Title:

Pre- Columbian Astronomy
Evidence amazing intellectual capacity

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Figure 1. Some fantastics ideas.

1.- Abstract

No one has to understand, for sure, what were the reasons why, after three thousand years of civilization, most pre-Columbian cultures lost its former glory and were lost in oblivion, a splendor that surprises us with its magnificence.

With the decline of ancient civilizations missed the significance of his writing and the invaluable legacy of their knowledge. The descendants of their people proudly still retain vestiges of their ancient traditions dialects as language, ceremonies and legends but not much more.

The meaning of the hieroglyphic writings, found in many stelae, friezes of temples and in the few codices that survived the intentional burning, has been known for centuries and only in recent years, with the work of many archaeologists, engineers and astronomers, we are starting to see and leaves us amazed.

The ignorance of the meaning of the scripture, wild imagination and journalistic success avidity of some have led to the proliferation of many texts and crazy ideas. Some examples: the idea that pre-Columbian civilizations originated in a "clearly" alien, in the "interpretation" of some contrails are "demonstrated" genetic experimentation with primitive inhabitants of our planet or very recently come to the times as planetary disaster.

Alongside this research we wanted to recreate some of the most significant buildings of the ancient Mayan civilizations.

2.- The discovery of an amazing culture

In 1916, at the second archaeological expedition to Central America, organized by the Carnegie Institution of Washington, performed in Peten the discovery of the ruins of Uaxactún (in Guatemalan jungle).

During the seventh expedition (1924), Frans Blom studied the monuments called group E and found that they formed a giant astronomical observatory: on the highest point of the building E-VII, or Temple of the Masks, is the wake-20, from which are displayed, to the east, the buildings E-I, E-II and E-III. The March 21 and September 21 the rising sun coincides with the central axis of the structure E-II indicating the ancient astronomer the right time of the equinoxes, the day June 21 the sun rises north face touching the building EI and the December 21 South face E-III now showing the arrival of summer and winter solstices respectively.

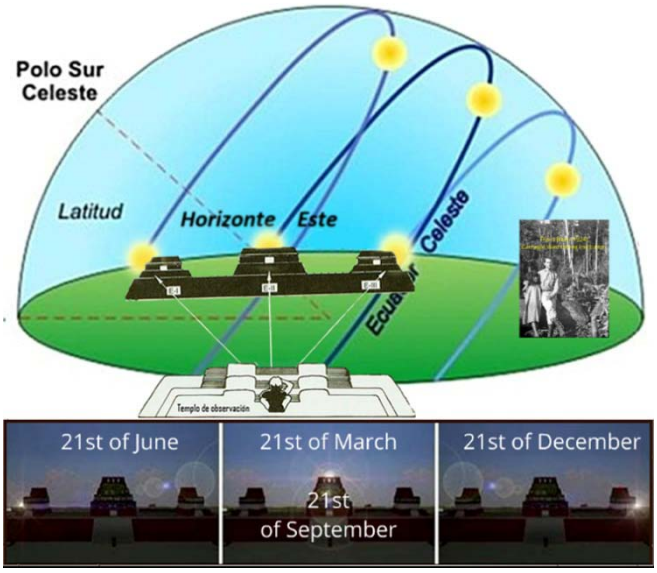
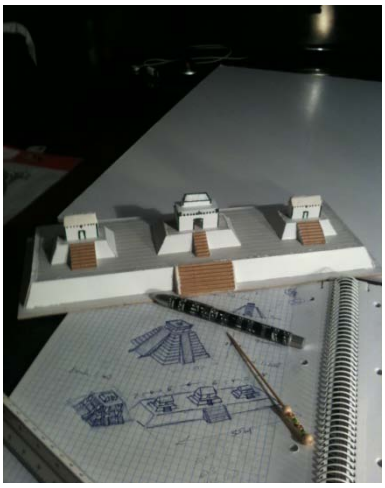
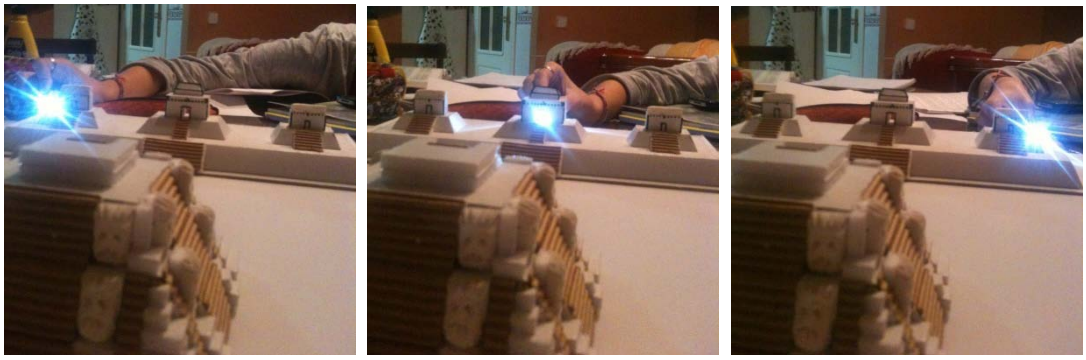


Figure 2. Frans Blom and *Astronomical Complex E*



Figures 3 and 4.
Preparation of models of *Astronomical Complex E*



Figures 5, 6 and 7.
Check of others solars in the *Astronomical Complex E*

Perhaps this first discovery we found it familiar and similar to observations of the same kind made by other ancient civilizations, but soon discovered that this was just the beginning ...

