

# TIĀN DÌ

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**Anniversary**

**Special Feature- Egypt**

**Calendar**

**The Pyramids**

**The Sphinx**

**Andromeda**

**Aristotle**

**Ancient Greek astronomy**

*The Sphinx  
23-9-00*

# TIÀN DÌ

**Editor:**

**Kepler**

**Consultant:** Newton

**Vice editor:**

Galileo

**Reporting team:**

**Group 56**

Chua Li Min

Lim Yi Hui

Soh Wanqin

Tan Lee Ming

Wang Ren Hong

**Publishing:**

GEM1506K Limited

**Email address:**

**Astronuts@astrobiz.com**



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# LETTERS



## Star letter:

If I may say...

Your magazine ROCKS!!! It was only after I had gone through the first magazine that I realized this was a very informative and value-for money magazine.

Learnt about when Chinese New Year will coincide with Hari Raya Puasa, the black holes that exist in the universe, and last but not least, the time for sunset in Singapore during different seasons, so that my hubby and I could book a seat at Westin hotel's Equinox at a certain time for Valentine's Day, to enjoy watching sunset without waiting too long or missing it. Can't imagine life without you.

-Natalie

Via email

Wonderful sections....

The events section introduced many good astronomy shows and I never give it a miss!

And the astrology parts are really interesting as well. It tells us when Goddess Venus is on our zodiac.

Keep it up. - Edison

Suggestions...

Really interested in knowing details about the different planets in the universe and about ancient China's astronomy. Please include more of such articles. Thank you. - Janice

*Janice, you would be thrilled to know that your topic of interest - Ancient China is up next. Stay tuned!*

A brilliant magazine written to cater to the astronomy dummies! It is one of the best works on the market. Reader friendly without loss in depth.  
- Stress Times.

I accidentally saw your magazine in my brother's bedroom a few months ago, and since then I have borrowed every issue from him. I even gave my wife a copy, and pointed out the articles you guys have done on constellations. Let's just say your articles have rekindled the fire. We hardly have time to notice the stars and were totally impressed by the in depth and detailed write up about the stars and constellations. And thank god it was in simple English! These days my wife and I have been doing a lot of star gazing. Thank you! - Man In Black

*We are glad to be of help in other aspects of life to our dear readers!*

Astronomy is so cool! Thank you for giving normal folks a chance to appreciate the wonders of the universe. Previously stars and moons are just bright lights in the sky but now I know so much more. My sister is twelve and she can understand your articles too! This magazine is just brilliant! However is it possible to mark down the price of the magazine because it is a bit too expensive - Ned

*You might be delighted to know that our magazine is offering student subscription at the lowest price possible from this issue onwards. Please continue to support us!*

Just want to thank you people for the great stuff you have produced. Keep it up! - Joseph

# Greece

## Introduction

7 centuries before Christ, the most remarkable human intellectual explosion occurred. Greek philosophy tried to give rational impersonal answers that could be subjected to criticism and query.

## Qualitative phase

Thales was the first person who gave a general description of nature and the Universe without invoking the supernatural. He proposed that some different forms of water made everything including the Sun and the stars. The Universe was a gigantic ball of water in which the earth floated on a water base at the bottom. Although this was a primitive and wholly ludicrous concept, but it was the first non-occult attempt to describe the Universe.

Pythagoras. He made astonishing development in arithmetic and geometry,

linking numbers to shapes and ultimately to nature and to astronomy. Although mathematics was considered a supporting tool and not as a means of explaining nature, it plays a critical role in the developments of astronomy. However the separation of mathematics and natural philosophy was to continue until the monumental work of Isaac Newton.

Aristotle. His works were revered by all and accepted without question. This attitude is represented by Pope's 18<sup>th</sup> century poem, the "Danger of imperfect knowledge", from which the following extract is taken.

Concluding all were desperate sots and fools, who durst depart from Aristotle's rules Aristotle unlike his teacher Plato believed that power of the intellect was sufficient to determine the nature of the Universe. Logic was more important than experimental test.

Aristotle's cosmology was, the Universe was finite and bounded by a sphere that contained the fixed stars. Outside the sphere there was nothing. Between this sphere and the Moon's orbit was the intermediate region containing the Sun and the planets, with the Earth and the Moon forming the inner region. The Earth was stationary and at the centre of the Universe. The 3 regions were different in their nature, as well as in their location. The inner Earth-Moon region was subject to change, as clearly evidenced on Earth by thunderstorm, precipitation, rainbows, floods, and so on, and therefore all the phenomena that change are in the inner region. In the inner region, Aristotle proposed that everything was made from the 4 elements- earth, water, fire and air. The stars at the boundary of the

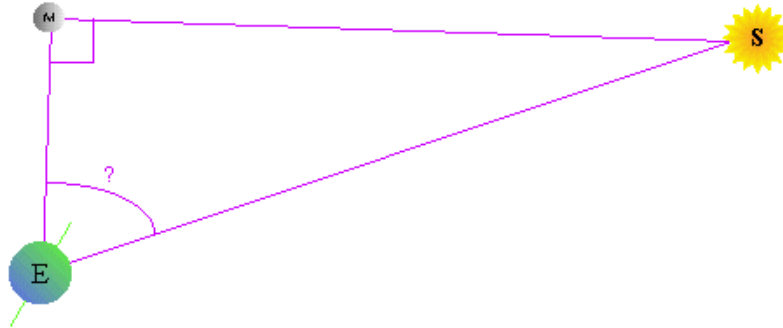
Universe were quite different; they were fixed unchanged and eternal. They were made by a sublime element, ether, which had the property of self-luminescence, thereby explaining the light emission from them. Till this stage, Greek astronomy had been largely qualitative, but soon enters the quantitative phase.

### **Quantitative phase**

Aristarchus was the first to determine the distances of heavenly bodies.

He pointed out that when the Moon was exactly half illuminated by the Sun, the angle between the Earth-Moon line and the Moon-Sun line was a right angle ( $90^\circ$ ). This way he could determine the distance of the Sun in terms of the Earth-Moon distance.

Aristarchus' method of determining the relative distances from the earth to the moon and to the sun



With the measurement of angle MES the ratio of EM and ES can be found.

He found that:  $MES = 87^\circ$  so  $EM/ES = 1/19$   
 actually:  $MES = 89^\circ 51'$  and  $EM/ES = 1/400$

The calculation is:

$$\tan ( 87^\circ \times \pi \times 1/180) \approx 19$$

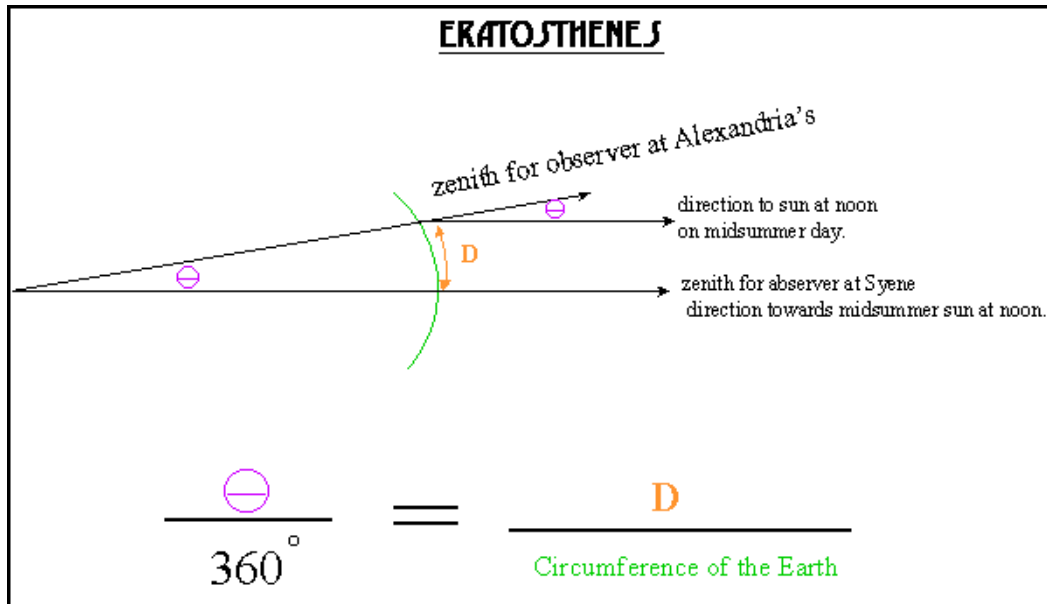
The distance ratio of moon to sun and moon to earth is 19/1. Thus the ratio of  $EM/ES = 1/19$ .

Aristarchus's measurements were probably off because it was hard to determine the exact centres of the Sun and the Moon. Secondly it was hard to

know exactly when the Moon is full.

Thirdly the diameter of the Earth was unknown. However it was a remarkable achievement when he managed to show that the Sun is much further away from us than the moon is. However

Eratosthenes was able to solve part of his problem as he was able to calculate the diameter of Earth.



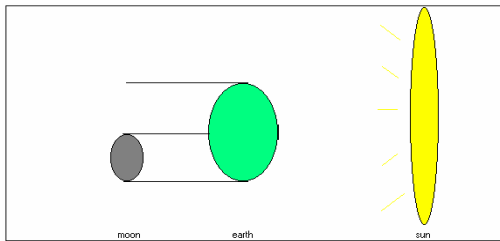
Circumference of Earth =  $\pi \times$  diameter of Earth.

(Thus we can find the diameter of Earth)

Eratosthenes had noticed that at Syene the Sun was directly overhead at noon in mid summer. He devised an experiment to measure the size of the Earth and assumed that the earth is round. He erected a tall vertical pole at Syene and a similar one in Alexandria. At the summer solstice the Syene gnomon cast no shadow, showing that the sun was directly overhead, but that in Alexandria cast a small shadow whose length was 1/5 of the length of the pole. The angle involved ( about 7°) represents the angle between the two lines drawn from the earth's centre to Syene and Alexandria

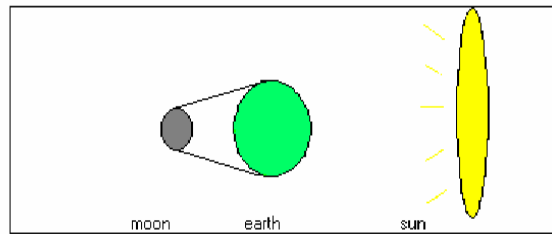
respectively, and the simple geometry says the distance between them is 2 percent the circumference of the Earth. The unit of length used at the time was the stadium, and Eratosthenes measured the Syene Alexandria distance to be 5000 stadia, giving the Earth's circumference as 250000 stadia. This is approximately 40000 kilometres. Since Alexandria is due north of Syene, Eratosthenes was measuring the polar circumference of the Earth for which the present value is 39940 kilometres. Thus it was very accurate.

Aristarchus also figured out how to measure the size of the moon. During a lunar eclipse the Sun, Earth and Moon are in line in that order, with the Moon appearing full.



He measured the duration of time between the moment when the edge of the Moon first entered the umbra and the moment when the Moon was first totally obscured. He also measured the duration of the totality. The 2 observations taken were the same, so the distance where the Moon crosses width of the Earth's shadow must be twice the diameter of the moon.

However the shadow due to Earth is not straight as indicated above, as assumed by Aristarchus. It is actually of the form shown in the diagram below.



