the sky above”.