3.- The Astronomy in multiples aspects of the life

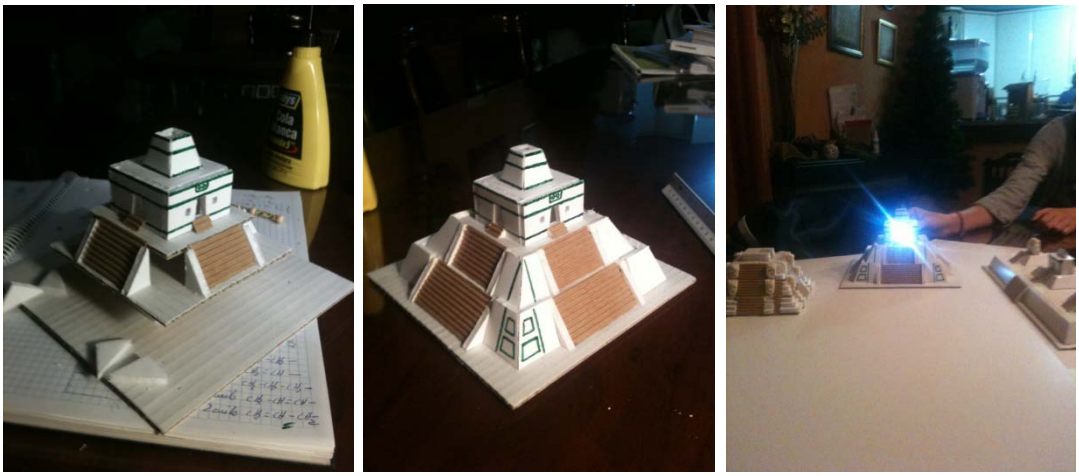
a.- Astronomy and Agriculture

The ancient peoples need to determine the solstices and equinoxes is closely linked to the need to know the most conducive to agricultural work: the time of sowing in spring, for example. Moreover, in the latitudes in which the cities of Mesoamerica (between 15 ° and 25 ° N), should determine the steps of the Sun through the zenith as these announce the first and second rainy seasons.

And Uaxactún buildings are not the only example of the determination of these important moments:

- In Dzibilchaltun, Yucatan, Mexico, is the Temple of the Seven Dolls: during the equinoxes the rising sun through the central corridor of the structure that crowns the building. And when the sun passes through the zenith, vertical light beam illuminates an altar located inside.

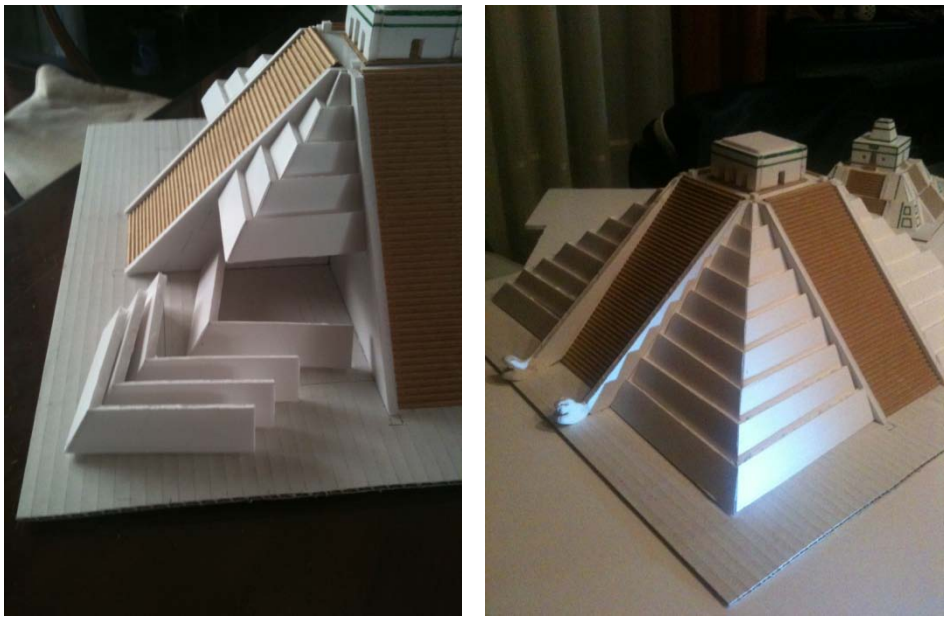
Figure 8.
Temple of the 7 dolls in Dzibilchaltun.



Figures 9, 10 and 11.
Construction and check of the *Temple of the 7 dolls.*

In the archaeological site of Chichen Itza, Yucatan, is the Pyramid of Kukulkan (or El Castillo): during sunset at the equinoxes, a clever play of light and shadows makes it appear in the North steps of the building, serpent (the winged god Quetzalcoatl) descending the pyramid indicating this sacred astronomical event and the arrival of spring (or fall).

Figure 12. *Pyramid of Kukulkán*



Figures 13 and 14.
Construction of the *Pyramid of Kukulkán* and efects of the shadows

• There is another building almost identical construction, found at Mayapan, also in the north of Yucatan, but this time the effect of light and shadow occurs on the evening of the winter solstice (December 21).