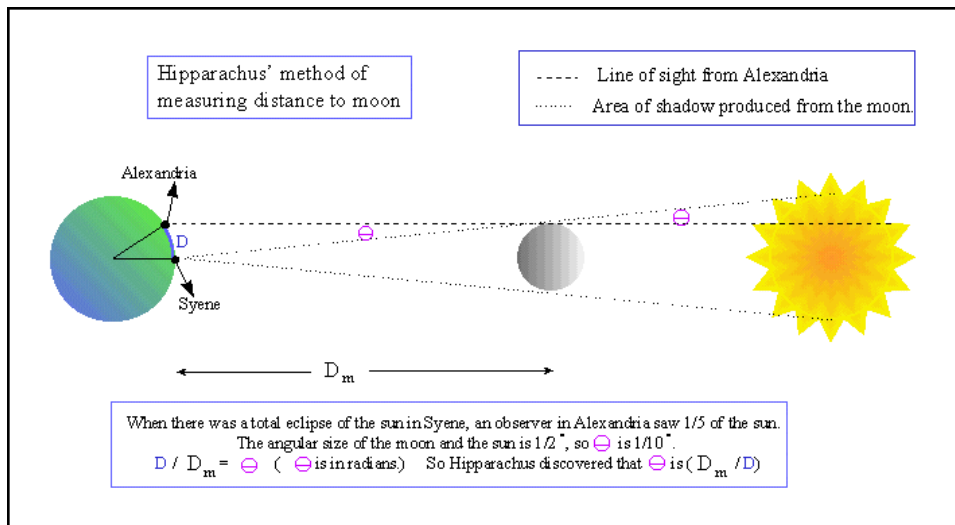
From the picture we can estimate that the size of Moon is about  $\frac{1}{4}$  as big as Earth.

Aristarchus also reasoned that since the Sun and Moon have the same angular size and the Sun is 19 times further, then the Sun must be 19 times larger than the Moon.

His logic was correct, but the sun is actually about 400 times farther from the Earth than the Moon. Although his measurements were not very accurate, he demonstrated a good understanding of the sizes and distances of celestial objects.

Aristarchus's cosmology was bold, but not accepted by the populace because of a lack in evidence. He thinks that since the Sun is 300 times the volume of Earth, it must be the better choice as the central place in the Universe. The Earth revolved around the Sun in a circle at a constant velocity and rotated about its axis. This model gave him a method of measuring the distance to the stars because the motion of the Earth from one point of its orbit to the extreme opposite point would cause the stars to show parallax, that is, they would appear to be slightly shifted in the sky. However he was unable to detect parallax since the stars were very far away. The nearest star was Proxima Centauri, 4.3 light years away. This meant that even the nearest stars only have a stellar parallax of about 1 second arc. Thus Aristotle's theory remained supreme.

Hipparchus was the first great observational astronomer. He conducted astronomical observations from Rhodes over a 30 year period. Using a consistent method with a simple instrument, a rod, which could be swiveled about the vertical and was pointed at the object being observed. The angle to the vertical was measured against a circle marked out in degrees. He mapped the positions of 1080 stars and gave estimates of their brightness. These data were to be the basis for astronomical studies for the next 17 centuries. He also detected the precession of the Earth's axis, which maintained the same angle to the plane of its orbit but rotates about the line at the right angle to that orbit with a period of about 26000 years. Hipparchus also measured the distance from the Earth to the Moon which was accurate to about 1 percent.



During a solar eclipse, there was total eclipse at Syene and partial eclipse at Alexandria. Observers at Syene saw the Sun blocked by the Moon. Observers at Alexandria saw 1/5 of 30 arc minutes of the Sun's disk. Thus the visible angle is 0.1 degrees.

Angle  $\theta$ :  $1/5 \times 1/2^\circ = 1/10^\circ$

Angle  $\theta$ :  $1/10 \times \pi \div 180 = 1/1800 \pi$  radians

Using small angles approximations, when  $\theta$  is small  $\tan \theta$  is  $\theta$ .

Thus  $D$  (distance from Alexandria to Syene) /  $D_m$  (distance to Moon) =  $\theta$  rad

Since we know the distance from Alexandria to Syene and the angle  $\theta$ , we are able to evaluate the distance of Earth to the Moon.

Ptolemy, famous for documenting the history of previous observations called "Almagest". It consisted of 13 books, with the first 5 books about the achievements of past Greek astronomers.

The last 5 books recorded his contribution to astronomy. He took the cosmology of Aristotle and quantified it by using the observations of Hipparchus, supplemented by some of his own. His view was that the Earth is round, stationary and very small relative to the celestial sphere of the sky. The stars are fixed points of light inside the celestial sphere. Day and night result from the rotation of the entire celestial system around the fixed, stationary Earth. The planets moved in small circular paths, called epicycles. The centres of these epicycles moved around the Earth of other circular paths called deferents. Ptolemy's system allowed the positions of the heavenly bodies to be predicted.

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 Astronomy through the Ages

# Personality of the Month

Aristotle was born in Stagirus, on the Chalcidic peninsula of northern Greece.



His father was Nicomachus, a doctor, while his mother was named Phaestis. Aristotle might very well turn out to be a doctor if not for the fact that his father had died at the age of 10. This was because the tradition was that medical skills were kept secret and handed down from father to son. As Nicomachus was appointed the personal physician to Amyntas III, king of Macedonia, Aristotle got to be on very good terms with Philip, king Amyntas's son. Philip would eventually come to become king of Macedonia.

## Aristotle

In 367 BC Aristotle, at the age of seventeen, became a student at Plato's Academy in Athens. Plato's academy was not just a non-political organisation only interested in abstract ideas. It was actually quite involved in politics at that time and this played a major role in influencing the course of Aristotle's life. After being a student, Aristotle soon became a teacher at the Academy and he remained there for 20 years. All Aristotle's writings of this time strongly supported Plato's views and those of the Academy. After 20 years however, Aristotle's position became difficult due to the political events. Around this time, Philip came to the throne and started to conquer areas to expand his territory. This worried Athens as Macedonia seemed to be growing stronger each time, meaning there was the possibility of attack by Philip. Since Plato's Academy was in Athens and Aristotle seemed to be on such good terms with Philip as was known in Athens, Aristotle had no choice but to leave the Academy.

Aristotle then traveled from Athens to Assos that faces the island of Lesbos. There, he received a warm reception by the ruler Hermias of Atarneus as it seemed that he was acting as an ambassador for Philip. Aristotle then married Pythias, the niece and adopted daughter of Hermias, and they had one child, a daughter also called Pythias. Unfortunately, his wife died after 10 years. Aristotle did not marry again after the death of his wife though he formed a relationship with Herpyllis, who came from his home town of Stagirus with whom he had a son, Nicomachus, named after his father.

In Assos, Aristotle became the leader of the group of philosophers that Hermias had gathered there. Besides having an interest in astronomy, Aristotle was also interested in biology and zoology, which was why he had worked with members in his group in this area. Aristotle however did not stay long in Assos for he soon fled when the Persians attacked. He then stayed on in Lesbos for a year. Then, he returned to the court of Macedonia where he stayed for 7 years, being tutor to the young Alexander the Great, son of Philip. At that time, Macedonia was at peace with Athens.

Making use of the dislike which the then head of Plato's Academy (Speusippus) had for Aristotle, Philip suggested that Aristotle should be the new head of the Academy which prompted Speusippus to put forward the idea of war in Athens

Although the head of Plato's Academy died shortly after, Aristotle was not elected as head. Then when Alexander, became King, he sent Aristotle back to Athens to start a rival institution, protecting Plato's academy at the same time. So, in 335 BC Aristotle founded his own school the Lyceum in Athens. He brought a wide range of teaching material along with him. In his school, Aristotle pursued a broad range of subjects.

However, Alexander the Great died in 323BC. This resulted in Aristotle returning to his hometown in Chalcis where his family were as anti-Macedonian feelings started to stir in Athens. He then died a year later from a stomach complaint at the age of 62.

# The Calendars in Ancient Egypt

## **An overview**

In ancient Egypt, the people actually worked with not 1 calendar but 3 calendars in all. All of these calendars were not created round the same time and each of them served different purposes in the life of the ancient Egyptians. The Egyptians had a civil calendar for administrative and economic purposes, a stellar calendar (lunar in origin) for their farming and agricultural needs and a lunar calendar, the earliest of the 3 to be created which was used mainly for their religious celebrations and duties.

## **Details**

### **The lunar calendar**

The lunar calendar was by far the oldest the ancient Egyptians used back in ancient Egypt and it determined the timing of the majority of the religious festivals back then. The dates of the sacred holidays were not fixed due to the dissimilarity of the lunar cycle. The

average twelve month lunar cycle lasts about 354 days.

The lunar year begins with the first New Moon which follows the heliacal rising of Sirius. Then, whenever Sirius rose helically in the last eleven days of the twelfth month of the previous lunar year an intercalary (additional) month would be added to the new year. This thirteenth lunar month was called Djehuty (Greek name: Thoth) and was always added at the beginning of the new year. This had to be done to avoid having the festival of Wep-ropet, "Opener of the Year" (the rising of Sirius) from falling into the first lunar month of the next year. This resulted in a "Great Year" of 384 days, which was used every 3, or occasionally every 2 years, in much the same way as we have a leap year every 4 years. An additional month was also added when the first day of the lunar calendar fell before the first day of the civil calendar.

In the lunar calendar, a lunar week was the time between each of the four phases of the moon, which is approximately seven days. Each lunar month was

named after a specific Egyptian Goddess or God or after a major festival that occurred during that month. The following is a list of the different months and it is interesting to note how the

names of the months had changed throughout the centuries, especially when Egypt had a change of leadership and became ruled by the Greeks in the later part of their history.

Season	Original Names	Late Period	Greek
Intercalary Month:	Djehuty		
I Akhet	Tekhy	Djehuty	Thoth
II Akhet	Menhet	pA-n-IpAt	Phaophi
III Akhet	Hwt-Hrw	Hwt-Hrw	Athyr
IV Akhet	Ka-Hr-Ka	Ka-Hr-Ka	Choiak
I Peret	Sf-Bdt	tA-aAbt	Tybi
II Peret	Rekh Wer	(pA-n) mhr	Mechir
III Peret	Rekh Neds	pA-n-Imn Htpw	Phamenoith
IV Peret	Renwett	(Pa-N) Rnnwtt	Pharmuthi
I Shomu	Hnsw	(PA-n) xnsw	Pachons
II Shomu	Hnt-htj	pA-n-Int	Payni
III Shomu	Ipt Hmt	Ipip	Epiphi
IV Shomu	Wep-Renpet	mswt-Ra	Mesore

### **The Stellar calendar for agriculture**

The word “stellar” alone would already give us some idea of how this calendar came about. Yes, this calendar was a result of the observations made on one star, known by many of us as Sirius

but as Sopdet, the “bright one” to the ancient Egyptians.

The ancient Egyptians depended on the Nile's annual rising and flooding for the support of their agricultural system, which was essential for the whole civilization's survival. The Nile

can be said to be the life blood of Egypt. Because of this event the Egyptians divided their year into three distinct seasons: *Akhet* meaning inundation, *Peret* meaning emergence or growth, and *Shomu* meaning low-water and harvest. So, during *Akhet*, the Nile would be flooding and depositing its soil along the river banks, the planting, cultivating and maintaining of the crops would be done during *Peret* and consequently, *Shomu* would then follow with the beginning of this being the time



of harvest. Each of these seasons lasted for about 12 lunar months in all.

