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## LOGISTICS OF THE SHAFTS IN CHEOPS' PYRAMID

A Religious "Function" Expressed with  
Geometrical Astronomy and Built in Architecture

By Robert G. Bauval

INTRODUCTION

It is an accepted fact that the design of the Cheops' Pyramid -and other pyramids to a lesser degree of precision- incorporates a basic knowledge of geometry and observational astronomy <1>. The intensely geometrical shape of the structure, the precision of design ratios, and its very accurate alignments along a precise meridian makes this a certainty. Many geometers who have studied the pyramid agree that a harmony of angles and dimension ratios is to be found in the design <2>. Those who have studied its astronomical alignments generally agree that stellar alignments taken at the meridian was the means by which the base of the monument was set out and, as some have shown <3>, the means by which some of the internal features were positioned <4>.

Above all else, however, the monument is intensely religious, with the main cultic purpose to assist the dead king in his "ascent to the sky" <5>. In brief, therefore, the monument is a "sepulchre" with a very potent "function" which, for lack of appropriate terminology, can be said to be "astrological" <6-Archaeologia>. This last fact is a widely accepted consensus and, furthermore, is indeed confirmed by the liturgy of the Pyramid Texts <7>. In short, the religion and rituals of the Pyramid Age was a sort of "sky-religion" whereby the king is often said to become a "star" and that his star-soul is to become "established" or transferred to the southern stars of Orion and Sirius and to the northern stars (the circumpolars) which included the three circumpolar constellations of Ursa Major, Ursa Minor and Draco <8>. The supreme task of the ancient architect, therefore, was to express these vital elements of the sky-religion in the design of the monument. When all is said and done, therefore, it cannot be doubted that the pyramid structure was primarily an instrument of rebirth for the departed king.

To achieve this religious function, it is also obvious that the architect based his design on simple geometrical principles using right angles and bisected angles fixed with simple mathematical ratios and proportions. This is the common way of architectural and building engineering design principles in order to create the ideal "functional" monument within the constraints of structural considerations and building practice limitations. In this respect, elementary mathematics are thus bound to be detected by all those who study the design of the Cheops pyramid <9>. Yet such researchers should not imagine that such elementary mathematics was the essential aspect of the pyramid cult but merely the "tool", albeit probably considered a "sacred tool" by which the priestly architects could perform his trade. In short, mathematics is not the motive of the enterprise but the means by which it could be achieved within the basic principles of architectural design. Clearly the motive was intensely religious and, in this specific case, with main objective to "establish" the departed king in his celestial afterlife abode.

## THE NARROW SHAFTS

There are four narrow shafts in the Great Pyramid, two that emanate, northward and southward, from the King's Chamber; two others that emanate, also northward and southward, from the Queen's Chamber. These were discussed in numerous books and articles since 1837 <10>. Though first thought to be for the purpose of ventilating the internal chambers of the pyramid, the generally accepted thesis today is that they served a religious purpose, this to act as passageways for the ascent of the "soul" of the dead king towards the stars <11>. Such a conclusion thus meets up with the main religious "function" of the pyramid and the present writer is a firm supporter of such a thesis <12>. There is, however, one main element of the mathematics that needs to be carefully integrated in such a thesis on the shafts if the latter is to withstand proper scientific scrutiny: the "stellar" thesis must also account for the fact that the architect intended each pair of shafts to emerge at the same horizontal levels on the outside of the pyramid (diagram 1). It is thus important to follow a strategic logic in order to conclude, through a series of question/answers, what was likely the intention of the ancient architect when he opted for such a feature.

## MATHEMATICAL ASTRONOMY OR ASTRONOMICAL MATHEMATICS ?

The question that must be answered is this:

- 1) was the architect "briefed" to design a monument in order to express some principles of "sacred mathematics" in the pyramid or, alternatively, was he "briefed" to use "sacred mathematics" in order to provide the pyramid with features that could service the "function" of the cult i.e. to assist the departed king to "ascend to the sky" ?