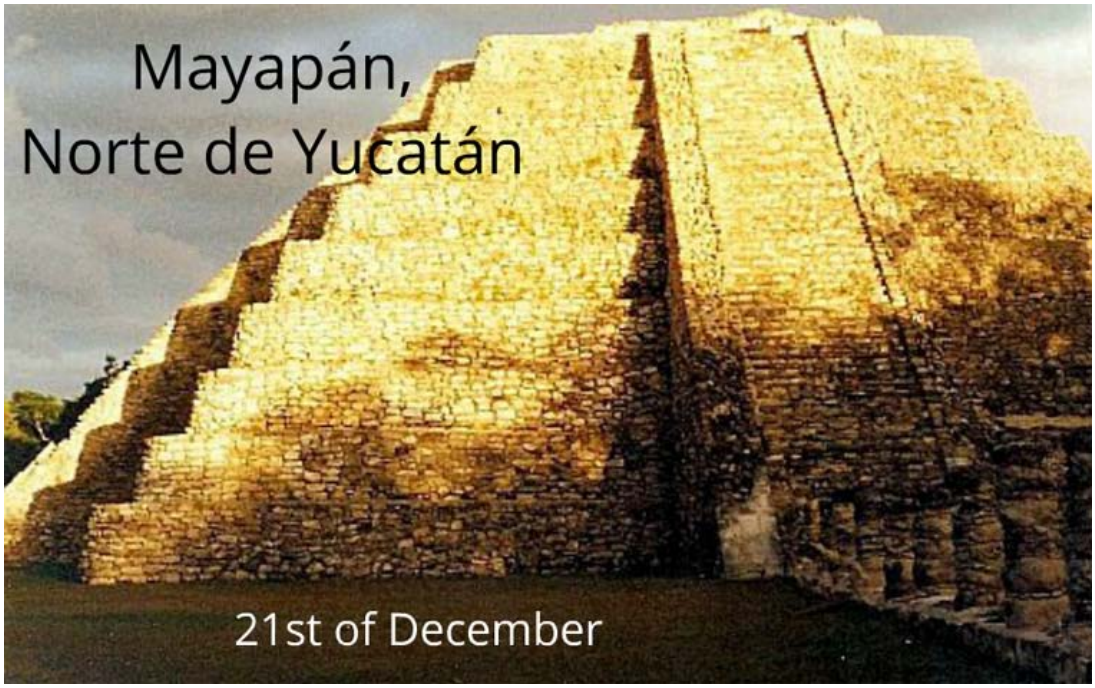


Figure 15. Pyramid of Mayapán, Yucatan Nord

The great similarity of these two pyramids reminds us of the importance of astronomical knowledge these ancient peoples, despite being city states different, and often competing, the body of knowledge was, in some way or other, always shared .

Figure 16.
Sharing knowledge despite their enmity

b. Astronomy y society

We can see another event equinoctial Oxkintoc City, in the building called Satunsat (meaning labyrinth).

In this building, in addition to normal doors, small windows can be placed in strategic locations. Normally, the interior of this two-storey building is completely dark but for about 16 minutes, to sunset at the equinoxes, the windows produced "light corridors" that guide to navigate the maze.

This building was used in initiation rituals: aspiring priests (and rulers) should find the output path showing his wisdom.

Figure 17. *Satunsat* and Oxkintok

Moreover, in the frescoes of the Temple of the Foliated Cross (Chiapas, Mexico), in the Paris Codex (one of the few codices preserved) and various ornamental objects of use, reference to the cardinal points for the successful completion sacred ceremonies. These are clear signs of the importance attached to the Order Cosmological and so reflected in daily actions.

Figura 18. *Temple of the Foliated Cross* and symbols of the quartes

Figure 19. Codex Paris and references to the quarters in ritual acts

4.- Others observationals events

Most of the civilitations of America (Maya, Inca, Aztec, Nazca, Olmec ...) had knowledge of these and many other astronomical events.Compartían calendarios similares.

- They watched closely the phases of the moon
- Recognized their own constellations (the flame of silver, for example, with the star Vega in his eye)
- They knew the synodic periods of the planets then known
- They were able to predict eclipses

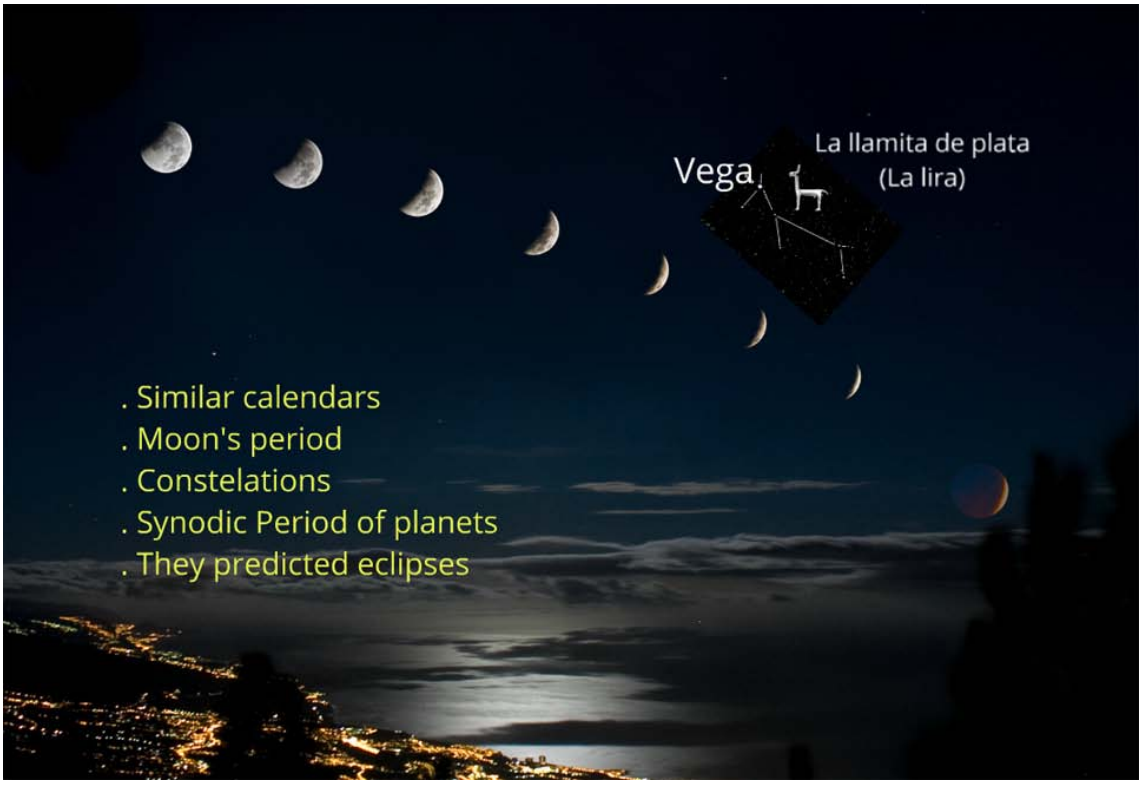


Figure 20. Many astronomical observations

We found a significant reference to the other observations in the archaeological site of Uxmal, Yucatan.