The Egyptians noticed that a celestial event, the rising of the star Sirius on the eastern horizon at sunrise ('heliacal' rising of Sirius) always preceded the flooding of the Nile by a

few days. For approximately seventy days this star would remain hidden from view, suddenly making its appearance at sunrise on that very day. This was seen as a very powerful, spiritual moment, so much so it was commemorated with elaborate temple rituals. As a result, the Egyptians regulated their original lunar calendar based on this "heliacal rising" of Sirius and hence the creation of the stellar calendar. Consequently, this cosmic event came to be seen as the starting point of the year both for the stellar and lunar calendar. In all, the stellar calendar had 365.25 days based on this heliacal rising of the star Sirius.

### The civil calendar

The civil calendar as mentioned earlier was used mainly by the Egyptians for administrative purposes though they considered it to be devoid of spiritual significance. It was derived from the lunar calendar (using months) and the agricultural, or Nile, fluctuations (using seasons).

In the civil calendar, each season was composed of four months, each month was made up of three weeks, and

each week consisted of ten days. The total number of days in the civil year was 360. At the end of the last month of the civil year five days were added that were considered to be independent from the year. These were viewed as the days in the year on which several gods were born and they were known as "the Days Upon the Year". On these days, there would be a lot of celebrating going on as the Egyptians viewed them with great significance.

Then, since the stellar calendar had 365.25 days, it soon became obvious that the civil calendar soon would move out of sync with the actual rising of Sirius even though it was actually created in the first place to have its first day coincide with the day of the appearance of Sirius/*Sopdet* at sunrise. The Egyptians were not really very

concerned about this as the civil calendar was used just used for administrative purposes. It was only until the time of Ptolemy III Euergetes when a fourth year was made a leap year with the addition of a sixth epagomenal day to try keep the civil calendar in line with the natural Sirius cycle.

Initially there were no names for the civil months. Eventually though, names were developed, the majority of which were derived from those used in the older lunar calendar. Hence, to avoid confusion, often only the number of the month in a season would be used when referring to the civil calendar. For example, a full civil date would be: "Regnal year 1, fourth month of Inundation, day 5, under the majesty of King So-and-So."

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# Great Pyramid

## *Introduction*

The great pyramid of Giza is the only surviving wonder of the world. Perhaps no other object, structure or human artifact has inspired so many theories, speculations and certainly, in at least some cases, fantasies. In this section, the geographical and astronomical relations with the pyramid are analyzed.



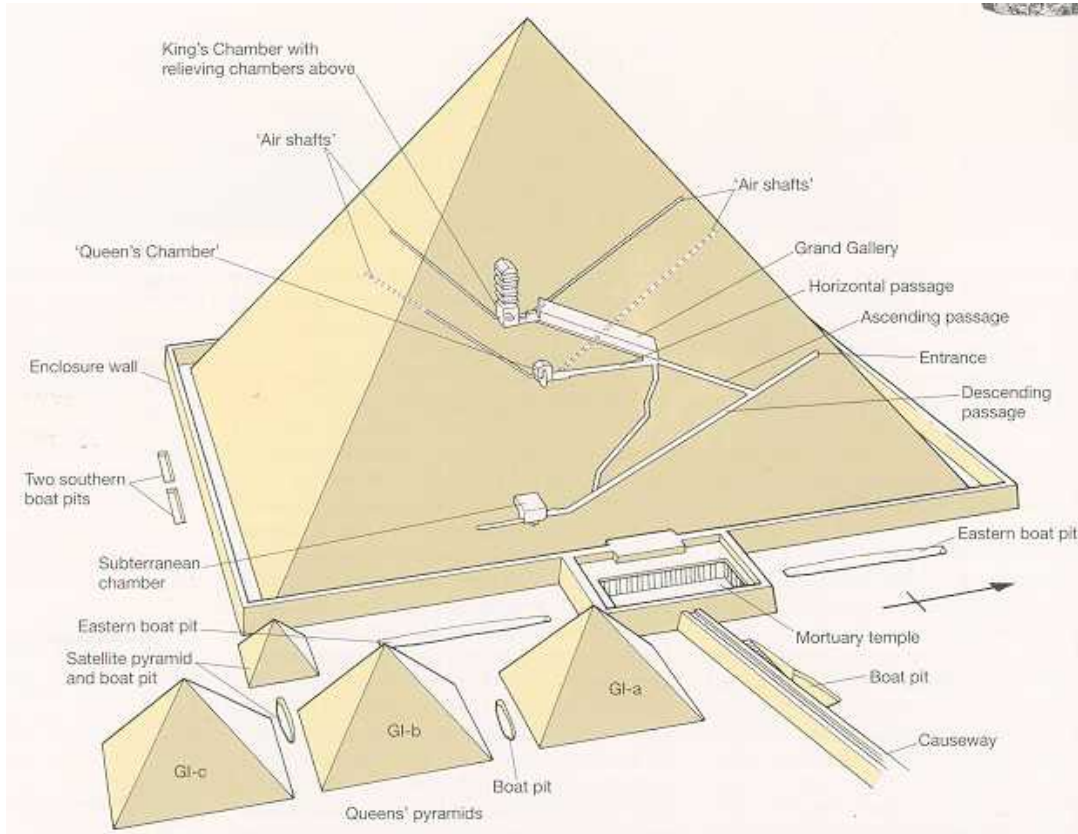
**Figure 1- Outlook of the Pyramid**

## *Statistics of Great Pyramid*

The Great Pyramid is located at the extreme northern edge of a limestone plateau next to the Nile flood plain where the river meets the Delta. It rises

about 450 feet (having lost about 30 feet off the top over the years) and covers 13 acres. The length of each side was originally 754 feet, but is now 745 feet.

## Structure of the Great Pyramid



**Figure 2 structure of pyramid**

Inside the pyramid, there are three chambers, the standard layout for an Old Kingdom pyramid. The entrance is high up on the north face, offset by 24 ft (7.29 m) east from the central axis of the pyramid and the passageway it leads into, descends 58.5 m through the pyramid into a subterranean chamber,

carved out of solid bedrock (though never completed). There is a mysterious small passage leading out of the subterranean chamber, large enough for only 1 man at a time. However, it is a dead end.

Higher up in the pyramid is the "Queen's Chamber" (misnamed by early explorers), lying exactly on the east-west central axis of the pyramid. (When it was built, it was sealed off from the rest of the pyramid, making it a good candidate for the location of the king's *ka* (spirit) statue.)

A little way down the descending passage is a small ascending passage. It's only 1m wide and about the same in height. However, it leads into one of the wonders of the Great Pyramid, the Grand Gallery, which has a corbelled roof 26 ft (8.74 m) high. At the top of this is the King's Chamber, which contains Khufu's sarcophagus. The room is built entirely out of red granite, as was the king's sarcophagus. Above it are five stress-relieving chambers.

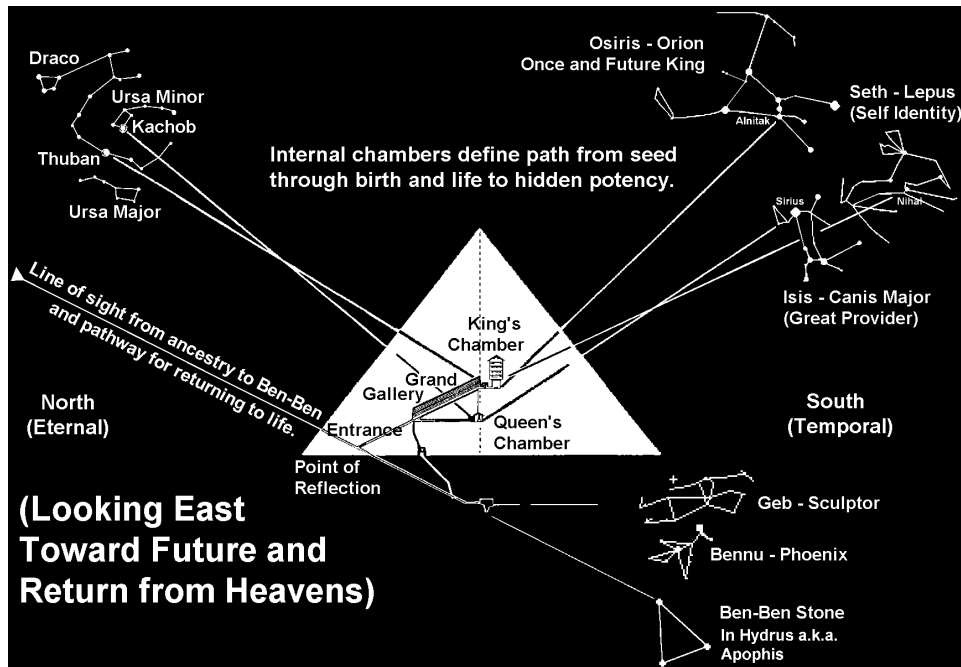
There are also some "air-shafts" which go through the pyramid. These were probably intended to allow the dead king's spirit to leave the pyramid and ascend to join the gods. (There are 4 in total – 2 are oriented towards Orion, and the other 2 towards the polar stars. At least one of these shafts is blocked by a set piece of stone, discovered when a

small camera mounted on a robot was sent up there.)

### *Geographical Relations with the Great Pyramid*

- The pyramid is located at 29 degrees, 58 minutes, 51.06 seconds north latitude, and 31 degrees, 9 minutes, and 0.0 seconds east longitude.
- This position is right at the center of the landmass of the earth. The east/west parallel that crosses the most land and the north/south meridian that crosses the most land intersect in two places on the earth, one in the ocean and the other at the Great Pyramid.
- The Great Pyramid was the most accurately aligned structure in existence and faces true north with only 3/60th of a degree of error. The position of the North Pole moves over time and the pyramid was probably exactly aligned at one time.

## *Astronomical relations with the Great Pyramid*



**Figure 3**

**Looking from east**

### **1. Structure with constellations**

**Entrance passage** -- Nearly all of the pyramids of Egypt have an "entrance" passage on their north face. This passage typically runs parallel to the north-south meridian and descends at approximately 26 degrees. In the Egyptian celestial mythology, this passageway represents the route ancient souls take in becoming the generations of tomorrow. It projects through the planet to the top of a triangular asterism known as the Ben-Ben stone, or the place of the "First Occasion." It is a clear statement of the Egyptian belief that everything on Earth

came from the celestial vault known as the heavens, a fact which modern science has proven beyond a shadow of doubt. At Giza, the region of the sky around the North Pole never goes below the horizon, and is symbolic of the realm of eternal life, from whence kings and ancestors can return to Earth as spirits reincarnated into the flesh of youth.

**Underground chamber** -- Within the underground chamber a passage points toward the modern constellation called Sculptor. That constellation was called Geb by the Egyptians, and he was the spirit of the earth. Between the

projections of the descending passageway and the horizontal passageway is the region of the sky from the Ben Ben stone in the southern constellation Hydrus, through the Phoenix, to Geb.