Perhaps the best way to answer this is to use a more modern analogy. In medieval times -and indeed sometimes still today- cathedrals were designed in the shape of a cross which was generally orientated east. The main entrance of the monument was on the west side and at the foot of the cross which meant the a congregation entering the cathedral would be moving eastward, and thus symbolising the "rising" of Christ, the east being the place where the celestial orbs rise each day as the birth star of Christ, "the star of the east" <13>. It is, therefore, an undisputed fact that cathedrals were religious monuments specifically intended to service the liturgical aspects of the Christian religion. Now the main "brief" given to the architect was based on such requirements. Yet the architect, as is clearly evident, developed his design using geometry and mathematics to express in a *symbolic manner* the religious requirements and thus provide the monument with the necessary features to service the liturgical "function" of the cult. The "cross" plan was thus designed in geometrical proportions which were imbued with deep symbolic meaning, the dome represented the sky-vault, the altar was a the "head" of the Christic cross and so forth. Furthermore the architect used simple observational astronomy to orientate the monument eastwards, certain panels towards the solstitial sunrise or sunsets and so forth.

It stands to reason, therefore, that if a medieval cathedral (such as Chartres in France for example) is *scientifically* scrutinised, it will be extracted from its design and orientation both a "sacred mathematics" and the elements of a simple

observational astronomy. Yet to conclude that the main purpose of the architect was to express either is clearly misleading. The correct conclusion, there can be no doubt, was that the architect made use of symbolic mathematics and observational astronomy to express the liturgical "function" of the religious monument. Those who seek to prove that "mathematics" or "geometry" was the true ultimate expression are merely ignoring the intense religious purpose of the monument and also the "function" that it was given.

The same applies to the Cheops pyramid. Clearly a scientific scrutiny will only extract the principles of a "sacred geometry" and certain aspects of observational astronomy. Yet this is only discovering the "tools" of the architect's trade and in themselves alone, devoid of a religious input, do not elucidate the true purpose and "function" of the monument. Such scientific scrutiny thus left without the religious input is misleading. Quite evidently a scientific approach is necessary only in that it provides us with the "tools" of the architect, and thus with the "architectural language" through which the deeper religious purpose and "function" of the monument can be understood.

The correct approach to a full understanding of the pyramid design is to make use, therefore, of elementary mathematics and observational astronomy in order to extract the symbolic meaning of the various features of the design and ultimately link them to the liturgy of the cult. This is therefore also the approach one is to take in the scrutiny of the mathematical and astronomical aspects found in the various shafts in the Cheops pyramid. In short, an astronomical mathematics or, if you prefer, a mathematical astronomy must be put to use.

#### THE "ARCHITECT'S BRIEF" BASED ON THE RELIGIOUS "FUNCTION"

We know from the Pyramid Texts that both the northern stars and the southern stars were essential aspects of the rebirth rituals and, as many have shown, directly related to the celestial "destiny" of the departed king <14>. It has also been shown by many researchers, Egyptologists and astronomers alike, that the constellations in question were:

1) THE NORTHERN MERIDIONAL REGION: those of Ursa Major, Ursa Minor and Draco. The last, of course, had its main star, Alpha Draconis, as the Pole Star of the Pyramid Age (epoch i.e. c. 2500 BC +- two century).

2) THE SOUTHERN MERIDIONAL REGION: essentially, as V. Trimble has shown, these were the culmination of the constellations of Orion and Canis Major (which contains Sirius). To this we must add the constellation of Taurus, including the Hyades, which are known also to have had an important cultic significance.

All stars, of course, have to be Precessed and Proper Motioned back to the epoch of c. 2500 BC to meet up with the assumed date of the Cheops pyramid.