The building known as The Governor's Palace has a different alignment of the remaining structures. This orientation coincides with the decline of Venus at the time of maximum elongation South. Thus, after observing Venus two followed steps by the same place, they knew the synodic period of Venus: 584 days (although, the truth is that the Mayas used only integer).

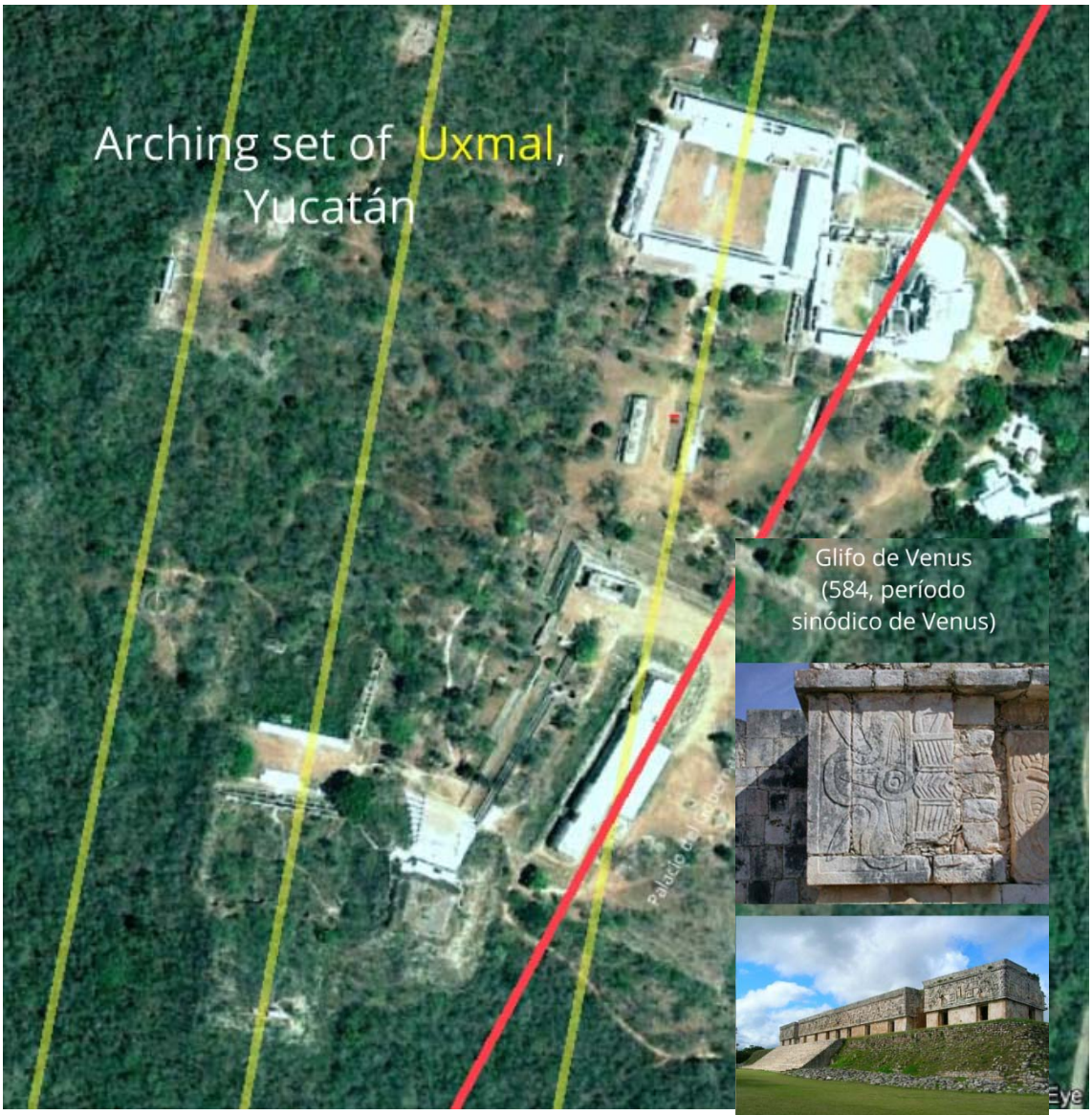


Figure 21. Governor's Palace in Uxmal.

Figure 22.
Detail and Venus glyph

In this building, dedicated to the rain god, Chaac, and therefore related to agriculture, there are numerous glyphs which represent "the star Venus" (there is no record of the word planet in European cultures).

The archaeologist Victor Segovia counted in this structure 581 glyphs that represent but, considering the deteriorated state of some areas of the building and the uniform distribution of

all of them, he is sure that, originally, it would have 584 glyphs in total (precisely, the Venus synodic period).

There are other references to Venus in the Dresden Codex Venus and we found that not only was related to agriculture but also war: and that is that Venus was a gentle and loving god, and Europe but was a powerful god (always accompanied the Sun) which demanded blood to ensure good harvests. So the Mayans were very warlike peoples: their gods, from observable signs in the sky, blood and human sacrifices demanded.

5.- The Mayan calendar

The making of calendars was necessary to organize domestic life, ceremonies, rituals and farming. Deeply religious, ancient peoples had to have, in addition, with the blessing of the gods to successfully accomplish their tasks. It is for this reason that the Maya established a dual calendar: civil calendar (solar type) of 365 days and another sacred calendar (ritual mole type) simultaneous 260 days.

The Mayans used a vigesimal system of counting and included among its numerals zero. (No other ancient civilization had this breakthrough of including zero).