**Queen's Chamber** -- The southern shaft in the Queen's Chamber (39 deg, 30 min, 00 sec) pointed to the star Sirius, circa 2450 B.C. Sirius was associated with the Egyptian goddess Isis and is also part of a unique ceremony practiced by the African Dogon tribe. The northern shaft in the Queen's Chamber (39 deg, 00 min, 00 sec) pointed to the star Ursa Minor, circa 2450 B.C.

**King's Chamber**— The southern shaft in the King's Chamber (45 deg, 00 min, 00 sec) pointed to the star Al Nitak (Zeta Orionis) in the constellation Orion, circa 2450 B.C. The Orion constellation was associated with the Egyptian god Osiris. No other star aligned with this shaft during that Epoch. The northern shaft in the King's Chamber (32 deg, 28 min, 00 sec) pointed to the star Alpha Draconis, circa 2450 B.C.

**Pyramids mirror Orion Constellation:**  
The pyramid positions on the ground are

a reflection of the positions of the stars in the constellation Orion circa 10,400 B.C. Five of the 7 brightest stars have pyramid equivalents: The 3 great pyramids of Khufu, Khafra, and Menkaura for the belt of Orion, the pyramid of Nebka at Abu Rawash corresponds to the star Saiph, the pyramid at Zawatah corresponds to the star Bellatrix. The only two missing star positions are for Betelgeuse and Rigel.

**Grand Gallery**-- All of the great chambers have passages, which project northward, and southward, this is also true for Grand Gallery. This twenty-eight foot high corbelled ceiling chamber proceeds upward toward the constellation of Lepus, which the Egyptians called Seth. Seth was the spirit of personal identity, and is most commonly called the ego today. This chamber has no direct connections to the outside world, and it is aligned with the spirit of selfishness in the constellation of Seth. To understand it better, it is necessary to look toward the west, as well as east through the pyramid. (See Figure 4 below) In the west perspective, the constellation of Seth is looking back

down the Grand Gallery and beyond to passage.  
the intersection at the north entrance

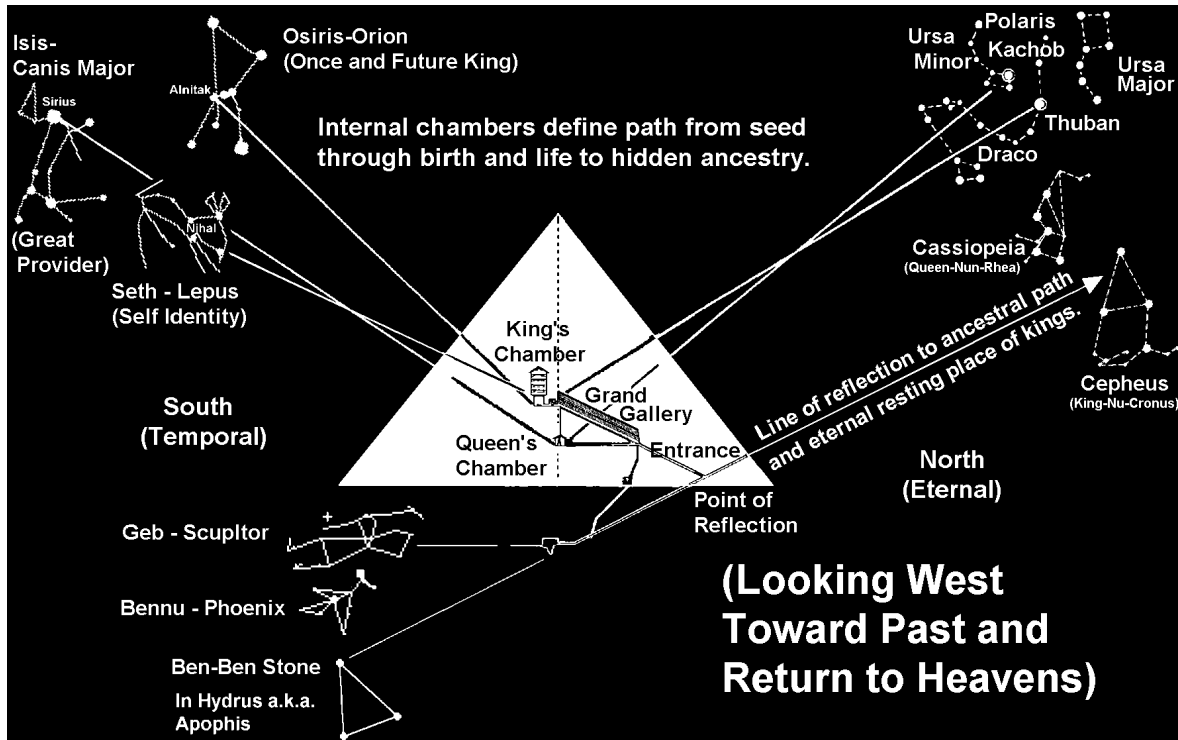


Figure 4 Looking from west

## 2. Pyramids with Tropical Year

Pyramid is mysterious not only because that it points to some constellations high in the sky, but also the data obtained from itself has interesting relationships with the earth, the sun, the moon, calendar, and so on.

### Tropical Year—

- 1) The length of a base side is 9131 pyramid inches measured at the

mean socket level, or 365.24 pyramid cubits, which is the number of days in a year.

{9131/25 = 365.24, accurate to 5 digits}

- 2) The perimeter of the base divided by 100 = 365.24, the number of days in a year. {9131 PI \* 4 / 100, accurate to 5 digits}

- 3) The perimeter of the base divided by 100 = 365.24, the number of days in a year. {9131 PI \* 4 / 100, accurate to 5 digits}
- 4) The length of the granite portion of the floor of the antechamber to the King's Chamber times  $2 \cdot \sqrt{\text{Pi}} = 365.242$
- 5) The ratio of the lengths of the Grand Gallery to the solid diagonal of the King's Chamber times 100 equals the number of days in a tropical year.  $\{(1881.5985600 / 51.516461) * 100 = 365.242200, \text{ accurate to 8 digits}\}$

### Sidereal Year

- 1) The length of the antechamber of the King's Chamber times Pi = length of a sidereal year {  $116.26471 \text{ PI} * 3.14159 = 365.25636 \text{ days, accurate to 8 digits}\}$
- 2) The length of the antechamber of the King's Chamber times Pi = length of a sidereal year {  $116.26471 \text{ PI} * 3.14159 = 365.25636 \text{ days, accurate to 8 digits}\}$

### Precession of the Equinoxes

- 1) The distance from the ceiling of the King's Chamber to the apex of the pyramid = 4110.5 PI. Which is the radius of a circle whose circumference = the precession of the equinoxes.  $\{4110.5 * 2 * \text{Pi} = 25827\}$
- 2) The perimeter of the 35th course of blocks, which is much thicker than any of the other courses, gives a figure for the precession of the equinoxes.

### Mean Distance to the Sun

- 1) The height of the pyramid times  $10^{**9} = \text{avg. distance to sun.}$   $\{5813.2355653 * 10^{**9} * (1 \text{ mi} / 63291.58 \text{ PI}) = 91,848,500 \text{ mi}\}$
- 2) Half of the length of the diagonal of the base times  $10^{**6} =$  *average distance to the sun*
- 3) The height of the pyramid times  $10^{**9}$  represents the mean radius of the earth's orbit around the sun, or Astronomical Unit. {  $5813.235565376 \text{ pyramid inches} * 10^{**9} = 91,848,816.9 \text{ miles}\}$

**Mean Distance to Moon**

- 1) The length of the Jubilee passage times 7 times  $10^{**7}$  is the mean distance to the moon.  
 $\{215.973053 \text{ PI} * 7 * 10^{**7} = 1.5118e10 \text{ PI} = 238,865 \text{ miles} \}$

**North Star Pointer**

- 1) The Descending Passage pointed to the pole star Alpha Draconis, circa 2170-2144 B.C. This was

- 2) the North Star at that point in time. No other star has aligned with the passage since then.
- 3) The 344 ft. length of the Descending Passage provides an angle of view of +/- 1/3 of a degree. Alpha Draconis has not been in alignment for thousands of years. The next alignment will be with the North Star, Polaris, in about 2004 A.D.



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# The Sphinx

On the Giza necropolis, there stand the Great Pyramids. However, there is the Sphinx too, albeit much smaller than the Pyramids, but still a monolith nonetheless. As we have seen in the previous part, the Pyramids are an engineering feat as well as an indication of the astronomical and mathematical advances of the civilisation that built them. The Sphinx may not have been built out of nothing, but its age has remained a mystery till now, and together with its physical and astronomical features, it may well be the key to the enigma of the Giza necropolis. In the meantime, we shall ignore the age dispute of the Sphinx (and the Pyramids for that matter) till later where we attempt to piece everything together.

## **Some background information**

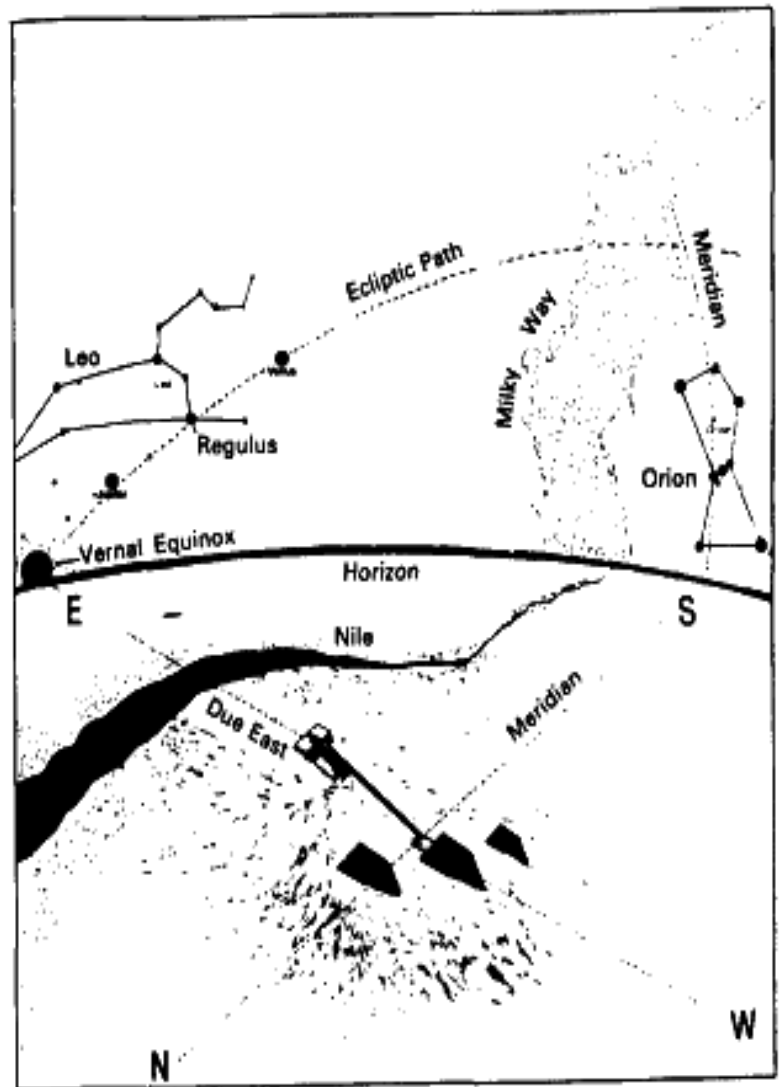
The Sphinx is situated on the Giza necropolis such that you can see the face of the Sphinx if you approach it from the east. There is a complex in front of it, popularly known as the ‘Sphinx Temple’, and to the right of the

‘Sphinx Temple’ is the Valley Temple of Khafre with a causeway running 14 degrees to the north from there to the Pyramid of Khafre. Since the Sphinx faces due east, it acts as an equinoctial marker, identifying the vernal and autumnal equinoxes. Now, the ancient Egyptians have this concept of duality in their religious ideas- that all things above will have their terrestrial counterparts. Hence, in their worship of the gods, the ancient Egyptians attempted to duplicate the celestial landscape onto land. In fact, they believed that their kingdom is bound to the heavens in perfect duality. (*The Message of the Sphinx, Graham Hancock, pp132*) In the last section we see that the Pyramids mirror the stars on Orion’s belt. The Nile was the earthly Milky Way. What will the Sphinx represent?