The religious rituals that took place AFTER the death of the king was essentially one that can be loosely termed a "rebirth" ritual, with main objective to ensure that the soul of the king would depart to the important regions of the sky. Some have termed such a ritual the "Osirian Rites", since ultimately the dead king was imagined to have become an "Osiris" and depart to the celestial afterlife kingdom of this god, which was the sky region of Orion <15>. First, however, a variety of rituals had

to be performed before the dead king was deemed ready to undertake his afterlife journey to Orion-Osiris. The most essential of these was the so-called ceremony of "the opening of the mouth" during which "Horus" and his "four sons" came to the chamber where the mummy of the dead king was stood upright and, with ceremonial cutting instruments, opened the mouth of the "Osiris-king" in order to induce its rebirth. This ceremony, too, had strong astral connotation but this time linked to the circumpolar region of the sky. It has generally been accepted that the two ceremonial cutting instruments, which much resemble a carpenter's adze, were so shaped to look like the constellations of Ursa Major and Ursa Minor <16> (diagram 2). Another ritual which was also a major part of the event was the symbolic "birth" of a "new Horus" i.e. the new king, which also had a stellar connotation as "Horus who is in Sirius-Isis" <17>.

We can therefore conclude with a high margin of safety that the "architect's brief" was to incorporate within the design of the "rebirth" chambers architectural elements which would service the two essential rituals, namely the "opening of the mouth", the "birth" of "Horus who is in Sirius-Isis" and, ultimately, the departure of the "soul" to the celestial kingdom of Osiris-Orion. In previous articles <18> it was shown that the two southern shafts pointed to Orion's Belt and to Sirius, both mythologically regarded as Osiris and Isis respectively. As for the two northern shafts, these were directed to the Pole Star, Alpha Draconis, and to the "head" of Ursa Minor, the celestial adze of "Horus" also called the "adze of Upuaut" <19>. All these alignments work out for the same precessed epoch of c. 2450 BC +- 25 years <20>.

#### THE "TOOLS" AND TECHNIQUES OF THE ARCHITECTURAL DESIGN

In considering the techniques of design, we must define the context in which the architect is to be placed. We are, historically, looking at an epoch c. 2500 BC, when the two pyramids at Dashour and also that at Meidum were completed by king Sneferu, the father of Cheops. The experience acquired in true pyramic design and construction is thus, quite evidently, to be related to those pyramids. In accepting that now the architect of Cheops used, as primarily design elements, basic geometry to define the scale and proportions of the monument, and basic observation astronomy to align the base and various other architectural features such as the shafts, we must also accept that he also had in mind a wider vision based on the past geometrical and astronomical design of the Dashour pyramids and a future vision of the general layout of the Giza necropolis as a whole <21>. In this respect all these elements must be inter-linked in one, unified architectural vision which, if correct, should be somehow visible in the integrated design and layout of the Dashour pyramid site and the Giza pyramid site and, ultimately in the specific internal and external design of the pyramid of Cheops <22>. In extension, the final product i.e. the design of the Cheops pyramid, must link itself with the religious "purpose" of the monument. This, we have seen, are:

- (1) the "opening of the mouth ceremony"
- (2) the "birth of Horus Who is In Sirius-Isis"
- (3) the departure of the "soul" of the dead king to the stars of Osiris-Orion.



Diagrams 3 & 4 show the geometrically integrated scheme and also how this projects mythologically into the sky image to produce the stellar vision of the rituals.