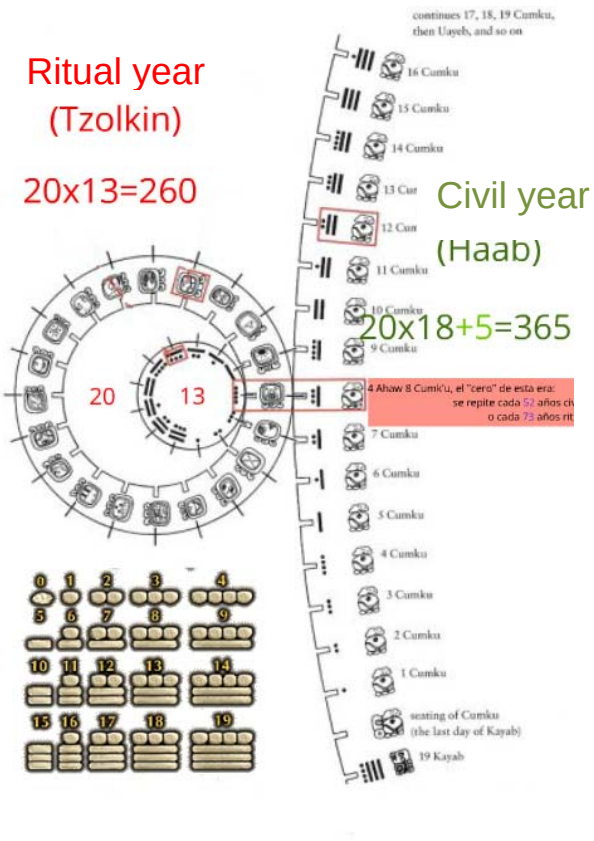


Figure 23. Vigesimal and calendar system

In the civil calendar (Haab), the months of the Maya (Winal) they were 20 days old and were making calculate 18 of them a year doing a total of 360 days (days Tun) and they were adding 5 days extras more (days that were called Wayeb: unlucky or uncertain days in which no event was predicted).

The sacred calendar (Tzolkin) consisted of 20 months of 13 days doing a total of 260 days. We must think that this number 13 (besides 20) was a sacred number for the Mayas: it was the third part of the synodic of the Moon (three trecenas were driving to a new lunation).

We observe that the year calendar was longer than the ritual year and, therefore, this second was renewed to a pace faster than the first one. But both calendars were returning always to coincide when 52 calendar years were happening or 73 ritual years (after 18.980 days: the common multiple minimum of the numbers 365 and 260).

Since the Mayas only were using entire numbers how were they calculating the leap years? The former Mayan astronomers were very careful in his observations and his annotations. There is had witness of which in some writings there are "inexplicable" jumps of one day in certain dates, there being stated this way the corrections that these former wise persons realized constant. These calendars (with its corrections) were, therefore, more exact that they were never known

Figure 24. Events Registre

Of another part, the incorporation of the zero in the arithmetic of the Maya drove to the idea of that the passage of time was cyclical, without beginning or end: the end of a cycle was the beginning of a new age that had to the previous one to happen very similar. Again we see here the social importance of all that: all the events were annotated (favorable especially) related to the governing family and the company in general and of this form "they" "were" "assuring" that in the following cycle all the things would repeat themselves. Nobody saw in it either any apocalyptic augury or an end of the times.

And on the other hand, the former Maya established a form date for the calendar indicating this way the beginning of every age.

According to some epigrafistas, this point of beginning was established in 4 Ahau, 8 Cumkú, which in our in force calendar it would correspond on August 13 of 3.114 AC.

The complete cycle would end after 13 Baktún's cycles (13 x 144.000 = 5.125 years) and would happen on December 22, 2012. Though also it is true that not in all the Mayan calendars is exactly like that. We repeat that, probably, nobody saw in it any end of the times but the beginning of a new age ado.