## Putting together the pieces

Contemporary works such as songs and literature have mentioned the phrase ‘the dawn of the Age of Aquarius’. This is an example of an astrological Age, defined by the zodiacal constellation that rose just before the Sun on the March equinox, and is caused by the extremely slow precession of the Earth’s axis. We are at the end of the ‘Age of Pisces’ now and the proper ‘Age of Aquarius’ will come in AD 2,500 (AD 2,000 to AD 4,160). With this precession of the equinoctial ‘houses’ of the zodiac in mind, we will know that for the supposed epoch or period of time that the Pyramids *and* the Sphinx were built (which is 2,500 BC), the astrological Age would be that of Taurus. Now, if the Sphinx was really fashioned at that time, and coupled with the ancient Egyptian concept of ‘duality’, the Sphinx could very well take the shape of the Bull instead of the leonine form we are all so familiar with. This would bring us to the idea of the Sphinx being shaped at the ‘Age of Leo’ which started in 10,500 BC. What the real catch is, is that the stars in the ‘Belt of Orion’ would have reached their lowest culmination around that time in *due south* and, the *only* time where the Pyramids mirror the ‘tilt’ of the stars of Orion *perfectly*.

In addition, the group of three ‘satellite’ pyramids south of the Pyramid of Menkaure (the smallest of



10 The moment of sunrise on the vernal equinox in 10,500 BC. At the exact moment that the top of the solar disc broke over the horizon due east in direct alignment with the gaze of the Sphinx the three stars of Orion’s belt culminated at the meridian in the pattern that is mimicked on the ground by the three great Pyramids. Sphinx and Pyramids thus appear to ‘work together’ as an architectural representation of this unique celestial conjunction.

the trio of the Giza Pyramids) are found to imitate the east-west alignment of the Orion’s belt when Alnitak, the lowest of the belt stars, set at azimuth 207 degrees in 10,500 BC. Noteworthy is that the satellite pyramids are at azimuth 207 degrees on the artificial ‘horizon’ of Giza with the centre being the Pyramid of Khafre. All this corresponds to the era which Professor Robert Schoch, an eminent geologist, had *conservatively* estimated to be 7,000 BC judging from the precipitation-related corrosion of the body and not the head of the Sphinx. A thing

to note is that the size of its head is not proportional to the body; it is much smaller, and could indicate that the head had been recarved later by the ancient Egyptians to possibly the likeness of any Pharaoh. Now, we do not dispute that the Giza Pyramids were built in 2,500 BC but we may either think that the master-plan for the Pyramids may have been set down physically in 10,500 BC in the form of low platforms, or the astronomical data from the 10,500 BC era had been passed down to the priests in Heliopolis.

The age dispute aside, the focus now is what god the Sphinx could have represented in the eyes of the ancient Egyptians. In the funerary text *Reu Nu Pert Em Hru*, literally the 'Book of Coming Forth By Day' or more well known as the Book of the Dead, there was mention of the Judgement Hall of Osiris. In another religious text, the ancient Egyptians had written about their belief that there was a 'time of the gods', *Zep Tepi*, which was a golden age following Creation, and it had been 're-enacted' in the heavens above. The sun would be the counterpart of Re (or Ra in other literature), Osiris represented by Orion, and Isis was Sirius the star and so on. The gods set up their terrestrial kingdom in the triangular region

...south of the apex of the Nile delta encompassing Heliopolis, Memphis and Giza was the actual geographical location of the 'First Time' stated in *The Message of the Sphinx* by Graham Hancock (pp141) or *Zep Tepi* as mentioned earlier. Re existed as Re-Atum, the 'Father' of the gods, and Osiris was the first king of this divine kingdom with Isis as his consort. However, Osiris was later murdered by his brother Seth (Set in other literature), and Isis

revived Osiris long enough to conceive their only child Horus. In a great quarrel with Seth, Horus got back his father's kingdom when Geb the earth-god and father of Osiris and Isis summoned the Great Council of the Gods and decided to make Seth the king of Upper Egypt and Horus the king of Lower Egypt. It occurred to Geb later that he should have given Horus both lands since Osiris was his first born and that was how Horus finally restored the integrity of his father's throne.

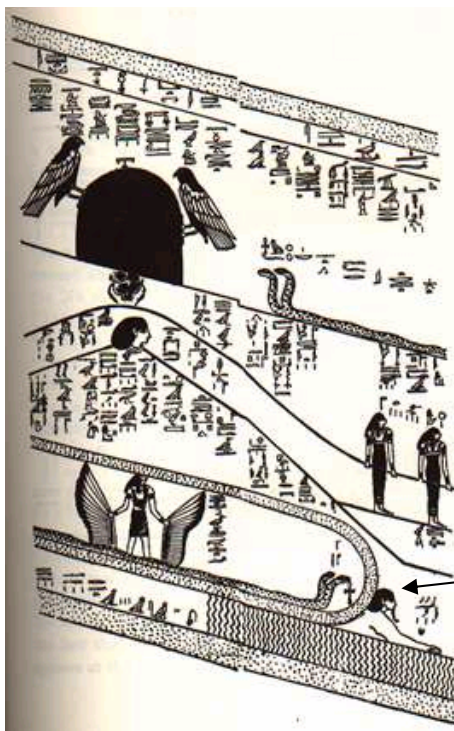
Osiris was taken and buried in the land of Sokar, which is the Memphite necropolis, inclusive of the Giza Pyramid-field (known to the ancient Egyptians as Rostau). Sokar was a predynastic deity of the dead, and when Osiris was safely installed in 'the house of Sokar', the spirit of Osiris was freed to go to the area around the constellation of Orion where the *Duat* was established as the celestial 'Kingdom of Osiris' for the Dead. In the *Book of What is in the Duat*, it said that 'The land of Sokar occupies the Fifth Division of the *Duat* and: the centre of the Fifth Division [is] called Rostau.' The illustrations of the Fifth Division of the *Duat* on tomb walls are similar to the passageways, chambers and corridors of the Great Pyramid, which has caused people to wonder if the Great Pyramid was like a model of the afterworld. In addition, there is a giant 'double-lion' Sphinx god Aker believed to be the protector of the Kingdom of Sokar, and

there is a large Pyramid above Aker. This corresponds to the view of the Sphinx and the Great

Pyramid from the south-east.



The view of the Great Sphinx from the southeast



**Depiction of the 'Fifth Division of the Duat'.**

**Only one of Aker's heads is shown here (indicated by the arrow).**

**The head on top of the triangular structure is the vertex of the Great Pyramid.**

The ancient Egyptians see their Pharaohs as human 'Horus-Kings', those who inherited the

throne from Horus, and Horus had inherited from Osiris. We shall see how it relates to the

Sphinx.

In 1883, Swiss Egyptologist Edouard Naville cited that the deity Nefer-Atum can be represented with the head of a lion... normally he has a human form, and wears on his head a lotus from which emerge two straight plumes. Sometimes the two emblems [lion and human] are united and between the head of the lion and the plume there is the bird [hawk] of Horus. We can see from there, besides the Pyramid texts that describe Atum to appear as the ‘master of the lake, who shines as *Rwty*’ where *Rwty* loosely means ‘double-lion’, the ancient Egyptians see Atum the creator god mainly in sphinx-like form.

Atum was also often called ‘The Lord of Heliopolis’, the centre of sun worship, and at the start of the Pyramid Age, Egyptologist Rosalie David said: “the god Re had taken over the cult of an earlier god Atum... [thus] Re-Atum was now worshipped as the creator of the world according to the Heliopolitan theology, and his priests sought to distinguish his various characteristics.”

One of these was the manifestation of Re as Re-Horakhti, with Horakhti meaning ‘Horus-of-the-Horizon’. Horakhti appears in reliefs as a human (possibly the Pharaoh) with the head of a hawk (symbolising Horus) atop which lies

the solar disc (symbolising Re) and hence symbolising the Horus-King. The recombinant effect of this composite deity originating from the leonine Atum would have again given the deity a sphinx like form.

Hence we may conclude that the Great Sphinx at Giza is indeed the *Sheshep-ankh Atum* or the ‘living image of Atum’, as it was known to the ancient Egyptians, and the earthly Horakhti (i.e. Hor-em-Akhet, Horus-in-the-horizon) at June solstice (with the rising of Sirius: birth of the gods) where the representative constellation of Horakhti (celestial Sphinx), Leo will have the Sun between its paws. This becomes important when we consider how the Horus-King must journey to the *Duat* and revive Osiris. In the heavens the cosmic Horus-King is the son of the Sun and must follow the ecliptic, cross the Winding Waterway on its right bank, on the Solar-bark with Re to reach the Gateway that lead to the celestial *Duat* in the eastern horizon. He will need to go on one of the roads to Rostau, the centre of the *Duat* where the belt stars are to be found. The Sphinx is the guardian of the Gateway on Earth and when the Horus-King stands between the paws of the Sphinx, he is deemed to have reached the Gateway. Similarly, we may deduce that when the Sun is between the paws of Leo, Horus has finally come to the Gateway with the solar disc.

# Precession and the Pyramids

The priests of ancient Babylonia and Egypt were also pioneer astronomers. They studied the heavens, mapped their constellations, identified the path of the Sun and estimated the periods of the Moon and Sun as they moved across the sky. Now, in order to uncover some of the mysteries that are shrouded in mythological and religious symbols, including the Great Sphinx, we must look beyond our Earth year to a much longer cycle of our planet. That is what we call greater cycle, or one wobble of the Earth, the Platonic year in honor of the Greek philosopher Plato — whose ideas concerning the realities of the physical and metaphysical planes are still cherished by many of us who are seeking the wisdom of the ages. In this section, the general knowledge of this cycle will be presented.

## 1. General Knowledge about Precession

More precisely, *The Precessional Periodicity Cycle of the Equinoxes*

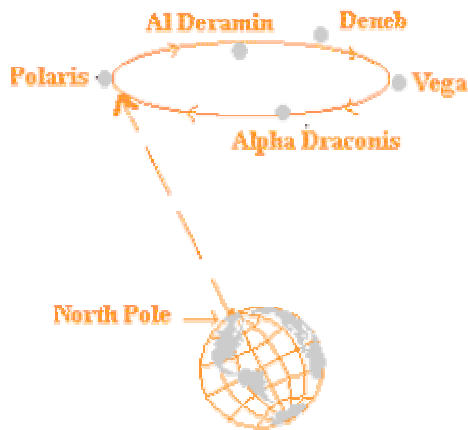
(discovered by Hipparchos in 150BC) is a mechanism caused by the variations in the torque generated by gravitational forces acting upon the planet Earth. The greatest gravitational force (Lunisolar Precession) is produced by the Moon's orbit around the Earth, and to a lesser degree by the Sun, although very small variations occur due to the action of the other planets (Planetary Precession). The effect of both mechanisms is termed General Precession.