#### Notes:

- 1) As examples for Astronomy see DE vols. 13, 14, 16, 26 and 27 articles by R. G. Bauval. For Geometry and mathematics see DE 10 and 14 articles by J.A.R. Legon. See also I.E.S. Edwards, *The Pyramids Of Egypt*, Penguin 1993 ed. pp. 245-251.
- 2) See Robin Cook, *The Pyramids Of Giza*, Seven Islands Ed. 1992 distributed by Ashgrove Press and Solos Press.
- 3) I.E.S. Edwards op.cit.
- 4) Such as the shafts. See I.E.S. Edwards op.cit. p. 285.
- 5) See DE 13 and DE 14 articles by R.G. Bauval and references therein.
- 6) Very recently in *Archeologia*, September 1993 No. 283, p.6.
- 7) DE vols. 13, 14 and 16 articles by R. Bauval.
- 8) DE Vol. 26 article by R. Bauval.
- 9) J. Legon in DE op. cit. and R. Cook op. cit. Also R. Gan-tenbrink (unpublished).
- 10) I.E.S. Edwards op.cit. p.285. Also in DE vols. 13, 16, 26 and 27 articles by R. Bauval.
- 11) A. Badawy "The Stellar Destiny of Pharaoh and the so-called Air-shafts of Cheops' Pyramid" in *Mit. der Inst. fur Orient. Akad. der Wissen. zu Berlin*, Band 10, 1964 pp. 189-206.
- 12) See DE vols. 13, 16, 26 and 27.
- 13) See Jean Phaure, *Introduction a la Geographie Sacree de Paris*, Edition du Borrego, 3eme Ed.1985. See also William Letharby, *Architecture, Mysticism and Myth*, Solos Press ed. 1993.
- 14) See R.O. Faulkner "The King and the Star-Religion in the Pyramid Texts" *JNES* vol. 25, 1966 pp.153-161.
- 15) Example: Pyramid Texts lines 820; 882; 2180.
- 16) DE 28 and DE 29.
- 17) Pyramid Text line 632.
- 18) DE 13 and DE 16 articles by R. Bauval.
- 19) Pyramid Text line 13.
- 20) DE 26 and 27 articles by R. Bauval.
- 21) DE 10, DE 14 articles by J. Legon. Also J. Legon "The Geometry of the Bent Pyramid" in *Gottinger Miszellen* No. 116, 1990, pp.65-73.
- 22) Ibid. ; also see R. Cook op.cit.