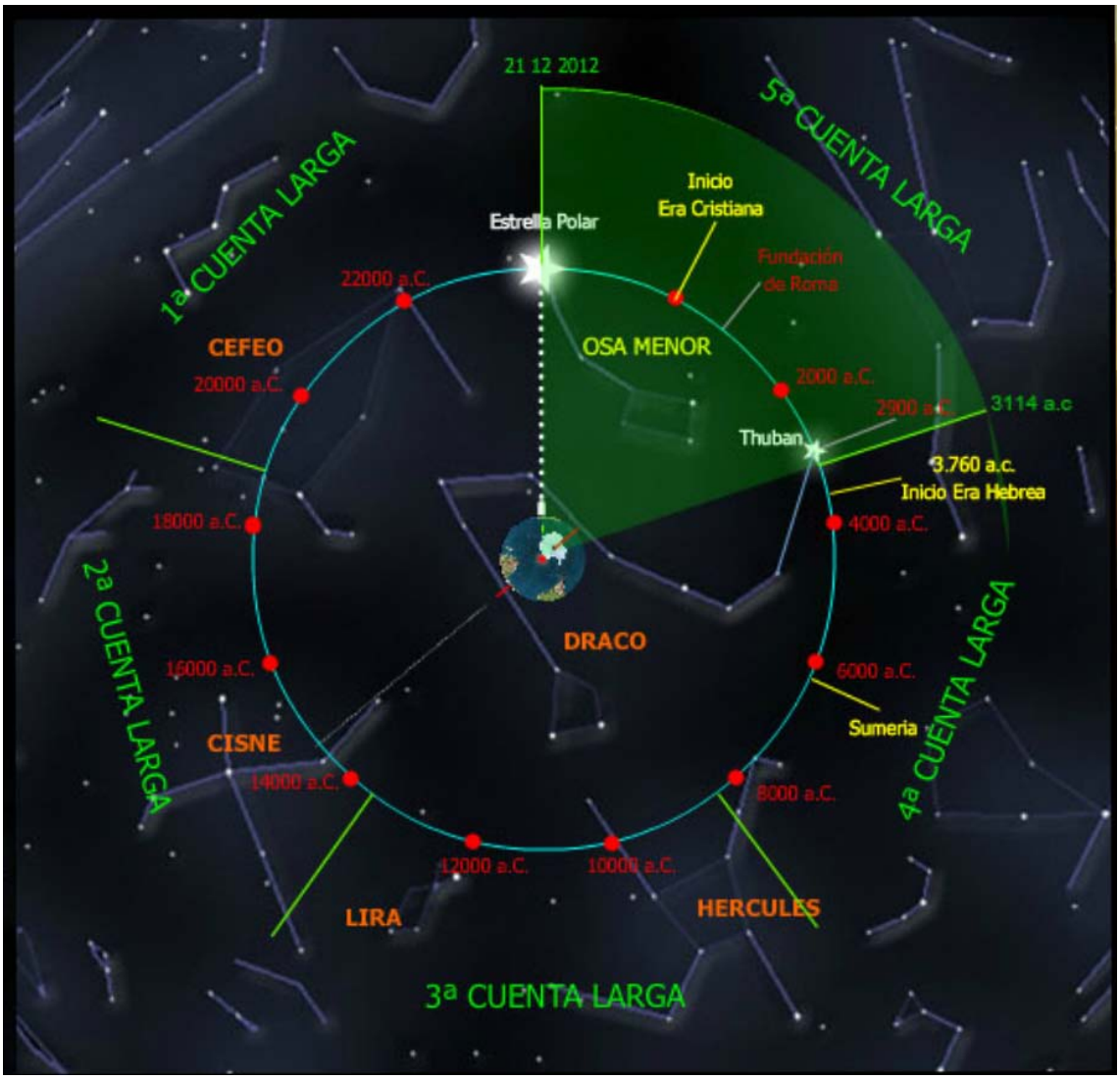


Figure 25. Complet cycle

We can observe the social importance that was granting to itself to this beginning of the calendar in the Stela C de Quiriguá (Honduras): it is a question of a stela dedicated to the leader Jaguar Durmiente and in it, you can see the date 4 Ahau, 8 Cumkú. Between his inscriptions, the above mentioned leader was assuring that his family initiated the regency in these dates, demonstrating this way, for all, the importance of his lineage.

Figure 26. *C ste*

6.- Amazing relations between the calendar and the Astronomy

Figure 27. Pyramidal visible structure from the Temple of Five Floors towards the west one

From the apex of the Temple of Five Floors of Edzná's city, (Campeche, Mexico), a surprising observation can be done: looking at the west one, we locate a pyramidal structure that stands out between the trees. Not special at all to the first sight.

However, if we register the places where the Sun puts, day after day, we state:

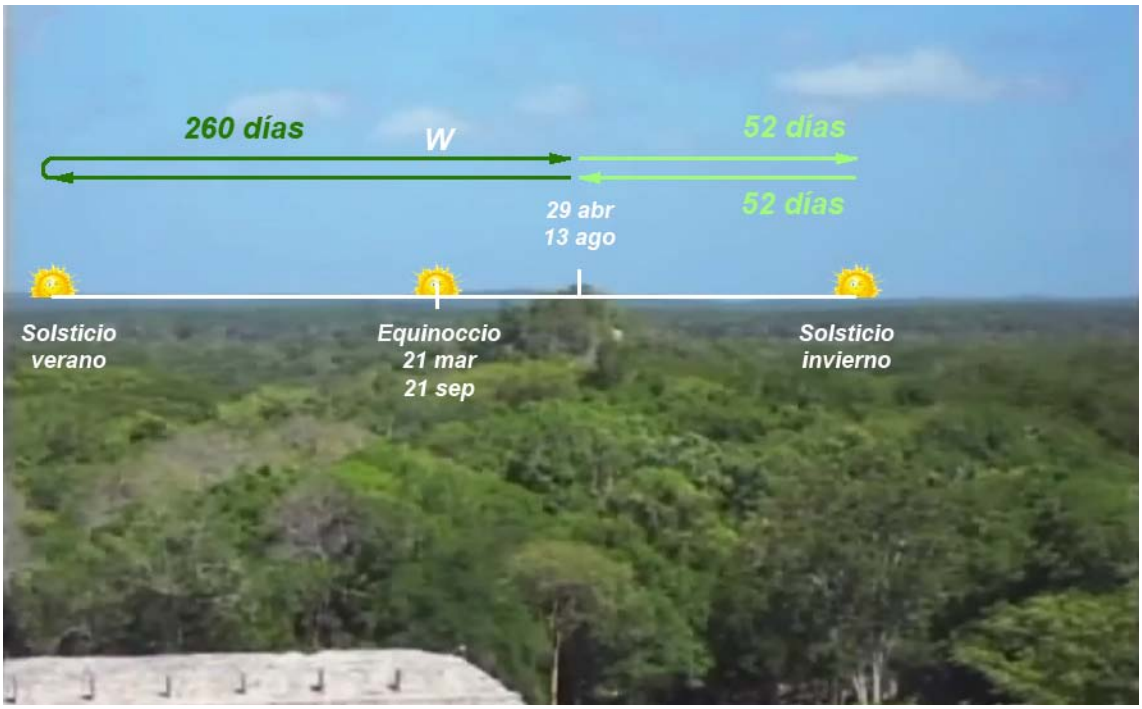


Figura 28. Puttings Suns from the Temple of Five Floors

The location of this solitary structure coincides with the putting Sun on Abril the 29 and on August 13 (the latter date us turns out to be familiar: it is present in the beginning of the calculation of the time of the Mayas).

From this moment, the time that spends the Sun in coming to the winter solstice is 52 days (and 52 more to return). This number of 52 also is familiar to us (they must spend 52 calendar years in order that both calendars coincide).

The rest (time that is late the Sun in coming to the summer solstice and returning to the point of item) turns out to be of 260 days, number that also us is enough acquaintance (it is the duration of the ritual year).

From this moment, the time that spends the Sun in coming to the winter solstice is 52 days (and 52 more to return). This number of 52 also is familiar to us (they must spend 52 calendar years in order that both calendars coincide).

We can find more examples of the record of these sacred numbers in other constructions:

· The tower of The Palace that exists in Fence has a window in the shape of T (it is the symbol Ik of the wind) for the one that enters the Sun from April 29 until August 13 (52 days) and the rest remains in the darkness (260 days).

· In Chichén Itzá's Snail there is also a window that gives towards the west one for that they enter the beams of the Sun from April 29 until August 13.