The Earth is not a sphere but is slightly ovoid in shape. This is the result of centrifugal forces acting upon it's partially fluidic core, and it spinning around the axis of the North and South Poles (termed the Celestial Poles - NCP & SCP) - it's diameter is approx. 0.6% larger at the imaginary line of the Equator (zero degrees) than it is from Pole to Pole (North = 90 deg & South = -90 deg). If the Earth were in fact spherical, *precession* would not occur.

The Earth's Celestial Poles in turn, very slowly, move in a circumferential

manner (counter clockwise in the northern hemisphere) around imaginary points of axes termed 'Ecliptic Poles' which are perpendicular to the plane of the Ecliptic. The Ecliptic is the path that the Earth follows as it orbits the Sun. The Northern Ecliptic Pole (NEP) is set at 66.73 deg/N (23.27 degs from the Celestial Pole) and currently 90 deg/W of the Meridian - at the zenith of an area on the Arctic Circle, just north of the Hudson Bay. It is in fact centred, and

proceeding along a path indicated by our Arctic Circle latitude. It takes 25.75k years to complete one full cycle. This can be accurately demonstrated by calculation using vectors of spherical trigonometry, or graphically if one views the North Pole from space, and draws a circle around these co-ordinates (radius of which being from the co-ordinates given to the North Pole), the circumference of the circle passing through the North Pole\*.



Precession of the North Pole Axis  
*(It takes 25,800 years to complete one cycle)*

## 2. Precession in Egypt

### Quote

*"The Northern Shaft built into the King's Chamber of Khufu's Pyramid is aligned to point to the 'Indestructibles' - a group of stars within the Arctic region. In the northern hemisphere, these stars never set, and remain in view throughout the year."*

### 2.1 Did the Pyramid Builders of the Old Kingdom use the Pole of the Ecliptic?

A new study suggests that the Giza Pyramids might have been deliberately 'anchored' to the *pole of the ecliptic* at two distinct epochs by making use of certain stars, of religious importance to the Pyramid Builders, found in the circumpolar and non-circumpolar constellations. Such a hypothesis fortifies the possibility that the Pyramid Builders of Egypt were aware of the Precession of the Equinoxes.

### 2.2 Awareness of Precession?

There has been an ongoing heated debate between researchers in archaeoastronomy and Egyptologists as to whether the ancient pyramid builders of Egypt were aware of the phenomenon known as the *precession of the equinoxes*. In simple and brief terms, the precession of the equinoxes is the result of a very slow wobble-like gyration of the earth that takes around 26,000 years. The 'discovery' of the precession of the equinoxes is attributed to the Alexandrian-Greek astronomer Hipparchus in around 130 BC, and Egyptologists and historians in general totally reject the idea that the Egyptians might have known of the phenomenon thousands of years before.

Contrary to popular opinion, the apparent effect of precession is quite noticeable in the sky across a few centuries, as there is considerable change in the position of stars that can be easily picked up by naked-eye observations. Indeed, Philip Morrison of MIT noted that to discover precession requires only a tree (solar gnomon) and faith in the veracity of one's grandfather (an oral

record). Thus over the 700 years or so that led from the formation of the ancient Egyptian civilization in c. 3200 BC to the start of the 4<sup>th</sup> Dynasty in c. 2500 BC, the rising place (known in astronomy as the azimuth) of stars such as, say, those in Orion's belt, would have changed by as much as 3° on the horizon, and as much as 2.5° at culmination on the meridian. This alone has remarked that it would have been unlikely for a people like the ancient Egyptians, who were very keen and avid observers of the sky and stars, not to be aware of the precessional shift, even though they might not have understood its underlying cause or have been able to compute it mathematically. Some researchers found that ancient Egyptians' aligned their temples to stars rising in the east *and often changed the alignment of the temple in order to take into account the drift caused by precession.* The below is a quotation from the famous book *the Dawn of Astronomy*

*"When a stellar temple is oriented so accurately that it requires several reconstructions at intervals of a few*

*centuries, which involved each time the rebuilding of its narrow alignment on a star, and the wrecking of the main symmetry that goes with it; when Zodiacs, like that of Denderah, are deliberately depicted in the appearance they would have had centuries before, as if to date the changes, then it is not reasonable to suppose the Egyptians were unaware of the precession of the equinoxes, even if their mathematics was unable to predict it numerically. Lockyer let the facts speak for themselves, but it is he who has given the proof. Actually, the Egyptians do describe the Precession, but in a language usually written off as mythological or religious."*

### **3. Effects of Precession**

#### **3.1 The Variation of “North Pole Star”**

Polaris will reach the point at which it comes closest to aligning with the North Pole axis of our Earth in the year A.D. 2095. In two thousand years, because of the effects of the Platonic year, there will be no pole star, as there was no pole star two thousand years ago.

The next North Pole star after Polaris will be Al Deramin around the year A.D. 7500 later, Deneb will hold that position. Thirteen thousand years from now, the bright star Vega will be the North Pole star again, as it was the North Pole star nearly thirteen thousand years ago. As the precession continues, Alpha

Draconis, which is also known as the Dragon Star or Thuban, becomes the next North Pole star after Vega around the year A.D. 21600. Alpha Draconis aligns closer to the North Pole axis of our Earth than all of the other pole stars in a Platonic year. It is also the only pole star in a great year to be in the exact position to shine down the Descending Passage of the Great Pyramid of Giza, because the Descending Passage is in true alignment with the North Pole axis of our planet.

The imaginary line off the North Pole axis of the Earth moves away from Alpha Draconis as it continues to scribe its 25,800-year circle in the heavens. Around the year A.D. 27900, our North Pole axis will once again point at Polaris, where it is at this time in history.

### 3.2 The coming Seventh Age- The Age of Aquarius

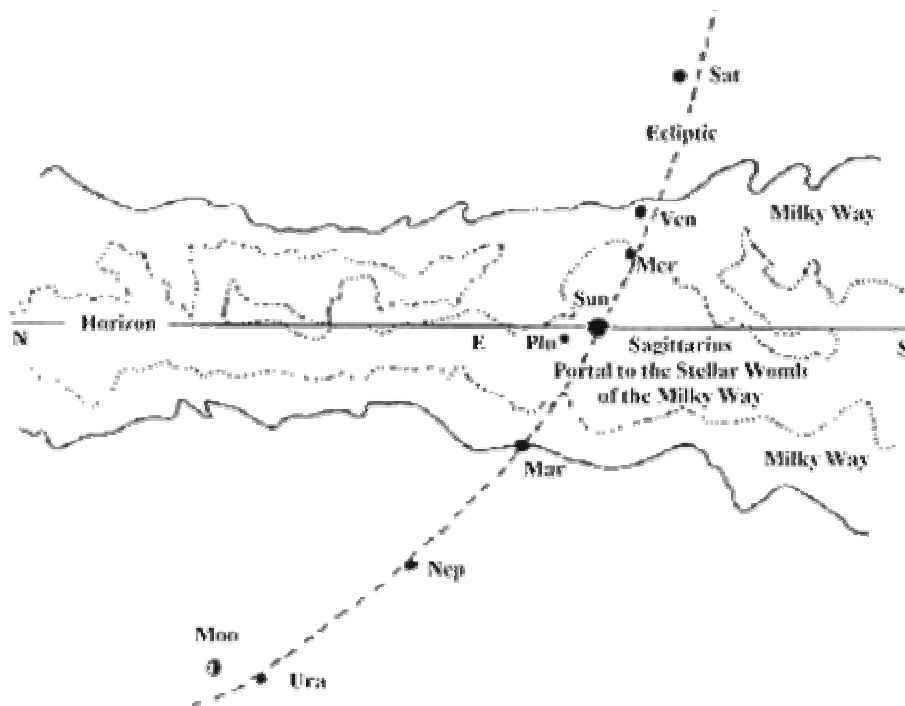
Soon we will be entering the Age of Aquarius. According to the calculations of the Ancient Egyptians, this will be:

- The Seventh Age
- The Winter Equinox in the Precession of the Ages of the Zodiac
- The beginning of a new Galactic Season

- The beginning of a new Trinity or Triad of Ages

The Age of Aquarius will dawn when the Winter Equinox in the Precession of the Ages of the Zodiac takes place at sunrise on the 21st of December 2012.

The beginning of a New Age was considered to be a Process of Purification by the Ancient Egyptians. The Great Conjunction will occur when four celestial events in Time converge and synchronize. Time and co-ordination must be *precise*.



**The Great Conjunction  
marking the Dawn of The Age of Aquarius  
at 6:48 am 21st December 2012**

The two celestial events in Time that will converge to mark the Dawn of the Age of Aquarius, and which can only be viewed with precision from Latitude 30 degrees North, will be:

- The rising Winter Solstice Sun. This will be viewed from Earth as half above and half below the horizon.
- The ecliptic. This is the apparent course of the Sun across the sky over a one-year period. In reality it is the Earth moving around the Sun over a one-year period that causes this illusion ... and also the Seasons.

As already noted, the Great Conjunction can *only* be viewed with precision from Latitude 30 degrees North ... a fact which brings to light *another lost secret of the Ancient Egyptians: the Guardians*

*of Time.* The Great Pyramid of Giza, which stands on Latitude 30 degrees North, is the perfect viewing point of the Great Conjunction. *The Great Pyramid of Giza was built as a stellar observation deck for the Great Conjunction of December 21st 2012.*

What would we expect to see as sunrise occurs at 6:48 am on December 21st 2012 in the direction of ESE?