SOUTH

EPOCH  $\approx$  2450 BC

NORTH

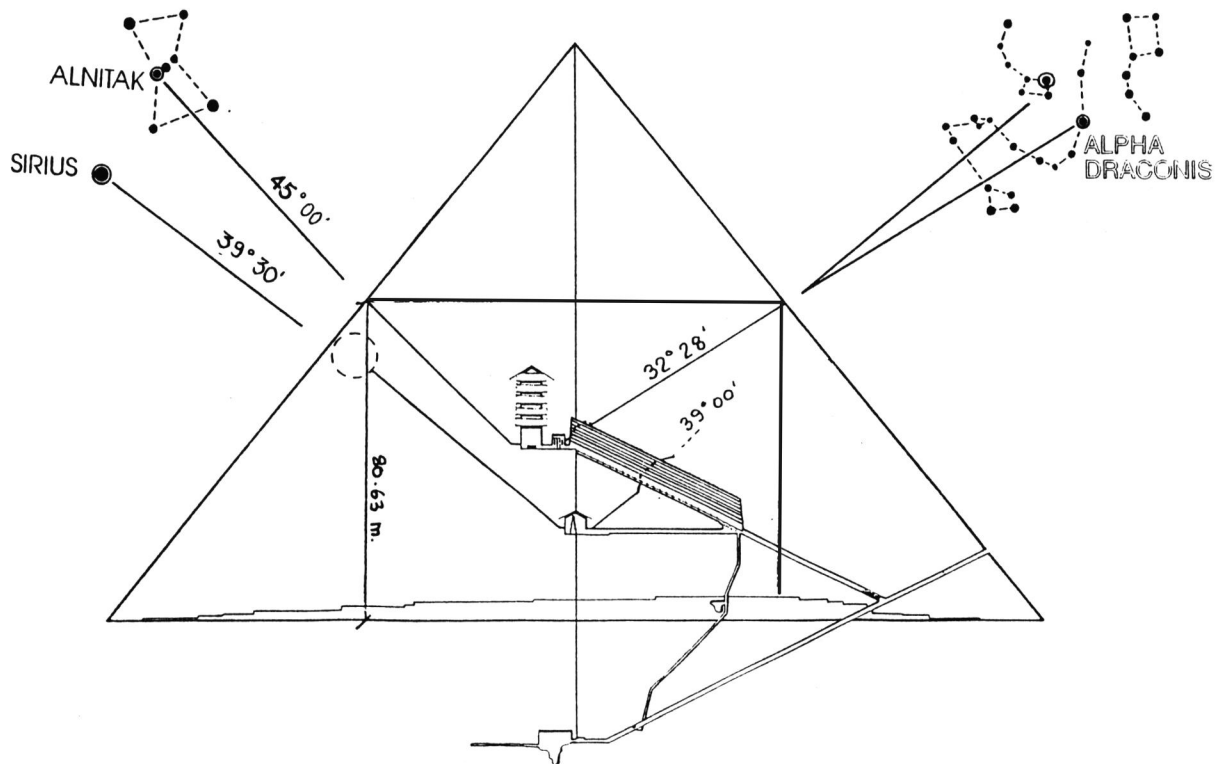
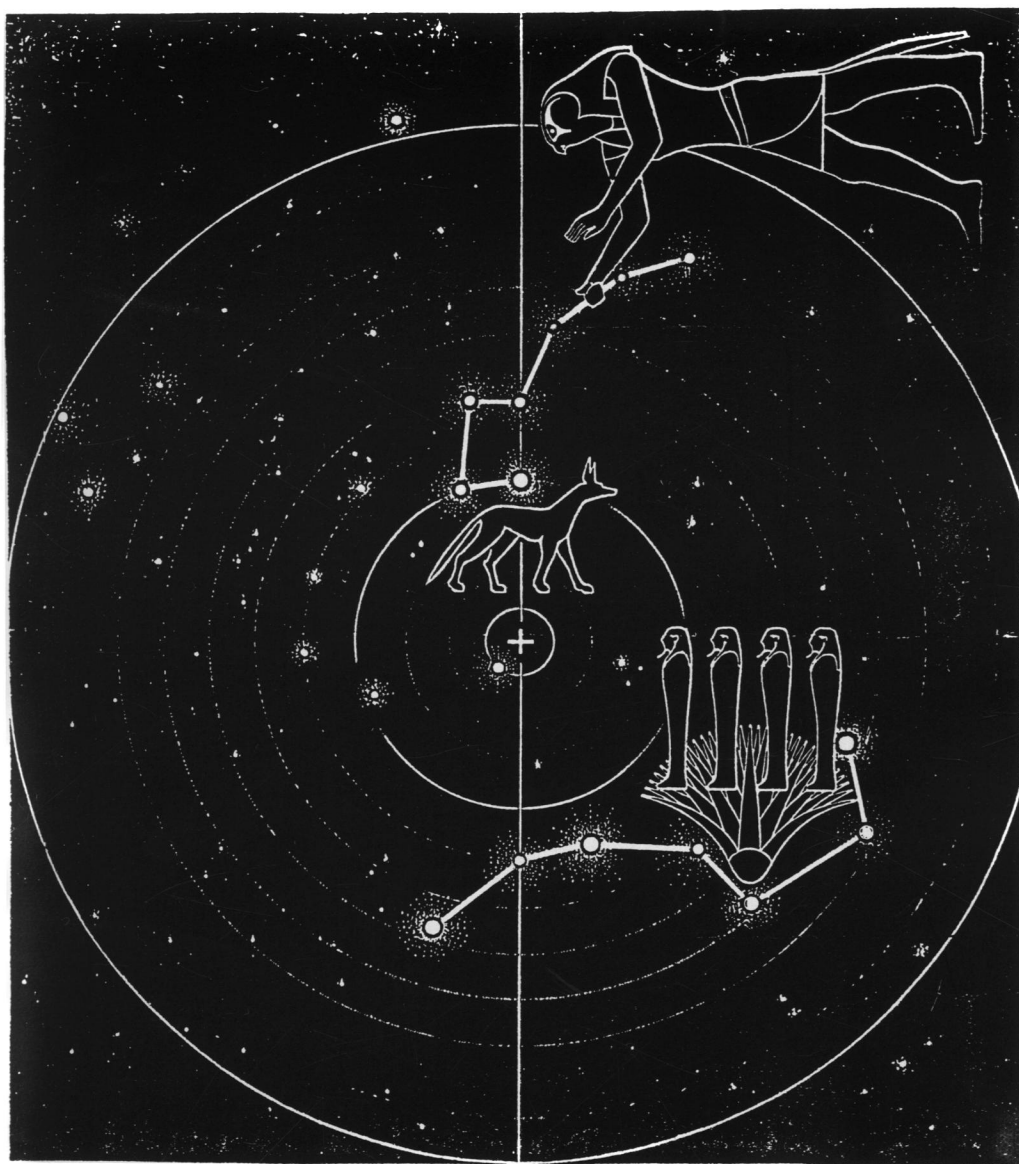