Figura 29. Palace's tower, Palenque

Figura 30. '*El Caracol*', Chichen Itzá

Figura 31. South Palace and '*The diablito*'

And still we can observe another way more of registering sacred numbers between astronomic events: The Palace South, which we find in Oxkintoc's site, is surrounded with numerous props; one of them, and only one, has carved the figure of a personage (the diablito).

It is a clear sign that leads us to another astronomic scoreboard.

From the position in which this one is, we can see the Oxkintoc's highest pyramid; if we register in this occasion the places where the Sun goes out, we have:

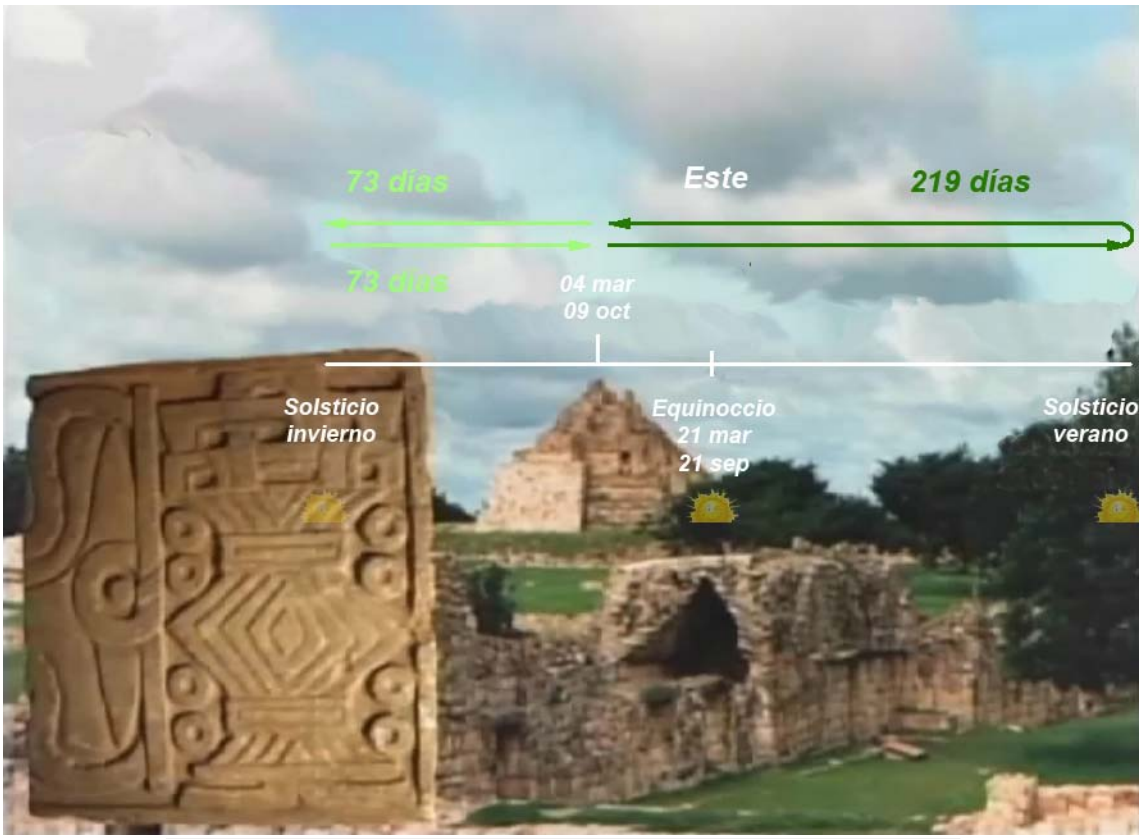


Figure 32. Solar rise from South Palace.

The sun touches the top of the pyramid on March 4 and October 9: and apparently, there are not special dates.

This time the winter solstice is far from that point 73 days (other 73 in return). Recall that 73 is the number of rituals years that must happen for the two calendars coinciding. The rest (219 days) is about three times that amount (73 x 3 = 219). Thus, the number 73 must have seemed magical to the ancient peoples also:

- Is the number of turns you have to give the sacred calendar to match the civil calendar

- It is the only number (plus 5) which divide the days of the calendar year (5 x 73 = 365)

- What's more, if we count three periods over 73 get: 8 x 73 = 584 days.

So last but not least, on that magic number was also hidden the synodic period of Venus "was shown" that was linked to the movements of the Sun.

The picture on the left that we see in Figure 32 is called Venus Trail. The archaeological research astronomer Jesus Galindo recognizes in it an initial form (pre-mathematical formula) to express the fact that 5 times 73 resulting in 365 days (calendar year) and that the number 73 is associated with Venus.

7. - Prediction of eclipses

We found a number of references to the ancient peoples ability to predict eclipses. Surely, Maya and other peoples, knew the Saros period (18 years, 11 days and 8 hours) then, after three thousand years of observations, had important opportunities to see the regularity with which they occur (especially that of the eclipses moles).