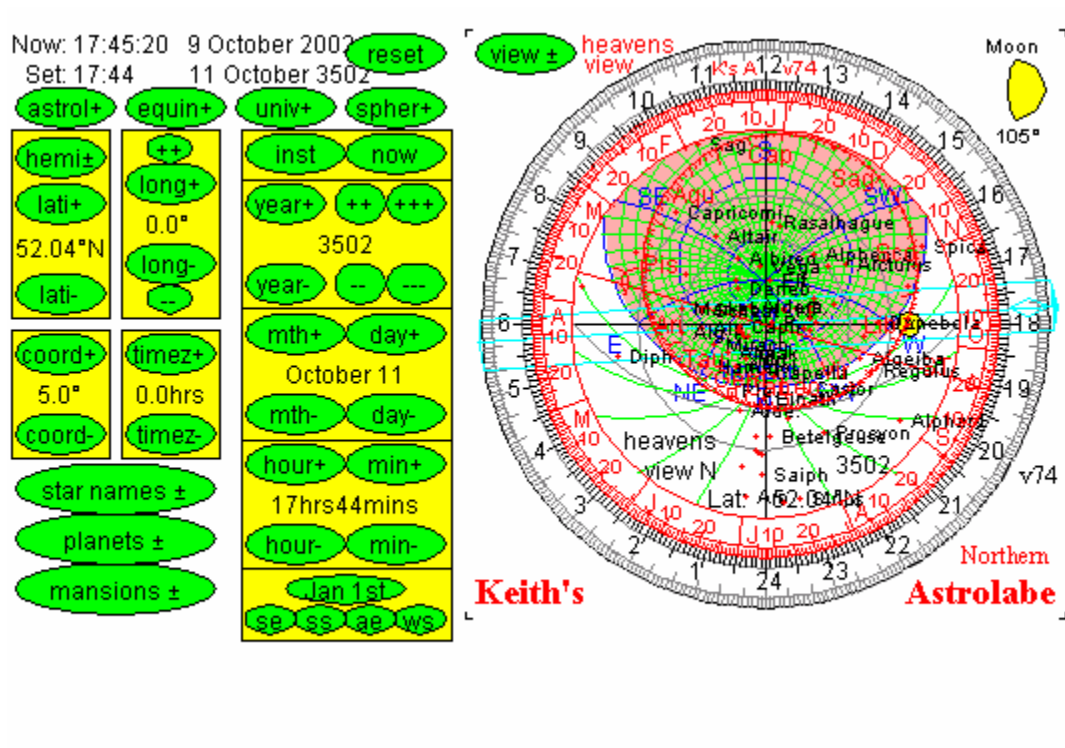
- The Sun is rising from its baptism in the waters of the Milky Way: a sign of the Sun's *purification* upon leaving the Age of Pisces, and also the consecration of the New Age of Aquarius.
- The Milky Way is straddling the full 360 degrees of the horizon.



**Viewing 360 degrees of the dawn skies from the top of the Great Pyramid at Giza, latitude 30 degrees North, at 6:48 am 21st December 2012**

- The Belt of the Milky Way is bisected by the horizon.
- The visible section of the Milky Way above the horizon is "reflected" like a mirror image below the horizon ... "As above, so below."
- Similarly the Sun is reflected in the waters of the Milky Way.

#### 4. An Interesting Java Applet to Demonstrate the Precession



Folder: [precession](#)

Description on this java applet

On an astrolabe, precession is only significant over the centuries. To advance the centuries quickly, it is most

convenient to click and hold down the mouse button when the pointer is over the +++ or --- button in the date section of the button panel, which causes the century to change by up to three times per second with a reasonably fast computer. To observe the effect of

precession on the traditional astrolabe, if you select the latitude of 66.6 degrees North or South, you will see that the stars move along the almucantars as you change the centuries.

If you hold down the --- button, you will see that the star called Polaris, which is very close to the North Pole around the year 2000 AD, moves away from it and the star called Thuban moves close to the North Pole roughly in the year 2600 BC.

Going the other way, holding down the +++ button, Vega becomes the North Star when the year is about 14000 AD.

On the equinoctial astrolabe, the North and South Poles are both shown in the centre of the astrolabe. There is no point in selecting a latitude of 66.6 degrees because it only shows horizons with their azimuths, and doesn't show almucantars. Also, it doesn't allow separate hemisphere settings of North and South of the Equator, because both these projections are shown on top of each other. Instead, click on the ws button (Winter Solstice button) at the bottom of the time and date button panel.

From 2000 AD, hold down the --- button and watch the filled circle indicating Polaris move away from the North Pole. The hollow circle showing beta-Hydrus will then slowly move over the South Pole when the date setting indicates about 300 BC and then, as beta-Hydrus moves away, the filled circle showing Thuban moves over the North Pole when the date setting indicates about 2600 BC.

Precession has sometimes been considered in an endeavour to date - or to confirm the date of - medieval astrolabes. However, the position of the stars on the rete can only give a rough indication of the epoch of the star chart used when the star pointers were initially set - or last adjusted. On the back of the astrolabe, the relationship of the date and the First Point of Aries can usually provide a better indication with astrolabes manufactured before the introduction of the Gregorian calendar.

Incidentally, the program doesn't allow for the 'real' motion of the stars.

# Calendars of Ancient Civilizations

Like many ancient civilizations, the Egyptians produced a civil calendar to keep track of time and events. While some of the other nearby cultures based their calendars on the cycles of the moon, the Egyptian calendar was arranged around the sun. The Egyptian year consisted of 12 months of 30 days each. Five extra days were added to the end, for a grand total of 365 days a year. The year was also divided into 3 seasons: inundation, winter and summer. Each day was divided into 24 hours, 12 of day and 12 of night. This calendric arrangement was adopted by the Romans and eventually became the basis of the system we still use today.

You might be aware that an actual year on Earth lasts 365.25 days. Given this phenomenon, we need to correct our modern calendar periodically so that it keeps up with that of nature. That's why we have a "leap year" every four years, adding an extra day for the adjustment. The Egyptians unfortunately, didn't use

such a correction, so, consequently, the civil calendar was essentially six months off to the astronomical year after 730 years! Fortunately, nature is a reliable calendar, and such observable phenomenon as the rise of certain stars in certain places probably announced to the Egyptians the coming of seasons even if their civil calendar was incorrect.

## Ancient Astronomy and Civilisation

Many ancient civilizations have left evidence of interest in astronomical events. Such interests were motivated by the numerous concerns of daily life, including timekeeping and calendar-making, agriculture, navigation, religion, politics and the desire to comprehend the world. Two of the greatest civilizations that are noteworthy in their research of astronomy are the Greeks and the Babylonians. In particular, the Babylonians were noted for the achievements in their calendar-

making. To perfect their calendar, they studied the motions of the sun and moon. It was their custom to designate as the beginning of each month the day after the new moon, when the lunar crescent first appears after sunset. Originally this day was determined by observations, but later the Babylonians wanted to calculate it in advance. About 400 BC they realized that the apparent motions of the sun and moon from west to east around the zodiac do not have a constant speed. These bodies appear to move with increasing speed for half of each revolution to a definite maximum and then to decrease in speed to the former minimum. The Babylonians attempted to represent this cycle arithmetically by giving the moon, for example, a fixed speed for its motion during half its cycle and a different fixed speed for the other half. Later they refined the mathematical method by representing the speed of the moon as a factor that increases linearly from the minimum to maximum during half of its revolution and then decreases to the minimum at the end of the cycle. With these calculations of the lunar and solar motions, Babylonian stargazers could

predict the time of the new moon and the day on which the new month would begin. As a by-product, they knew the daily positions of moon and sun for every day during the month. In a similar manner the planetary positions were calculated, with both their eastward and retrograde motions represented.

The distinction that separates the Greeks and the Babylonians in their study of astronomy is that the Babylonians used arithmetical methods to predict astronomical events while the Greeks sought to explain the apparent motions of the heavenly bodies using geometric models. However, it is undeniable that there is an extensive debt of Greek astronomy to the Babylonians with regard to the transmission of both observational data and astronomical methods. Second-century B.C.E Greek astronomer Hipparchus arguably played an enormous role in the transmission process. In the Hellenistic period, the Greeks made use of Babylonian data and astronomical methods, yet certain approaches to the study of heavens are recognised as distinctively Greek. Examples include the application of

geometrical methods to the problem of accounting for the apparent motions of the heavenly bodies and the intertwining of natural philosophy and astronomy. It is clear that ancient Greek astronomy relied on certain natural philosophical postulates as its foundation, one example would be the cosmological principle of the sphericity of the heavens. The assumption of an important connection between ethics and the organization of the natural world was not uncommon in the writings of the ancient Greek authors, and such assumptions suggest that the accounts were meant to describe the universe in terms which, on some level, must be regarded as real. Some scholars believe that the major Greek astronomers (with the exception of Aristotle) were interested simply in providing explanations that did not contradict the phenomena that occurred in the universe. The testimony of astronomical writers and practitioners including Ptolemy, indicates that astronomers routinely started from philosophical assumptions regarding the physical makeup of the universe, including the generally accepted ideas regarding the regularity,

uniformity and circularity of the motions of the heavenly bodies, as well as assumptions about which bodies were in motion and which were at rest.

The Greeks research in astronomy was so extensive that it became part of their culture and the early texts by Greek authors suggest important relationships between celestial phenomena and divinity. In some cases, Greek astral piety did not simply entail the veneration of celestial divinities; notably a particular form of astral piety was linked to an ethical teaching that emphasized the benefits to be derived from the study of the heavens. Examples may be found in the writing of Plato, Aristotle and their followers including Ptolemy. According to this view, the intellectual work of the astronomer is a striving for a noble and disciplined character, which enables the astronomer to become more similar to the celestial divinities. The celestial bodies were also regarded as divinities within several Near Eastern religious traditions. While there is evidence that these religions influenced Greek ideas regarding celestial divinity,

the nature and extent of their influence is not well-known, neither in general terms nor with regard to the possible influence of local religious practice on particular ritualized practices, salvation and the afterlife. In the Greek philosophical tradition, many authors discussed the relationship between the heavens and earth, suggesting that the entire universe is intimately connected physically. In a separate tradition, celestial phenomena were used to predict the weather. Astrological practice was based on the notion that celestial events influence what occurs on the earth and that such influences could be predicted using astronomical knowledge and techniques. The importance of astrology in the Hellenistic Alexandria is indicated by the fact that the most important astronomers of the period are associated so closely with the practice. Hipparchus is mentioned often in the literature; Ptolemy devoted an entire treatise to astrology, which he explained is a second type of astronomical prediction. He considered the study of astrology to be worthwhile since it concerned the configurations of the sun, moon and

communities or individuals. Within the Hellenistic astral religions generally there was an emphasis on

stars as well as the changes that result from these configurations. According to the principles of Hellenistic astrology, events on the earth could be predicted by the physical influence of the motions of celestial bodies.

The above detailed analysis provides us with the knowledge of the extent of astronomical research carried out by the Greeks as well as the impact that it had on their culture. Many of the principles developed by the Greeks and the Babylonians have formed the foundations of modern astronomy and enable us to continually explore the universe.

#### References:

1. The complete idiot's guide to Ancient Egypt by Donal P. Ryan
2. British Museum Dictionary of Ancient Egypt by Ian Shaw & Paul Nicholson
3. The Complete Pyramids by Mark Lerner
4. In Ancient Egypt by Michael Rice

# Upcoming Events in October

## SSC Astronomical Calendar

### October

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02	15	Jupiter 4° S of Moon
05	09	Mars 4° S of Moon
06	10	Mercury stationary
06	19	NEW MOON
08	18	Venus 10° S of Moon
10	17	Venus stationary
11	21	Saturn stationary
13	14	FIRST QUARTER MOON
13	16	Mercury greatest elongation W (18°)
14	22	Neptune 5° N of Moon
16	06	Uranus 4° N of Moon
20	19	Neptune stationary
21	15	FULL MOON
26	17	Saturn 3° S of Moon
27	17	Mercury 4° N of Spica
29	13	LAST QUARTER MOON
30	06	Jupiter 4° S of Moon
31	20	Venus in inferior conjunction

### Highlight of the month: Saturn

*Contributed by Astronomy.com*

Saturn rises in the late evening just before midnight during October, and it glows at a respectable magnitude 0. The Ringed Planet lies between the well-known constellations Taurus the Bull and Gemini the Twins, and it spends the entire month in a small northern section of Orion. By midnight, Saturn is well clear of the western horizon. Binoculars will reveal the planet sitting nearly 4° west-southwest of the open star cluster M35.