DIAGRAM 1



NORTH HORIZON C. 2450 BC

DIAGRAM 2

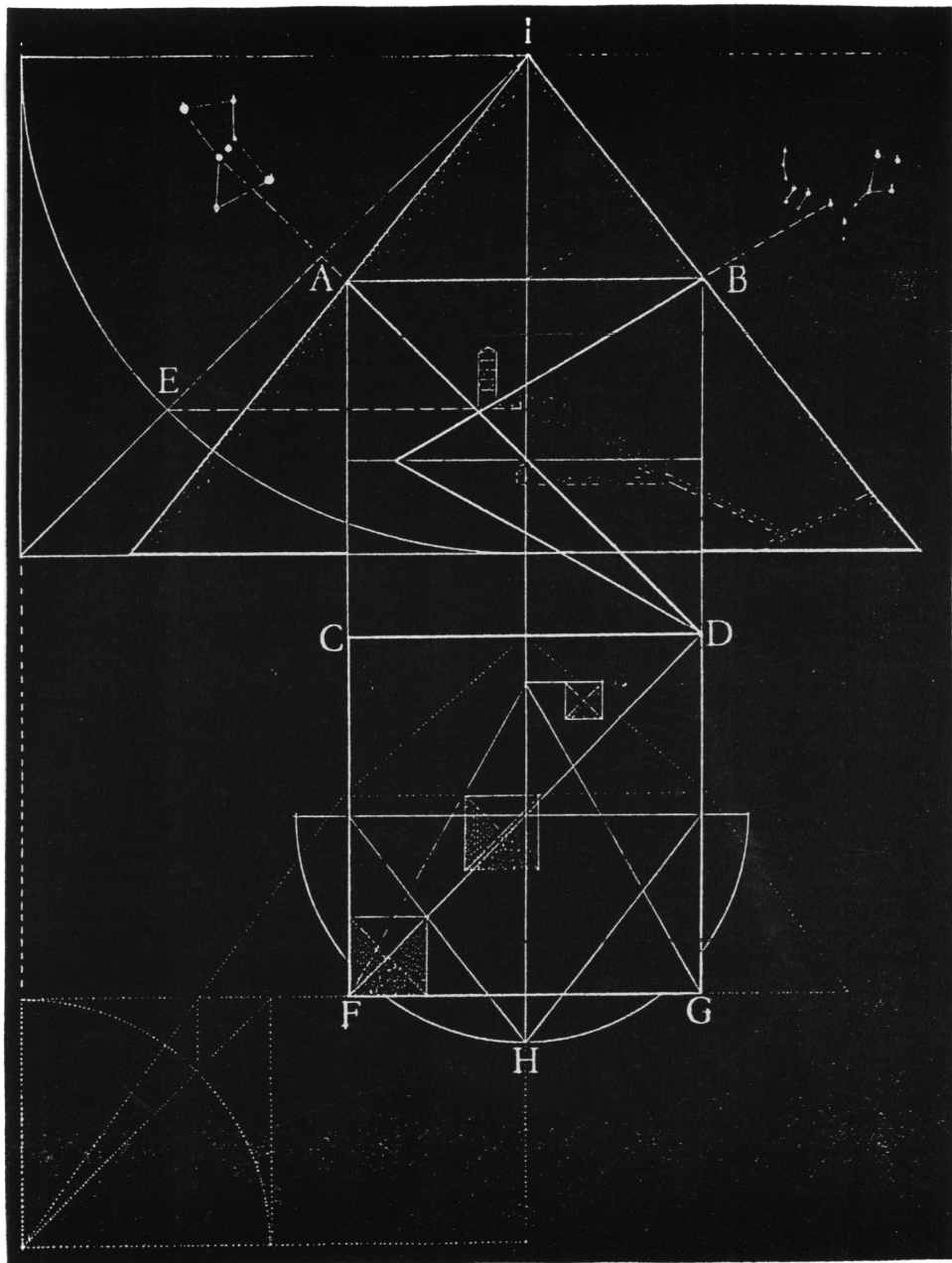