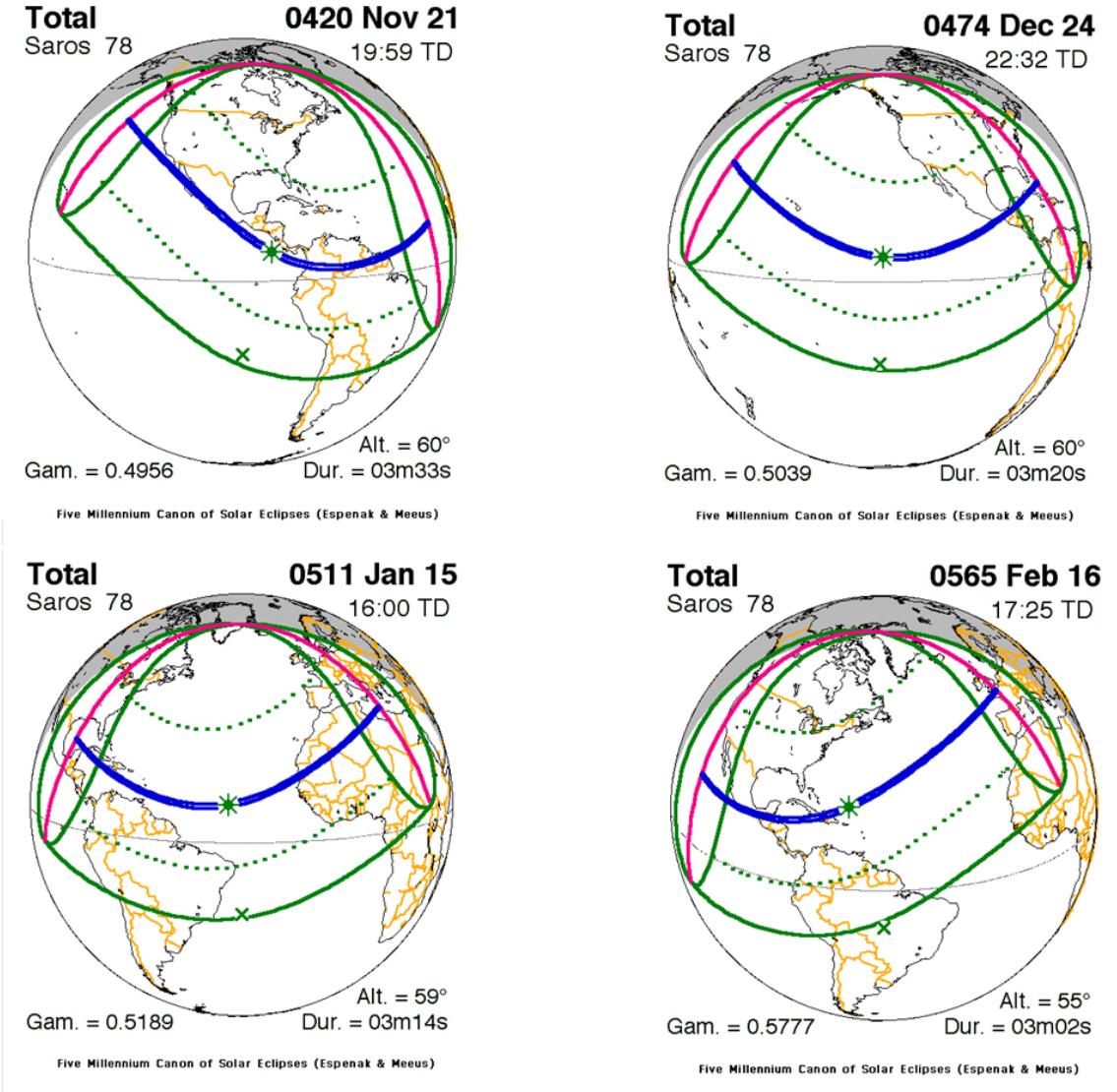


Figure 33. Flashy solar eclipses between 420 and 565

As an example, in the previous image we wanted to show four elements of a family of solar eclipses (belonging to the Series 78 in Five Millennium Catalog Of Solar Eclipses, NASA) to had to call particular attention:

- Eclipses of November 21 of 0420 and 16 February 0565 were total or near-total in Yucatan
- On December 24, 0474 completely hid the setting sun
- And the January 15th 0511/0, almost total, occurred at dawn[1].

8.- Epilogue

As usual often is fair to say that truth is stranger than fiction: it is that the ancient pre-Columbian people did not need the help of extraterrestrial civilizations to develop, they enjoyed an intelligence worthy of the greatest civilizations and flaunted of their rich knowledge in building their amazing cities, in his writings, in his astronomical observations and art that permeated each of these great deeds.

[1]Observación: 8 hours Period Saros make solar eclipses will happen 120° further east each time, so that, for two solar eclipses in the same series occurring again in the same place, they have to spend 54 years (18 x 3 = 54) and 34 days (11 x 3 + 1 = 34).

Exceptionally, between 474 and 511 there are only two periods since one of the eclipses happen at dusk and the following dawn.

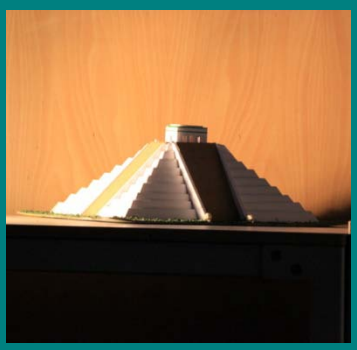
9.- Gallery

Complex E

Complex E
Final Appearance

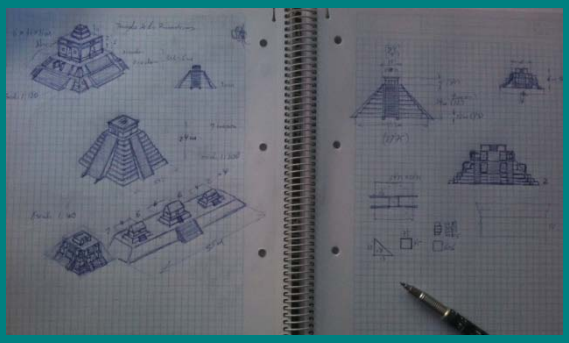
Complex E

Temple of the 7 Dolls
Final Appearance



Piramids of Kukulkán
Final Appearance

Temple of the Masks
(construction)



Designs

10.- References

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- http://www.liada.net/Astro/El%20antiguo%20seguimiento%20de%20los%20astros.pdf

Pages about Mayan Astronomy:

- http://www.michielb.nl/maya/astro.html
- http://www.danielmarin.es/hdc/astronomiamaya.htm
- http://www.tudiscovery.com/guia_mayas/ciencia_maya/index.shtml

Documentary videos:

- https://www.youtube.com/watch?v=f0E4Q_J_gNs
- https://www.youtube.com/watch?v=1_KxEM8HzLw
- https://www.youtube.com/watch?v=zLBxHFt78jI