Saturn's path against the stars will slow to a halt October 11. Later it begins its retrograde path as Earth overtakes Saturn in the race around the sun. In two months, Saturn will reach opposition and shine a half-magnitude brighter. However, this month the rings open to their widest since they first began opening following 1995's ring crossing. The southern face of the rings has been opening ever since.

The rings of Saturn, visible in any small telescope, span 44" along the major axis and nearly 20" across the minor axis. Saturn's disk spans 19". Good observing conditions should reveal the rings' Cassini Division now that they are so open to view. Small telescopes will also show Saturn's largest moon Titan, which shines at magnitude 8.3. Titan lies due north of Saturn on October 8 and 24, and due south on October 16.

The Astronomical Society Of Singapore (TASOS) was formed with the following objectives:

- The promotion of an interest in astronomy for beginners as well as the advanced.
- The encouragement of all aspects of observational astronomy and the association of observers at all levels for mutual benefit.
- The circulation of current astronomical information and observational materials.
- The support of regional and international cooperation among astronomical organisations.

The application for membership to The Astronomical Society Of Singapore (TASOS) must be made on prescribed forms and submitted together with the one time payment of entrance fees and annual subscription fees to the Honorary Secretary. Membership forms can be collected at our office or you can print out our [online membership form](#) (requires acrobat reader) and post it to us.

There are four categories of membership:

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Open to all persons over 18 years of age.

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Annual Subscription: S\$48/- per annum

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Annual Subscription: S\$36/- per annum

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Open to all corporations and organisations.

Entrance Fees: S\$240/-

Annual Subscription: S\$240/- per annum

Online- Benefits n Privileges FREE subscription to the Society's quarterly newsletter, the MOONstarer.

Borrowing privileges from the society's wide range of astronomical related books and journals collection.

Exclusive invitation to talks and seminars on astronomy.

Members who in the opinion of the Management Committee are suitably experienced, will be allowed to borrow the Society's equipment for project work.

Invitation to join the society for numerous observations in Singapore and abroad.

Observing with the Science Centre's Observatory at selected [dates](#)

# Horoscopes

## What's on this month?

**New Moon:** **October 6 th -13 degrees of Libra**(That Lennon song...encouraging us to give peace a chance provides the perfect signature for this Libra New Moon. Bring it into your life, find ways to embrace diversity. New beginnings offer empowering partnerships and harmony)

**Full Moon:****October 20- 28 degrees of Aries**(The fiery, active, creative and courageous essence of the Ram provides the energies that make new moon beginnings come into full bloom. Actively chase those goals.)

**Mercury:** Mercury ends its retrograde in Virgo on October 6th, quickly retraces its route and re-enters Libra on 10th. The details found during this retrograde help bring diversity, new possibilities and ideas into full swing.

**Basic energies:**

*Virgo: Detail oriented, painstaking, focused, practical, logical.*

*Libra: Creative, mild, peaceful, fair, poetic, watchful, joyful.*

**Venus:** Venus begins her retrograde in Scorpio on October 10th. Passions from the past, feelings, intuitions and deep desires all carry a touch of nostalgia and a hint of valuable connections, possessions and relationships. Be ready to reminisce, remember and muse.

**Mars:** Mars remains detail focused and practical as it spends the first two weeks of the month in Virgo then changes its atmosphere and passions on the 15th when it moves into Libra. If there are things still needing your attention tap into the busy, earthy energy and get them done. Once Mars adopts the gentle, peaceful aura of Libra the focus and drive calms down and takes on some of its mellowest hues.

**Jupiter:** Jupiter remains direct in Leo. Extravagance is the rule...self control important and finding new ways to fall in love with life, with the world and everything they offer is one of this giant's most powerful gifts.

**Saturn:** Saturn begins its relatively long retrograde cycle in Gemini on the 11th. Time to check out all we've learned and see how well it works in the real time aspects of our lives.

**Uranus:** Uranus is retrograde again in Aquarius and bringing in the future. Sitting in the sign it rules it promises amazing new possibilities...albeit surprising and eclectic ones.

**Neptune:** Neptune ends its retrograde on October 20th and begins encouraging us to now live some of those ideals, dreams and visions it brought to the surface over the last few months.

**Pluto:** Pluto remains direct in Sagittarius. Sagittarius symbolizes ideals, beliefs, philosophies, religions and higher learning and education. Pluto represents the ultimate truth, transformation, change and power. The journey of Pluto through the sign of the Archer signifies a long term period where personal and collective beliefs are renewed, transformed and empowered.

**Chiron:** Chiron is now in Capricorn where it will work through our wounds and heal us in the areas of prosperity consciousness, personal responsibilities and obligations and business related efforts.

<b>Planet Retrogrades for 2002</b>			
<p><b>Mercury Retro's</b>  <i>Jan 19-Feb 8</i>            (Aquarius)  <i>May 15-June 8</i>            (Gemini)  <i>Sept 15-Oct 6</i>            (Libra-Virgo)</p>	<p><b>Venus</b>  <b>Oct 10-Nov 20</b>            (Scorpio)</p>	<p><b>Mars</b>  <b>Mars has no retrograde this year.</b>  <i>(Begins year in Pisces ends year in Scorpio)</i></p>	<p><b>Jupiter</b>            Retrograde until  <b>March 1</b>            (5 Cancer)  <b>Retrograde Again</b>  <b>Dec 5</b>            (18 Leo)</p>
<p><b>Saturn</b>            Retrograde until  <b>Feb 7</b>            (8 Gemini)  <b>Next retrograde:</b>  <b>Oct 12</b>            (29 Gemini)</p>	<p><b>Uranus</b>            Retrograde  <b>June 3-Nov 3</b>            (Begins 28 Aqua and ends at 24 Aqua)</p>	<p><b>Neptune</b>            Retrograde  <b>May 14-Oct 21</b>            (Begins at 10 Aquarius ends at 8 Aquarius)</p>	<p><b>Pluto</b>            Retrograde  <b>March 21</b>  <b>Direct on Aug 29</b>            (17 degrees of Sagittarius to 14 degrees Sagittarius)</p>

## ARIES

Although the harvest may be plentiful, it looks as if there are also many mouths to feed. Your ruler, Mars, in late Virgo, may cause you a certain amount of anxiety early in the month. Once Mars enters Libra on the 15th, you will be certain as to where you stand - particularly economically! The Full Moon shows you in voluntary exile once your obligations are met. Property and living space benefits from a facelift! Make it fun!

## TAURUS

Venus, your ruler, is in intense Scorpio all month. It retrogrades on the 10th calling you to review how love has been demonstrated in your life. Looking back can be full of smiles and tears as the chapters of life are always changing. Your deepest intuitions can be right on target. Many of your own predictions regarding family matters may come true. Resist the urge to isolate - unless you do it with one other person intensely!!

## **GEMINI**

Mercury, your ruler is retrograde, on New Moon. Careful listening and applying this knowledge will be required of you - one way or another. The social opportunities are abundant and you may find yourself being both the student and the teacher in more than one conversation. Mercury goes direct hours later, but is still in it's shadow until the Full Moon on the 21st. Repeat yourself, elaborate and prove in this cycle.

## **CANCER**

Career will be very challenging this month. Any legal matters or contracts you deal with are best foregone until after the 7th of this month. Upgrade your technology while the Moon is New! Expect that friends and family will be full of ideas for the upcoming holidays! At Full Moon, you will find it imperative to have time alone. It will be an illuminating time when the motives of others will become crystal clear.

## **LEO**

With your ruler, the Sun and the Moon conjunct in Libra, this proves to be a very harmonious month! Jupiter, the Greater Benefic of the Zodiac, smiles in your sign of Leo. If you do everything dramatic, abundantly and fair - you will have no worries! Intimacy is the real challenge! Beware of jealousies and manipulation as Venus in Scorpio makes stressful aspects to your Sun. Respond, but do not react! Rest on your dignity!

## **VIRGO**

Yes, this is the perfect month to be politically opinionated for you! Just be careful that you are not accused of conspiracy! With your ruler, Mercury in retrograde, your own words can come back to haunt you! In the Full Moon chart, your sign is in the Ascendant. After the 21st, you can sort out all the technical errors and soothe torn egos. Until then, someone needs to be keeping score and you are so good at it! Enjoy the garden!

## **LIBRA**

Happy Solar Return, Libra! This is your month! A Triple Grand Trine crowns you this month! You should be flying!! Expect that others will want to celebrate your special day! On a more serious note, keep your financial matters private at this time. You are considering a career change, be very discreet. Property values for you are on the rise. Any loans you give or take should be carefully reviewed before signing. Move ahead!

## **SCORPIO**

Your rulers, Mars and Pluto, although not in conflict by degree, can make you feel a bit scattered these days. Mars in Virgo early this month shows industry behind the scenes. Pluto in Sagittarius keeps calling you to come out and play!! Tough choices, moment to moment, to be sure! Venus in your sign this month, however, promises passion and strong intentions. When Mars enters Libra, romance and passion begin to merge! Enjoy!

## **SAGITTARIUS**

Your ruler, Jupiter in Leo trines you strongly this month with many planets in the element of air to feed the fire! You may find yourself happily pursuing private interests with your closest friend or mate. Expect sudden luck! At Full Moon, you seem to be reestablishing your territory! Open doors seem to welcome you at every turn. One word of caution! Comparison shop. Extravagance is easy in this cycle. Your enthusiasm prevails!

## **CAPRICORN**

Your ruler, Saturn, is in the last degree of Gemini and ready to retrograde! You are very misunderstood at New Moon. If you are a bit confused about your goals or have too many choices, you are cosmically correct! The role you are playing in your world is about to change, but not that drastically. Traveling and teaching are awesome ways of expressing yourself now. Strenuous physical activity is ill advised. Put your feet up!

## **AQUARIUS**

This is a wonderful month to collect on debts and promises! Many unfinished projects will be miraculously done! Angels in the form of traveling friends or family may just pop in to help you get them done! Friendship abound this month. Share old stories and new dreams. As much as you are aching to break free since June 3rd (when your ruler, Uranus, went retrograde), you must wait. November 5th is just around the corner! Have a party!

## **PISCES**

At New Moon, appreciate old friends, peace and the trances you have been living. Your ruler, Neptune resumes direct motion at Full Moon and then you will be manifesting new dreams for your future. The peaceful energy of the Libra cycle makes this a comfortable transition for you. Busy yourself doing what you love. It makes it so much easier to say "No!" when others try to hijack your time! Gather flowers and feast on nature now.

# THE LAST PAGE...

We took a lesson trip to EGYPT to uncover the astronomical issues of the pyramids built. We hope the fascinating pictures and mathematical equations would have captured your attention and spiced up the articles.

The people who made remarkable contributions to the ancient astronomy of Greece, from the different phases and periods are also one of our highlights. A short summary of their theories were given to give you readers a better understanding of their achievements. Shortcomings in each of their theories were written as well to show how future astronomers correct them.

Babylonian and Greek ancient astronomy had many links and we see how the different astronomers made use of them to make new discoveries and hypotheses.

How can we forget to include the critique on the latest movie in the cinema? And the astrology part as well.

In the next issues, we will touch on the astronomy of ancient Indian, Chinese civilizations.

Lastly we hope you readers can give us your utmost support and continue to buy our magazines.