DIAGRAM 3

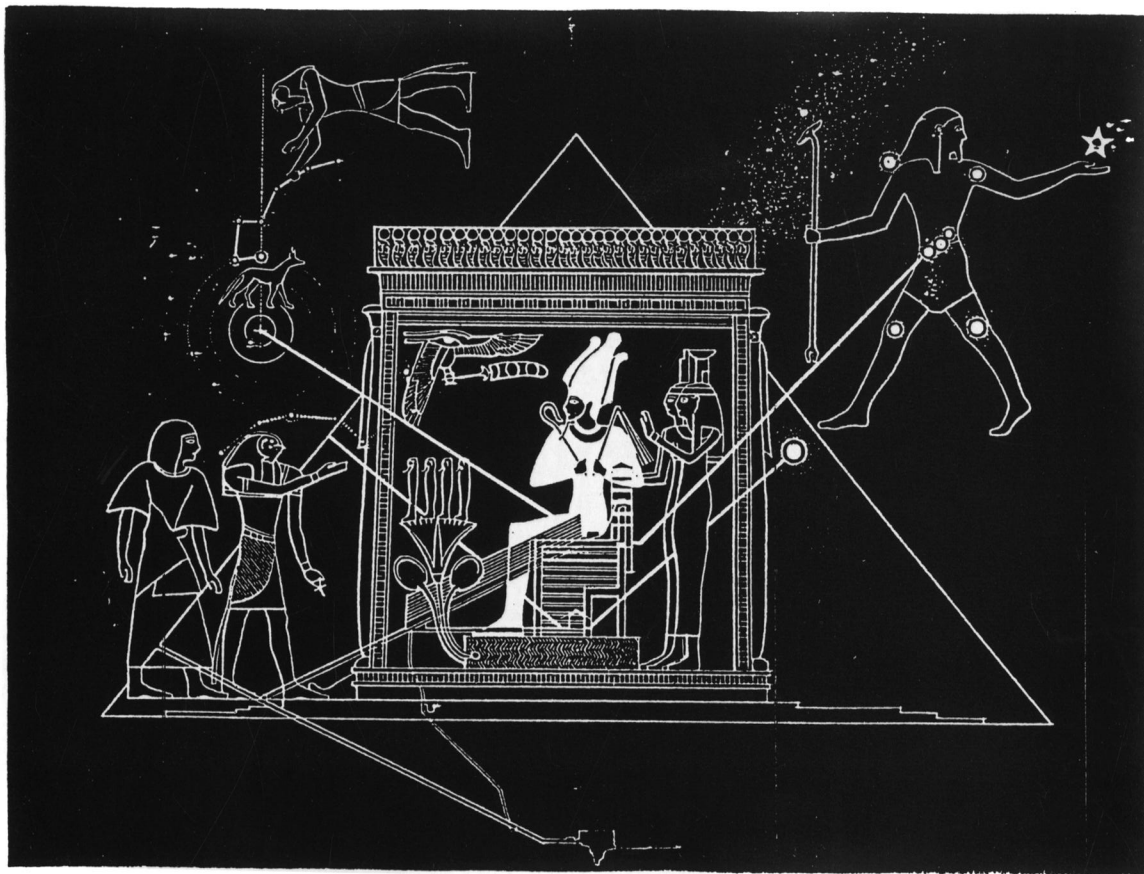


DIAGRAM 4.